THE IMPACT OF REAL EFFECTIVE EXCHANGE RATE AND ITS VOLATILITY ON ECONOMIC GROWTH IN THE OECD

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ABSTRACT

This study examines the effects of the real effective exchange rate (REER) and its volatility on economic growth from 1996 to 2020 in 36 OECD countries utilizing fixed effects (FE) and random effects (RE) methodologies from panel data econometrics. For empirical analysis, the Hausman test indicates that the fixed effect method is superior to the random effect method; and there were presence of cross-sectional dependencies, autocorrelation, and heteroskedasticity in the FE model. The robust estimates derived by the FE estimation using DRK S.E. indicate that the impact of the real effective exchange rate on economic growth is negative and statistically significant whereas the REER volatility has an insignificant effect on economic growth in the OECD throughout the examined period. The findings from the FE model with robust S.E. further evidence a significantly negative impact of GCE and a significantly positive impact of GCF on economic growth. While population growth and trade do not result in any significant impact on economic activity, the influence of inflation on GDP growth presents mixed findings on significance levels both of which point out to negative impacts. This study presents crucial outcomes in that the impacts of REER and REER volatility on economic growth present diversified outcomes over the past decades in the OECD.

Keywords: Economic Growth, Exchange Rate, Fixed Effect, REER, Volatility, OECD.

OECD'DE GERÇEK EFEKTİF DÖVİZ KURU VE VOLATİLİTESİNİN EKONOMİK BÜYÜME ÜZERİNDEKİ ETKİSİ

ÖZET

Bu çalışma, 36 OECD ülkesinde reel efektif döviz kurunun (REDK) ve onun oynaklığının ekonomik büyüme üzerindeki etkisini 1996 ile 2020 yılları arasındaki dönem için panel veri ekonometri yöntemlerinden sabit etkiler (SE) ve tesadüfi etkiler (RE) tahmincilerinden faydalanarak incelemektedir. Ampirik analizde; Hausman test sonuçları, SE modelinin RE modeline kıyasla üstün olduğuna işaret ettiğinden SE modeli tahmin edilmiş ve bu modelde yatay-kesit bağımlılığı, değişen varyans ve otokorelasyonun varolduğu tespit edilmiştir. Driscoll-Kraay standard hataları türetilerek tahmin edilen dirençli SE model sonuçlarına göre, OECD ülkelerinde incelenen dönem boyunca, REDK'nin iktisadi büyümeyi istatistiksel olarak anlamlı ve negatif yönde etkilediği, REDK oynaklığının ise istatistiksel olarak anlamlı bir etkisinin olmadığı sonucuna ulaşılmıştır. Dirençli standard hatalarla elde edilen SE modeline ilişkin bulgular, iktisadi büyüme üzerinde; kamu tüketim harcamalarının anlamlı ve negatif, gayri safi brut sermaye oluşumunun ise anlamlı ve pozitif etkide bulunduğunu göstermektedir. Nüfus artışı ve ticaretin ekonomik aktivite üzerine etkisine rastlanmazken, enflasyona ilişkin sonuçlar ters yönlü etkiye işaret ederken istatistiksel anlamlılık bakımından birbirinden farklı sonuçlar göstermektedir. Bu çalışma ile elde edilen bulgular, OECD ülkelerinde son on yıllarda, REDK ve REDK oynaklığının iktisadi büyüme üzerindeki etkisinin birbirinden farklı olduğunu ortaya koyması bakımından önem taşımaktadır.

Anahtar Kelimeler: İktisadi Büyüme, Döviz Kuru, Sabit Etkiler, Volatilite, Oynaklık, Reel Efektif Döviz Kuru, OECD

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Samson Adewale DADA

DEDICATION

To the glory of God and in loving memory of the brave Turkish people who passed away in 2023 earthquake incidence and to my mother-in-law, Dr. Mrs. Oluwayemisi Oludoyi nee Adeniyi who passed away on March 21, 2021 during COVID-19 episode. May your gentle souls rest in perfect peace.

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ABBREVIATIONS LIST

ADF: Augumented Dickey-Fuller

AEER: Actual Effective Exchange Rate

AIC: Akaike Information Criterion

ARCH: Autoregressive Conditional Heretoroskedasticity

ARCH-LM: Autoregressive Conditional Heretoroskedasticity Langrage Model

BIC: Bayesian Information Criterion

DF: Degrees of Freedom

DGMM: Dynamic Sytem Generalized Method of Moments

ECU: European Currency Unit

EMS: European Monetary System

EGARCH: Exponential Generalized Autoregressive Conditional Heteroskedasticity

ERM: Exchange Rate Mechanism

ERT: Exchange Rate Targeting

FE: Fıxed Effect

GARCH: Generalized Autoregressive Conditional Heteroskedasticity

GATT: General Agreement on Tariffs and Trade

GC: Government Consumption

GCE: Gross Consumption Expenditure

GCF: Gross Capital Formation

GDP: Gross Domestic Product

GLS: Generalized Least Square Estimation Method

GMM: Generalized Method of Moments

GNI: Gross National Income

GNP: Gross National Product

Ha: Alternative Hypothesis

Ho: Null Hypothesis

HQC: Hannon-Quinn Information Criterion

IMF: International Monetary Fund

LBI: Lagrange Multiplier Breusch-Godfrey

LM: Lagrange Multiplier Test

LR Test: Likelihood Ratio Test

NEER: Nominal Effective Exchange Rate

OECD: Organisation for Economic Co-operation and Development

OLS: Ordinary Least Squares

PPP: Purchasing Power Parity

P-Value: Probability Value

QIC: Quasi-Likehood under the Independence Criterion

RE:Random Effect

RER: Real Exchange Rate

REER: Real Effective Exchange Rate

R&D: Research & Development

R-Sq: R-Squared

S. E.: Standard Errors

SIC: Schwarz Information Criterion

USA: United States of America

USD: United States Dollars

U.SA.: United States of America

WTO: World Trade Organization

CHAPTER 1

1. INTRODUCTION

Both the short- and long-term negative effects of a poorly managed real effective exchange rates policy on economic growth are widely acknowledged. Consequently, there has been a growing emphasis on investigating the relationship between the real effective exchange rate and its volatility in relation to economic growth, including both developing and developed economies. Prior to Solow (1957) and Rostow (1960), the primary emphasis of the first iteration of neoclassical growth models was not on real exchange rate volatility.

These models emphasized the determinants of savings and investment within the framework of a closed economy, with capital formation playing an essential role in economic growth (Abramowitz, 1995). Nonetheless, following the 1973 dissolution of the Bretton Woods agreement, which signaled the end of the fixed exchange rate system, many developing nations adopted a flexible exchange rate system. As a result, the exchange rates for various currencies became increasingly erratic, exposing merchants to heightened uncertainty regarding trade profitability and volume, thereby posing a threat to importers and exporters (McKenzie, 1999; Bahmani-Oskooee & Heggerty, 2007).

There are a variety of exchange rate administrations, such as currency boards and pegged exchange rate systems with or without a gold standard reference. In these administrations, governments determine the price of their currency and are prepared to defend it on the foreign exchange market by intervening during various business cycles, either by increasing or decreasing the supply of foreign currencies. The managed floating exchange rate system is characterized by minimal governmentintervention, whereas the floating exchange rate system is determined by

the interaction of international market forces. In a system with a fixed exchange rate, governments are required to maintain sufficient foreign currency reserves. When the central bank purchases currency, the money supply decreases, resulting in macroeconomic adjustments to income, interest rates, and pricing. In contrast, an increase in foreign currency supply increases the money supply, which has expansionary macroeconomic effects on income, interest rates, and prices (Appleyard, Filed, & Cobb, 2010).

Prior to World War I, the global economic landscape adhered to the gold standard, a system of fixed exchange rates wherein most currencies could be directly converted into gold at predetermined rates. Consequently, this setup maintained constant exchange rates between different currencies. However, it also meant that countries had limited control over their monetary policies, as the money supply was contingent on the flow of gold between nations. During the 1870s and 1880s, when gold production was minimal, the world's money supply expanded slowly, leading to deflation. Conversely, the gold discoveries in Alaska and South Africa in the 1890s triggered inflation, which persisted until the outbreak of World War I.

Following World War II, the victorious nations established a new fixed exchange rate system known as the Bretton Woods System in 1944, which endured until 1971. As a part of this agreement, the International Monetary Fund (IMF) was established in 1945 with 30 initial member countries, and it has since grown to include over 180 member nations. The IMF was entrusted with the responsibility of fostering global trade growth by setting regulations for maintaining fixed exchange rates and extending financial aid to countries facing balance of payment challenges.

Furthermore, the Bretton Woods accord also gave rise to the International Bank for Reconstruction and Development, commonly referred to as the World Bank. Additionally, the General Agreement on Tariffs and Trade (GATT) was established to oversee trade rules, including tariffs and quotas, between nations, eventually evolving into the World Trade Organization (WTO). The U.S. dollar assumed a dominant role as the world's reserve currency during this period, resulting in the widespread adoption of the dollar for international trade and reserves. The Bretton Woods system was ultimately abandoned in 1971. Subsequently, from 1979 to 1990, the European Union introduced its own fixed exchange rate system, known as the European Monetary System (EMS), among its member states. Under the exchange rate mechanism (ERM) of this system, currencies were expected to remain within narrow fluctuation limits. In

practice, all member countries in the EMS pegged their currencies to the German mark.

Between 2002 and 2008, the U.S. dollar experienced a consistent decline in value relative to other currencies, raising concerns among policymakers about the potential for a drastic crash. Such a crash could have had adverse impacts on both economic activity and inflation. However, a remarkable shift occurred when credit markets seized up in September and October 2008. Instead of continuing its depreciation, the U.S. dollar underwent a significant appreciation. This unexpected turn of events can be attributed to a "flight to quality" phenomenon. Investors, seeking safety, not only increased their investments in U.S. Treasury securities but also desired to hold more U.S. Dollars, thereby driving up the value of the dollar. This surge in the dollar's value had a dual effect—it made imported goods, from flat-screen televisions to wines, more affordable for U.S. consumers and made traveling abroad more economical. While this was a positive development for the U.S. dollar, it often had adverse consequences for other currencies. Many countries in Latin America and Eastern Europe saw their currencies experience a free fall in value. Responding to this situation, the International Monetary Fund (IMF) took action and established a new lending facility to provide loans to distressed countries with fewer conditions attached than its previous lending programs. The IMF, which had initially seemed somewhat peripheral during the spread of the subprime financial crisis worldwide, now assumed a more central and proactive role. The subprime crisis served as a stark reminder that events in the United States can have far-reaching global repercussions. It highlighted the crucial role of international financial institutions like the IMF in responding to ensure the continued smooth operation of the international financial system. Nonetheless, the supremacy of the U.S. dollar faced challenges from the European Monetary System (EMS) and the growing influence of the Chinese Yuan in global trade. (Mishkin, 2009).

The organizational structure of this thesis is as follows: the Chapter provides a brief introduction. In Chapter 2, delve into the theoretical underpinnings of the thesis, where we scrutinize the relationship between the real effective exchange rate, its volatility, and economic growth in OECD economies. This chapter offers an extensive examination of exchange rate markets, both in the short run and the long run, and delves into the Price Level Approach to analyze these markets. It also discusses the significance of concepts such as Purchasing Power Parity, the Monetary Approach, and introduces terms like ERT and ER overshooting. Furthermore, we explore how these concepts impact long-term economic growth among OECD countries.

Chapter 2 explained the theoretical background of exchange rates, the fundamentals of the foreign exchange markets, and the exchange rate demand and supply in short run and in the long run, the models of foreign exchnage markets which includes the price level approach to real exchange rate and monetary approach to real exchange rate and how all these concepts relates to economic growth.

Chapter 3 explained the nexus between the exchnage rate, volatility and economic growth in the OECD, the various exchnage rate regimes in selected OECD economies and the interpay of the real effective exchnage rate, REER volatility and major macroeconomic variables as it relates to economic growth.

Chapter 4 serves as the methodological framework, wherein we comprehensively discuss and elucidate various econometric concepts, providing the necessary rationale for the inclusiion of the Driscoll-Kraay Estimation in the orrection of the cross-sectional dependencies in the models; and summarizes the empirical analysis. In this phase, we employ both the Fixed Effects (FE) and Random Effects (RE) approaches to account for heteroscedasticity, autocorrelation, and cross-sectional dependence. This thesis endeavors to investigate the influence of the real effective exchange rate and its volatility on real economic growth in OECD countries from 1996 to 2020. The Driscoll-Kraay estimation techniques was used in correcting for the presence of the cross-sectional dependencies in the models.

Lastly, Chapter 5 presents our conclusions, summarizing the key findings and insights derived from our research.

CHAPTER 2

2. EXCHANGE RATE: THEROETICAL BACKGROUND

2.1 Definition of Terms and Conceptual Considerations

The exchange rate (ER) indicates the value of one country's currency relative to that of another. It can either be expressed as the amount of foreign currency per unit of domestic currency or the amount of domestic currency per unit of foreign currency. The RER, on the other hand, takes into account the relative prices of a standard selection of products and services in two countries. When a nation's currency experiences an appreciation, meaning it increases in value compared to other currencies, the result is that the country's exports become pricier for foreign buyers, while imports become more affordable for domestic consumers, assuming that domestic prices in both countries remain constant. Conversely, in the case of currency depreciation, a nation's exports become more competitively priced for foreign markets, while imported goods become relatively costlier for domestic consumers. (Mishkin, 2009). This adjustment facilitates the determination of the purchasing power parity (PPP) of one country's currency relative to another. In essence, it provides an estimate of the relative cost of a basket of products and services in one country relative to another, taking ER differences into consideration (Begg, Fischer, & Dornbusch, 2008; Ibrahim & Jimoh, 2012).

The NEER is an index that reflects the average value of a nation's currency. It considers the ER of the currency against a basket of currencies. The REER adjusts the NEER for differences in inflation between countries. The REER provides a more comprehensive measurement of a country's ER by incorporating the prices of products and services in a basket of countries with which a country engages in trade. The REER

is determined by allocating weights to each trading partner based on their relative importance to the nation's total commerce. This weighted average provides insight into macroeconomic analysis and policymaking in a country. However, it is crucial to recognize the limitations of the REER and to employ it in conjunction with other competitiveness indicators and ER analysis. It should not be used as the sole indicator of a nation's ER competitiveness. Rather, the REER should be viewed as one of several indicators used to evaluate the trade competitiveness and economic performance of a nation (Aghion & Howitt, 2009; Jones & Kenen, 1990).

According to another definition, the volatility of the REER refers to the fluctuations in the value of a currency relative to a basket of other currencies, adjusted for inflation. REER volatility is a measure of the degree of instability in a country's currency ER, and it is frequently employed to evaluate the impact of ER fluctuations on trade and investment (Jones & Kenen, 1990).

The ER is the nominal value of one currency relative to another. The RER is a measure of a currency's purchasing power parity adjusted for price differences between two countries, whereas the REER is a measure of a currency's ER adjusted for both price differences and the relative importance of different trading partners. (Lius, 2022). While the AEER has numerous advantages, there are also a number of crucial factors to consider. One of the primary criticisms of the REER is its inability to precisely capture the effects of ER fluctuations on a nation's trade competitiveness. The real effective exchange rate takes into account only the prices of a basket of products and services in a country's main trading partners, which may not provide a complete picture of a country's trade patterns and competitiveness. For instance, if a country has a large trade volume with a non-traded goods sector, the AEER may not accurately reflect the impact on that sector (Matteo & Alessandro, 2010).

The AEER is also criticized for its calculation methodology. Typically, the weights used to calculate the AEER are derived from a single year's worth of trade data, which may not accurately reflect the current condition of a country's trade patterns. In addition, the selection of the bundle of products and services used to calculate the REER is susceptible to interpretation and bias. Insensitive to the effects of ER fluctuations on inflation, the actual effective exchange rate is also criticized. The REER only takes into consideration differences in inflation between a country and its trading partners, but does not account for the impact of exchange rate fluctuations on domestic prices. This can lead to an overestimation or underestimation of a

country's competitiveness and to inappropriate policy recommendations (Matteo & Alessandro, 2010).

Aghion, Bacchetta, Ranciere, and Rogoff (2009). conducted a thorough exploration of the link between ER volatility and productivity growth, with a special emphasis on the role of financial development. Utilizing advanced GMM dynamic techniques, the researchers moved beyond a narrow focus on ER volatility alone. They advocated for a more holistic approach, one that considers the intricate interplay among ER volatility, the extent of financial development, and the characteristics of macroeconomic shocks. The study's central hypothesis postulated that heightened levels of excessive ER volatility might impede economic growth, particularly in countries marked by constrained capital markets and where financial shocks constitute the primary driver of macroeconomic instability. Through a meticulous analysis of cross-country panel data, the investigation provided robust support for this hypothesis. Consequently, the research underscored the critical role of financial development in shaping the connection between the choice of ER regime and the trajectory of long-term economic growth Aghion, Bacchetta, Ranciere, and Rogoff (2009)

2.2 The Foreign Exchange Markets

The foreign exchange market facilitates the exchange of currencies and bank deposits denominated in various currencies. Transactions within this market play a pivotal role in establishing currency ERs, thereby influencing the pricing dynamics of international commodities and financial services. There exist two distinct categories of ER transactions in the international financial landscape. The primary category, known as "spot transactions," revolves around the immediate exchange of bank deposits, typically occurring within a two-day timeframe. The ER applicable to such spot transactions is referred to as the "spot exchange rate." In contrast, the second category, termed "forward transactions," involves the ER of bank deposits at a predetermined future date, commonly one, three, six, or twelve months from the present. These forward transactions involve a predetermined ER established today, with the actual transfer of funds taking place in the future, serving as a hedge against potential fluctuations in foreign ERs. Most participants engaged in international trade, including importers and exporters, frequently opt for forward transactions as a risk management strategy to safeguard themselves against the volatility of ERs. When a

currency appreciates, it experiences an increase in value, whereas a depreciation implies a decline in value, resulting in fewer foreign currency units being exchanged for it. These fluctuations in currency value have significant consequences. For instance, when a country's currency appreciates concerning other currencies, its exports become relatively more expensive to foreign buyers, while imports into that country become comparatively cheaper, assuming that domestic prices remain constant in both countries. Conversely, when a country's currency undergoes depreciation, its exports become more competitively priced abroad, while foreign goods within its borders become relatively more expensive. This dynamic has far-reaching effects; a depreciating currency can provide a boon to domestic manufacturers looking to expand their overseas market share, yet it can adversely affect domestic consumers by increasing the cost of foreign-produced goods. An illustrative example of this phenomenon is the period between 2002 and 2008 when the U.S. dollar depreciated. During this time, American industries experienced increased export opportunities due to their more competitive pricing in foreign markets. However, this depreciation also had repercussions on American consumers, as foreign goods became more expensive in the domestic market. (Mishkin, 2009).

2.3 The Exchange Rate in the Short Run: A Supply and Demand Analysis

To comprehend the short-term behavior of exchange rates, it is essential to acknowledge that an ER represents the valuation of domestic assets, such as bank deposits, bonds, equities, and similar financial instruments denominated in the domestic currency, relative to foreign assets denominated in foreign currencies. Historically, approaches to ER determination grounded in supply and demand have emphasized the significance of import and export demand. In contrast, contemporary asset market approaches place greater emphasis on the accumulation of assets as opposed to the flow of exports and imports during short timeframes. This shift in perspective is due to the observation that export and import transactions constitute a relatively small fraction when compared to the overall volume of domestic and foreign assets available at any given point in time. Consequently, over short periods, decisions concerning the acquisition and retention of domestic and foreign assets exert a more pronounced influence on ER determination than the demand for exports and imports. (Krugman and Obstfeld, 2009). The demand curve delineates the quantity demanded

at various prevailing exchange rates while keeping all other factors constant, particularly the anticipated future value of the exchange rate. In Figure 2.1, where the current ER stands at (E_2) and the future expected value of the ER remains stable at E_{t+1}^e, a reduced ER value, such as E*, suggests a greater likelihood of the dollar appreciating in value. A more substantial expected rise in the dollar's value corresponds to a heightened relative expected return on dollar-denominated (domestic) assets. İn figure 2.2 below, An upward adjustment in the domestic interest rate, denoted as i^D induces a rightward shift in the demand curve for domestic assets, hereafter referred to as 'D,' resulting in an appreciation of the domestic currency (E_2). Conversely, should i^D decrease, leading to a decline in the relative expected return on dollar-denominated assets, it triggers a leftward shift in the demand curve, causing the ER to decrease. A reduction in the domestic interest rate i^D shifts the demand curve for domestic assets, 'D,' to the left, ultimately leading to a depreciation of the domestic currency (E_1). In Figure 2.3, when there is an upward movement in the foreign interest rate denoted as i^F this results in a leftward shift of the demand curve 'D.' This shift has the effect of causing the domestic currency to undergo depreciation, essentially diminishing its value. Conversely, a decrease in the foreign interest rate i^F leads to a rightward shift in the demand curve 'D,' thereby prompting an appreciation of the domestic currency, implying an increase in its value. Transitioning to Figure 2.4, an increase in the expected future ER denoted as E_{t+1}^e triggers a rightward shift of the demand curve, contributing to the appreciation of the domestic currency. This shift reflects the anticipation of a stronger future exchange rate, bolstering the attractiveness of the domestic currency. Conversely, a decrease in the expected future ER E_{t+1}^e results in a leftward shift of the demand curve, consequently causing a depreciation of the domestic currency as it is expected to weaken in the future. This phenomenon signifies a decrease in the currency's perceived value, affecting its ER accordingly. (Mishkin, 2009).

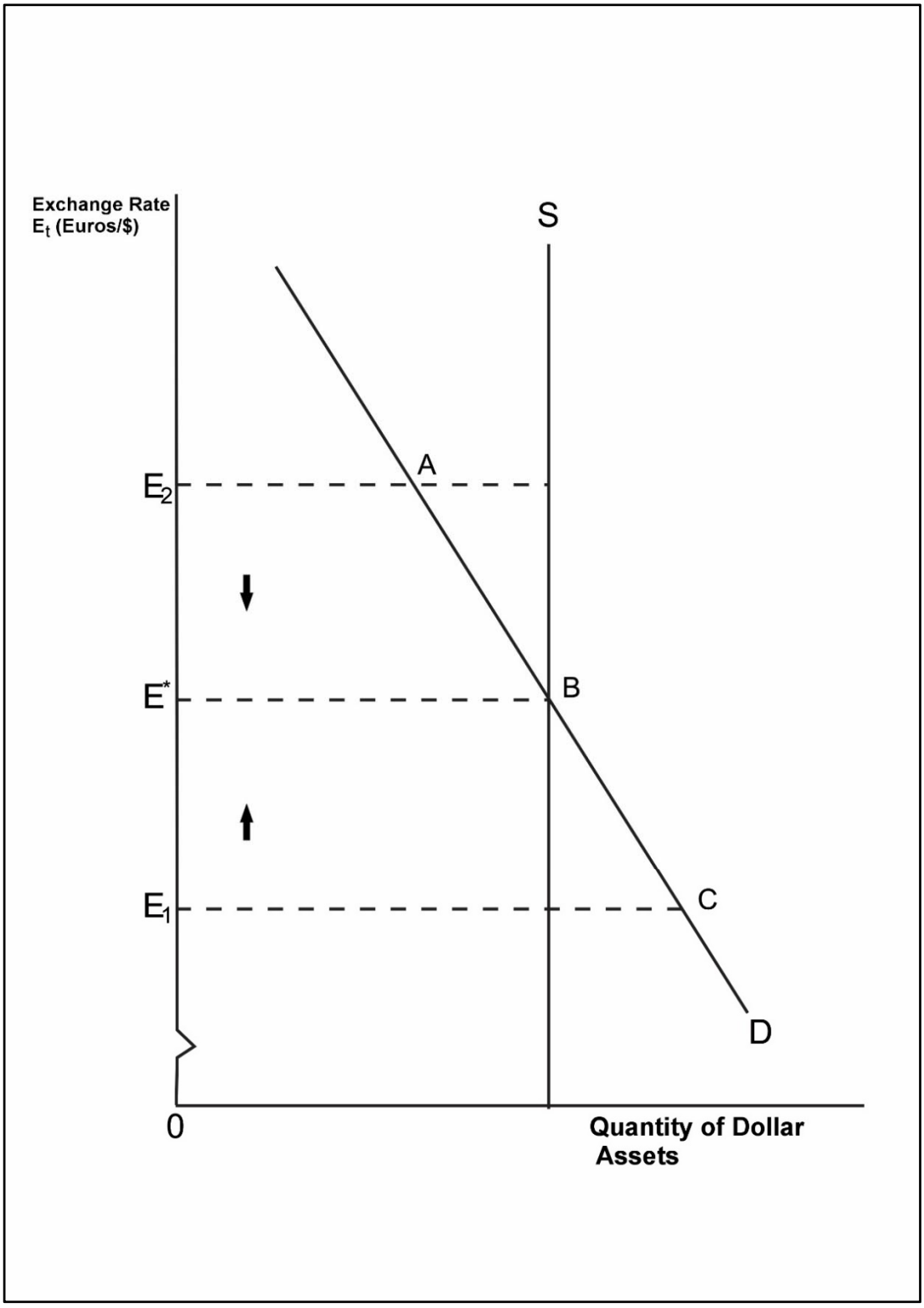

Figure 2.1 The Equilibrium in the Foreign Exchange Market (Mishkin, 2009).

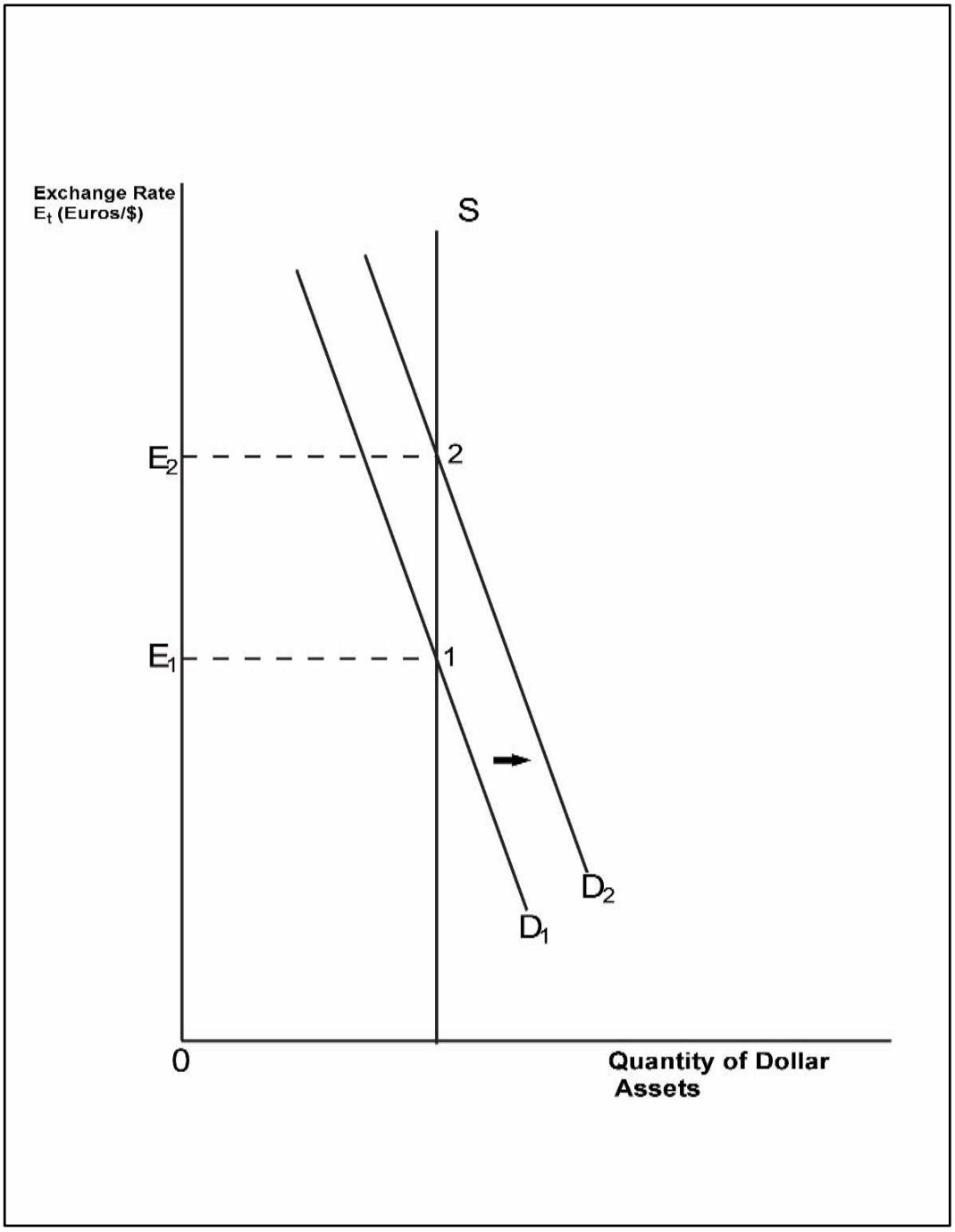

Figure 2.2 Response to an Increase in the Domestic Interest Rate $\boldsymbol{i^D}$ (Mishkin, 2009).

Figure 2.2 elucidates the dynamics in response to a rise in the domestic interest rate i^D. As the domestic interest rate experiences an increase, there is a concurrent uptick in assets, resulting in a rightward shift of the demand curve. This shift culminates in an upward movement of the equilibrium ER from E_1 to E_2 (Mishkin, 2009).

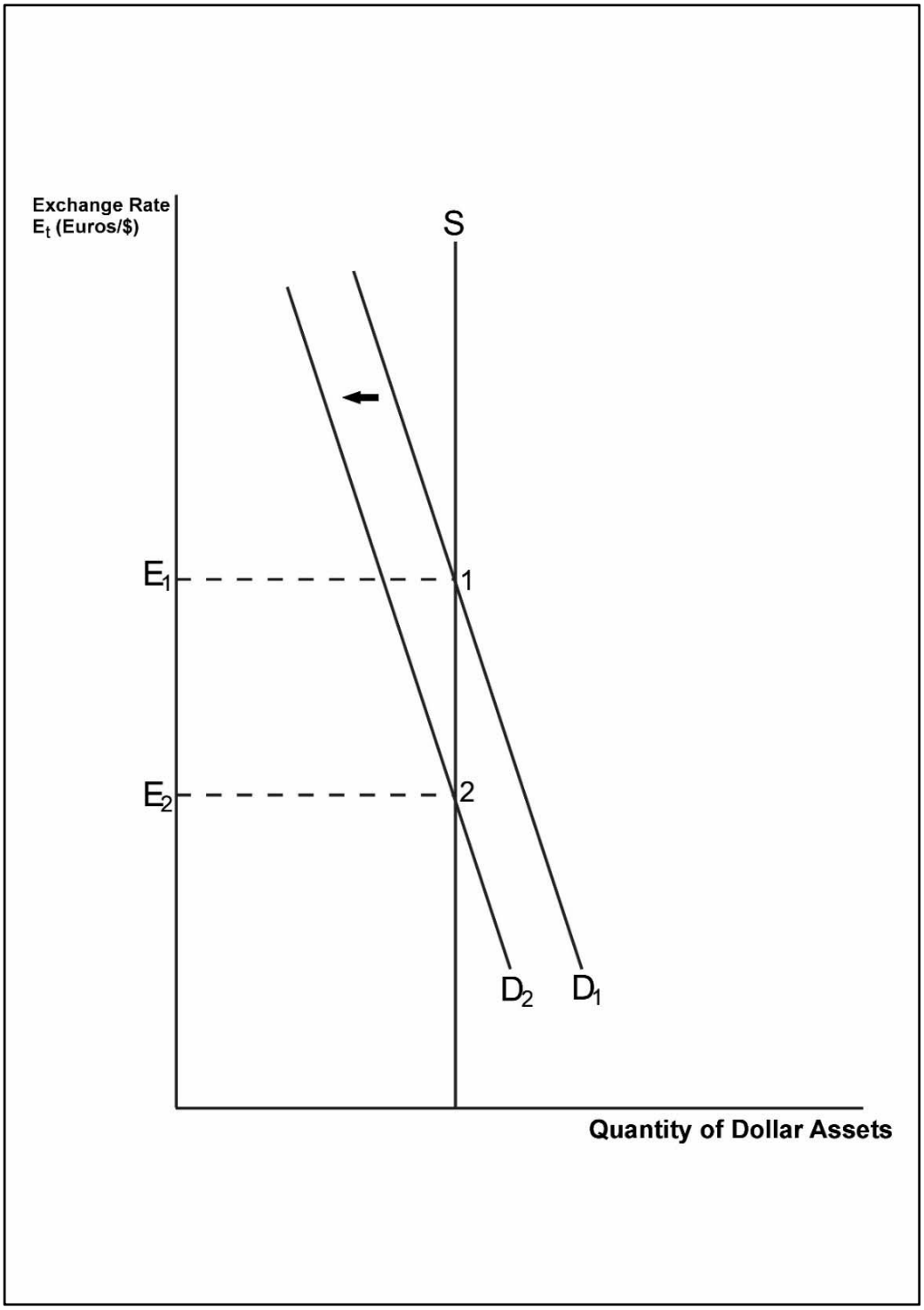

Figure 2.3 Response to an Increase in the foreign interest rate, i^f (Mishkin, 2009).

When the foreign interest rate, denoted as i^f, experiences an increase, there is a decrease in the relative expected return on domestic (dollar) assets, leading to a leftward shift of the domestic (dollar) curve. This shift results in a decline in the equilibrium rate, moving from E_1 to E_2. (Mishkin, 2009).

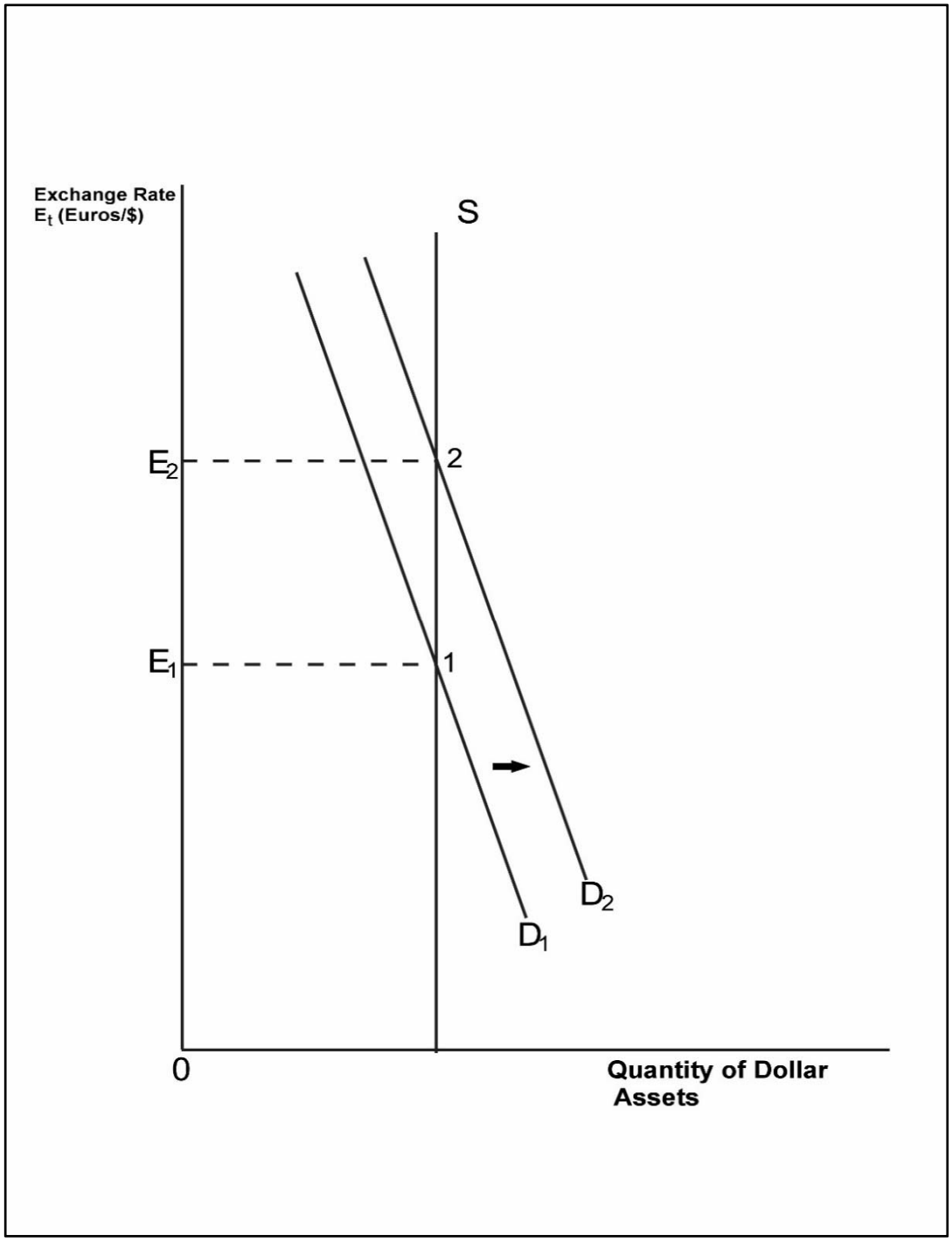

Figure 2.4 Response to an Increase in the Expected Future Exchange Rate, E^e_{t+1}(Mishkin, 2009).

When the anticipated future ER shows an increase, it leads to an escalation in the relative expected return on domestic dollar assets, consequently causing a rightward shift in the demand curve. As a result of this shift, the equilibrium rate ascends from E_1 to E_2. (Mishkin, 2009).

2.4 The Exchange Rate in the Long Run

In the long run, exchange rates are influenced by four fundamental factors, namely relative price levels, trade barriers, consumer preferences for domestic versus foreign products, and the level of productivity within a nation. These factors collectively shape the dynamics of ER movements. When any of these factors alter the demand for domestic goods in relation to foreign goods, it has a direct impact on the valuation of the domestic currency. If a particular factor enhances the appeal of domestic goods in comparison to foreign alternatives, it results in an appreciation of the domestic currency. Conversely, when a factor diminishes the relative desirability of domestic goods, it leads to a depreciation of the domestic currency. First and foremost, adhering to the principles of the Purchasing Power Parity (PPP) theory, a country experiences an ER adjustment when the prices of its goods rise (assuming constant prices of foreign goods). This is driven by the rationale that as the prices of a nation's goods increase, the demand for those goods diminishes, necessitating a currency depreciation to maintain their competitiveness in international markets. In the long-term perspective, an increase in a country's price level relative to the foreign price level results in a corresponding depreciation of its currency. Conversely, a decline in the country's relative price level causes its currency to appreciate as it becomes more attractive to international consumers. These factors, operating in tandem, play a pivotal role in shaping the intricate world of ER dynamics, influencing the economic fortunes of nations on the global stage. Secondly, trade barriers, including tariffs (taxes imposed on imported goods) and quotas (restrictions on the quantity of foreign goods allowed for import), exert a significant influence on exchange rates. The escalation of trade barriers has a noteworthy impact on a country's currency valuation over the long term, leading to currency appreciation. Thirdly, the preferences for domestic versus foreign goods hold considerable sway over long-term ER dynamics. An upsurge in demand for a country's exports results in a gradual appreciation of its currency.

Conversely, a surge in demand for imported goods exerts downward pressure on the domestic currency, leading to depreciation. These multifaceted factors underscore the intricate interplay of economic forces that ultimately determine ER movements, shaping the international economic landscape. Fourthly, an increase in a country's productivity tends to be concentrated in its domestic sectors involved in the production

of traded goods rather than nontraded goods. This heightened productivity translates into a reduction in the prices of domestically manufactured traded goods compared to foreign equivalents. Consequently, the demand for these traded goods surges, leading to an appreciation of the domestic currency. Conversely, when a country's productivity lag behind of that of other nations, its traded goods become relatively more costly, causing its currency to depreciate. Over the long term, as a country enhances its productivity relative to others, its currency tends to appreciate. In summary, it's worth noting that certain circumstances, such as the size of a country, can render changes in productivity or shifts in preferences between domestic and foreign goods inconsequential in terms of their impact on the relative prices of these goods compared to foreign alternatives. In such instances, while changes in productivity or consumer preferences may influence a country's income, they might not necessarily exert a discernible effect on the value of its currency. (Mishkin, 2009).

2.5 The Model of Foreign Exchange Rate Markets.

Using prior research conducted by Krugman (2008), this thesis provides the following summary of the foreign ER model. The model postulates that, in a state of equilibrium, all deposits in various currencies offer the same expected rate of return, also known as interest parity. According to the principle of interest parity, deposits in all currencies are regarded as equally desirable assets, eliminating the possibility of arbitrage on the foreign exchange market.

Mathematically, the equation can be written as follows.

$$R_{\$} = R_{\text{foreign currency}} + \frac{E^{e}_{\frac{\$}{\text{foreign currency}}} - E_{\frac{\$}{\text{foreign currency}}}}{E_{\frac{\$}{\text{foreign currency}}}}$$

Where R denotes the rate of return on dollar and E denote the expected return, respectively. Using the request (rate of return) on remote cash named store and the request of (rate of return) on dollar designated stores. When the interest parity is not held, one has the following expression:

$$R_{\$} > R_{foreign\ currency} + \frac{E^{e}_{\frac{\$}{foreign\ currency}} - E_{\frac{\$}{foreign\ currency}}}{E_{\frac{\$}{foreign\ currency}}}.$$

It results in the following: Firstly, the lack of investor interest in holding pound deposits would result in a decrease in the demand and prices of pounds. Conversely,

all investors would exhibit a preference for holding dollar deposits, leading to an increase in the demand and prices of dollars. Secondly, when the domestic currency depreciates, the initial cost of investing in foreign currency deposits rises, causing a reduction in the expected rate of return on such deposits. Thirdly, when the domestic currency appreciates, the initial costs associated with investing in foreign currency deposits decrease, thereby elevating the expected rate of return on such investments.

2.6 Price Levels Approach to Real Exchange Rate

There are two main approaches to the REER, specifically the Law of One Price, together with the Monetary Approach. This area presents a brief outline of each of these strategies.

2.6.1 The Law of One Price

Upholds the notion that identical products traded in separate competitive markets (across varying nations) should command an identical price, assuming that the impact of transportation and trade barriers between these markets is negligible.

$$E_{\frac{US\$}{\text{foreign currency}}} = \frac{US\ Dollar}{foreign\ currency}$$

Where EUS$/foreign currency signify E(US$/foreign currency) speaks to the trade rate between the US dollar and the foreign currency. It indicates how many US dollars are required to one foreign currency. Mathematically, the law of one price can be expressed between (between what?) the US Dollar and the foreign currency, as it ensures that buyers have the same purchasing power across the two markets, based on its fundamental assumption of prices homogeneity (Krugman, 2008).

2.6.2 Purchasing Power Parity (PPP)

PPP involves expanding the standards of the law of one price to include all merchandise and administrations, or collections of products and administrations, over distinctive nations.

e.g., $P_{U.S}$= ($E_{U.\frac{S\$}{Foreign\ currency}}$) * ($P_{foreign\ country}$)

$$E_{U.\frac{S\$}{foreign\ currency}} = \frac{P_{U.S}}{P_{Country}},$$

Where $P_{U.S}$= the level of average prices in the U.S; and ($P_{foreign\ country}$) = the

level of average prices in foreign currency. The aforementioned equations explain that the ER is calculated by the average costs of a basket of products and services, and they predict that all countries' currencies will have the same purchasing power.

PPP exists in two distinct forms, known as absolute PPP and relative PPP. The former refers to exchange rates that equate the relative average prices among countries. It can be mathematically expressed as follows:

$$E_{\frac{\$}{\text{foreign currency}}} = \frac{P_{U.S}}{P_{\text{foreign country}}}$$

Where $E_{US\$/£}$ denote the conversion rate between the US dollar (USD) along with the foreign currency. It demonstrates how numerous US dollars are required to buy one foreign currency and Discharge speaks to the fetched level within the United States. It reflects the normal level of costs for products and comforts within the US economy and P(foreign currency) speaks to the fetched level within the United Kingdom. It speaks to the normal level of costs for merchandise and administrations within the UK economy, individually.

And relative PPP alludes to the changes in trade rates rise to the alter in costs (relative to swelling rate) between two nations and numerically, it can be communicated as takes after $\frac{(E_{\frac{\$}{£},t} - E_{\frac{\$}{£},t-1})}{E_{\frac{\$}{£},t-1}} = \Pi_{u.s,t} - \Pi_{Foreign\ country,t}$

Π_t=inflation rate from period t-1 to t.

In spite of its centrality, the PPP is subject to a few inadequacies (Krugman, 2008). To begin with, supreme acquiring control equality has small observational bolster since the costs of indistinguishable bushel of items and administrations when changed over to a single money, contrasts over nations. Whereas the Relative PPP appears more consistency with information but less effective in foreseeing the trade rates. As a matter of fact, the law of one cost may not hold since of advertise defects, the contrasts within the degree of normal costs for wicker container of products and administrations and the exchange boundaries and non-tradable segments.

2.7 Monetary Approach to Real Exchange Rates

Due to the limitations of PPP, economists have attempted to refine the theory by generalizing the monetary approach to PPP. The RER is a more comprehensive method for analyzing the exchange rate, and monetary and real factors influence

nominal exchange rates for the following reasons (Krugman, 2008):

i. The increase in monetary levels lead to temporary inflations and inflation expectation changes.
ii. The monetary growth rates expansion led to persistent inflation and changes in expectations about inflations.
iii. The increase in relative demand of domestic goods and services leads to a real appreciation.
iv. The real depreciation was caused by the increase in the relative supply of domestic products and services

PPP determines nominal exchange rates when economic changes are caused only by monetary factors and when the PPP assumptions hold.

In summary, the monetary approach to RER uses the supply and demand of real monetary assets and the PPP, changes in the money supply growth rate influences the inflation and exchange rates, the inflation expectations influence the exchange rate, the real interest rates are inflation-adjusted rates, and explains how much the purchasing power savers profits and borrowers lose; and the real interest rate parity explains that the differences in real interest rates between two countries equal expected changes in the real value of products.

2.8 Exchange Rate Targeting

There are various monetary policy strategies aimed at promoting price stability, including monetary targeting, inflation targeting, and monetary policy anchored to maintain price stability. One of these strategies is Exchange Rate Targeting (ERT), also known as an ER peg. Targeting the ER has a rich historical context. It can involve pegging the value of the domestic currency to a tangible asset like gold or, more recently, fixing the domestic currency's value to that of a larger, low-inflation country, such as the United States. An alternative approach is the crawling target or peg, where a currency is allowed to depreciate steadily, potentially permitting a higher inflation rate in the pegging country compared to the anchor country. ERT boasts several advantages. The nominal anchor provided by ERT directly contributes to maintaining control over inflation by linking the inflation rate for internationally traded goods to that of the anchor country. Additionally, ERT offers an automatic rule for the execution of monetary policy, helping to address the issue of time-inconsistency in

monetary policy. Nonetheless, despite its inherent merits, ERT faces substantial criticisms. Capital mobility limits the targeting country's ability to pursue an independent monetary policy to respond to domestic shocks that are distinct from those experienced by the anchor country. Furthermore, ERT exposes countries to speculative attacks on their currencies. For instance, following German reunification, there was an FX crisis in September 1992. The tight monetary policy in Germany post-reunification led to a negative demand shock in the countries participating in the Exchange Rate Mechanism (ERM), resulting in decreased economic growth and increased unemployment. (Mishkin, 2009).

2.9 Exchange Rate Overshooting

The concept of "exchange rate overshooting" elucidates that when the money supply increases, exchange rates tend to experience a more pronounced decline in the short term compared to the long term. Additionally, in the long run, a balance in the foreign exchange market necessitates that the expected return on foreign deposits must decrease. Given a fixed foreign interest rate, this diminished expected return on foreign deposits indicates that there must be an anticipated appreciation of the domestic currency (or depreciation of the foreign currency) when domestic interest rates decrease. This scenario can only materialize if the current ER falls below its equilibrium value over the long term. Illustrated in Figure 5, an augmentation in the money supply triggers an increase in the domestic price level, subsequently leading to a lowered expectation for future exchange rates. Simultaneously, the augmented money supply exerts downward pressure on domestic interest rates. The combined effects of reduced expected currency appreciation and lower domestic interest rates shift the demand curve to the left, transitioning from D1 to D2 in the short term. Consequently, in the short run, the equilibrium ER declines from E1 to E2. In the long run, however, interest rates are inclined to return to their original levels, and the demand curve shifts in the opposite direction, moving rightward to D3. As a result, the ER appreciates from E2 to E3 over the long term**.** (Mishkin, 2009).

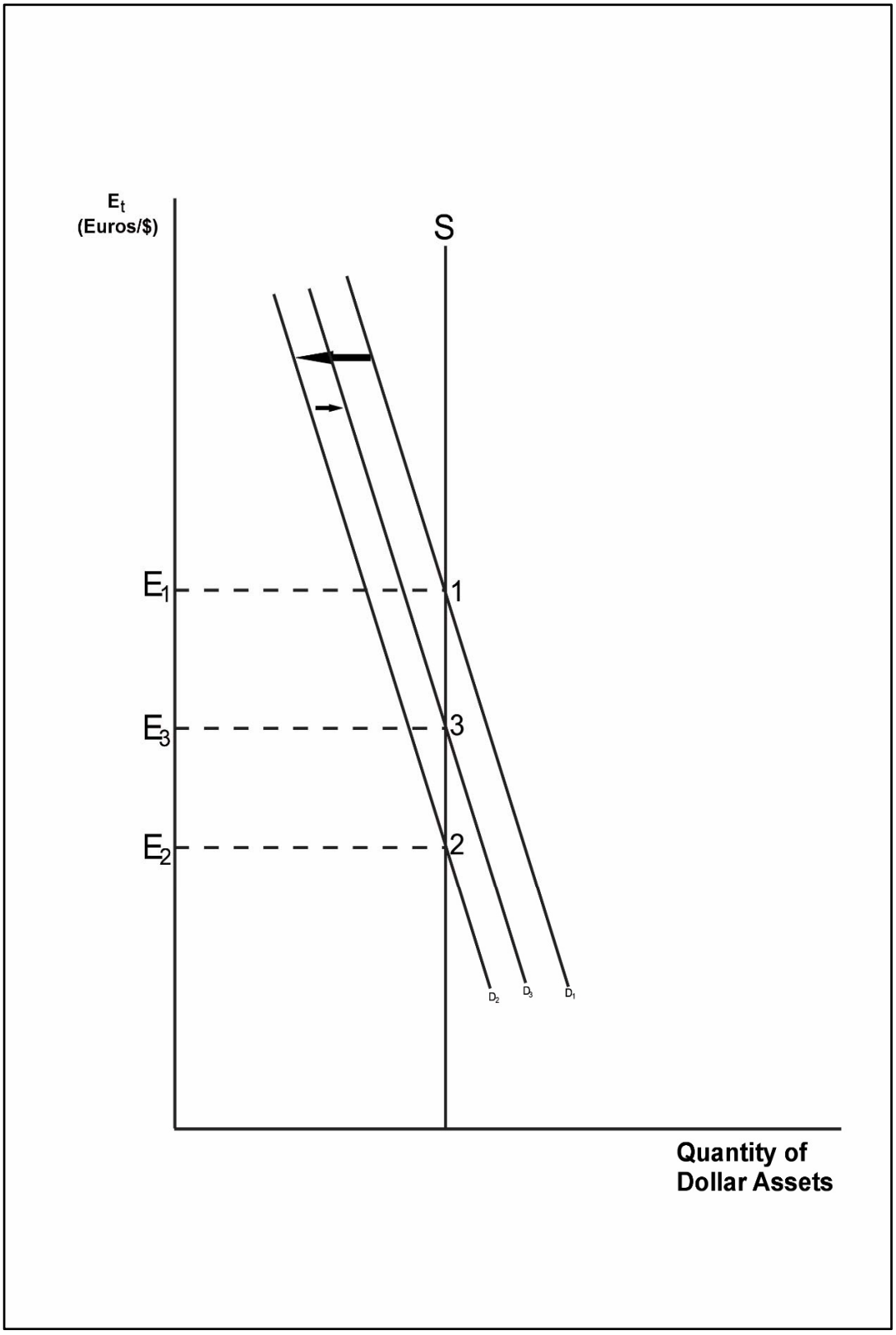

Figure 2.5 Effects of a Rise in Money Supply (Mishkin, 2009).

2.10 Theoretical construction of Real Effective Exchange Rate (REER) and Its Volatility

REER can be defined mathematically as follows, (Viera, Holland, Gomes de Silva & Bottecchia, 2013):

$$REER_{it} = \frac{P_{it}}{\left(\frac{S_{it}}{S_{io}}\right)\sum_{k=1} n\left\{\frac{P^*_{kt}}{S_{kt}}\middle|\frac{P^*_{ko}}{S_{ko}}\right\}^{w_k}}$$

Where the definition of the variables can be defined as: S_{it}= The nominal ER of country i in time t explained as a unit of U.S dollar relative to the domestic currencies; S_{kt}= This is the nominal ER of the trade partner k of country i in time t. w_k= weights attached to foreign currency country k in the index based on respective shares of bilateral trade. P_{it}= This can be the customer cost list of the exchange accomplice k of nation i in time t. N = The number of countries in the index.

The (REER) real effective exchange rate is defined as the valuation of a specific home country's currency relative to the weighted average of its major trade partners' currencies, divided by a price deflator or cost index. This measure serves to assess multilateral competitiveness and is consistently included in the IMF Penn World Tables (Eichengreen, 2008). Moreover, it can also be utilized as a straightforward bilateral measure of the RER in relation to the U.S. dollar, examined through the analysis of wholesale price indices (Eichengreen, 2008).

$$In_{RER_{WPI}} = \text{In}\left(\frac{E * PPI_{US}}{WPI}\right)$$

Let E speak to the ostensible trade rate of the domestic nation against the U.S. dollar, measured in units of domestic cash per dollar. PPI (US) signifies the maker cost list within the United States, whereas WPI alludes to the domestic country's discount cost list sourced from the IMF Universal Budgetary Measurements.

Thirdly, one can approach the RER as a relative cost, the cost of tradable products in terms of non-tradable products and can be communicated as takes after (Eichengreen, 2008; Jones and Kenen, 1990):

$$\text{REER} = \frac{P_T}{P_N}$$

Where PT speaks to the cost of tradeable merchandise and PN indicates the cost of non-tradeable merchandise (Eichengreen, 2008). An increment within the REER leads to a relative increment within the benefit of the tradable division, coming about in its extension at the cost of the non-tradable segment. From the viewpoint of a little

economy, where the worldwide cost of exchanged merchandise (P_T) remains steady, it can be normalized to solidarity. This normalization permits the real exchange rate (R) to be communicated as the ostensible trade rate in connection to the cost of non-tradables (Eichengreen, 2008).

$$R=\frac{P_N}{e}$$

2.11 The Impact of Real Effective Exchange Rate on Real Economic Growth

The events surrounding the Great Recession have raised significant uncertainty regarding the conventional sources of macroeconomic instability. (Dario, Paccagnini, & Pierluigi, 2016). But in economies with noteworthy, it is broadly recognized that the costs of non-traded items tend to change more gradually than the trade rate. Changes in money related arrangement and other stuns that proliferate through monetary markets can contribute to the instability of both the ostensible and REER. As a result, adjustments are made to inflation responses and prices of non-traded products within an economy. It is crucial to recognize that maintaining a specific exchange rate based on long-term fundamentals cannot be accomplished solely through monetary policy (Dornbusch, 1976; Bernanke, Boivin, & Eliasz, 2005; Kai-Cheng, 2020).

According to Keynes, arrangements influencing the REER within the middle of the road term can have a considerable impact on real economic growth. Unexpected alterations in financial arrangement pose can lead to instability within the REER, which can have a negative affect on venture, exchange, and financial development. Financial approach can too have enduring impacts on genuine financial development. In occurrences where the trade rate is pegged or entirely overseen, an increment in open use through financial extension comes about in cost increments for both exchanged and non-traded products (Dornbusch, 1976; Ayobami, Ogunmuyiwa and Salisu, 2022). This may result in an overvaluation of the RER, which has negative impacts on exchange competitiveness, venture, and financial development, as well as the assignment of beneficial assets to non-traded items. Alternately, contractionary financial arrangement coupled with a competitive REER and export-led development can be successful (Dornbusch, 1976; Beetsma, Bovenberg, and Giuliodori, 2008).

2.12 The Impact of Real Effective Exchange Rate Volatility on Real Economic Growth

The establishment for examining the relationship between oil cost vacillations and trade rates was laid by (Golub, 1993; Krugman, 2018). They propose that instability transmission happens since oil is exchanged in United States Dollars (USD), driving to spillover impacts on trade rate instability and, along these lines, financial development.

Instability has negative suggestions for exchange and speculation competitiveness, both of which are fundamental for financial development. The thought of minimizing trade rate instability holds significance, and the wrangle about over the need of an trade rate procedure for development remains among financial specialists. The affect of genuine viable REER instability on budgetary steadiness and development depends on the nearness or nonattendance of supporting markets and the profundity and improvement of the monetary segment Aghion, Bacchetta, Ranciere, and Rogoff (2009). Besides, REER instability disheartens exchange and venture, which are basic for financial development (Eichengreen, 2008).

The changes within the genuine viable REER can essentially influence an economy by impacting the competitiveness of sends out, the fetched of imports, and the venture climate. High REER instability can lead to an erratic trade rate, discouraging outside venture and complicating firms' universal exchange arranging (Sercu and Uppah, 2003). Additionally, increased instability within the REER can contribute to higher expansion levels, affecting the costs of imported products and administrations. This, in turn, may lead to expanded shopper costs and diminished acquiring control, eventually influencing financial development contrarily. On the other hand, lower levels of REER instability can make a more steady financial environment, which can be useful for genuine financial development (Edmonds and So, 2004; Aghion and Howitt, 2009). According to classical literature, there exists a proposition that posits a positive correlation between the extent of volatility exhibited by real shocks compared to financial shocks within a nation and the corresponding level of its exchange rate. Research examining the influence of exchange rate volatility on both productivity growth and financial development takes into consideration the phenomenon of augmented effects of financial market shocks within developing nations characterized by underdeveloped credit markets. This circumstance

underscores the necessity for comprehensive structural models in elucidating the intricacies of these trade-offs. Aghion, Bacchetta, Ranciere, and Rogoff (2009).

CHAPTER 3

3. THE NEXUS BETWEEN EXCHANGE RATE, VOLATILITY, AND ECONOMIC GROWTH IN THE OECD

3.1 Exchange Rate and Its Volatility in the OECD

In this segment, we are going deliver an diagram of the REER and its instability inside the OECD. To realize this, it starts by outfitting points of interest almost the OECD and its center regions. The accentuation will at that point move to looking at the relationship between trade rates, their instability, and financial development in this cluster of countries. Furthermore, the segment will investigate the interconnecting of different macroeconomic pointers and financial development in these nations.

3.2 OECD and Its Work Areas

OECD was built up in 1961 as an universal financial organization with the essential point of cultivating financial development, improvement, and universal exchange (OECD, 1996). At first, the organization comprised of the United States, Canada, and a few Western European countries, counting the United Kingdom, France, and Germany (OECD, 1996). Be that as it may, over time, the OECD has extended its participation to incorporate more than 40 nations around the world, such as Japan, South Korea, Australia, and New-Zealand. These part countries share a commitment to advertise economy standards, law based administration, and the trade of arrangement encounters. The OECD's overarching mission moreover includes tending to common challenges that will posture geopolitical dangers to the soundness and success of its part nations (OECD, 1996).

The OECD's work is separated into a few fundamental regions, counting

financial inquire about and investigation, the improvement of worldwide financial arrangement, and the advancement of exchange and speculation. The organization is additionally included in endeavors to combat destitution, advance economical advancement by means of green vitality speculation and climate inviting innovative advancements to combat climate alter, and progress the quality of life for individuals around the world. (OECD, 2022).

One of the OECD's key commitments has been its work in financial investigate and investigation. The organization produces a wide run of reports, considers, and other distributions on a assortment of financial themes, counting financial development and improvement, exchange, venture, and destitution lessening. The OECD is additionally known for its financial pointers, such as the OECD Composite Driving Marker, which gives a preview of financial movement over the organization's part nations. In addition to its work within the financial field, the OECD has moreover played an vital part in advancing great administration, human rights, and natural maintainability. Through its programs and activities, the organization has made a difference to progress these critical issues and to construct a more fair and maintainable worldwide community. (OECD, 1996; OECD, 2012).

The OECD has had a long and wealthy history as a key player within the worldwide financial field. Over the past six decades, the organization has made noteworthy commitments to the field of financial matters, advanced financial participation and development, and made a difference to construct a more economical and evenhanded world. (OECD, 2018).

3.2.1 Exchange Rate Regimes of Selected Economies in the OECD

Table 3.1: **Exchange rate regimes of Selected Economies in the OECD** (Appleyard, Filed, & Cobb, 2010).

S/N	Exchange rate regimes	Regime in 1997	Regime in 2008
1	Currency board	Estonia Lithuania	Estonia* Lithuania*
2	Targeted exchange rate (pegged exchange rate systems)	Hungary Latvia Poland	Latvia

		Slovakia	

Table 3.1: Exchange rate regimes of Selected Economies in the OECD (more)

3	Managed floating rate	Czech Slovenia	
4	Floating rate		Czech Hungary Poland Slovenia

Table 3.1 presents exchange rate regimes applied in selected transition economies. First, among the transition economies in the OECD, between 1997 and 2008, Estonia and Lithuania were under the currency board exchange rate regime. By 1997, Hungary, Latvia, Poland & Slovakia were using the targeted exchange rate (i.e the pegged exchange rate system, while by 2008 only Latvia operates this system. Additionally, by 1997, Czech Republic and Slovenia were operating the managed floating exchange rate system and by 2008, Czech, Hungary, Poland and Slovenia were already operating the floating exchange are system**.** *Nature of arrangement has changed because the country joined the European Union. The Slovak and Slovenia are now members of the Eurozone. (Appleyard, Field & Cobb, 2010; Norbert, 1996).

The OECD move economies felt the require for expanded capital portability and the macroeconomic alterations required to move from a centrally arranged economy to a showcase economy that empowers exchange and venture competitiveness. Until 1971, the global monetary landscape operated under a system where all currencies were fixed to the U.S. dollar, with the dollar itself being valued at a fixed rate of US $35 per ounce of gold. However, as the dollar faced challenges in maintaining this gold-backed price, most major economies eventually transitioned to a floating ER regıme. Nonetheless, it's noteworthy that numerous central banks in developing nations continue to adopt a pegged or fixed ER system, anchoring their currencies either to the U.S. dollar or a basket of major currencies, which includes the euro, Japanese yen, pound sterling, and Swiss franc. This deliberate choice is made with the aim of creating a stable and predictable environment for foreign investment. Under a pegged or fixed currency arrangement, investors are spared the concerns associated with daily ER fluctuations. This stability instills greater confidence in the currency's

reliability, thereby encouraging increased foreign direct investment into the economy. Nevertheless, maintaining a fixed ER peg over the long term poses considerable challenges, often leading to financial crises due to the tendency of central banks to uphold an overvalued currency. Historical instances of such crises underscore the risks involved. For instance, the Mexican financial crisis in 1994 witnessed the Bank of Mexico compelled to devalue the peso by a significant 30%. Similarly, the Thai Financial crisis of 1997 resulted in a sharp 50% depreciation of the local currency, the Baht, as the Thai Central Bank shifted to a floating ER. To mitigate these adverse effects, some central banks opt for a more flexible approach, adopting either a "floating" or "crawling" peg system. Under this arrangement, the central bank periodically re-evaluates and adjusts the peg's value. Notably, several oil-rich Arab nations, whose economies are highly dependent on oil revenues, have embraced this strategy to cushion themselves against economic shocks, particularly in light of the substantial volatility inherent in oil prices. Mishkin (2009)

Flood and Rose (1995) delves into the question of whether it is possible to identify fundamental economic factors that explain and justify the decisions of countries to fix or peg their ERs. The authors explore the motivations behind countries' choices of ER regimes and examine whether these choices can be attributed to economic fundamentals. The paper begins by addressing the importance of exchang ER regimes and their impact on international trade and financial stability. It acknowledges that countries choose different regimes, ranging from flexible ERs to fixed or pegged rates, for various reasons. Flood and Rose developed a theoretical framework that integrates economic fundamentals such as inflation rates, fiscal and monetary policies, and trade balances into an analysis of ER regime choices. They attempt to determine whether these fundamentals can explain why some countries opt for fixed ERs. The authors conduct empirical analyses using data from various countries to test whether economic fundamentals are significant factors in explaining the adoption of fixed ER regimes. They employ statistical techniques to assess the relationships between economic variables and ER decisions. The study finds mixed results regarding the influence of economic fundamentals on ER regime choices. While some economic factors appear to be associated with the decision to fixed ERs, others do not exhibit a significant relationship. This suggests that other non-economic factors or policymakers' preferences may also play a role in shaping ER policies. The paper discusses the policy implications of the findings. It highlights that policymakers

should consider a wide range of factors, including economic fundamentals and non-economic considerations, when deciding on an ER regime. It also emphasizes the complexity of this decision-making process. Flood and Rose's paper investigates the relationship between economic fundamentals and the choice of ER regimes, particularly fixed rates. While the study finds some evidence of a connection, it suggests that multiple factors, including non-economic ones, influence a country's decision to fix its ERs. This underscores the complexity of ER policy decisions and the need for policymakers to carefully weigh various considerations when making such choices.

3.2.2 European Monetary System

In March 1979, eight founding members of the European Economic Community (Germany, France, Italy, the Netherlands, Belgium, Luxembourg, Denmark, and Ireland) established the European Monetary System (EMS). Under this agreement, these nations committed to maintaining ERs with each other while allowing their currencies to float collectively against the U.S. dollar. Subsequently, Spain joined the EMS in June 1989, followed by the United Kingdom in October 1990 and Portugal in April 1992. Within the EMS, a new monetary unit known as the European Currency Unit (ECU) was introduced, and its value was pegged to a specified basket of European currencies. The Exchange Rate Mechanism (ERM) of the EMS functioned by setting limits on ER fluctuations between the participating countries. These limits were typically set at ±2.25%, but they were temporarily expanded to ±15% in August 1993. In the event that the ER between two member countries' currencies breached these limits, both central banks were obligated to intervene in the foreign exchange market. For instance, if the French franc depreciated below its lower limit against the German mark, the Bank of France was required to purchase francs and sell marks, depleting its international reserves. Simultaneously, the German central bank was compelled to sell marks and acquire francs, thus increasing its international reserves. The EMS mandated that intervention be symmetrical when a currency surpassed the limits, with the central bank of the weaker currency losing reserves and the central bank of the stronger currency gaining them. Central bank intervention was also commonplace even when ERs remained within the limits. However, in such cases, if one central bank intervened, there was no obligation for others to follow suit. One notable drawback of fixed ER systems like the Bretton Woods system or the European Monetary System is

their susceptibility to foreign exchange crises, which may involve speculative attacks on a currency. These attacks entail substantial sales of a weaker currency or purchases of a stronger currency, resulting in a rapid and significant shift in the ER. This vulnerability was demonstrated in the September 1992 ER crises that shook the EMS. Mishkin (2009).

3.3 The Real Effective Exchange rate in the OECD

From 1996 to 2020, the REER in OECD countries underwent significant fluctuations. Throughout this period, the REER was impacted by various factors, including exchange rate movements, inflation rates, and changes in the importance of trading partners. According to the available OECD dataset, notable fluctuations occurred in the OECD's REER from 1996 to 2019. The average OECD, REER index was 106.8 in 1996 and increased to 120.5 in 2002. It fluctuated between 116 and 105.0 until 2019, reaching its peak at 110.6% in that year. Among OECD countries, Luxembourg recorded the highest REER at 143.6, followed by Switzerland (133.5) and Norway (130.1). In contrast, countries with the lowest values were Columbia (84.7), Mexico (76.1), and Turkiye (83.4). The US, being the largest economy within the OECD, had a REER index of 101.6 in 1996, rose to 124.4 in 2002, and then decreased back to 101.6 in 2019 (OECD, 2022).

In their study, Chaudhuri and Daniel (1998) inspected 16 nations inside the OECD and found that the non-stationary nature of US dollar trade rates can be ascribed to the non-stationary nature of real oil prices. They displayed prove of a spillover impact between oil cost instability and trade rate esteem, showing a energetic transmission between variances in oil costs and developments within the esteem of the US Dollar. Between 1996 and 2000, numerous OECD nations experienced vigorous financial development, went with by moo swelling and fortified monetary standards compared to their fundamental exchanging accomplices. This driven to an appreciation of the REER in a few OECD countries, making their trades more costly and diminishing their universal competitiveness. From 2000 to 2008, the worldwide economy experienced turbulence, counting the dot-com bubble and the 2008 money related emergency. Amid this period, numerous OECD nations experienced weaker development and higher expansion, coming about in a devaluation of their REER and an increment in their worldwide exchange competitiveness (OECD, 2010).

From 2009 to 2012, the real compelling trade rates of a few OECD nations remained steady, whereas others experienced changes. A few export-dominated OECD countries saw expanded worldwide competitiveness, whereas others confronted a decrease (OECD, 2015). Between 2008 and 2020, the worldwide economy experienced noteworthy changes, counting recuperation from the money related emergency, the rise of developing economies, and the rise of unused exchange designs. Amid this period, numerous OECD nations experienced direct development, moo expansion, and a direct appreciation of the REER, reflecting the quality of their economies and the competitiveness of their trades within the worldwide markets (OECD, 2022). The REER of OECD countries over the past two decades has been influenced by various factors, including exchange rate fluctuations, inflation, the relative importance of trading partners (OECD, 2022). While the REER is a useful tool for assessing a country's export competitiveness in international trade, it is essential to recognize its limitations and use it alongside other competitiveness indicators and exchange rate analysis (OECD, 2022).

Contrasts in REER contribute to varieties in financial execution and competitiveness among OECD countries. Move economies inside the OECD had to experience alterations in their move from centrally arranged to market-oriented economies, with a center on exchange and venture competitiveness whereas expanding capital portability (OECD, 2022).

3.4 The Real Effective Exchange Rate Volatility and Economic Growth in the OECD

In recent decades, the fluctuation of the REER has had varying effects on the economic development of OECD countries. Excessive volatility in the REER can obstruct economic growth by diminishing export competitiveness, elevating import expenditures, and discouraging foreign investment. Consequently, these factors may lead to reduced trade, decreased investments, and a slowdown in real economic expansion. On the contrary, low volatility in the REER can also impede economic growth by limiting ER adaptability, thus making it challenging for an economy to respond to global economic shifts. Additionally, low REER volatility might contribute to economic imbalances, such as excessive consumption or investment, which can result in long-term adverse effects on real economic growth (OECD, 2016).

Opposite to the thought of minimizing instability, investigate shows that money

related markets tend to create more quickly when the trade rate is permitted to vary. Also, budgetary teach illustrate the next inclination to receive supporting techniques and preparatory measures to moderate trade rate instability beneath adaptable trade rate administrations as restricted to closely overseen or pegged trade rate frameworks (Hohensee & Lee, 2004).

According to Dunn (2000), foreign exchange controls may be implemented to address balance of payments deficits by using administrative measures on international transactions. However, his research revealed that such government interventions are rendered ineffective due to the presence of asymmetric information in the foreign exchange market. Despite this finding, some countries continue to institutionalize these controls for market regulation and balance of payment adjustments.

Harvey (2004) characterized outside trade controls as the distinctive shapes of controls forced by a government on the purchase/sale of outside monetary standards by inhabitants or on the purchase/sale of nearby money by non-residents. Esezobor (2009) supports this definition and argues that ER control is adopted by nations to tackle balance of payment imbalances and increase foreign reserves. Additionally, Easterly (2005) agrees that significant overvaluations in ERs have adverse effects on real economic growth and are consistently associated with balance of payment crises, corruption (particularly in developing countries), foreign currency scarcity, slow growth, macroeconomic instability, rent-seeking behavior, unsustainable huge current account shortages, and stop-and-go macroeconomic cycles, all of which are negative to genuine financial development.

Over the past twenty a long time, the impact of RER instability on financial development in OECD nations has been assorted, as both REER instability have brought about in negative impacts on genuine financial development. For policymakers, finding a balance between ER stability and flexibility is crucial to promote real economic growth and ensure long-term economic stability (Dunn, 2000; Harvey, 2004; Esezobor, 2009; Easterly, 2005).

Aghion, Bacchetta, Ranciere, and Rogoff (2009). Used the growth rate of outputs per worker as the dependent variable, the RER volatility, financial development (private domestic credit/GDP), as the independent variables and the control variables include educational enrollment, trade openness, government consumption/GDP, banking crisis dummy variable and inflation rate in an overlapping 5-years averages from 1960 to 2000 using the 2-step system GMM estimation and found RER volatility

to be negative and statistically significant.

3.5 The Impact of Various Macroeconomics Indicators on Economic Growth in the OECD

There are other macroeconomic factors that affects economic growth such as inflation, GCE, GCF, productivity growth, technology and innovations, population growth, RER misalignment and trade and others, either positively or negatively (Aghion & Howitt, 2009).

3.5.1 The İmpact Of İnflation on Real Economic Growth in the OECD

According to OECD information from 1996 to 2019, the cruel expansion rate within the part nations was 1.99%, the middle swelling rate was 1.7%, the least expansion rate recorded was -2.27%, and the greatest swelling rate come to was 21.85% (OECD, 2021).

The relationship between expansion and real financial advancement within the nations of the Organization for OECD has been both complex and energetic. In common, direct levels of increase can contribute to financial development by cultivating a favorable macroeconomic environment. Be that as it may, high levels of swelling can have hindering impacts on financial development. These impacts incorporate lessening customer investing and speculation, driving to an increment in intrigued rates, and disintegrating the acquiring control of cash (Boschen & Weise, 2003).

It's critical to note that the impact of swelling on genuine financial development is unexpected upon the macroeconomic environment, which incorporates components such as financial arrangement and the condition of the worldwide economy. These variables play a significant role in determining how inflation affects economic development within the OECD countries.During the period from 1996 to 2000, many OECD countries experienced low levels of inflation, which was accompanied by strong economic growth. This period was characterized by a favorable macroeconomic environment, including low interest rates and a supportive monetary policy, which contributed to the strong growth of the real economy (Gernot, 2007)**.** From 2000 to 2008, the global economy experienced a period of turbulence, including the dot-com bubble and the 2008 financial crisis equally known as the great recession, where the

international transmission shocks were addressed both by fiscal and monetary policy responses. During this period, many OECD countries experienced higher levels of inflation, which resulted in a reduction in consumer spending and investment and a slowdown in real economic growth. Between 2008 and 2020, the global economy underwent significant changes, including the ongoing economic recovery from the financial crisis, the rise of emerging economies, and the emergence of new trade patterns. During this period, many OECD countries experienced modest levels of inflation, which was accompanied by moderate real economic growth. This period, too, was characterized by a supportive monetary policy, including low interest rates, and a favorable macroeconomic environment, which contributed to the growth of the real economy**.** For example, some countries such as Japan has negative inflation and Switzerland, Germany, France, and Canada, have experienced relatively low inflation over the past several decades; the United States and UK have experienced relatively higher inflation over the same period; while Turkiye there was hyperinflation which is the highest in OECD followed by Costa Rica, Columbia, Mexico, and Hungary over the past two decades. **(**OECD, 2022).

In the past two decades, the impact of inflation on real economic development in OECD countries has been complex and dynamic. High levels of inflation can impair real economic growth by reducing consumer expenditure and investment and by increasing interest rates.

3.5.2 Gross Capital formation and Real Economic Growth in the OECD

The OECD's GCF fluctuates between 16.5% and 22.8% of GDP between 1996 and 2019, with an average of 19.8%, in accordance with the World Bank's Development Indicators. 2007 marked the maximum level before the 2008-2009 global financial crisis, which led to a decline, but there was a gradual recovery before the COVID-19 pandemic, which has negative residual effects on the global economy (OECD, 2022).

GCF, referring to investment in capital goods, has exhibited a significant influence on real economic growth in OECD countries throughout the last two decades (Ebru et al., 2020). This impact can be understood through various mechanisms (OECD, 2022). One mechanism is the enhancement of productivity. GCF the generation of new capital goods, such as machinery and equipment, thereby augmenting the economy's productive capacity. Consequently, this leads to increased

output levels, higher wages, and an overall improvement in living standards for the population. Furthermore, capital formation contributes to improved infrastructure, encompassing transportation, communication, and energy systems. By enhancing the efficiency of the economy, these developments foster economic growth. The attraction of foreign investment represents another mechanism. Substantial levels of capital formation signal to foreign investors that a country offers favorable investment prospects. As a result, this attractiveness can stimulate additional investment inflows, further bolstering economic growth. Consideration should also be given to the role of increased consumer confidence. Strong investment and economic growth instill a sense of optimism among consumers, encouraging them to increase their expenditures. This heightened consumer spending, in turn, becomes a driving force behind economic growth. Lastly, innovation emerges as a crucial mechanism. Higher levels of investment in research and development stimulate technological advancements and foster innovation. These innovations, subsequently, contribute to heightened productivity and overall economic growth (OECD, 2022).

However, it's also important to note that excessive levels of investment can lead to asset bubbles, inflation, and other economic imbalances that can negatively impact real economic growth. It's therefore important for governments and central banks to balance investment in capital goods with other economic policies aimed at promoting stability and sustainable growth (Begg, Fischer & Dornbusch, 2008). GCF has had a significant impact on real economic growth in the OECD countries over the past two decades. While investment in capital goods has helped to increase productivity, improve infrastructure, and spur economic growth, it's important for governments and central banks to balance investment with other policies aimed at promoting stability and sustainable growth (Ebru et al, 2020).

The global monetary emergency of 2008 had a critical negative affect on net capital arrangement within the OECD nations. The financial crisis led to a sharp contraction in economic activity, which in turn led to a reduction in investment in capital goods (Afonso & Blanco-Arana, 2022). This was due to several factors. First, the financial crisis led to a contraction in credit markets, making it difficult for firms and individuals to access the financing they needed to invest in capital goods. The financial crisis also led to increased uncertainty and decreased consumer confidence, which in turn led to reduced consumer spending and decreased demand for capital goods. In addition to these, it led to increased risk aversion among investors, who

became more cautious about investing in capital goods and other assets. It also resulted in decreased profitability for many firms, which in turn reduced their ability to invest in capital goods (OECD, 2022). The reduction in GCF because of the financial crisis had a negative impact on real economic growth in the OECD countries, as the reduced investment in capital goods led to reduced productivity, lower wages, and decreased economic activity. Such declines in GCF due to the 2008 global financial crisis resulted in a negative impact on real economic growth. The crisis also led to a contraction in investment in capital goods, which reduced productivity, decreased wages, and decreased economic activity, leading to a slowdown in the economies of the affected countries (Afonso & Blanco-Arana, 2022).

Over the past two decades, GCF has grown significantly in many OECD countries, reflecting increased investment and economic growth. For example, countries such as the US, Japan, Germany, and France have experienced relatively high levels of GCF, reflecting strong investment in technology, infrastructure, and other key industries (OECD, 2022).

However, there has been significant variation in GCF across OECD countries, reflecting differences in investment patterns and economic conditions. For example, some countries such as Spain, Italy, and Greece, have experienced lower levels of GCF due to weak economic growth, low level of consumer confidence, and low levels of investment in key industries (OECD, 2012; OECD, 2020).

3.5.3 Government Consumption Expenditure and Real Economic Growth in the OECD

The normal government utilization consumption as a rate of GDP in OECD nations from 1996 to 2019 was 44.8%, with a standard deviation of 9.0%, in agreement with the World Bank's Improvement Markers. The least esteem recorded was 22.3%, and the most elevated was 65.8%. (OECD, 2021).

From 1996 to 2020, the impact of government utilization consumptions on genuine financial development in OECD nations has been complex and variable. During this time, a number of OECD countries underwent significant changes in their economic policies, with some focusing on reducing GCE and others on increasing it.

In general, OECD countries that reduced GCE as a proportion of GDP tended to experience greater real economic growth, as this reduction aided to improve market efficiency and reduce inflationary pressures. In certain instances, however, the

reduction in GCE resulted in decreased investment in public products and services, which had a negative effect on real economic growth. (Jean-Marc, 2016). Sweden, Denmark, Israel, Iceland, and the Netherlands have the highest OECD GCE, while Mexico, Switzerland, Chile, and Turkiye have the lowest (OECD, 2022).

In a research conducted by Michael and Cheng (2016) on 34 OECD economies between 1995 and 2011, utilizing GMM estimation strategies, they examined the impact of government investing on financial development. The comes about of their inquire about demonstrated that government utilization investing and open venture did not have a noteworthy affect on financial development inside the OECD. Besides, they found a generally little negative and factually noteworthy impact of government social investing on financial development. Based on their investigation, they concluded that an increment in government investing driven to a lower development rate in GDP the taking after year, recommending that government investing inside the OECD hampers financial development.

In differentiate, another consider by Bloch, Blochliger, and Koopman (2016) uncovered that OECD nations that expanded government utilization consumption as a rate of GDP tended to encounter lower genuine financial development. This increment was related with higher expansion and government obligation. Be that as it may, it is worth noticing that in certain cases, the extension of government utilization use was coordinated towards ventures in foundation and human capital, which had a positive affect on genuine financial development.In general, these discoveries recommend that the relationship between government investing and financial development within the OECD is complex, and diverse sorts of uses can have shifting impacts. Both studies highlight the multifaceted nature of this relationship within the OECD context (Michael & Cheng, 2016; Bloch, Blochliger, & Koopman, 2016). The affect of government utilization consumption on genuine financial development within the OECD over the past two decades has been subject to different impacting variables, counting innovative headways, changes in exchange flow, and shifts in financial approach. Eminently, the worldwide money related emergency of 2008 had a significant impact on financial action inside the OECD, driving to diminished venture and a lull in genuine financial development (Dario, Paccagnini, and Pierluigi, 2016).

The relationship between open investing and financial development has yielded blended comes about over the a long time. Whereas tax collection has appeared negative impacts on the after-tax minimal item of capital, open administrations have

illustrated positive impacts on the minimal item. This highlights the interconnecting of government utilization uses and net capital arrangement, and their affect on genuine financial development within the economy (Barro, 1990; Michael & Cheng, 2016).

In rundown, the affect of government utilization consumptions on genuine financial development within the OECD over the past two decades has been complex and variable, impacted by a huge number of components, counting the advancement of financial arrangements, innovative headways, exchange flow, and money related approach. In any case, in common, nations that decreased government utilization use as a rate of GDP experienced higher genuine financial development, while nations that expanded government utilization consumption as a rate of GDP experienced lower genuine financial development (OECD, 2022).

3.5.4 The Impacts of Trade on Real Economic Growth in the OECD

Over the a long time, the OECD has seen a surprising development of exchange. Trades of items and administrations counted roughly $4.4 trillion in 1996, whereas imports totaled around $4.5 trillion. In any case, by 2019, the esteem of trades of merchandise and administrations outperformed imports of products and administrations, outperforming $19 trillion. Outstandingly, the United States, Germany, and Japan have risen as the beat three exchanging countries inside the OECD. (OECD, 2021).

The OECD is one of the largest trade blocs in the world, and its trade has significant global ripple effects. In the past two decades, there have been numerous dynamic shifts in terms of globalization's victors and losers, which have generated a great deal of smoke and cold conflicts between the United States and China. Luxembourg, Ireland, Slovakia, Belgium, Hungary, and the Netherlands rank highest in OECD commerce, while the United States, Japan, Columbia, Australia, and Turkiye rank lowest. The affect of exchange on genuine financial advancement in OECD nations has been considerable and broadened over the past two decades. Exchange has essentially contributed to financial development by improving firm competitiveness, growing get to to modern markets, and giving economies of scale. Amid this period, numerous OECD nations received more open exchange approaches, and exchange liberalization made a difference to extend the stream of products and administrations between nations, which in turn had a positive affect on genuine financial development. For example, countries that opened to trade saw increases in exports, which boosted

production and investment (OECD, 2018).

Nevertheless, the relationship between exchange and real financial development did not reliably abdicate positive results, every so often coming about in antagonistic impacts. Outstandingly, exchange liberalization applied negative results, exemplified by work misfortunes inside particular businesses due to companies moving generation to countries with lower labor costs. This decay in business levels had a hindering affect on customer investing and venture, subsequently obstructing genuine financial development. Moreover, the integration of China into the worldwide economy played a noteworthy part in impacting the affect of exchange on genuine financial development inside the OECD over the past two decades. China's quick financial development incited an upsurge in imports from the nation, which in turn reduced the competitiveness of firms in certain OECD countries, subsequently adversely influencing genuine financial development. The affect of exchange on genuine financial development within the OECD over the past two decades was critical and changed, and was impacted by a extend of variables, counting changes in exchange approaches, the integration of China into the worldwide economy, and the affect of exchange liberalization on business levels. Whereas exchange liberalization had a positive affect on genuine financial development in numerous cases, in a few cases it had negative results, such as work misfortunes and declining competitiveness (OECD, 2018).

Chor (2010) employs the Export Led Growth (ELG) model, which highlights exports as a crucial determinant of economic growth. Hypotheses on worldwide exchange and advancement propose that sending out plays a noteworthy part in advancing financial development. However, empirical studies have not provided sufficient evidence to support the ELG hypothesis. Cushman (1986) and Peree and Steinhart (1989) argue that trade and ER volatility are theoretically prone to negative effects. In contrast, Franke (1991) discovered a positive effect, while Sercu and Vanhulle (1992) utilized models to demonstrate that trade can also benefit from higher ER volatility.

3.5.5 Population Growth and Real Economic Growth in the OECD

The population growth from 1996 to 2019 in the OECD has a steady increase, with a total population of 1.35 billion in 1996 and 1.43 billion in 2019, with an average annual population growth rate above 0.6%, having a high level of 1.0% in 1996 and

declining to 0.3% in 2019 (OECD, 2021). Even though population growth is not directly an economic factor, it is tightly connected to the labor market indicators. For this reason, it is worthwhile to examine the population dynamics. The population growth in the OECD countries over the past two decades has varied across different countries and regions, the countries with the highest population growth rate were Israel, Luxembourg, Turkiye, Costa Rica, and Australia while Lithuania, Hungary, Poland, Japan, and Greece were the lowest. On average, population growth in the OECD countries has been moderate, reflecting both natural increase and immigration. In some countries, for instance US and Australia, Germany (from the Eastern and Central European countries) population growth has been driven largely by immigration, while in others, such as Japan and several countries in Europe, population growth has been limited by low birth rates and aging populations. (Angus, 2001; OECD, 2022). One of the key demographic trends in the OECD countries over this period has been aging populations, because of both low birth rates and increasing life expectancy. This has significant implications for real economic growth, as an aging population can lead to a decrease in the labor force, a slowdown in productivity growth, and a rise in public spending on health care and pensions (Wesley & Peterson 2017; Heady & Hodge, 2009).

To address the challenges posed by aging populations, many OECD countries have implemented policies aimed at increasing labor force participation, boosting productivity, and promoting immigration. These policies include measures to encourage older workers to stay in the workforce longer, to improve education and training opportunities, and to encourage the flow of skilled workers from other countries Mankiw, Romer & Weil (1992), OECD (2022), Kim (2016) inspected the impacts of statistic alter on GDP development within the OECD nations and they found that the statistic changes will proceed to limit financial development within the future based on the figure situation.

In conclusion, the population growth in the OECD countries from 1996 to 2020 has been moderate, but with significant variation across countries and regions. The trend of aging populations has important implications for real economic growth and requires a proactive response from policymakers to ensure that the economy continues to grow and support prosperity over the longer term.

3.5.6 Financial Development and Economic Growth in the OECD

Financial development is a fundamental driver of economic growth and prosperity, with the availability of credit to the private sector playing a pivotal role in shaping the economic trajectory of nations. The OECD, comprised of highly developed economies, provides an ideal backdrop for investigating the intricate relationship between financial development and economic growth. This paper explores the nexus between financial development, particularly private sector credit, and economic growth within the OECD member countries. The OECD member countries have a long history of financial development, marked by the evolution of banking systems, stock markets, and regulatory frameworks. Historically, financial institutions within these nations have played a crucial role in allocating capital efficiently and fostering economic growth (Levine, 1997). Over time, financial systems in the OECD have become increasingly sophisticated, with a wide range of financial instruments and services available to both businesses and individuals. The development of financial markets in the OECD has been facilitated by the presence of strong legal and regulatory frameworks (Beck, Demirgüç-Kunt, & Levine, 2000). These frameworks have helped create an environment conducive to trust and investment, further stimulating economic growth. Private sector credit, which encompasses loans extended to businesses and individuals by financial institutions, is a critical component of financial development. Access to credit enables firms to invest in productive activities, individuals to purchase homes and fund education, and entrepreneurs to start and expand businesses (Rajan & Zingales, 1998). In OECD countries, the availability of private sector credit has been a significant driver of economic growth (Bencivenga & Smith, 1991). Empirical studies have consistently shown a positive relationship between private sector credit and economic growth within the OECD (King & Levine, 1993; Arcand, Berkes, & Panizza, 2012). However, the nature and magnitude of this relationship can vary depending on several factors, including the level of financial development, the quality of institutions, and the size of the credit market.

The impact of private sector credit on economic growth can be channeled through various mechanisms. Private sector credit facilitates investment in both physical and human capital, which can boost productivity and economic output (Demirgüç-Kunt & Maksimovic, 1998), Access to credit enables entrepreneurs to innovate and expand their businesses, contributing to job creation and economic

growth (Beck, Demirgüç-Kunt, & Maksimovic, 2005), Private sector credit allows individuals to smooth consumption and make long-term investments such as homeownership (Mian & Sufi, 2009), Financial Intermediation: Financial institutions play a crucial role in channeling savings into productive investments, thereby increasing the efficiency of capital allocation (Levine, 1997)., A well-developed financial system with adequate private sector credit can enhance economic stability by reducing the vulnerability of the economy to external shocks (Levine & Zervos, 1998), Promoting Financial Inclusion: Ensuring that a wide range of businesses and individuals have access to credit can enhance economic growth and reduce income inequality (Beck, Demirgüç-Kunt, & Honohan, 2009); and Strengthening Regulatory Frameworks: Effective regulation and supervision of financial institutions are essential to maintain the stability and integrity of the financial system (Barth, Caprio, & Levine, 2004).

CHAPTER 4

4. EMPIRICAL ANALYSIS: Real Effective Exchange Rate, Its Volatility and Economic Growth IN THE OECD

4.1 The Aim and Objective

This consider points to examine the affect of the REER and its instability on financial improvement in a bunch of 36 OECD nations amid the period from 1996 to 2019. The investigate looks for to address the taking after investigate questions (RQs):

RQ1. Does REER affect economic growth significantly in the OECD?

RQ2. Is there REER volatility in the OECD?

RQ3: Does REER volatility affect economic growth significantly in the OECD?

4.2 Empirical Literature Review

The assurance of the REER has been investigated by Wong (2011), who observationally inspected its long-term affect on real economic growth. Lee, Ricci, and Rigobon (2002) advertised an elective approach to Acquiring Control Equality (PPP) by analyzing the impact of ostensible (current account, relative cash supply) and genuine factors (terms of exchange and industry efficiency) on the respective REER of Australia and New Zealand. Their inquire about demonstrated that genuine factors have a long-term affect on REER, whereas financial factors as it were have short-term impacts

Dollar (1992) utilized conventional slightest squares (OLS) estimation strategies to explore the relationship between genuine trade rates and financial development in 95 creating nations from 1976 to 1985. The study found a negative correlation between the two variables. Similar outcomes were confirmed by Bosworth and Susan (2003)

and Hausmann et al. (1995) in their examination of Latin American economies

Using the Dynamic System GMM, Vieira, Holland, Gomes de Silva, and Bottecchia (2013) considered the affect of trade rate instability on development in 82 created economies. Their inquire about uncovered a measurably critical and negative relationship between REER instability and financial extension. They concluded that trade rate steadiness contributes more to long-term financial development than misaligned trade rates, which are habitually related with macroeconomic insecurity. The evaluated coefficients for the instability of the conditional REER extended from -10.15 to -39.55. Besides, the discoveries shown that a 1% increment within the normal yearly instability of the REER over a five-year period would result in an increment of between 0.1 and 0.39 rate focuses in yearly genuine GDP development.

Choudhry, Hassan & Shabı (2019) conducted a ponder on the instability of the United Kingdom's imports from key exchanging accomplices Brazil, China, and South Africa amid the period from January 1999 to December 2011. They utilized the hilter kilter autoregressive conveyed slack (ARDL) co-integration procedure and found a long-term relationship between trade rate instability and imports. The analysts emphasized that endeavors to dishearten consequence development through exchange administration alterations may demonstrate incapable in case the trade rates of the third nations and the United Kingdom are unstable. Concurring to their discoveries, a 1% increment in dollar/pound instability brought about in a diminish in UK imports from China and Brazil by 1.23% and 2.44%, separately.

Eichengreen (2008) investigated the centrality of the REER and its instability in connection to financial development. The creator prescribed that economies keep up an fitting level of REER instability to avoid intemperate vacillations. This may contribute to changes in endeavor competitiveness, exchange, speculation, and mechanical development, all of which are basic for long-term financial development

Rapetti (2020) conducted a comparative study examination of different strategies utilized to look at the relationship between REER and financial development. The ponder considered settled and irregular approaches, energetic GMM, and framework GMM whereas bookkeeping for peculiar stuns within the models. The discoveries demonstrated a positive relationship between the REER and financial development. Mehdi and Cagay (2021) highlighted that the existing writing envelops considers centering on export-led development methodologies. Moreover, the significance of REER misalignments and their affect on financial development has

been emphasized within the inquire about.

Campbell, Lo, & MacKinlay (1997). examined the relationship between venture and volatılıty within the REER by utilizing information from the United States and Canada, yielding shifted results. Darby, Hallet, Ireland, and Piscitelli (1999) inspected the impact of trade rate instability on speculation within the United States, United Kingdom, Germany, France, and Italy, unveiling a considerable antagonistic affect. Schnabel (2009) focused the negative impact of trade rate instability on financial development in rising locales of Europe and East Asia. Selim and Murat (2012) investigated the affect of trade rate instability on Turkiye's sends out and identified a generally weaker short-term result. All things considered, over the long term, they watched a negative impact on sends out. Firat (2013) conducted a ponder that dug into the relationship between financial development and trade rate instability, especially centering on get to to remote value and the household value showcase in Turkiye. The study's discoveries disclosed a factually critical and antagonistic impact of trade rate instability on firm development, in spite of the fact that the exact size of this impact was not indicated.

Dierk, Jarko, & Haug (2005) utilize a board dataset including 20 rising advertise economies amid the period from 1990 to 2001. They utilize both a settled impact show and a arbitrary impact show to gage the impacts of trade rate mediations. The settled impact demonstrate accounts for country-specific characteristics, whereas the irregular impact show captures the differing qualities over nations. To evaluate the adequacy of trade rate intercessions, the creators look at their impact on the trade rate level and instability. They analyze both prompt and postponed impacts of mediations on trade rates. The observational discoveries uncover that trade rate mediations altogether influence the level of trade rates in rising markets. The creators distinguish prove of contemporaneous as well as postponed impacts of these mediations. Within the brief term, intercessions tend to have a positive affect on the trade rate, demonstrating a reinforcing of the residential cash. In any case, this impact reduces over time. In terms of trade rate instability, the creators reach clashing conclusions. A few nations involvement decreased instability as a result of intercessions, whereas others involvement expanded instability. This demonstrates that the affect of intercessions on instability changes among rising markets. Furthermore, the authors investigate distinctive sorts of intercessions, such as spot mediations and forward operations. They discover that spot intercessions have a more noteworthy affect on the trade rate level

compared to forward operations. In general, the experimental examination in this paper proposes that central bank trade rate mediations in developing markets can altogether impact the trade rate level, though with reducing impacts over time. The impacts on trade rate instability shift essentially over countries. These comes about contribute to understanding the viability of trade rate mediations in rising markets and have vital suggestions for policymakers and showcase members.

Mukherjee and Kemme (2007) analyze a board dataset enveloping 23 rising showcase economies amid the period from 1973 to 2001. They point to assess the impact of trade rate administrations on money related independence, employing a settled impact demonstrate to account for country-specific characteristics and control for imperceptibly heterogeneity between countries. The creators consider two markers to degree money related freedom: the degree of independence in setting residential intrigued rates and the flexibility to conduct optional money related arrangement. They examine how trade rate administrations affect these pointers. The observational comes about uncover that trade rate administrations essentially influence the money related independence of the chosen developing showcase economies. Specifically, countries adopting flexible exchange rate regimes tend to exhibit greater monetary independence compared to those with fixed or intermediate regimes. Notably, countries with adaptable trade rate systems have more elbowroom in deciding their household intrigued rates, allowing them more noteworthy control over financial arrangement and empowering alterations agreeing to household financial conditions. Moreover, countries with flexible exchange rate regimes enjoy more discretion in implementing monetary policy measures to stabilize their economies and respond to disruptions. In contrast, nations with fixed exchange rate regimes, such as currency platforms or currency boards, generally experience limited monetary autonomy. The requirement to maintain a fixed exchange rate constrains their ability to set interest rates and conduct monetary policy independently. The observational investigation displayed in this ponder illustrates the critical affect of trade rate administrations on the degree of money related independence in rising advertise economies. Adaptable trade rate administrations offer more prominent autonomy in setting intrigued rates and executing optional money related arrangement, though settled trade rate administrations are related with diminished financial independence. These discoveries hold imperative suggestions for policymakers when selecting an suitable trade rate administration that adjusts with their wanted level of money related autonomy.

In Altar and Kok (2012), the creators explore the affect of trade rate instability on financial development, considering potential edge impacts. Their point is to decide in case the relationship between trade rate instability and financial advancement is nonlinear and affected by particular limit levels. To analyze this, they utilize a limit vector autoregression (TVAR) strategy utilizing yearly information from 31 nations crossing the period from 1960 to 2007. The TVAR demonstrate permits them to appraise different administrations based on watched limit levels. Exchange rate instability is measured utilizing the conditional trade rate standard deviation, whereas genuine GDP development serves as an pointer of financial extension. Through energetic intelligent between trade rate instability and financial development, the creators assess the TVAR show. The experimental discoveries illustrate the presence of limit impacts within the relationship between trade rate instability and financial growth. They find that the impact of trade rate instability on financial improvement shifts depending on the level of instability. In a administration of negligible instability, trade rate instability has small affect on financial development. In any case, when instability outperforms a certain edge, the relationship gets to be noteworthy and negative, demonstrating that over the top trade rate instability can contrarily influence financial growth.

Furthermore, they look at the determination of the development impacts. Within the administration of high instability, they discover that the negative affect of trade rate instability on financial development persists over time. They explore potential asymmetry within the relationship, investigating whether positive and negative changes in exchange rate instability have distinctive impacts on financial development. Be that as it may, the comes about don't unequivocally bolster the presence of deviated effects. Overall, the experimental investigation in this paper highlights that the relationship between trade rate instability and financial advancement is nonlinear and characterized by limit impacts. High REER instability are appeared to have a negative impact on financial development. This underscores the significance of overseeing trade rate solidness to advance maintained financial expansion. To address the points of their think about, the authors use a arrangement of inactive board information models with settled and arbitrary impacts. Be that as it may, they recognize that their observational examination faces challenges due to the utilize of lacking rebellious. To moderate potential predisposition and improve accuracy, they utilize a two-step Generalized Strategy of Minutes (GMM) estimation for energetic board information

development models. The utilize of framework GMM is invaluable because it considers the time arrangement measurement of the information, accounts for imperceptible country-specific impacts, and treats all explanatory factors as endogenous. To combat concerns related to over the challenges in GMM estimations, the authors embrace two procedures. To begin with, they utilize the collapse sub-option for the xtabond2 command in Stata to combine disobedient into littler gatherings without losing any delays. Moment, they execute Slack limits, confining the utilize of lags as disobedient to decrease their number whereas protecting the time measurement linearity. These procedures point to address issues related with overidentification and the potential inclinations caused by an intemperate number of instruments.

Aghion, Bacchetta, Ranciere, and Rogoff (2009). undertook an examination of the correlation between RER volatility and productivity growth, emphasizing the role of financial development. They employed the GMM dynamic panel data estimator, as formulated by Arellano and Bond (1991), Arellano and Bover (1995), and Blundell and Bond (1998), and augmented their analysis with robust two-step S.E. following Windmeijer's (2005) prescribed methodology. This methodological approach was chosen to address concerns surrounding the potential joint endogeneity of all explanatory variables within a dynamic framework and to mitigate biases stemming from country-specific effects. The authors asserted that a comprehensive investigation should not solely focus on ER volatility in isolation; rather, it is imperative to examine the intricate interplay between ER volatility, the degree of financial development, and the characteristics of macroeconomic shocks. The central hypothesis posited that elevated levels of excessive ER volatility could hinder economic growth, particularly in nations characterized by limited capital markets and where financial shocks constitute the primary source of macroeconomic instability. Through an analysis of cross-country panel data, the study found substantial support for this hypothesis, thus substantiating the significance of financial development in influencing the relationship between the selection of an ER regime and long-term economic growth Aghion, Bacchetta, Ranciere, and Rogoff (2009). When addressing the potential endogeneity issue, researchers often turn to the existing literature that delves into the explanations behind ER volatility or ER regimes. Although the literature concerning RER volatility is relatively limited, it does identify certain robust factors influencing the extent of volatility. For instance, Hau (2002) establishes a negative correlation between RER

volatility and trade openness. However, the inclusion of both RER volatility and trade openness as regressors in our specification, treated as jointly endogenous, ensures that this does not impact our estimation. Further exploration by Hausmann et al. (2006) explores the determinants of RER volatility and discovers a positive and statistically significant relationship with GDP growth. These findings imply that if a reverse causality link exists between growth and volatility, it should exhibit a positive direction, thus fortifying the outcomes of their study.

4.3. Methodology

In this inquire about, the effect of the REER on financial development is inspected by utilizing settled impacts (FE) and arbitrary impacts (RE) gauges covering the period from 1996 to 2020. All factual examinations were carried out utilizing the STATA14 program bundle.

4.3.1. An Overview of Panel Data

The basic framework for a panel regression analysis which include the time and cross-sectional dimension can be expressed as follows (Wooldridge, 2010):

$y_{it} = x_{it}\beta + z_i'\alpha + \epsilon_{it}$ and $y_{it} = x_{it}\beta + c_i + \epsilon_{it}$

Where y_{it} and x_{it} are subordinate and free factors, separately. x_{it} will not be included within the steady term. The person or heterogeneity impact is clarified by $z_i'\alpha$. On the off chance that person, or group-specific z_i is watched for all person demonstrate is an OLS, By joining the watched person or group-specific factors (Z) nearby the standard free factors (X), it gets to be conceivable to look at the joint impacts of both sets of factors on the subordinate variable (Y) inside the OLS system. Be that as it may, it is vital to guarantee that the included variables are exogenous and don't endure from endogeneity or overlooked variable predisposition to guarantee the legitimacy of the OLS gauges. Complication emerges if z_i is in secret impacts. Firstly, one ought to modify the exogeneity with strict exogeneity given as takes after:

$$E\left[\frac{\varepsilon_{it}}{x_{i1}, x_{i2,} \text{-----} x_{in}}\right] = 0$$

So that the disturbances are uncorrelated with independent variables in every period and the unobserved variables also need to be uncorrelated with other variables. Therefore, the assumption on mean independence is as follows:

$E\left[\frac{c_{it}}{x_{i1},x_{i2,-----}x_{in}}\right] = \alpha$

A board can be either adjusted and uneven. A adjusted board comprises of n = N*T perceptions on people, i=1, …., N continuously t=1, ……., T whereas uneven board comprises of n = $\sum_{i=1}^{N} T_i$ perceptions on people watched at diverse number of times T_i.

4.3.2. Fixed Effect (FE) and Random Effect (RE) Estimation

4.3.2.1. Fixed Effects model

Settled impacts allude to the condition where the mediation of diverse substances may shift but stay steady over time. In other words, these intervention are time-invariant, meaning they don't alter as time advances. In case z_i is in secret but related with the x_{it},, at that point the slightest square is one-sided and conflicting gauge (Wooldridge, 2010).

Hence, the fixed effect model with $E\left[\frac{c_i}{Xi}\right] \neq 0$, $y_{it} = x_{it}\beta + c_i + \epsilon_{it}$, Where $c_i = z_i'\alpha$ contains all observable effects, and c_i = is a group specific constant term in a fixed effect approach. The term "fixed" in the fixed effects terminology means that the correlations of c_i and x_{it}, not that the c_i is non-stochastic, which means that in statistical modeling, variables can be classified as either stochastic (random) or non-stochastic (non-random). Stochastic variables are subject to randomness and can take different values with certain probabilities. On the other hand, non-stochastic variables are fixed or predetermined and do not vary randomly.

There are a few conceivable outcomes for such a matter. One can anticipate that the botch alter is the same for all cross-section units or one can anticipate that the botch alter is heteroskedastic. For each substance, one can expect that there's no autocorrelation over time, accept that its autocorrelated, say, of the AR (1) sort. For a given time, it is conceivable to that the mistake term for each nation is connected with the blunder term for another nation, or one can assume that there's no such correlation.

The rho comes from the between impact within the irregular impact board information examination, it can be characterized as the "fraction of change due to the person term, it clarifies the extent of variety by the person particular term". Torres-Reyna (2007).

Rho = $\frac{(Sigma\_u)^2}{(Sigma\_u)^2+(Sigma\_e)^2}$

Usually known as the intraclass relationship which appears the esteem of the contrasts over boards. In case Prob > F is < 0.05, at that point the show can be alright since all the coefficients within the show are diverse from zero. Corr (u_i, xb) measures the relationship between the blunder u_i and the regressors in a settled impact show. The t-values test the theory that each of the coefficients is diverse from and to dismiss the t-value needs to be higher than 1.96 for a 95% certainty interval.

The P > |t| speaks to the two-tailed p-values, testing the theory that each coefficient is measurably diverse from zero. For a coefficient to be considered noteworthy, its p-value must be less than 0.10 (or the chosen importance level, ordinarily 0.05). This shows that the variable of intrigued features a noteworthy affect on the subordinate variable.

The R-squared and balanced R-squared give measures of how much of the fluctuation within the dependent variable can be explained by the autonomous variable(s). These measurements demonstrate the extent of changeability within the subordinate variable that can be ascribed to the autonomous variable(s). The next R-squared esteem proposes distant better;a much better;a higher;a stronger;an improved">a distant better fit of the show, showing that the free variable(s) have a stronger illustrative control over the subordinate variable. The balanced R-squared considers the number of autonomous factors within the demonstrate, giving a more precise appraisal of the model's informative capacity when compared to R-squared.

4.3.2.2. The Random Effects Model

In irregular impact demonstrate, the variety over distinctive substances is expected to be irregular and uncorrelated with the free factors (Wooldridge, 2010). Green (2008) clarified the key separation between settled and irregular impacts lies in whether the imperceptibly person impact incorporates components that are irrelevant to the model's regressors, instead of centering on whether these impacts are stochastic or not. In the event that imperceptibly z_i can be accepted to be uncorrelated with included factors.

$E\left[\frac{c_i}{Xi}\right] = 0$, $y_{it} = x_i'\beta + E[z_i'\alpha] + \{z_i'\alpha - E[z_i'\alpha]\} + \epsilon_{it}$, $y_{it} = x_i'\beta + \alpha + u_i + \epsilon_{it}$ and $u_i + \epsilon_{it} = w_{it}$

Where u_i could be a group- specific arbitrary component. For each bunch, there's a single indistinguishable draw for each period. Irregular impacts show can be reliably but wastefully assessed by OLS (Baltagi, 2011). The composite mistake term w_it comprises of two components of ϵ_{it} which is the cross-section or person particular, blunder components, and u_i , which is the combined time arrangement and cross-section mistake components and is now and then called the peculiar term since it changes over cross-section as well as time. The irregular impacts demonstrate accept that Corr ($u_{\_i}$, x) = 0 i. e the contrasts over units are uncorrelated with the regressors. The Prob. > Chi2 can be deciphered in the event that the esteem is < 0.05, at that point one say that the show can be utilized for interpretation and the F-test clarified appears whether the coefficient(s) within the show are inside and out distinctive than zero.

4.3.3. Hausman Test.

The Hausman test explores whether the person components are related with the autonomous factors within the demonstrate; giving a clear heading of whether the settled impact or arbitrary impact is way better choice. The Hausman test insights is conveyed as X^2 and is analyzed a H = $(\beta_c - \beta_e)^1$ $(V_c - V_e)^{-1}$ $(\beta_c - \beta_e)$ Where β_c = is the coefficient vector from the steady estimator, β_e = = is the coefficient vector from the productive estimator, V_c = is the covariance lattice of the steady estimator and V_e= is the covariance lattice of the proficient estimator (Wooldridge, 2013).

The freedom of degrees for the insights of the fluctuation distinction measurements of the variance contrast frameworks. Typically the number of common coefficients among models being compared when the contrast is positive and authoritative (Baltagi, 2011; Wooldridge, 2000). The choice criteria is that FE ought to be chosen over RE in the event that the likelihood of the chi-square esteem is less than 0.05; something else, RE ought to be chosen over FE. (Green, 2012).

4.3.4. Diagnostic Tests for FE Estimations

4.3.4.1. Wooldridge Test of Autocorrelation

Autocorrelation is the mathematical expression of the degree of correlation between a given timeseries and the lagged of the variable over time; and sometimes refer to as the serial correlation (Baum, 2000).

Let assume a linear one-way model by reviewing the following:

y_{it}= α + $X_{it}\beta_1$+ $Z_i\beta_2$+ u_i+ ϵ_{it}, i ϵ {1, 2, …., N} , t ϵ {1, 2, ……, T},

where y_{it} is the subordinate variable, X_{it} may be a (1 x K_1) vector of time-varying covariates. Z_i may be a (1 x K_2) vector of time-invariant covariates; α, α, β_1, and β_2 are 1+K_1 +K_2 parameters, u_i is the individual-level impact, and ε_{it} is the peculiar error-term.

In case the u_i are related with the X_{it} or the Z_i, , the coefficients on the time-varying covariates X_{it} can be dependably assessed by a backslide on the within-transformed data or the essential differenced data but within the occasion that the u_iare uncorrelated with the X_{it} and the Z_i, the coefficients on the time-varying and time-invariant covariates can be dependably and viably assessed utilizing the random-effects backslide (Drukker, 2003; Baltagi, 2013; Wooldridge, 2000). All these estimates expect that E[ϵ_it ϵ_is] = for all s≠t, i.e., that there's no serial relationship within the peculiar mistakes, which would cause the standard mistakes to be one-sided and the gauges to be inefficient.

Hypotheses:

Null Hypothesis (H0): There is no first-order autocorrelation.

Alternative Hypothesis (Ha): There is first-order autocorrelation.

Serial relationship in a relapse demonstrate can lead to belittled standard blunders of the coefficients, expanded R-squared and Balanced R-squared values. To test for the nearness of serial relationship, the calculated likelihood (Prob) is compared to a centrality level (e.g., 0.05). On the off chance that Prob is less than 0.05, the invalid theory of no serial relationship is rejected, showing the nearness of critical serial relationship. Then again, in the event that Prob is more noteworthy than 0.05, the invalid speculation is acknowledged, recommending the nonattendance of critical serial relationship (Drukker, 2003; Baltagi, 2009; Wooldridge, 2000).

4.3.4.2 Tests for Cross-Sectional Dependence

The test for cross-sectional reliance in settled impact models or arbitrary impact models test the speculation of cross-sectional freedom in board information models with little T and expansive N by executing two semi- parametric tests as proposed by Frees (1995) and (Friedman, 1937) and the parametric testing handle proposed by Pesaran (2004).

Considering a board information show y_{it}= α_i+ $\beta' X_{it}$+ $Z_i\beta_2$+ u_{it}, i = 1, ….., N and

t = 1, ….., T. Where X_{it} is K x 1 vector of regressors, β may be a K x 1 vector of parameters to be evaluated, and α_i speaks to time-invariant person disturbance parameters. Beneath the invalid theory, u_it is expected to be autonomous and indistinguishably dispersed (i.i.d) over the periods and over cross-sectional units. The tests of cross-sectional reliance are substantial when T < N. The tests of cross-sectional conditions as proposed by Pesaran (2004), Liberates (1995; 2004) and Friedman (1937) investigations whether the residuals are connected over substances, which can cause the comes about to be predisposition.

4.3.4.2.1. Pesaran's CD Test

Pesaran (2004) proposed the following that CD = $\sqrt{\frac{2T}{N(N-1)}}\left(\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\hat{\rho}_{ij}\right)$ and shows that under the null hypothesis of no cross-sectional dependence CD $\underline{d}$ N (0, 1) for N → ∞ and T sufficiently large. The null hypothesis of non-correlated residuals, and the decision rule of P < 0.05, fail to accept the null hypothesis and conclude the presence of cross-sectional dependencies. (De Hoyos & Sarafidis, 2006; Torres-Reyna ,2007).

4.3.4.2.2. Friedman's Test

Friedman (1937) proposed a nonparametric test based on rank relationship coefficient of Spearman. The coefficient can be accepted as the regular product-moment relationship coefficient, but that the Spearman's rank relationship coefficient is computed from positions. Friedman's measurement is calculated based on the cruel Spearman's relationship and is communicated as takes after: $R_{ave} = \frac{2}{N(N-1)}\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\hat{r}_{ij}$; Where $\widehat{r_{ij}}$ = is the test gauge of the rank relationship coefficient of the residuals. Huge values of R_{ave} show the nearness of nonzero cross-sectional correlations.

Friedman (1937) illustrated that the Friedman measurement (FR) takes after an asymptotic chi-square conveyance with T-1 degrees of flexibility, where FR = (T-1){(N-1) R_ave 1}, as N gets to be expansive for a settled T. Within the setting of the invalid speculation of non-correlated residuals, a choice run the show of P < 0.05 leads to dismissing the invalid speculation and concluding the presence of cross-sectional conditions (De Hoyos and Sarafidis, 2006; Torres-Reyna, 2007).

4.3.4.2.3. Frees' Test

(Frees, 1995) Frees insights is based on the whole of the squared rank relationship coefficients and rises to the taking after: $R_{ave}^2 = \frac{2}{N(N-1)} \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \hat{r}_{ij}^2$. The joint dissemination of two autonomously drawn chi-square (X^2) factors is watched. Within the setting of the invalid speculation of non-correlated residuals, the choice run the show of $P < 0.05$ leads to the disappointment to acknowledge the invalid speculation and the conclusion of the presence of cross-sectional conditions (Torres-Reyna, 2007).

4.3.4.3. Modified Wald Test for Groupwise Heteroskedasticity in Fixed Effect Regression Model.

The adjusted Wald measurement gauges for groupwise heteroskedasticity within the residuals of a settled impact relapse show are displayed (Greene, 2000; Baum, 2000). The demonstrate accept the nearness of homoskedasticity, with the likely deviation from homoscedastic mistakes in board information being particular to the cross-sectional unit. Baum (2000) proposes the speculation for the test as takes after:

H□: $\sigma^2 i = \sigma^2$, for all i (Homoskedasticity assumption)

H□: $\sigma^2 i \neq \sigma^2$, for at least one i (Groupwise heteroskedasticity assumption)

The Modified Wald test statistic is calculated as: $MW = [(T - 1) / [(T - 2) * (N - K - 1)]] * [(\Sigma_i (R_i^2 - 1)) / [1 - (1 / T)]]$ Where: T represents the number of periods, N represents the total number of observations, K represents the number of explanatory variables in the regression model, R_i^2 represents the adjusted coefficient of determination of the ith fixed effect regression equation. The test statistic MW follows a chi-square distribution with degrees of freedom (T - 1). The calculated MW value is compared to the critical chi-square value at the desired significance level to determine whether or not to reject the null hypothesis of homoscedasticity. The modified Wald test is often used to detect group-specific heteroskedasticity in a fixed-effects regression model. It tests whether there is a significant difference in the variance of the error terms between different groups. Rejection of the null hypothesis indicates heteroskedasticity, indicating that error variances differ significantly between groups.

Sigma^^2(i)==sigma if i=1,N_g where N_g is the number of cross-sectional units. The resulting test statistic is divided by chi-square (N_g) under the null hypothesis of homoscedasticity. Greene (2000) explains that the likelihood ratio, the

Lagrange coefficient, and the standard Wald test statistic are sensitive to the assumption of normality of errors. However, for panels with "large N, small T" and FE, simulations have shown that the power of this test statistic is low for small samples. Therefore, caution is advised when interpreting the results of these tests in such contexts. If the calculated probability (Prob) is greater than 0.05, the null hypothesis of homoscedasticity is rejected, indicating the presence of heteroscedasticity. In this case, robust S.E. can be used to correct for heteroskedasticity (Baum, 2000; Greene, 2000).

4.3.5. Fixed-Effects Regression with Driscoll-Kraay Standard Errors

In the pursuit of robust econometric analysis, Hoechle (2007) employed the DRK S.E. approach to address the complex issue of cross-sectional dependence. This thesis undertook a comprehensive examination of both FE and RE estimates, while subjecting them to the stringent Hausman test. The findings of this analysis strongly advocate for the utilization of FE in the econometric model, particularly in the context of observed cross-sectional dependencies, heteroskedasticity, and a mild presence of autocorrelation within the data. It is imperative to underscore the importance of accurate modeling and inference in the face of these statistical challenges. Cross-sectional dependence, often encountered in panel data analysis, poses a significant concern for the validity of S.E. and, consequently, the reliability of estimated coefficients. As Driscoll and Kraay (1998) have highlighted, addressing this issue is of paramount importance in econometric research.

This methodological approach was pivotal in rectifying the presence of cross-sectional dependencies in the model, thereby enhancing the validity of the subsequent analysis. DRK's technique contributes to a more precise estimation of S.E., which is crucial for sound inference. Statistical evidence further underscores the relevance of Hoechle's methodology.

The Hausman test, a standard diagnostic tool in econometrics, provides compelling support for the FE approach when cross-sectional dependence and heteroskedasticity are encountered.

This test scrutinizes the distinction between FE and RE estimates, with the idea that if the two are significantly different, the FE model is preferred. In Hoechle's analysis, the results of the Hausman test align with the utilization of FEs, reinforcing the robustness of this model specification. Incorporating Driscoll and Kraay's

correction for cross-sectional dependencies not only aligns with best practices in panel data analysis but also addresses a well-documented source of bias.

This methodological choice aids in improving the quality of parameter estimates, reducing the risk of spurious results, and enhancing the overall robustness of the econometric model.

In conclusion, Hoechle's (2007) utilization of the DRK S.E. approach, the Hausman test, and the correction for cross-sectional dependencies through Driscoll and Kraay's technique offers a compelling and methodologically rigorous framework for addressing the challenges associated with cross-sectional dependence, heteroskedasticity, and mild autocorrelation in panel data analysis. The statistical evidence and the methodological underpinnings, as discussed in this thesis, highlight the critical role of these techniques in ensuring the integrity and reliability of econometric results.

4.3.6. The Baltagi-Wu GLS Estimator Test

The residual μ* can be used to estimate the variance components and invert the matrix formulas in (Baltagi, 2009). The sum yields the following variance component estimates. The Baltagi-Wu LBI is the sum of the expressions defined below:

$d_* = d_1 + d_2 + d_3 + d_4$, Where

$$d_1 = \frac{\sum_{i=1}^{N}\sum_{j=1}^{n_i}\{\widetilde{z_{\iota t_{\iota,J-1}}} - \widetilde{z_{\iota t_{\iota,J-1}} I(t_{\iota J} - t_{i,j-1}=1)}\}^2}{\sum_{I=1}^{N}\sum_{j=1}^{ni}\widetilde{z_{\iota t_{\iota J}}}^2}$$

$$d_2 = = \frac{\sum_{i=1}^{N}\sum_{j=1}^{n_{i-1}}\widetilde{z_{\iota t_{\iota,J-1}}}^2 - \{1 - I(t_{ij}\ t_{i,j-1}=1)\}^2}{\sum_{I=1}^{N}\sum_{j=1}^{ni}\widetilde{z_{\iota t_{\iota J}}}^2}$$

$$d_3 = \frac{\sum_{i=1}^{N}\widetilde{z^2_{\iota t_{\iota 1}}}}{\sum_{i=1}^{N}\sum_{j=1}^{n_i}\widetilde{z_{\iota t_{\iota J}}}}, \qquad d_4 = \frac{\sum_{i=1}^{N}\widetilde{z^2_{\iota t_{\iota n_\iota}}}}{\sum_{i=1}^{N}\sum_{j=1}^{n_i}\widetilde{z^2_{\iota t_{\iota J}}}}$$

The I() is the specific indicator function that takes the value of 1 (and becomes I(1)) if the condition is true and 0 if otherwise. The $\widetilde{z_{\iota t_{\iota,J-1}}}$ The residuals used in the within estimator are obtained from Baltagi (2009) study. Likewise explained that d_1 is the Durbin Watson statistic has been adapted to address unbalanced panel datasets, unequally spaced datasets, and the issue of missing data.(Baltagi, 2009; Baltagi, 2013; Drukker, 2003).

Two-tailed p-values test the theory that each coefficient is essentially distinctive from zero utilizing the comparing t-values. A P esteem underneath 0.05 demonstrates dismissal of the invalid speculation, which shows that the indicator is measurably

noteworthy within the show at the 95% noteworthiness level (Torrres-Reyna, 2007). So also, in case the likelihood (Prob) related with the chi-square test measurement is less than 0.05, this implies that the demonstrate is palatable. The F-test examines whether all coefficients within the show are noteworthy together, which shows whether the show as a entire is factually critical (Torrres-Reyna, 2007).

4.4 Modeling Exchange Rate Volatility

Modeling and estimating the conditional change, frequently alluded to as the instability of an financial or budgetary variable, is vital to scholastics and professionals. Engle (1982) presented autoregressive conditional heteroskedasticity (Curve) to demonstrate the conditional change. Bollerslev (1986) presented an inconceivably imperative portion of the ARCH show with generalized ARCH (GARCH) models, which give an unconstrained elective to the higher arrange ARCH demonstrate. Money related modeling experts regularly lean toward the GARCH prepare since it gives a more practical setting than other shapes when determining costs and intrigued rates of money related disobedient. The issue with Bend is that the number of squared residuals can now and then be as well expansive, so that the non-negativity condition may not hold. Numerous budgetary connections are non-linear in nature (Campbell and Mackinlay, 1997). Straight basic models (and time arrangement) come up short to clarify a few critical properties common to budgetary information, such as leptokurtosis, instability clustering (or instability accumulation), and use impacts.

4.4.1 Stationarity Test

X_t = is stationary if the following conditions exist which are that the financial or economic data series fluctuates around a constant long run mean, it has a finite variance, i.e it is not dependent upon time, the covariance between X_t and X_{t-1} depends only on the difference apart in time E (X_t) = μ (The mean is constant in time t), Var (X_t) = σ^2 (The variance is constant in time t) and the Cov (X_t, X_{t+k}). The stationarity test is confirmed by an Augmented Dickey-Fuller (ADF) test. (Horvath, 2014; Horvath, 2015).

The augmented dynamic model follows the process as presented below (Mackinnon,1996; Dickey & Fuller, 1976): $\Delta y_t = \beta y_{t-1} + u_t$ which has the following

properties: The Constant or drift of term α_0, $\Delta y_t = \alpha_0 + \beta y_{t-1} + u_t$, the Time trend t $\Delta y_t = \alpha_0 + \gamma T + \beta y_{t-1} + u_t$, the lagged values of the dependent variable $\Delta y_t = \alpha_0 + \gamma T \beta y_{t-1} + \delta_1 \Delta y_t + \delta_2 \Delta y_t + \ldots + u_t$

In this model, the following pair of hypotheses are evaluated: H_o: > 0 vs. H_A:ϕ< 0 that is based on the t-statistic of the coefficient ϕ from an OLS estimation of (2) and H_o i. e . the null hypothesis will be rejected if the t-statistic is smaller than the relevant critical value process (Mackinnon, 1996; Dickey & Fuller, 1976; Horvath, 2015; Horvath, 2014). ARCH-LM test is immensely popular for testing conditional heteroskedasticity, by fitting ARCH(q) model estimation of the residuals and has an asymptotic $\chi^2(q)$ of the distribution if the null hypothesis of no conditional heteroskedasticity exists (Engle,1982). $\hat{u}_t^2 = \beta_0 + \beta_1 \hat{u}_{t-1}^2 + \ldots + \beta_q \hat{u}_{t-q}^2 + e_t$ and checking the null hypothesis H_o: $\beta_1 = \ldots. \beta_q = 0$ and H_a: $\beta_1 \neq 0$ or $\ldots. \beta_1 \neq 0$. Instability could be a key parameter utilized in monetary applications- from subordinates valuation to asset/risk administration which incorporates corporate supporting and proficient financial approach for financial soundness.

4.4.2 ARCH TEST

The Autoregressive Conditional Heteroscedasticity (ARCH) / Generalized Autoregressive Conditional Heteroscedasticity (GARCH) are the main tools for volatility modeling and forecasting. In many economic and financial time series, it shows conditional volatility when the conditional variance changes over time. Volatility is high when large changes occur frequently in a financial or economic time series, but when large changes occur less frequently, volatility is low. (Nelson, 1991; Campbell, Lo, & Lefront, 1996; Bollerslev, 2008; Horvath, 2015).

The conditional mean of y is given by E (y_t / Ω_{t-1}). The regression error is mean zero and unforecastable, that is E (e_t / Ω_{t-1}) = 0. The conditional variance of y is Var (y_t / Ω_{t-1}) = E ($(y_t - (y_t / \Omega_{t-1}))^2 / (\Omega_{t-1})$ = E (e_t^2 / Ω_{t-1}). The squared regression error can be predicted. If the squared error is predictable, then the conditional variance is time-varying and correlated, so the magnitude of changes is predictable.

ARCH (1) Model can be presented as follows: $y_t = \mu + e_t$, σ_t^2 = var (e_t^2 / Ω_{t-1}) = w + α e_{t-1}^2, w > 0, α ≥ 0, α > 0 . The condition over focuses out that the conditional change is tall when the slacked squared mistake is tall. Expansive mistakes sign nowadays implies tall anticipated errors (in magnitude) within the future. Little size

blunders estimate following period is little size mistakes. $\alpha_t^2 = \sigma^2 + \alpha\ (e_{t-1}^2 - \sigma^2)$. large error signs refer to the presence of significant and sizable errors or residuals. These errors are often characterized by their magnitude and can indicate the presence of heteroscedasticity, which means that the variability of the error terms is not constant across observations. In an ARCH model, the conditional variance of the error term is modeled as a function of past error terms. When the errors exhibit large signs, it suggests that the conditional variance is not adequately capturing the heteroscedasticity present in the data. This can be problematic because it implies that the model may not fully capture the changing volatility patterns and might underestimate the impact of extreme observations on future volatility. Large error signs in ARCH models may indicate the need for model improvement or specification adjustments to better account for the heteroscedasticity in the data. This could involve exploring alternative functional forms, incorporating additional explanatory variables, or considering alternative volatility models such as GARCH models that allow for more flexible modeling of volatility Dynamics (Nelson, 1991; Campbell, Lo & Lefront, 1996; Bollerslev, 2008; Horvath, 2015).

This clarifies that the conditional fluctuation may be a combination of the unrestricted fluctuation and the squared mistake deviation of its cruel. These can be sent as takes after: $e_t^2 = w + \alpha e_{t-1}^2 + \mu_t$, Where μ_t = is white noise. The white noise process can be defined as the building block in most time series and associated with a zero mean, constant variance, and no autocorrelation. (Paul, 2005). e^2 is an AR(1) allowing for p lags of squared errors e_t = is normally distributed, then its said to be a Gaussian white noise. $y_t = \mu + e_t$ and $\sigma_t^2 = w + \alpha_1 e_{t-1}^2 + \alpha_2 e_{t-2}^2 + \ldots + + \alpha_p e_{t-p}^2$.

4.4.3 GARCH

GARCH model was proposed by Bollerslev (2008). to simply fix the problem of positive and negative shocks of financial time series provided as follows: $\sigma_t^2 = w + \beta\sigma_{t-1}^2 + \alpha e_{t-1}^2$, $\beta > 0$, $w > 0$, and $\alpha \geq 0$. This makes the variance a function of all previous lags: $\sigma_t^2 = w + \beta\sigma_{t-1}^2 + \alpha e_{t-1}^2 = \sum_{j=0}^{\infty} \beta^j\ (w + \alpha e_{t-1-j}^2)$. It's also smother than an ARCH model with a small number of lags. In the GARCH (p, q) model, the value of p represents the number of lags of squared errors, while the value of q represents the number of lags of conditional variance. $\sigma_t^2 = w + \beta_1\sigma_{t-1}^2 + \ldots + \beta_q\sigma_{t-q}^2 + \alpha_1 e_{t-1}^2 + \ldots + \alpha_p e_{t-p}^2$

The generalized ARCH (GARCH) was developed by Bollerslev (1986). GARCH allows the conditional variance of a stock index to be dependent upon previous own lags. The GARCH (p,q) model is given by: $R_t = \alpha + \varepsilon_t$ and $\sigma_t^2 = \mu + \sum_{i-1}^{q} \gamma\, \varepsilon_{t-1}^2 + \sum_{j=1}^{p} \beta_j\, \sigma_{t-j}^2$. Where p is the order of GARCH while q is the order of ARCH process. It was presented by the work of Zakoian (1994) and Glosten, Jagannathan, and Runkle (1993). The most target of this show is to capture asymmetry in terms of positive and negative stuns. The determination for the conditional variance of this demonstrate is additionally proposed by Zakoian (1994).

4.4.4. EGARCH

Exponential GARCH (EGARCH) provides better information about whether a shock is positive or negative than the GARCH process. Distinguishing the effects of negative and positive shocks in a financial or economic time series is a special form of heteroscedasticity (Bollerslev, 2008 & Nelson, 1991).

It can be specified as $\varepsilon_t = \sigma_t z_t$, z_t is a standard Gaussian process and In (σ_t^2) = w + α (|z_t - □[|z_{t-1}|] + γ. The shock at time t-1 has impacts on the variance at time t; therefore the volatility is more llikely to be higher. Noteworthy, the effective coefficient of an association with a negative shock is γ-α; while the coefficient associated with a positive shock is γ + α. Where γ- is generally negative and statistically siignificant in many financial time series. In a generalized specification for accounting for more lag(s); the EGARCH (p, q) model assumes that In (σ_t^2) = w + $\sum_{i=1}^{p}\{\alpha_i$ (|z_t - □[|z_{t-1}|] + γ; EGARCH (1, 1) is usually the option with the best fits in many financial time series (Bollerslev, 2008; Nelson, 1991).

4.5. Model, Hypothesis, and Data

This section includes the model utilized in this study, the hypothesis tested, and the data.

4.5.1. Empirical Model Specification of the impact of Real Effective Exchange Rate on Real Economic Growth in the OECD

In accordance with previous empirical research investigating the influence of the REER on economic growth over a long period of time, this study employs comparable

variables to those utilized by Barro (1991), Andrea and Stefano (2001), and Eichengreen (2008). To analyze the effects of the REER and its volatility on economic growth, a framework with fixed and random effects is applied, concentrating on country I and time t. In particular, the FE method is used to evaluate the impact of the REER on economic development within the OECD.

For the modelling of the FE and RE, it is started as follows

$\text{GDP Growth}_{it} = \alpha_0 + \beta_2 \text{ In REER}_{it} + \beta_3 \text{ In Govt cons exp}_{it} + \beta_4 \text{ Population growth}_{it} + \beta_5 \text{InGross capform}_{it} + \beta_6 \text{ Infl, GDP Deflator}_{it} + \beta_7 \text{In Trade\%GDP}_{it} + f_t + \mu_i$

Where, Reer is real effective exchange rate, govtcons is government consumption expenditure, popgrowth is the population growth, grosscapform is the gross capital formation, inf is the inflation rate, Trade is trade as percentage of GDP.i is countries, t is time, f_t is the FE term, and μ_t is the error term. All the variables are expressed in natural logarithms.

The specification for the fixed effect method on the impacts of REER volatility on economic growth in the OECD is expressed as follows:

$\text{GDP Growth}_{it} = \alpha_0 + \beta_2 \text{ In REER Volatility}_{it} + \beta_3 \text{ In Govt cons exp}_{it} + \beta_4 \text{ Population growth}_{it} + \beta_5 \text{InGross capform}_{it} + \beta_6 \text{Infl, GDP Deflator}_{it} + \beta_7 \text{In Trade\%GDP}_{it} + f_t + \mu_i$

Where, Volatility is REER volatility.

The specification for the random effect method on the impacts of REER on economic growth in the OECD is presented as follows:

$\text{GDP Growth}_{it} = \alpha_0 + \beta_2 \text{ In REER}_{it} + \beta_3 \text{ In Govt cons exp}_{it} + \beta_4 \text{ Population growth}_{it} + \beta_5 \text{InGross capform}_{it} + \beta_6 \text{Infl, GDP Deflator}_{it} + \beta_7 \text{In Trade\%GDP}_{it} + \mu_{it} + \xi_{it}$; where, μ_{it} is the random effect and ξ_{it} is the error term.

The specification for the random effect method on the impacts of REER volatility on economic growth in the OECD is as follows:

$\text{GDP Growth}_{it} = \alpha_0 + \beta_2 \text{ In REER Volatility}_{it} + \beta_3 \text{ In Govt cons exp}_{it} + \beta_4 \text{ Population growth}_{it} + \beta_5 \text{ In Gross Cap form}_{it} + \beta_6 \text{Infl, GDP Deflator}_{it} + \beta_7 \text{ In Trade\%GDP}_{it} + \mu_{it} + \xi_{it}$

4.5.2. Study Hypothesis

Hypothesis 1: There is no REER volatility in the OECD Countries

H_0 : $\beta_2 = 0$: The REER volatility has no significant impact in the OECD

H_1 : $\beta_2 > 0$: The REER volatility has a significant impact in the OECD

Hypothesis 2: The REER has a Positive Impact on Economic Growth in the OECD

H_0 : $\beta_2 = 0$: The REER has no significant impact on GDP Growth in the OECD

H_1 : $\beta_2 > 0$: The REER has a positive impact on GDP Growth in the OECD

Study Hypothesis 3: The REER volatility has a negative impact on Economic Growth in the OECD

H_0 : $\beta_2 = 0$: The REER volatility has no impact on GDP growth

H_1 : $\beta_2 < 0$: The REER volatility has a negative impact on GDP growth in the OECD

4.5.3. Data Description and Sources of variables

The sample used in this study is a strongly balanced panel of 36 OECD countries from 1996 to 2020 for the FE, RE and the Driscoll-Kraay aspect part of the thesis, even though Estonia and Latvia are part of OECD but were omitted in this research modelling because as of 1996, they were still in their transitioning stages and their volatility shows outliers to other countries Table 1 provides the summary of variables and their data sources. Turkiye and Slovakia have the lowest REER to GDP growth rate, while Estonia is an outlier because of the relatively high REER to GDP growth over the year as a sign of over-valuation of their ER and relatively lowest GDP growth rate to trade in the OECD. Estonia and Latvia have the highest GDP growth to population growth while Japan, Italy, Lithuania, and Poland have the lowest population growth rates in the OECD. Across the years, there were major regional and global shocks which were the east Asian tiger economic crisis from 1997-1999 in South Korea include in the OECD, and by 1996 -1999 many of the eastern European countries like Czech, Lithuania and Poland just transited from a socialist economy to mixed economy, while the great recession of 2007-2009 and the pandemic shocks from 2019 to 2020 were captured in the idiosyncratic shocks of the FE.

The year 2020 was required in clarifying the energetic component of the proposition since of the worldwide instability in financial development within the OECD, it provides more financial appears that's vital in clarifying the energetic board investigation of the affect of REER and its instability on economic growth,

subsequently it was incorporate:

Table 4.1: Description of the Variables and their Sources

Description of the Variables and their Sources			
S/N	**VARIABLE**	**DESCRIPTION**	**SOURCE**
1	GDP Growth	GDP growth (annual %) of country i at time t	World Bank's World Development Indicators (WDI) & OECD
2	Real effective exchange rate	Natural logarithm of Real beffective exchange rate index (2010=100) of country i at time t	WDI and Bruegel Institute
3	Govt Consumption Expenditure	Natural logarithm of Final Consumption Expenditure (% of GDP) of country i at time t	WDI & OECD
4	Population Growth (annual %)	Population growth (annual %) of country i at time t	WDI & OECD
6	Gross Capital Formation	Natural logarithm of gross capital formation (% of GDP) of country i at time t	WDI & OECD
7	Inflation	Inflation GDP Deflator (annual %) of country i at time t	WDI & OECD
8	Trade	Natural logarithm of Trade (% of GDP) of country i at time t	WDI & OECD
9	Volatility	Natural logarithm of Real effective exchange rate volatility of country i at time t	Authors computation using STATA 14

Table 4.2: Summary Statistics in the OECD -Mean and Variance

Summary Statistics in the OECD: Mean and Variance			
Variable	**Obs.**	**Mean**	**Variance.**
$GDP\ Growth_{it}$	898	2.453562	10.12073
$In\ Real\ Effective\ Exchange\ Rate_{it}$	900	4.577982	0.0200814
$In\ Govt\ Consumption\ Expenditure\ (\%\ of\ GDP)_{it}$	900	2.909191	0.0531543
$Population\ growth,\ (annual\ \%)_{it}$	900	0.6683329	0.521178
$In\ Gross\ Capital\ formation\ (\%\ of\ GDP)_{it}$	900	3.127118	0.0318007
$Inflation\ GDP\ Deflator_{it}$	900	3.525931	57.04418
$In\ Trade\ (\%\ of\ GDP)_{it}$	900	4.337096	0.2712142
$In\ REER\ Volatility_{it}$	900	1.314051	0.9174197

Table 4.3: Summary Statistics in the OECD- Skewness and Kurtosis

Summary Statistics in the OECD: Skewness and Kurtosis		
Variable	**Skewness**	**Kurtosis**
$GDP\ Growth_{it}$	-0.5204121	8.486627
$In\ Real\ Effective\ Exchange\ Rate_{it}$	-0.6577932	6.297816
$In\ Govt\ Consumption\ Expenditure\ (\%\ of\ GDP)_{it}$	-0.7827339	3.229739
$Population\ growth,\ (annual\ \%)_{it}$	0.037337	3.661572
$In\ Gross\ Capital\ formation\ (\%\ of\ GDP)_{it}$	-0.14214	4.612411
$Inflation\ GDP\ Deflator_{it}$	10.62871	161.9619
$In\ Trade\ (\%\ of\ GDP)_{it}$	0.2136827	3.406107
$In\ REER\ Volatility_{it}$	-0.2536885	2.287016

The following explain the summary statistics analytically one by one the mean, variance, skweness and kurtosis and how it relates to economic growth in the OECD graphicallly. Firstly, GDP Growth has 898 observations which is relatively sizable, which generally enhances the reliability of the calculated statistics and the insights we can draw from the data. The mean value of 2.453562 indicates that, on average, the GDP Growth has a positive growth rate of approximately 2.45%. The relatively high

variance of 10.12073 suggests a significant dispersion of data points around the mean. This indicates that there are fluctuations in the growth rates of GDP, with values that deviate notably from the mean. The negative skewness of -0.5204121 suggests that the distribution of GDP growth rates might be slightly skewed to the left. This implies that there may be some negative growth rates or smaller positive growth rates that are causing the distribution to lean towards the left side. The kurtosis value of 8.486627 indicates that the distribution has relatively high kurtosis. This suggests that the distribution of GDP growth rates has heavy tails and potentially more outliers or extreme values than a normal distribution. The presence of heavy tails could be due to economic shocks or significant events affecting GDP growth. The data suggests that, on average, there has been positive growth, but the relatively high variance and kurtosis indicate that there have been periods of both higher and lower growth rates, potentially influenced by economic fluctuations or significant events. The negative skewness also implies that there might be instances of slower or negative growth rates impacting the overall distribution. This information can guide further analysis into the factors influencing GDP growth and its volatility.

The Log of REER has 900 observations and the mean value of 4.577982 suggests that, on average, the REER has a value of approximately 4.58. This provides a central point around which the ER values tend to cluster. The low variance of 0.0200814 indicates that the ER values have relatively low dispersion around the mean. This suggests that the REER has been relatively stable over the observed period. The negative skewness of -0.6577932 suggests that the distribution of REER values might be slightly skewed to the left. This implies that there could be some lower ER values that are causing the distribution to lean towards the left side. The kurtosis value of 6.297816 indicates that the distribution has higher-than-normal kurtosis. This suggests that the distribution of REER has heavier tails and potentially more outliers or extreme values than a normal distribution. This could indicate that there have been periods of significant ER movements, it represents the real effective exchange rates over time. The data suggests that, on average, the ER has been relatively stable, with a low variance indicating limited fluctuations around the mean. The negative skewness suggests a slight skew to the left, potentially indicating instances of lower ER values. The higher kurtosis suggests that there have been periods of more extreme ER movements or volatility, which might be associated with economic events or policy changes affecting ERs.

Figure 4.1 below displays the relationship between GDP growth and the REER which shows a mixed relationship at the country specific level but heavily clustered but few outliers that is highly positive.

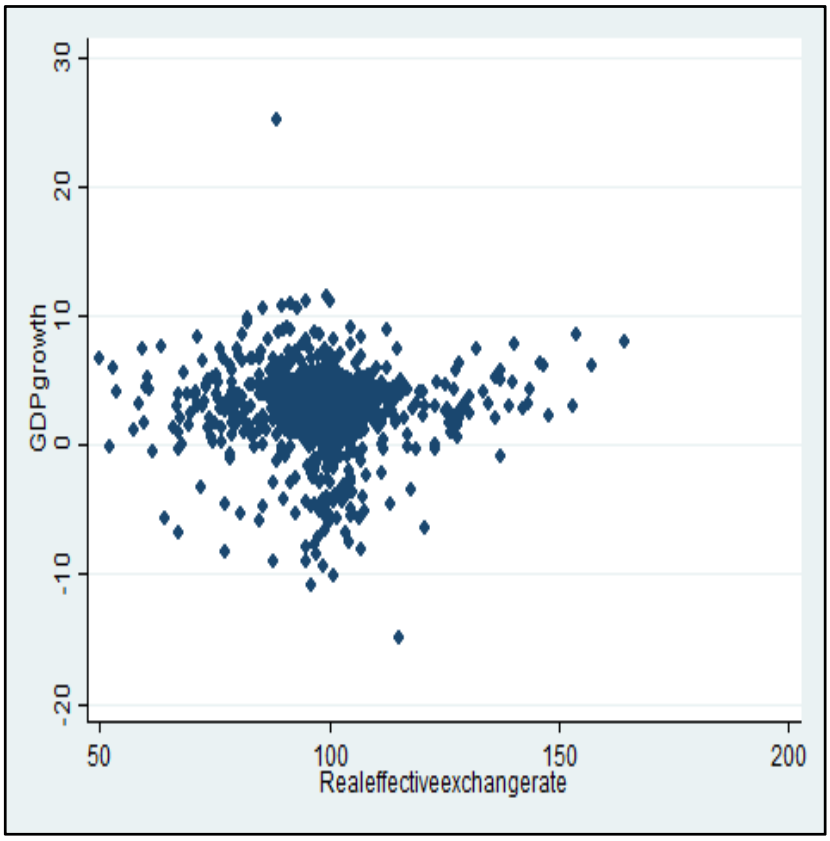

Figure 4.1: The Graphical Relationship between GDP Growth and the REER in the OECD Countries

The REER Volatility has 900 observations and the mean value of 1.314051 suggests that, on average, the volatility of the (REER) is approximately 1.31. This provides a measure of the average variability or fluctuations in the REER over time. The variance of 0.9174197 indicates a relatively high level of dispersion in REER volatility values around the mean. This suggests that the REER experiences substantial fluctuations over time. The negative skewness of -0.2536885 suggests that the distribution of REER volatility values might be slightly skewed to the left. This implies that there may be instances where REER volatility is lower than the average. The kurtosis value of 2.287016 suggests that the distribution has kurtosis higher than that of a normal distribution. This implies that the distribution of REER volatility has relatively heavier. For the variable "ln REER Volatility", the data suggests an average

REER volatility of approximately 1.31, with substantial fluctuations around this mean. The distribution is slightly skewed to the left, indicating instances of lower volatility, and has heavier tails, indicating the presence of more extreme volatility values. This is shown in figure 2 explaining the dynamics of the relationship between the REER volatility and economic growth in the OECD countries. Figure 2 shows the relationship between the REER volatility and economic growth in the OECD as explained in about the details of the variable above.

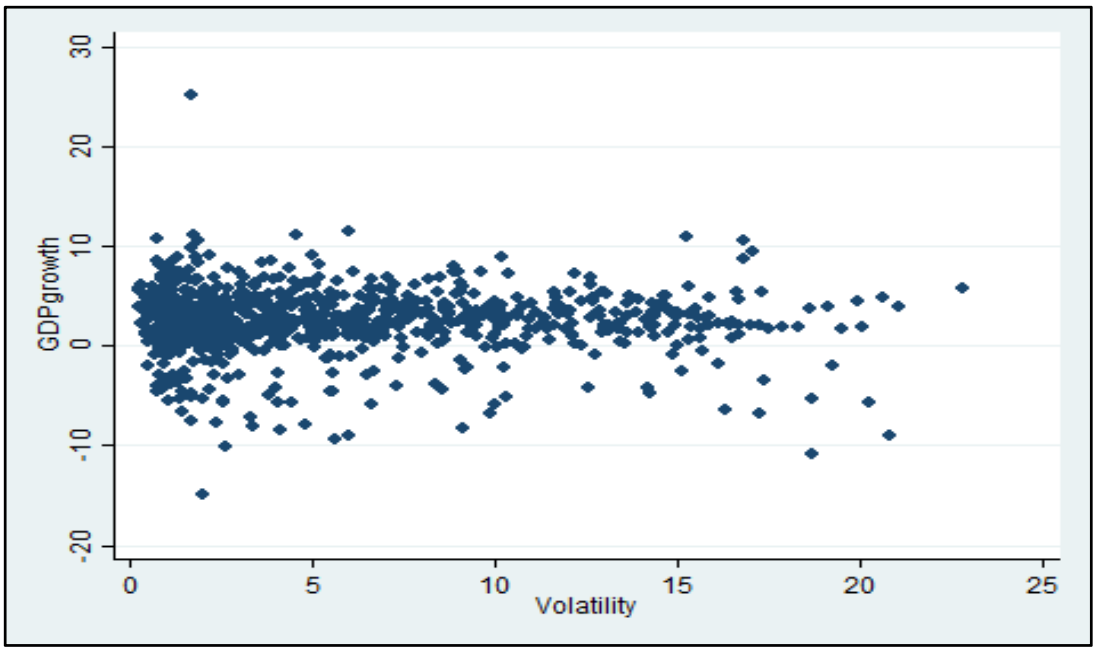

Figure 4.2: The Graphical Relationship between GDP Growth and REER Volatility in the OECD Countries

Population Growth Rate (annual %) : This variable also has a substantial number of observations (900). The variance is moderate (0.52), indicating some variability in annual population growth rates. The skewness is close to zero (0.04), suggesting a nearly symmetric distribution. The kurtosis is moderate (3.66), indicating a distribution with somewhat heavy tails.The relationship between the populations growth and economic growth in the OECD tends to be negative, from the graphical point of view; while a positive relationship with growth in fewer countries in the OECD.

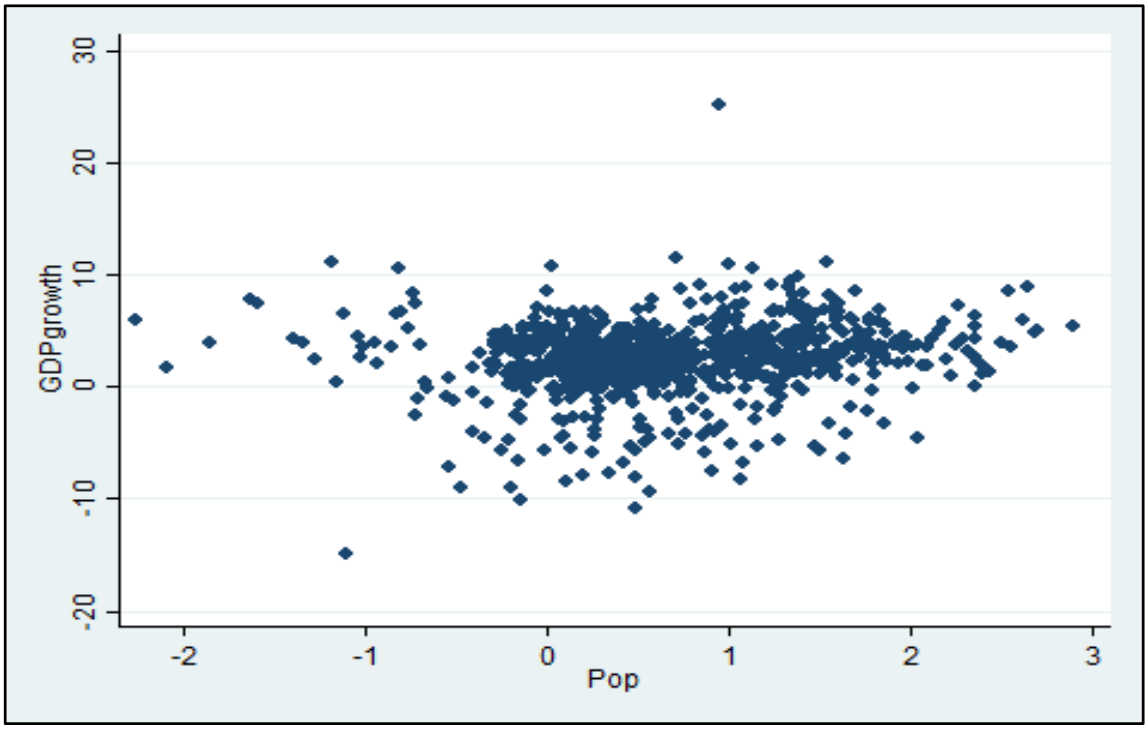

Figure 4.3: The Graphical Relationship between GDP Growth and Population Growth (annual of) in the OECD Countries

The Log of GCF has 900 observations and the mean value of 3.127118 suggests that, on average, GCF as a percentage of GDP is approximately 3.13%. This provides an average level of investment in capital relative to the size of the economy. The variance of 0.0318007 indicates that the GCF values have relatively low dispersion around the mean. This suggests that there is a relatively consistent proportion of GDP allocated to capital formation. The negative skewness of -0.14214 suggests that the distribution of GCF as a percentage of GDP is slightly skewed to the left. This implies that there may be instances where the proportion of GDP allocated to capital formation is lower than the average. The kurtosis value of 4.612411 indicates that the distribution has higher-than-normal kurtosis. This suggests that the distribution of GCF has relatively heavier tails and potentially more outliers or extreme values than a normal distribution. This could indicate periods of significant shifts in investment level. It represents the proportion of GDP allocated to GCF (investment in capital) over time. The data suggests that, on average, gross capital formation constitutes around 3.13% of GDP. Figure 9 below graphically display the cluster of the GCF in relations with GDP Growth over the years in the OECD, although few countries displays a situation of an outlliers. The low variance indicates a consistent allocation of GDP to capital

formation. The slightly negative skewness suggests instances where the proportion allocated to capital formation is lower than the average. The higher kurtosis implies that there are periods of more extreme shifts in the proportion of GDP allocated to capital formation, possibly reflecting changes in investment patterns or economic conditions.

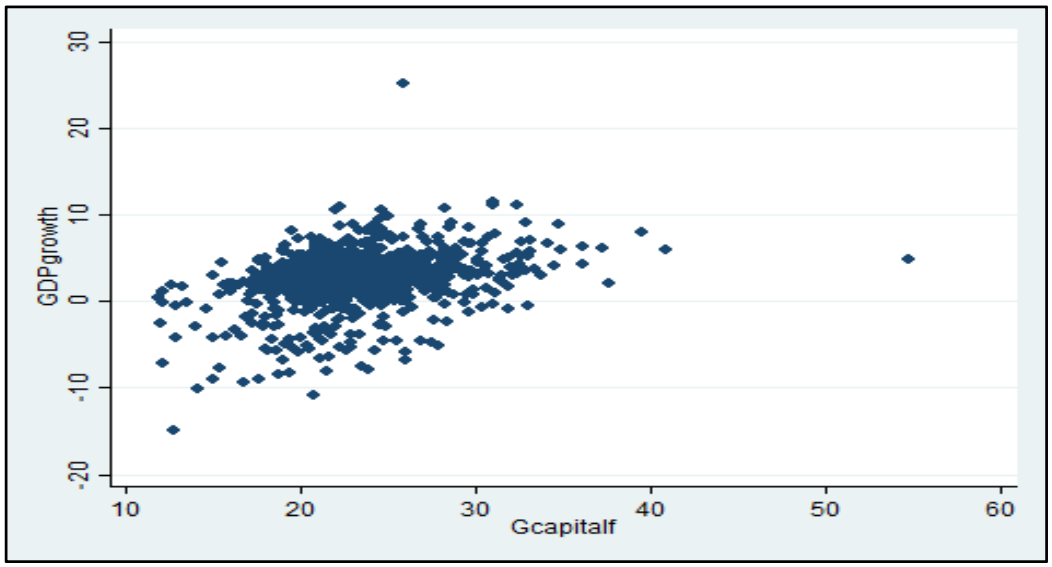

Figure 4.4: The Graphical Relationship between GDP Growth and Gross Capital Formation (% of GDP) in the OECD Countries

The Log of GCE as percentage of GDP has 900 observations and the mean value of 2.909191 suggests that, on average, GCE as a percentage of GDP is approximately 2.91%. This provides an average level of GCE relative to the size of the economy. The variance of 0.0531543 indicates that the GCE values exhibit moderate dispersion around the mean. This suggests that there are variations in the proportion of GDP allocated to GCE. The negative skewness of -0.7827339 suggests that the distribution of GCE as a percentage of GDP might be slightly skewed to the left. This implies that there may be instances where the proportion of GDP allocated to government consumption is lower than the average, The kurtosis value of 3.229739 indicates that the distribution has kurtosis that is moderately higher than that of a normal distribution. This suggests that the distribution has relatively heavier tails, which could be due to occasional higher values of GCE as a percentage of GDP. It represents the proportion of GDP allocated to GCE over time. The data suggests that, on average, GCE constitutes around 2.91% of GDP. The moderate variance indicates variations in this

proportion over time. The negative skewness suggests a slight skew to the left, indicating instances where GCE is lower than average. The moderately higher kurtosis suggests occasional spikes in the proportion of GDP allocated to GCE, which might be linked to specific economic or policy circumstances.

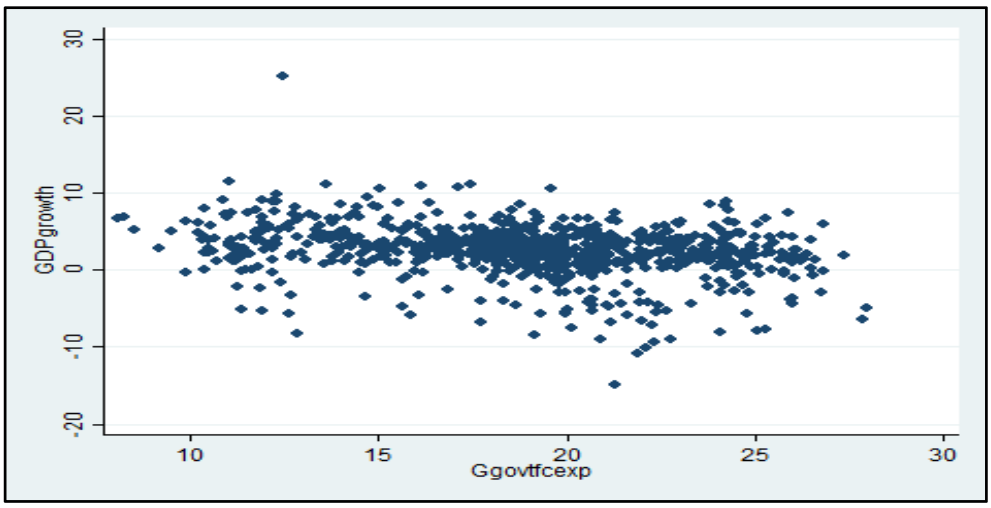

Figure 4.5: The Graphical Relationship between GDP Growth and Government Consumption Expenditure (% of GDP) in the OECD Countries

Inflation GDP Deflator : This variable also has 900 observations, providing a robust dataset. The variance is high (57.04), indicating substantial variability in the inflation GDP deflator. The skewness is extremely high (10.63), indicating a highly positively skewed distribution. The kurtosis is very high (161.96), suggesting a distribution with extremely heavy tails, likely indicating the presence of outliers.The higher kurtosis implies that there are periods of more extreme inflation rates, potentially associated with significant economic events, policy changes, or shifts in supply and demand dynamics.

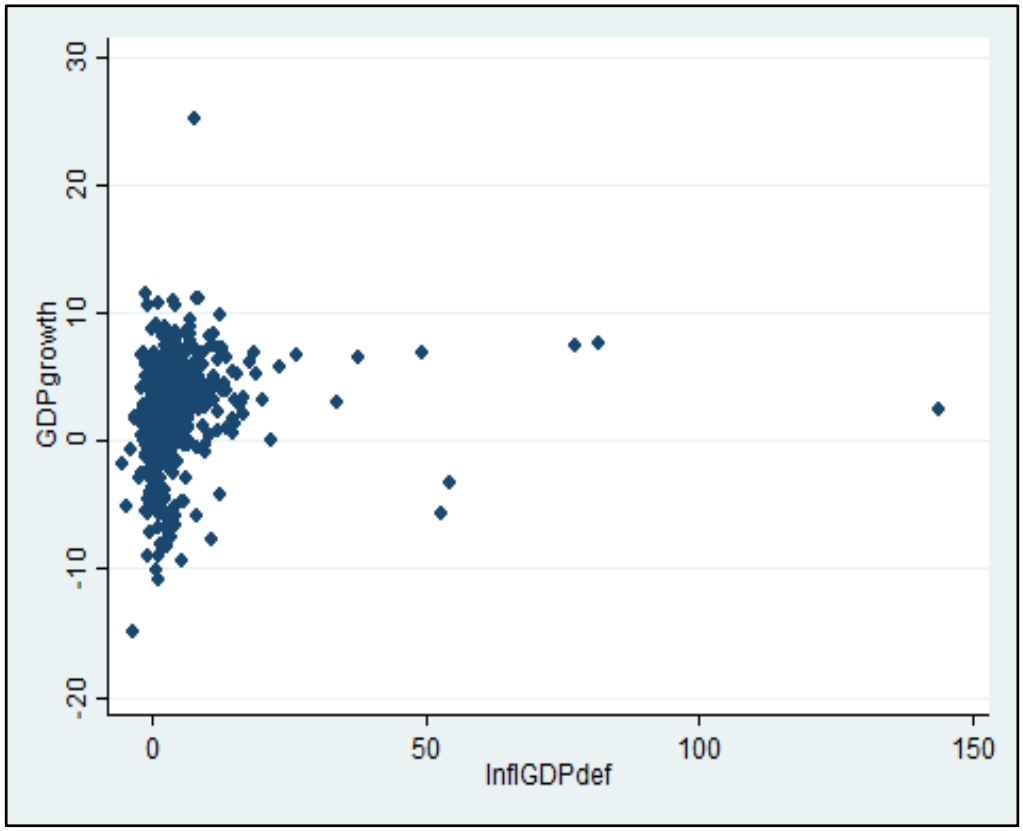

Figure 4.6: The Graphical Relationship between GDP Growth and Inflation, GDP Deflator in the OECD Countries

The Log of Trade (% of GDP) has 900 observations and the mean value of 4.337096 indicates that, on average, the trade as a percentage of GDP is approximately 4.34%. This provides an average level of trade activity relative to the size of the economy. The variance of 0.2712142 suggests that the trade percentage values have moderate dispersion around the mean. This indicates variations in the proportion of GDP attributed to trade over time. The positive skewness of 0.2136827 suggests that the distribution of trade percentages might be slightly skewed to the right. This implies that there may be instances where the proportion of trade relative to GDP is higher than the average. The kurtosis value of 3.406107 indicates that the distribution has kurtosis is moderately higher than that of a normal distribution. This suggests that the distribution of trade percentages has relatively heavier tails, which could indicate occasional periods of more extreme trade levels. he data suggests an average trade percentage of around 4.34% of GDP. The moderate variance indicates variations in trade proportions over time, with a slight skew to the right and occasional periods of higher trade activity relative to GDP.

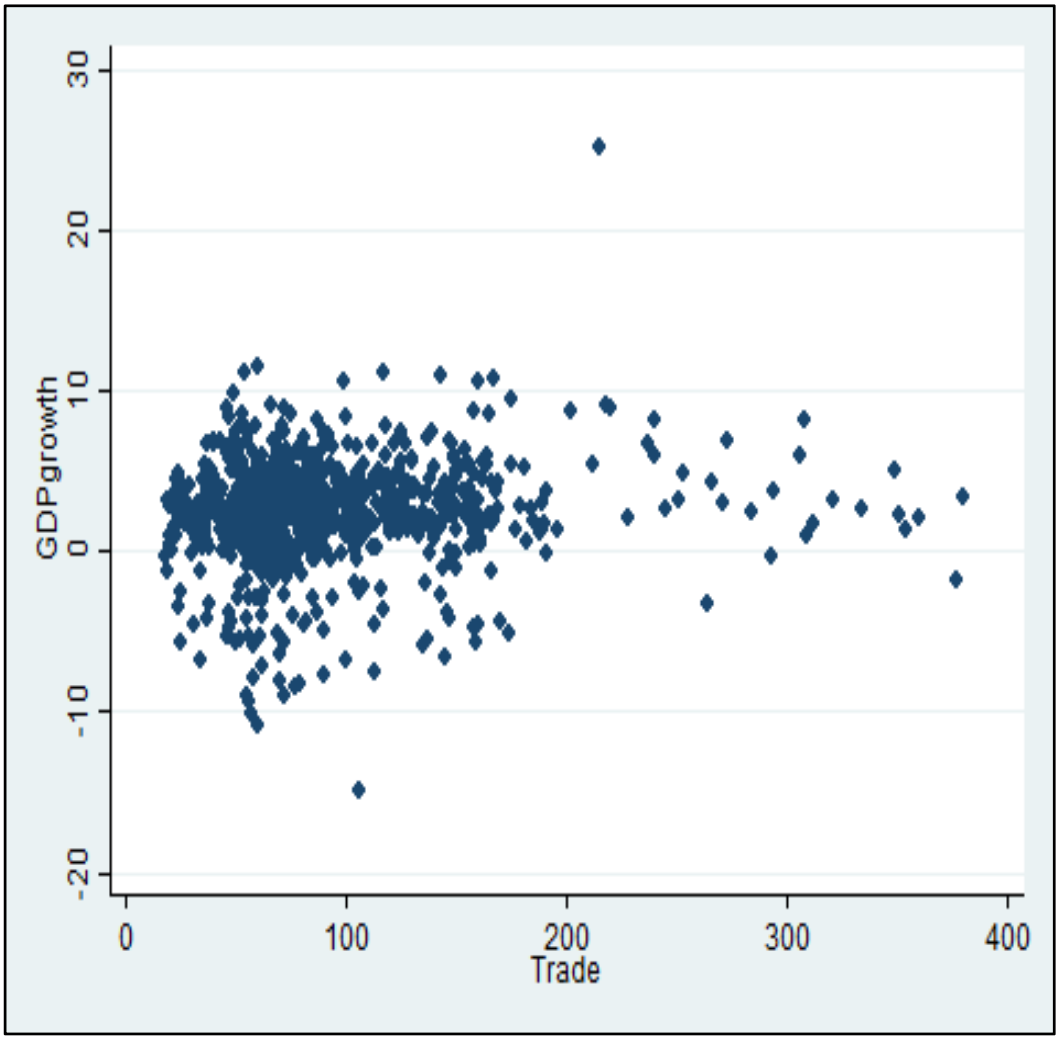

Figure 4.7: The Graphical Relationship between GDP Growth and Trade (% of GDP) in the OECD Countries

Table 4.4: Summary Statistics in the OECD: Pearson Correlation Descriptive Statistics

Pearson Correlation Descriptive Statistics				
	$GDP\ Growth_{it}$	$In\ Govt\ Cons\ Exp_{it}$	$Pop\ growth,\ annual\ \%_{it}$	$In\ Gross\ Capital\ form\ (\%\ of\ GDP)_{it}$
$GDP\ Growth_{it}$	1.0000			
$In\ Govt\ Cons\ Expe\ (\%\ of\ GDP)_{it}$	-0.2673* 0.0000	-0.2686* 0.0000	1.0000	
$Pop\ growth,\ (annual\ \%)_{it}$	0.1474* 0.0000	-0.2686* 0.0000	1.0000	
$In\ Gross\ Capital\ form\ (\%\ of\ GDP)_{it}$	0.3437* 0.0000	-0.1927* 0.0000	0.0914* 0.0060	1.0000
$Inflation,\ GDP\ Deflator_{it}$	0.1232* 0.0002	-0.2518* 0.0000	-0.1859* 0.0000	0.0439* 0.1892
$In\ Real\ Effective\ Exchange\ Rate_{it}$	-0.0397 0.2348	0.0124 0.7105	0.0657* 0.0488	-0.1071* 0.0013
$In\ Trade\ (\%\ of\ GDP)_{it}$	0.0918* 0.0059	0.1406* 0.0000	-0.1084 0.0011	0.0196* 0.5564
$In\ REER\ Volatility_{it}$	-0.0435 0.1928	-0.0283 0.3956	0.1124* 0.0007	-0.0992* 0.0029

Note: p-values in the parantheses.

Table 4.5: Summary Statistics in the OECD: Pearson Correlation Descriptive Statistics -Contınuatıon

Pearson Correlation Descriptive Statistics			
	$Inflation, GDP\ Deflator_{it}$	$In\ Real\ Effective\ Exchange\ Rate_{it}$	$In\ Trade\ \%\ of\ GDP\ growth_{it}$
$GDP\ Growth_{it}$			
$In\ Govt\ Cons\ Expe\ (\%\ of\ GDP)_{it}$			
$Pop\ growth, (annual\ \%)_{it}$			
$In\ Gross\ Capital\ form\ (\%\ of\ GDP)_{it}$			
$Inflation, GDP\ Deflator_{it}$	1.0000		
$In\ Real\ Effective\ Exchange\ Rate_{it}$	-0.3008* 0.0000	1.0000	
$In\ Trade\ (\%\ of\ GDP)_{it}$	-0.0974* 0.0035	-0.0304 0.3631	1.0000
$In\ REER\ Volatility_{it}$	-0.0105 0.7544	0.0958* 0.0040	-0.0061 0.8553

Note: p-values in the parantheses.

4.6. Empirical Findings

This section presents empirical findings for FE, RE, and robust FE estimates. The last estimate mentioned indicates findings generated utilizing DRK S.E. that are robust the presence of cross-sectional dependence, autocorrelation, and heterosedasticity.

4.6.1. Findings from the FE, RE and Driscoll-Kraay Estimates: The impact of Real Effective Exchange Rate on Economic Growth in the OECD.

Table 4.6. indicates findings from FE, RE, and robust FE estimates that present the impact of REER on economic growth in 36 OECD economies between 1996-2020

Table 4.6: Summary of the Fixed Effect, Random Effect and FE Driscoll-Kraay on the impact of real effective exchange rate on economic growth in the OECD

Summary of the Fixed and Random Effect and Driscoll-Kraay Estimateson the impact of real effective exchange rate on economic growth in the OECD Countries Dependent Variable: GDP Growth Rate			
	Fixed Effect Model (1)	Random Effect Model (2)	FE Model (Driscoll-Kraay) (3)
$In\ Real\ Effective\ Exchange\ Rate_{it}$	-1.771** (-2.14)	-0.303 (-0.38)	-1.771 (-1.80)
$In\ Govt\ Cons\ Expenditure\ (\%\ of\ GDP)_{it}$	-14.96*** (-13.55)	-6.074*** (-6.93)	-14.96*** (-4.18)
$Population\ growth_{it}$	-0.437* (-1.68)	-0.145 (-0.73)	-0.437* (-1.01)
$In\ Gross\ Capital\ form\ (\%\ of\ GDP)_{it}$	7.426*** (10.14)	7.048*** (10.89)	7.426*** (3.12)
$Inflation,\ GDP\ deflator_{it}$	-0.0295** (-1.97)	0.00202 (0.14)	-0.0295 (-1.72)

Table 4.6: Summary of the Fixed Effect, Random Effect and FE Driscoll-Kraay on the impact of real effective exchange rate on economic growth in the OECD (more).

$In\ Trade\ (\%\ of\ GDP)_{it}$	0.416 (0.70)	0.808** (2.60)	0.416 (0.34)
$Constant_{it}$	29.43** (1.96)	-3.947 (-0.74)	29.43 (1.87)
N	898	898	898
F-statistic (stars for p-value)	0.0000***	0.0000***	0.0004***
R-squared Within	0.3183	0.2843	0.3183
R-squared Between	0.1280	0.1947	
R-squared Overall	0.1224	0.1654	
Hausman Test	Chi-square: 340.74 p-value: 0.0000 ***not positive definite		

Notes: Significance level (* denotes 10%, ** denotes 5%, and *** denotes 1% significance levels), the numbers in the parentheses are the standard errors.

Source: Author's own calculations.

Model 1 in Table 4.6 is a FE Model that investigates the relationship between various independent variables and GDP Growth in OECD (Organization for Economic Cooperation and Development) countries. This model accounts for country-specific effects, allowing for the consideration of the unique characteristics of each OECD member state when examining the impact of these variables on GDP Growth. Here's a detailed explanation of the relationship of each variable with GDP Growth, along with their corresponding significance levels:

ln Real Effective Exchange Rate (REER): Coefficient: -1.771** (significant at the 5% level). The REER is a key economic indicator reflecting a country's currency's value relative to the currencies of its major trading partners, adjusted for inflation.

With a significant negative coefficient of -1.771**, it suggests an inverse relationship between the real effective exchange rate and GDP Growth in OECD countries. A 1% increase in the REER is associated with a 1.771% decrease in GDP Growth, holding other variables constant. This implies that a stronger domestic currency (appreciation) can potentially hinder economic growth.

ln Govt Consumption Expenditure (% of GDP): Coefficient: -14.96*** (highly significant at the 1% level). GCE as a percentage of GDP represents government spending on goods and services. The notable negative coefficient of -14.96 indicates a strong inverse relationship between GCE and GDP Growth in the OECD. A 1% increase in GCE as a percentage of GDP is associated with a substantial 14.96% decrease in GDP Growth, holding other variables constant. This suggests that a high level of GCE relative to GDP may impede economic growth.

Population Growth: Coefficient: -0.437* (significant at the 10% level). Population growth measures changes in a country's population over time. The coefficient of -0.437* signifies an inverse relationship between population growth and GDP Growth in the OECD. A 1% increase in population growth is associated with a 0.437% decrease in GDP Growth, holding other variables constant. This implies that rapid population growth may pose challenges for economic development.

ln GCF (% of GDP): Coefficient: 7.426*** (highly significant at the 1% level). GCF represents a country's investment in physical assets such as infrastructure and machinery. The robust positive coefficient of 7.426*** indicates a strong positive relationship between capital formation and GDP Growth in the OECD. A 1% increase in GCF as a percentage of GDP is associated with a substantial 7.426% increase in GDP Growth, holding other variables constant. This highlights the potentially significant positive impact of increased investment in physical assets on economic growth.

ln Inflation, GDP deflator:Coefficient: -0.0295** (significant at the 5% level). Inflation, as measured by the GDP deflator, provides a broad indicator of price levels. The significant negative coefficient of -0.0295** suggests an inverse relationship between inflation and GDP Growth in the OECD. A 1% increase in inflation (measured by the GDP deflator) is associated with a 0.0295% decrease in GDP Growth, holding other variables constant. This implies that high inflation may erode purchasing power and negatively affect economic growth.

ln Trade (% of GDP): has a coefficient of 0.416 while statistically insignificant.

Trade as a percentage of GDP measures a country's openness to international trade.

The R-squared Within (0.3183): This R-squared value represents the proportion of the variation in GDP Growth that is explained by the independent variables within the model, while accounting for country-specific FE. It tells us how well the model fits the data when taking into consideration the unique characteristics of each OECD country. In this case, approximately 31.83% of the variability in GDP Growth can be explained by the set of independent variables when considering within-country variation.

The R-squared Between (0.1280): This R-squared value represents the proportion of the variation in GDP Growth that is attributed to differences between the countries in the OECD. It quantifies how well the model captures the variation in GDP Growth across countries. About 12.80% of the variation in GDP Growth is explained by differences between the OECD countries in the model.

The R-squared Overall (0.1224): The Overall R-squared represents the total proportion of the variation in GDP Growth that the model can explain, combining both the within-country and between-country effects.In this model, the Overall R-squared is 12.24%, indicating that the independent variables collectively account for approximately 12.24% of the total variation in GDP Growth across the OECD countries.

In summary, the findings from Model 1 underscore that the REER, GCE, population growth, GCF, and inflation have significant relationships with GDP Growth in OECD countries, with different levels of statistical significance. These results offer valuable insights for policymakers and analysts concerning how these economic variables can influence the economic growth trajectory of OECD member states.

Model 2 in Table 4.6 is a RE Model that examines the relationship between various independent variables and GDP Growth in OECD (Organization for Economic Cooperation and Development) countries. Unlike the FE Model, this model does not account for country-specific effects and treats them as random.

ln REER: Coefficient: -0.303 (statistically insignificant). The REER reflects a country's currency value relative to the currencies of its major trading partners, adjusted for inflation. The coefficient of -0.303 is not statistically significant, implying that there is no relationship between the REER and GDP Growth in OECD countries in this model.

ln Govt Cons Expenditure (% of GDP): Coefficient: -6.074*** (highly significant at the 1% level).GCE as a percentage of GDP represents government spending on goods and services. The substantial negative coefficient of -6.074*** indicates a significant inverse relationship between GCE and GDP Growth in the OECD. A 1% increase in GCE as a percentage of GDP is associated with a considerable 6.074% decrease in GDP Growth, holding other variables constant.

Population Growth: Coefficient: -0.145 (statistically insignificant). Population growth measures changes in a country's population over time. The coefficient of -0.145 is not statistically significant, suggesting that there is no significant relationship between population growth and GDP Growth in this model.

ln GCF (% of GDP): Coefficient: 7.048*** (highly significant at the 1% level).GCF represents a country's investment in physical assets, such as infrastructure and machinery. The substantial positive coefficient of 7.048*** indicates a strong positive relationship between capital formation and GDP Growth in the OECD. A 1% increase in GCF as a percentage of GDP is associated with a considerable 7.048% increase in GDP Growth, holding other variables constant.

ln Inflation, GDP deflator: With a coefficient: of 0.00202, is statistically insignificant). Inflation, as measured by the GDP deflator, provides a broad indicator of price levels. The coefficient of 0.00202 is not statistically significant, indicating no significant relationship between inflation and GDP Growth in this model.

ln Trade (% of GDP): Coefficient: 0.808** (significant at the 5% level). Trade as a percentage of GDP measures a country's openness to international trade. The coefficient of 0.808** is statistically significant at the 5% level, suggesting a positive relationship between trade and GDP Growth in the OECD. A 1% increase in trade as a percentage of GDP is associated with a 0.808% increase in GDP Growth, holding other variables constant.

Model 2 in Table 4.6 reveals varying levels of significance for its independent variables in their relationship with GDP Growth in OECD countries. While GCE and GCF appear to be significant determinants of GDP Growth, other variables such as the REER, population growth, inflation, and trade may not have any statistical relationships with economic growth, as indicated by their p-values and coefficient significance levels.

The R-squared Within (R^2 Within = 0.2843): R-squared Within measures the proportion of the variation in GDP Growth that is explained by the independent

variables while accounting for individual-level (within-country) effects. In this case, approximately 28.43% of the variability in GDP Growth can be attributed to the set of independent variables within each country in the OECD. This means that the model captures around 28.43% of the variation in GDP Growth when considering the unique characteristics and conditions within each individual country.

The R-squared Between (R^2 Between = 0.1947): R-squared Between assesses the portion of the variation in GDP Growth that is attributed to differences between the OECD countries. In this model, roughly 19.47% of the variability in GDP Growth can be explained by distinctions between the countries, which suggests that the model can account for almost 19.47% of the variations in GDP Growth across different OECD member states.

The R-squared Overall (R^2 Overall = 0.1654): R-squared Overall represents the total proportion of the variation in GDP Growth that the model can explain when considering both within-country and between-country effects. In this case, the model collectively explains about 16.54% of the total variation in GDP Growth across the OECD countries. It considers both the common factors shared by all countries and the unique factors specific to each country.

As presented in Table 4.6.; the FE and RE estimates indicate diversified findings. To choose among these estimates, Hausman test is utilized.The Prob > Chi2 (Chi-squared test p-value = 0.0000). The Chi-squared test evaluates whether the RE Model is appropriate for the analysis. A low p-value (in this case, 0.0000) suggests that the RE Model is not a suitable choice, and it indicates a strong preference for the FE Model. The Chi-squared test checks if the variations between the individual country-specific effects are correlated with the independent variables. A significant test result indicates that the RE are not uncorrelated with the explanatory variables, favoring a FE specification.

In summary, the R-squared values help quantify the extent to which the RE Model can explain the variation in GDP Growth within and between OECD countries, as well as overall. These values offer valuable information about the model's explanatory power and its suitability for the dataset. Additionally, the low p-value from the Chi-squared test reinforces the preference for the FE Model over the RE Model in this analysis.

The statistical analysis conducted in this study yielded the following results: The Hausman test indicated a highly significant result (Prob>chi2 = 0.0000), suggesting a

strong preference for the FE model over the RE model (Hausman, 1978).

As a next step, the empirical analysis employs diagnostic checks to question whether cross-sectional dependence, autocorrelation, and heteroscedasticity exist in the FE model. For this purpose, the study utilizes relevant tests. Depending on the outcomes from the relevant tests, the empirical analysis then proceeds to the estimation of final FE estimation that utilizes robust S.E. Cross-sectional dependencies were assessed using various tests. Pesaran's test of cross-sectional independence yielded a test statistic of 59.297 with a p-value of 0.000, indicating the presence of cross-sectional dependencies (Pesaran, 2004). Similarly, Friedman's test of cross-sectional independence resulted in a test statistic of 296.652 with a p-value of 0.000, indicating significant cross-sectional dependencies (Friedman, 1937). Additionally, Frees' test of cross-sectional independence produced a test statistic of 4.989, and critical values from Frees' Q distribution were utilized, with alpha values of 0.1124 for 10% significance, 0.1470 for 5% significance, and 0.2129 for 1% significance (Frees, 1995).

Autocorrelation was tested using the modified Bhargava et al. Durbin-Watson statistic, resulting in a value of 1.3512889, indicating the presence of autocorrelation (Bhargava et al., 1982). Furthermore, the Baltagi-Wu LBI test yielded a statistic of 1.5902078, confirming the presence of autocorrelation (Baltagi, 2009).

The Modified Wald test for groupwise heteroskedasticity in the FE regression model showed a chi-squared statistic of 2264.33 and Prob> Chi2 of 0.000, indicating the presence of heteroskedasticity in the data (Greene, 2003).

These statistical findings play a crucial role in model selection, addressing cross-sectional dependencies, autocorrelation, and heteroskedasticity, thereby enhancing the robustness and reliability of the regression analysis (Wooldridge, 2010; Gujarati, 2003).

The findings from diagnostic checks indicate that cross-sectional dependence, autocorrelation, and heteroscedasticity is present in the model. To generate robust S.E. for all these, this study employs DRK S.E. to FE estimation Model 3 in Table 4.6 is a FE Model with DRK S.E. that explores the relationship between a set of independent variables and GDP Growth in OECD (Organization for Economic Cooperation and Development) countries. This model takes into account country-specific effects and employs the DRK S.E. for improved estimation. Here is a detailed explanation of the relationship between each variable and GDP Growth, along with their respective levels of significance, Hoechle (2007) using the DRK S.E. approach in correcting for the

cross-sectional dependence, this thesis first analyzes the FE and RE estimates and the Hausman test strongly accept the FE in the model with the presence of cross-sectional dependencies and heteroskedasticity in the model and presence of autocorrelation, then the use of the DRK technique to fix the cross-sectional dependencies issue with the model. (Driscoll & Kraay, 1998).

ln REER: Coefficient: -1.771* (significant at the 10 % level). The real effective exchange rate reflects a country's currency value relative to the currencies of its major trading partners, adjusted for inflation. The statistically significant negative coefficient of -1.771* implies an inverse relationship between the REER and GDP Growth in OECD countries. A 1% increase in the REER is associated with a 1.771% decrease in GDP Growth, all other factors held constant. This suggests that a stronger domestic currency may negatively impact economic growth.

ln Govt Cons Expenditure (% of GDP): Coefficient: -14.96*** (highly significant at the 1% level). GCE as a percentage of GDP represents government spending on goods and services. The highly statistically significant negative coefficient of -14.96 indicates a strong inverse relationship between GCE and GDP Growth in the OECD. A 1% increase in GCE as a percentage of GDP is associated with a substantial 14.96% decrease in GDP Growth, all other factors held constant. This suggests that high GCE relative to GDP may have a detrimental effect on economic growth.

Population Growth: Coefficient: -0.437* (significant at the 10% level). Population growth measures changes in a country's population over time. The statistically significant coefficient of -0.437 suggests an inverse relationship between population growth and GDP Growth in the OECD. A 1% increase in population growth is associated with a 0.437% decrease in GDP Growth, all other factors held constant. This implies that rapid population growth may pose challenges for economic development.

ln GCF (% of GDP): Coefficient: 7.426*** (highly significant at the 1% level). GCF represents a country's investment in physical assets, such as infrastructure and machinery. The highly statistically significant positive coefficient of 7.426 indicates a strong positive relationship between capital formation and GDP Growth in the OECD. A 1% increase in GCF as a percentage of GDP is associated with a substantial 7.426% increase in GDP Growth, all other factors held constant. This highlights the potentially significant positive impact of increased investment in physical assets on economic

growth.

ln Inflation, GDP deflator: Coefficient: -0.0295* (significant at the 10% level). Inflation, as measured by the GDP deflator, provides a broad indicator of price levels. The statistically significant negative coefficient of -0.0295* suggests an inverse relationship between inflation and GDP Growth in the OECD. A 1% increase in inflation (measured by the GDP deflator) is associated with a 0.0295% decrease in GDP Growth, all other factors held constant. This implies that high inflation may erode purchasing power and negatively affect economic growth.

ln Trade (% of GDP): Coefficient: 0.416 (not statistically significant). Trade as a percentage of GDP measures a country's openness to international trade. The coefficient of 0.416 is not statistically significant in this model, indicating that there is no significant relationship between trade and GDP Growth in the OECD, as it doesn't meet the 10% significance threshold.

The R-squared within (R^2 within): The R-squared within, registering at 0.3183, serves as a key metric to quantify the extent to which the independent variables expound upon the variation in economic growth at the individual country level within the OECD. This implies that approximately 31.83% of the variance in GDP growth can be elucidated by the included independent variables. This metric provides insights into the model's effectiveness in explaining variations in economic growth at the individual country level.

Prob > F: The Probability associated with the F-statistic, presenting a value of 0.0004, underscores the statistical significance of the overall model. A p-value of 0.0004 indicates that the model's performance is highly statistically significant. This signifies compelling evidence that the independent variables collectively contribute to explaining variations in economic growth within the OECD, particularly under the FE model with DRK robust S.E. correction. This emphasizes the robustness and reliability of the model in the specified analytical context.

These statistical indicators contribute to a comprehensive assessment of the FE model with DRK robust S.E. correction, shedding light on the relationship between REER and economic growth in the OECD. The R-squared value highlights the explanatory power of the model at the individual country level, while the highly significant Prob > F value underscores the model's overall statistical significance and credibility in the context of the analysis.

In summary, Model 3 in Table 4.6 demonstrates significant relationships

between the REER, GCE, population growth, GCF, and inflation with GDP Growth in OECD countries. These findings offer valuable insights for policymakers and analysts regarding how these economic variables can influence the economic growth trajectory of OECD member states.

Comparative discoveries were watched within the OECD, where populace development and swelling were found to have a negative affect on financial development (Bassanini and Scarpetta, 2001). In any case, Bassanini and Scarpetta (2001) found that exchange contains a positive relationship with financial development within the OECD. Be that as it may, Eichengreen (2008) and Rapetti (2020) detailed the effect of the REER on economic growth among a board of created nations and found the REER to have a positive and critical impact using the settled impacts approach, whereas other factors accommodate with these discoveries. The number of nations analyzed was more noteworthy than the number of a long time, and the uniqueness of the discoveries in this proposition is that the accessible datasets among OECD nations appeared a littler number of nations compared to the number of a long time when utilizing the settled impacts approach to clarify the connections with genuine GDP growth.

Reliable with these findings, Bassanini and Scarpetta (2001) found a positive relationship between net capital formation and financial development within the OECD utilizing the pooled mean group estimation approach. Bassanini and Scarpetta (2001) watched within the OECD that populace development and swelling have a negative affect, whereas exchange has a positive and factually noteworthy affect on financial growth. In any case, Eichengreen (2008) and Rapetti (2020) detailed positive and critical impacts of RER and Economic Growth among a board of developed nations utilizing the irregular impacts approach, whereas other factors align with these discoveries. The number of nations analyzed surpasses the number of a long time, and the uniqueness of the discoveries in this proposal lies within the truth that the accessible datasets among OECD nations have less nations than years

4.6.2. Generating Volatility Variable and Findings from the FE and RE Estimates: The impact of Real Effective Exchange Rate Volatility on Economic Growth

This section presents findings from the FE and RE estimates for the impact of REER volatility on economic growth. For this purpose, it is necessary to compute

REER volatility as a first step.

4.6.2.1. Generating real effective exchange rate Volatility

In generating the REER volatility from the annual data, the following step were double checked.

i. Stationary tests for unit root presence using the Augmented Dickey-Fuller test
ii. GARCH modelling techniques using the variants of ARCH (1,1), GARCH (1,1), and EGARCH (1,1) processes.
iii. The Decision rules for the most optimal GARCH variant for each of the countries in the estimation processes were based on the Prob > Chi2, AIC and BIC criterion.

Recall that, the augmented unit root test of stationarity of the REER data follows the following hypothesis specification. (Dickey & Fuller, 1976). H_o: > 0 vs. H_A: ϕ< 0 that is based on the t-statistic of the coefficient ϕ from an OLS estimation. H_o i. e . the null hypothesis will be rejected if the t-statistic is smaller than the relevant critical value (Mackinnon, 1996; Dickey & Fuller, 1976; Horvath, 2015; Horvath, 2014). The null hypothesis is the REER data has a unit root and it presents not stationarity. On the other hand, the alternative hypothesis is the REER data has no unit root, corresponding to stationarity. The p-value for Japan is 0.0058, the p-value for Korea is 0.0041, the p-value for New Zealand is 0.0894 and the p-value for Sweden is 0.0400; while the remaining countries has p-value above the 10% significance level. The stationarity level tests of the REER data for the 36 OECD countries show that the data for Japan, Korea, New Zealand, and Sweden is not stationary based on the Mackinnon P-values for Z(t) while all other remaining countries in the analysis of the REER data shows a stationarity presence (Horvath, 2014; Horvath, 2015).

For Table 4.7 Below SIGNIFICANCE LEVEL (* denotes 10%, ** denotes 5%, and *** denotes 1% significance levels.) Numbers in the parentheses are the standard errors - Source: Author's own calculation

Table 4.7: Stationarity Tests for Unit Root: Augmented Dickey-Fuller test for unit root in real effective exchange rate (Country Specific)

Stationarity Tests for Unit Root: Augmented Dickey-Fuller test for unit root in real effective exchange rate (Country Specific)			
		Z(t)	
Country	Obs	Test statistics (L1)	1% critical value
Australia	23	-1.872	-4.380
Austria	23	-2.442	-4.380
Belgium	23	-2.233	-4.380
Canada	23	-1.504	-4.380
Chile	23	-3.091	-4.380
Columbia	23	-1.875	-4.380
Costal Rica	23	-1.754	-4.380
Czech	23	-1.496	-4.380
Denmark	23	-1.967	-4.380
Finland	23	-2.864	-4.380
France	23	-2.227	-4.380
Germany	23	-2.432	-4.380
Greece	23	-1.374	-4.380
Hungary	23	-0.781	-4.380
Iceland	23	-2.244	-4.380
Ireland	23	-1.734	-4.380
Israel	23	-1.501	-4.380
Italy	23	-1.955	-4.30
Japan	23	-4.125	-4.380
Korea	23	-4.226	-4.380
Lithuania	23	-1.909	-4.380
Luxembourg	23	-1.933	-4.380
Mexico	23	-2.773	-4.380
Netherland	23	-2.191	-4.380

Table 4.7: Stationarity Tests for Unit Root: Augmented Dickey-Fuller test for unit root in real effective exchange rate (Country Specific)(more)

New Zealand	23	-3.176	-4.380
Norway	23	-1.068	-4.380
Poland	23	-2.639	-4.380
Portugal	23	-1.586	-4.380
Slovakia	23	-1.078	-4.380
Slovenia	23	-2.750	-4.380
Spain	23	-1.419	-4.380
Sweden	23	-3.495	-4.380
Switzerland	23	-2.444	-4.380
Turkiye	23	0.337	-4.380
UK	23	-2.786	-4.380
USA	23	-1.632	-4.380

Source: Author's own calculations.

Stationarity Tests for Unit Root: Augmented Dickey-Fuller test for unit root in real effective exchange rate (Country Specific)			
	• Z(t)		
Country	5% Critical value	10% critical value	Mackinnon P-value for Z(t)
Australia	-3.600	-3.240	0.6692
Austria	-3.600	-3.240	0.3576
Belgium	-3.600	-3.240	0.4715
Canada	-3.600	-3.240	0.8277
Chile	-3.600	-3.240	0.1083
Columbia	-3.600	-3.240	0.6675
Costal Rica	-3.600	-3.240	0.7263
Czech	-3.600	-3.240	0.8306
Denmark	-3.600	-3.240	0.6195

Finland	-3.600	-3.240	0.1744
France	-3.600	-3.240	0.4749
Germany	-3.600	-3.240	0.3629
Greece	-3.600	-3.240	0.8684
Hungary	-3.600	-3.240	0.9673
Iceland	-3.600	-3.240	0.4652
Ireland	-3.600	-3.240	0.7359
Israel	-3.600	-3.240	0.8288
Italy	-3.600	-3.240	0.6256
Japan	-3.600	-3.240	0.0058
Korea	-3.600	-3.240	0.0041
Lithuania	-3.600	-3.240	0.6502
Luxembourg	-4.380	-3.600	0.6372
Mexico	-3.600	-3.240	0.2072
Netherland	-3.600	-3.240	0.4948
New Zealand	-3.600	-3.240	0.0894
Norway	-3.600	-3.240	0.9342
Poland	-3.600	-3.240	0.2622
Portugal	-3.600	-3.240	0.7980
Slovakia	-3.600	-3.240	0.9326
Slovenia	-3.600	-3.240	0.2159
Spain	-3.600	-3.240	0.8554
Sweden	-3.600	-3.240	0.0400
Switzerland	-3.600	-3.240	0.3564
Turkiye	-3.600	-3.240	0.9964
UK	-3.600	-3.240	0.2023
USA	-3.600	-3.240	0.7795

Estimation of Real Effective exchange Rate Volatility: Real Effective Exchange Rate Volatility Modelling (STATA 14 Results Presentation): Country Specific Outputs				
Country	Log Likelihood	Wald Chi2 (1)	Prob > Chi2	GARCH Variants
Australia	-63.85246	87.44	0.0000	Egarch (1,1)
Austria	-74.32652	20.80	0.0000	Egarch (1,1)
Belgium	-73.13458	37.59	0.0000	Egarch (1,1)
Canada	-66.23959	2262.70	0.0000	Egarch (1,1)
Chile	-75.40102	16.07	0.0001	Egarch (1,1)
Columbia	-71.63029	12.36	0.0004	Arch (1,1)
Costa Rica	-62.64641	107.47	0.0000	Arch (1,1)
Czech	-50.08218	729.45	0.0000	Egarch (1,1)
Denmark	-74.27015	7.92	0.0049	Arch (1,1)
Finland	-70.11049	26.33	0.0000	Arch (1,1)
France	-64.91645	31.04	0.0000	Arch(1,1)
Germany	-66.29638	157.97	0.0000	Arch (1,1)
Greece	-69.49917	88.88	0.0000	Arch (1,1)
Hungary	-63.49953	157.45	0.0000	Egarch (1,1)

Iceland	-72.90723	56.27	0.0000	Egarch (1,1)
Ireland	-70.13773	27.94	0.0000	Arch (1,1)
Israel	-70.28724	322.11	0.0000	Egarch (1,1)
Italy	-71.24813	8.48	0.0036	Egarch (1,1)

Source: Author's own calculations.

Table 4.8: Estimation of Real Effective exchange Rate Volatility: REER Volatility Modelling

Japan	-65.41291	118.62	0.0000	Arch (1,1)
Korea	-75.46301	2.75	0.0970	Arch (1,1)
Lithuania	-55.74517	146.08	0.0000	Arch (1,1)
Luxembourg	-68.81132	29.55	0.0000	Arch (1,1)
Mexico	-66.83244	928.07	0.0000	Egarch (1,1)
Netherland	-73.97075	5.88	0.0154	Arch (1,1)
New Zealand	-71.33898	89.47	0.0000	Arch (1,1)
Norway	-73.96134	26.38	0.0000	Egarch (1,1)
Poland	-71.12468	50.56	0.0000	Egarch (1,1)
Portugal	-68.0851	36.63	0.0000	Arch (1,1)
Slovak	-51.48319	287.91	0.0000	Arch (1,1)
Slovenia	-74.24038	28.06	0.0000	Arch (1,1)

Table 4.8: Estimation of Real Effective exchange Rate Volatility: REER Volatility Modelling-Contınuatıon.

Spain	-65.13039	53.79	0.0000	Arch (1,1)
Sweden	-62.83577	49.28	0.0000	Garch (1,1)
Switzerland	-74.26271	19.65	0.0000	Egarch (1,1)
Turkiye	-70.07603	63.86	0.0000	Egarch (1,1)
U.K	-70.20247	190.74	0.0000	Egarch (1,1)
USA	-65.92373	55.68	0.0000	Egarch (1,1)

Estimation of Real Effective exchange Rate Volatility: Real Effective Exchange Rate Volatility Modelling (STATA 14 Results Presentation): Country Specific Outputs					
Country	OBS	DF	AIC	BIC	GARCH Variants
Australia	25	6	137.8006	145.1139	Egarch (1,1)
Austria	25	6	160.6530	167.9663	Egarch (1,1)
Belgium	25	6	158.2692	165.5824	Egarch (1,1)
Canada	25	6	144.4792	151.7924	Egarch (1,1)
Chile	25	6	162.8020	170.1153	Egarch (1,1)
Columbia	25	4	151.2606	156.1361	Arch (1,1)
Costa Rica	25	4	133.2928	138.1683	Arch (1,1)

Czech	25	6	112.1644	119.4776	Egarch (1,1)
Denmark	25	4	156.5403	161.4158	Arch (1,1)
Finland	25	4	148.221	153.0965	Arch (1,1)
France	25	4	137.8329	142.7084	Arch(1,1)
Germany	25	4	140.5928	145.4683	Arch (1,1)
Greece	25	4	146.9983	151.8738	Arch (1,1)
Hungary	25	6	138.9991	146.3123	Egarch (1,1)
Iceland	25	6	157.8145	165.1277	Egarch (1,1)
Ireland	25	4	148.2755	153.151	Arch (1,1)
Israel	25	6	152.5745	159.8877	Egarch (1,1)
Italy	25	6	154.4963	161.8095	Egarch (1,1)
Japan	25	4	138.8258	143.7013	Arch (1,1)
Korea	25	4	158.926	163.8015	Arch (1,1)
Lithuania	25	4	119.4903	124.3658	Arch (1,1)
Luxembourg	25	4	145.6226	150.4981	Arch (1,1)
Mexico	25	6	145.6649	152.9781	Egarch (1,1)

Netherland	25	4	155.9415	160.817	Arch (1,1)
New Zealand	25	4	150.678	155.5535	Arch (1,1)
Norway	25	6	159.9227	167.2359	Egarch (1,1)
Poland	25	6	154.2494	161.5626	Egarch (1,1)
Portugal	25	4	144.1702	149.0457	Arch (1,1)
Slovak	25	4	110.9664	115.8419	Arch (1,1)
Slovenia	25	4	156.4808	161.3563	Arch (1,1)
Spain	25	4	138.2608	143.1363	Arch (1,1)
Sweden	25	5	135.6715	141.7659	Garch (1,1)
Switzerland	25	6	160.5254	167.8387	Egarch (1,1)
Turkiye	25	6	152.1521	159.4653	Egarch (1,1)
U.K	25	6	152.4049	159.7182	Egarch (1,1)
USA	25	6	143.8475	151.1607	Egarch (1,1)

SIGNIFICANCE LEVEL (* denotes 10%, ** denotes 5%, and *** denotes 1% significance levels.) Numbers in the parentheses are the standard errors. Source: Author's own calculations

Table 4.8 provides an overview of the REER volatility for all 36 OECD countries using multiple GARCH variants. The selection of models was based on criteria such as log likelihood, AIC, and BIC values (Lee & Brorsen, 1997; Lundbergh &

Terasvirta, 2002; Karanasos & Kim, 2003; Kanda, 2015; Hansen & Huang, 2016; Bernardin & Desmond, 2017).

When ARCH (1,1) and GARCH (1,1) fail to capture the leverage effects in the volatility and the REER over time, the EGARCH (1,1) model is employed, which accounts for asymmetric effects. The selection of the EGARCH model is based on information criteria such as AIC, HQC, SIC, or BIC values, indicating the best fit (Lee & Brorsen, 1997; Lundbergh & Terasvirta, 2002; Karanasos & Kim, 2003; Kanda, 2015; Hansen & Huang, 2016; Bernardin & Desmond, 2017).

Countries exhibiting ARCH (1,1) presence include Columbia, Costa Rica, Denmark, Finland, France, Germany, Greece, Ireland, Japan, Korea, Lithuania, Luxembourg, Netherlands, New Zealand, Portugal, Slovakia, Slovenia, and Spain. Only Sweden shows the presence of GARCH (1,1) in the sample years for the REER. Countries displaying EGARCH (1,1) presence comprise Australia, Austria, Belgium, Canada, Chile, Czech Republic, Hungary, Iceland, Israel, Italy, Mexico, Norway, Poland, Switzerland, Turkiye, UK, and USA. These findings align with previous studies conducted by Horvath (2015), Vieira, Holland, Gomes de Silva (2013), and Bottecchia & MacDonald (2020), which investigate the behavior of RER volatility movements in these countries.

4.6.3. Findings from the FE, RE and Driscoll-Kraay Estimates: The impact of Real Effective Exchange Rate Volatility on Economic Growth in the OECD

Table 4.9. indicates findings from FE, RE, and robust FE estimates that present the impact of REER volatility on economic growth in 36 OECD economies between 1996-2020.

Table 4.9: Findings from the FE, RE, Driscoll-Kraay Estimates: The impact of REER Volatility on Economic Growth in the OECD

Findings from the FE and RE Estimates: The impact of Real Effective Exchange Rate Volatility on Economic Growth in the OECD Dependent Variable: GDP Growth Rate			
	Model 4 (Fixed Effects)	Model 5 (Random Effects GLS)	Model 6 Fixed Effects (Driscoll-Kraay)

Table 4.9: Findings from the FE, RE, Driscoll-Kraay Estimates: The impact of REER Volatility on Economic Growth in the OECD (more).

$In\ REER\ Volatility_{it}$	-0.0138 (-0.15)	-0.0326 (-0.34)	-0.0138 (-0.04)
$In\ Govt\ Consumption\ Expenditure\ (\%\ of\ GDP)_{it}$	-14.50*** (-13.35)	-5.939*** (-8.61)	-14.50*** (-3.89)
$In\ Population\ growth,\ (annual\ \%)_{it}$	-0.530** (-2.37)	-0.134 (-0.68)	-0.530 (-0.94)
$In\ Gross\ Capital\ form\ (\%\ of\ GDP)_{it}$	7.624*** (10.39)	7.009*** (10.82)	7.624*** (2.90)
$Inflation,\ GDP\ Deflator_{it}$	-0.0192 (-1.31)	0.00405 (0.29)	-0.0192 (-0.91)
$In\ Trade\ (\%\ of\ GDP)_{it}$	0.555 (0.96)	0.813** (2.65)	0.555 (0.44)
$Constant_{it}$	18.82*** (3.41)	-5.600* (-1.67)	18.82 (0.99)
N	898	898	898
Countries	36	36	36
F-statistic (stars for p-value)	0.0000***	0.0000***	0.0003***
R-squared: Within	0.3147	0.2819	0.3147
R-squared: Between	0.1309	0.1981	
R-squared: Overall	0.1253	0.1667	
Hausman Test	Chi-square: 150.20 p-value: 0.0000*** The result is not positive definite		

Notes: Significance level (* denotes 10%, ** denotes 5%, and *** denotes 1% significance levels), the numbers in the parentheses are the standard errors.

Source: Author's own calculations.

Model 4 in Table 4.9 of the FE approach delves into the intricate relationship between REER volatility and its impact on GDP Growth in the OECD. The results are presented, considering a hypothetical 1% increase in the Dependent Variable (GDP Growth), and their significance levels are outlined.

The REER Volatility: An estimated coefficient of -0.0138 was observed, implying that a 1% increase in REER volatility corresponds to a slight negative impact on GDP Growth. However, this coefficient did not reach statistical significance even at the 10% level, as the t-statistic registered at -0.15.

The GCE (% of GDP): A pronounced and highly statistically significant negative effect on GDP Growth was revealed, with a coefficient of -14.50***. This implies that for every 1% increase in GCE as a percentage of GDP, a substantial decrease in GDP Growth is anticipated. The t-statistic for this variable was exceptionally low at -13.35.

The Population Growth (Annual %): This variable exhibited a statistically significant at 5% level with a negative influence on GDP Growth. With a coefficient of -0.530** and a t-statistic of -2.37, a 1% increase in Population Growth is associated with a decline in GDP Growth.

The GCF (% of GDP): GDP Growth displayed a highly significant at 1% positive response to GCF. A 1% increase in GCF, as a percentage of GDP, is linked to a remarkable rise in GDP Growth, indicated by a coefficient of 7.624*** and a robust t-statistic of 10.39.

Inflation (GDP Deflator): Inflation was associated with a negative coefficient of -0.0192*. However, the impact is statistically significant at the 10% level, with a t-statistic of -1.31. This implies that a 1% increase in the GDP Deflator significantly affect GDP Growth.

Trade (% of GDP): The relationship between Trade as a percentage of GDP and GDP Growth appeared positive, with a coefficient of 0.555. However, this effect did not achieve statistical significance, with a t-statistic of 0.96, even at the 10% level.

Constant Term: The constant term in the model, representing unaccounted factors, yielded an estimated value of 18.82. Importantly, this constant term was highly statistically significant at the 1% level, suggesting that factors not included in the model have a substantial impact on GDP Growth.

R-squared within (R^2 within): The R-squared within, with a value of 0.3147, serves as a pivotal metric in evaluating the extent to which the independent variables explain the variation in economic growth at the individual country level within the OECD. It indicates that approximately 31.47% of the variability in GDP growth can be attributed to the included independent variables when considering the FE. This metric offers insights into the effectiveness of the model in explaining variations within individual countries.

R-squared between (R^2 between): The R-squared between, which stands at 0.1309, plays a significant role in quantifying the proportion of variation in economic growth that can be attributed to differences between countries in the OECD. It provides valuable information about the impact of these differences on the overall model's performance, representing approximately 13.09% of the variation.

R-squared overall (R^2 overall): The R-squared overall, with a value of 0.1253, offers an assessment of the total explanatory power of the model, incorporating both within-country and between-country variations. It informs us that, collectively, the model can account for roughly 12.53% of the total variance in economic growth within the OECD. This metric provides a holistic perspective on the model's ability to explain variations in GDP growth across the entire region.

Prob > F: The Probability associated with the F-statistic, with a value of 0.0000, signifies the statistical significance of the overall model. A p-value of 0.0000 implies that the model's performance is highly statistically significant. In other words, there is strong evidence to suggest that the independent variables collectively contribute to explaining variations in economic growth within the OECD when considering FE. This underscores the robustness and reliability of the model in the context of the specified analysis.

In summary, when considering a 1% increase in the Dependent Variable (GDP Growth), this analysis unveils insights into the intricate relationships between REER volatility, GCE, Population Growth, GCF, Inflation, Trade, and the overall impact on GDP Growth in the OECD. It highlights the significant influence of Population growth, GCE and GCF, while indicating that REER volatility, Inflation, and Trade may not exert statistically significant effects on GDP Growth in this context.

The Model 5 in Table 4.9 of the RE approach delves into the intricate relationship between REER volatility and GDP Growth in the OECD. The results presented here are accompanied by significance levels, with *** indicating high

statistical significance at the 1% level, ** indicating significance at the 5% level, and * indicating significance at the 10% level.

REER Volatility: The coefficient associated with REER volatility is estimated to be -0.0326, signifying a statistically insignificant impact on GDP Growth. This impact is statistically insignificant even at the 10% level, as indicated by a t-statistic of -0.34.

GCE (% of GDP): GCE exhibits a substantial and highly statistically significant negative effect on GDP Growth. The coefficient is -5.939***, indicating that for every 1% increase in GCE as a percentage of GDP, there is a substantial decrease in GDP Growth. The t-statistic for this variable is -8.61.

The Population Growth (Annual %): Population grow shows statistically insignificant impact on GDP Growth, with a coefficient of -0.134 and a t-statistic of -0.68. This impact is statistically insignificant at the 10% level, however, the coeffiicient of the population growth suggest that a 1% increase in annual population growth might leads to a decrease in GDP Growth.

GCF (% of GDP): GDP Growth responds significantly to Gross Capital Formation. The coefficient is 7.009***, signifying a substantial increase in GDP Growth for every 1% increase in GCF as a percentage of GDP. The t-statistic for this variable is robust at 10.82.

Inflation (GDP Deflator): Inflation, as measured by the GDP Deflator, presents a minor impact with a coefficient of 0.00405 and a t-statistic of 0.29. However, this impact is not statistically significant even at the 10% level, implying that a 1% increase in the GDP Deflator does not significantly affect GDP Growth.

Trade (% of GDP): The relationship between Trade as a percentage of GDP and GDP Growth is positive, with a coefficient of 0.813**. This impact is statistically significant at the 5% level, suggesting that a 1% increase in the share of trade in the economy corresponds to an increase in GDP Growth.

Constant Term: The constant term in the model, representing unaccounted factors, is estimated at -5.600**. While the impact is statistically significant at the 10% level, the magnitude of this effect is modest.

The analysis of the RE Model provides insights into the intricate relationships between REER volatility, GCE, Population Growth, GCF, Inflation, Trade, and their collective impact on GDP Growth in the OECD. It emphasizes the significant influence of GCE, GCF, and Trade as percentage of GDP Growth while indicating that

REER volatility, Population Growth and Inflation insignificant effects. Furthermore, Trade as a percentage of GDP demonstrates a significant and positive relationship with GDP Growth.

R-squared within (R^2 within): The R-squared within, with a value of 0.2819, serves as an essential measure of the proportion of variation in economic growth that can be explained by the independent variables at the individual country level within the OECD. In this case, it indicates that approximately 28.19% of the variability in GDP growth can be accounted for by the included independent variables. This metric provides insights into the model's ability to explain variations in economic growth within each country in the OECD under the RE specification.

R-squared between (R^2 between): The R-squared between, with a value of 0.1981, quantifies the proportion of variation in economic growth that can be attributed to differences between countries in the OECD. It represents approximately 19.81% of the total variation. This metric is significant as it offers insights into the impact of these differences on the model's performance within the context of the RE specification.

R-squared overall (R^2 overall): The R-squared overall, with a value of 0.1667, provides an assessment of the total explanatory power of the model, considering both within-country and between-country variations. It indicates that, collectively, the model can explain about 16.67% of the total variance in economic growth within the OECD under the RE specification. This metric offers a holistic perspective on the model's ability to elucidate variations in GDP growth across the entire region while accounting for RE.

Prob > F: The Probability associated with the F-statistic, with a value of 0.0000, signifies the statistical significance of the overall model within the RE specification.

As presented in Table 4.9.; the FE and RE estimates indicate diversified findings. To choose among these estimates, Hausman test is utilized. As presented in Table 4.9.; the FE and RE estimates indicate diversified findings. To choose among these estimates, Hausman test is utilized. The Hausman test yielded a highly significant result, with a Prob>chi2 of 0.0000 (Hausman, 1978). This outcome strongly indicates a preference for the FE model over the RE model.

As a next step, the empirical analysis employs diagnostic checks to question whether cross-sectional dependence, autocorrelation, and heteroscedasticity exist in the FE model. For this purpose, the study utilizes relevant tests. Depending on the outcomes from the relevant tests, the empirical analysis then proceeds to the estimation

of final FE estimation that utilizes robust S.E. In the examination of cross-sectional dependencies, Pesaran's test of cross-sectional independence reported a test statistic of 59.111 with a p-value of 0.000 (Pesaran, 2004), highlighting the presence of substantial cross-sectional dependencies. Similarly, Friedman's test of cross-sectional independence resulted in a test statistic of 290.708 with a p-value of 0.000 (Friedman, 1937), further confirming the existence of significant cross-sectional dependencies. Moreover, the Frees' test of cross-sectional independence yielded a test statistic of 4.989, and critical values from Frees' Q distribution were employed, with alpha values of 0.1124 for 10% significance, 0.1470 for 5% significance, and 0.2129 for 1% significance (Frees, 2004).

Autocorrelation was assessed using the modified Bhargava et al. Durbin-Watson statistic, resulting in a value of 1.337722 (Bhargava et al., 1982), suggesting the presence of autocorrelation. Additionally, the Baltagi-Wu LBI test produced a statistic of 1.5748077 (Baltagi, 2009), confirming the existence of autocorrelation.

The Modified Wald test for groupwise heteroskedasticity in the FE regression model revealed a chi-squared statistic of 1670.00 and Prob> Chi2 of 0.000 (Greene, 2000"), indicating the presence of heteroskedasticity in the data.

These statistical findings are instrumental in guiding the selection of the appropriate model, addressing cross-sectional dependencies, identifying autocorrelation, and recognizing heteroskedasticity, all of which contribute to the robustness and reliability of the regression analysis (Wooldridge, 2010; Gujarati, 2003).

The findings from diagnostic checks indicate that cross-sectional dependence, autocorrelation, and heteroscedasticity is present in the model. To generate robust S.E. for all these, this study employs DRK S.E. to FE estimation. Model 6 in Table 4.9 explains the intricate relationship between REER volatility and GDP Growth in the OECD. This model incorporates the FE approach and DRK S.E. correction to enhance the robustness of the analysis, and significance levels are denoted as *** for high statistical significance at the 1% level, ** for significance at the 5% level, and * for significance at the 10% level.

The REER Volatility: The coefficient associated with REER volatility remains consistent with a value of -0.0138, signifying a modest impact on GDP Growth. This impact, however, is statistically insignificant at any of the specified significance levels (indicated by the t-statistic of -0.04).

GCE (% of GDP): GCE continues to exhibit a substantial and highly statistically significant negative effect on GDP Growth. The coefficient remains at -14.50***, emphasizing the substantial decrease in GDP Growth associated with a 1% increase in GCE as a percentage of GDP. The t-statistic for this variable is 3.89.

Population Growth (Annual %): Population growth maintains its modest impact on GDP Growth, with a coefficient of -0.530 and a t-statistic of -0.94. This impact is statistically insignificant at the 10% level.

GCF (% of GDP): The relationship between GCF and GDP Growth continues to be highly statistically significant. The coefficient remains at 7.624***, highlighting the substantial increase in GDP Growth for every 1% increase in GCF as a percentage of GDP. The t-statistic for this variable remains robust at 2.90.

Inflation (GDP Deflator): Inflation, as measured by the GDP Deflator, exhibits negative impact with a coefficient of -0.0192. The t-statistic of -0.91 indicates that the impact is statistically insignificant even at the 10% level.

Trade (% of GDP): The relationship between Trade as a percentage of GDP and GDP Growth is positive, with a coefficient of 0.555. This impact is statistically insignificant even at the 10% level.

Constant Term: The constant term in the model, representing unaccounted factors, retains its estimated value of 18.82, but the impact is statistically insignificant even at the 10% level.

R-squared within (R^2 within): The R-squared within, with a value of 0.3147, serves as a fundamental metric that quantifies the extent to which the independent variables elucidate the variation in economic growth at the individual country level within the OECD. In this context, it implies that approximately 31.47% of the variability in GDP growth can be accounted for by the included independent variables. This metric offers insights into the model's efficacy in explaining variations in economic growth at the individual country level.

Prob > F: The Probability associated with the F-statistic, having a value of 0.0003, underscores the statistical significance of the overall model. A p-value of 0.0003 demonstrates that the model's performance is highly statistically significant. This signifies compelling evidence that the independent variables collectively contribute to explaining variations in economic growth within the OECD, particularly under the FE model with DRK robust standard errors correction. This emphasizes the robustness and reliability of the model in the specified analytical context.

These statistical indicators contribute to a comprehensive assessment of the FE model with DRK robust standard errors correction, shedding light on the relationship between REER volatility and economic growth in the OECD. The R-squared value highlights the explanatory power of the model at the individual country level, while the highly significant Prob > F value underscores the model's overall statistical significance and credibility in the context of the analysis.

In summary, this analysis, employing the FE Model with DRK standard errors correction, offers valuable insights into the complex relationships between REER volatility, GCE, Population Growth, GCF, Inflation, Trade, and their combined effect on GDP Growth in the OECD. It underscores the substantial influence of GCE and GCF and the slight effect of Inflation on GDP Growth. Notably, the DRK standard errors correction enhances the model's robustness by addressing potential autocorrelation and heteroskedasticity issues. Hoechle (2007) using the DRK standard errors approach in correcting for the cross-sectional dependence, this thesis first analyzes the FE and RE estimates and the Hausman test strongly accept the FE in the model with the presence of cross-sectional dependencies and heteroskedasticity in the model and weak presence of autocorrelation, then the use of the DRK technique to fix the cross-sectional dependencies issue with the model (Driscoll & Kraay, 1998)

4.7. Discussion on the Empirical Findings Obtained

On the analysis of REER and its volatility on economic growth in the OECD, there were presence of autocorrelation, heteroskedasticity and the presence of cross-sectionality in the model specifications, which requires the use of DRK standard errors in corrections to produce a more robust standard errors in the analysis. (Driscoll & Kraay, 1998).

Viera, Holland, Gomes de Silva, and Bottecchia (2013) examine development and trade rate instability utilizing a board information examination of GMM appraise of a board development demonstrate for eighty-two created nations. They discover that the relationship between REER instability and development is factually critical, with a negative coefficient, and conclude that trade rate solidness tends to play a more noteworthy part in cultivating long-term financial development than misalignment of the trade rate, which is closely related with macroeconomic insecurity. The assessed coefficients of the conditional RER instability extend from -10.15 to -39.55, and it can

be concluded that a 1% increment within the normal yearly genuine viable trade rate instability over the past five a long time will diminish the normal yearly genuine GDP development over the past five a long time by 0.39 rate points.

Rapetti (2020) conducted a comprehensive writing audit on the experimental relationship between the REER and financial development. There's a positive relationship between the REER and financial development, while there's a negative relationship between the REER instability and financial development, especially in creating and new markets. Between created and creating economies, he compared numerous methodological approaches, counting settled impact, framework GMM, and Dynamic GMM. Imaginatively, the creator analyzes the economic growth discoveries employing a panel of trade rate instability and undervaluation. Within the settled impacts, he utilized a vector of standard control factors, which included remote obligations and terms of exchange, expansion rate, degree of exchange openness, human capital, government utilization, and net residential reserve funds. Utilizing Dynamic OLS and a time slip by of the subordinate factors to clarify the relationship; and to find measurably critical gauges that relate with the hypothesis, he isolated the nations into creating and created economies between 1950-2014, 1950-1984, and 1985-2014. Later, he joined both Dynamic GMM and Framework GMM to clarify the relationship between REER and financial; the Hansen tests of Dynamic GMM and Framework GMM were 0.778 and 0.631, individually, which were still inside the ideal esteem of 0.8. It was affirmed that the cross-sectional measurement of these considers uncovered a negative relationship with financial improvement (Cottani, Cavallo and Khan, 1990; Aguirre and Calderon, 2005; Razin and Collins, 1999; Rapetti, 2020; Vierra, Holland, Gomes de Silva and Bottecchia, 2013). Broadly clarified utilizing the energetic board environment of the impacts of the genuine viable trade rate to have a positive relationship with financial development, whereas controlling for the REER misalignment in their demonstrate specifications.

The research conducted by Aghion, Bacchetta, Ranciere, and Rogoff (2009). Using the Dynamic System GMM explores the relationship between RER volatility, financial development, and productivity growth. Employing a comprehensive methodology, the study employs panel data from diverse nations and employs advanced econometric techniques to delve into the intricate connections among these variables. The authors propose that ER volatility could impact productivity growth through several avenues, with financial development potentially acting as a mitigating

factor. To probe this hypothesis, they establish a theoretical framework that encompasses macroeconomic and microeconomic mechanisms. The empirical analysis amalgamates country-level data on ER volatility, financial development metrics, and productivity growth across a substantial timeframe. The pivotal empirical outcomes of the study are two-fold. Initially, the researchers identify a negative correlation between ER volatility and productivity growth. Amplified ER volatility aligns with diminished productivity growth rates. Secondly, the investigation underscores the vital role played by financial development in this correlation. Economies with more advanced financial systems demonstrate a weaker adverse impact of ER volatility on productivity growth. A notable contribution to comprehending the intricate interplay between ER volatility, financial development, and productivity growth. Their discoveries propose that a well-developed financial structure can potentially serve as a safeguard, diminishing the detrimental effects of ER volatility on a nation's productivity growth. These findings bear significance for policymakers and economists alike, providing insights into the intricate dynamics at play among these economic variables.

CHAPTER 5

5. CONCLUSION

This thesis undertakes a comprehensive exploration of the intricate relationship between the REER and economic growth across 36 OECD countries during the period spanning 1996 to 2020. Additionally, it investigates the influence of REER volatility on economic growth within the same set of countries and time frame. The analytical framework employs ARCH, GARCH, and Exponential GARCH models to derive proxies for REER volatility.

The initial phase of this research involves a meticulous examination of Random and FE Estimates, along with the application of the Hausman Test. The presence of cross-sectional dependencies, heteroskedasticity, and autocorrelation in the model's context leads to the use of DRK standard errors . To address the challenges arising from the presence of cross-sectionality, autocorrelation and heteroskedasticity, the study employs the DRK technique. The outcomes of the robust FE model in this study reveal that the REER exerts a significantly negative impact on real economic growth, whereas the volatility of the REER demonstrates a(n) (negatively) insignificant relationship in the FE, RE and FE DRK methods used in the analysis. Within the context of the FE method, the statistical significance of the estimated coefficients remains modest at the 5% level; while the REER volatility were statisticallly insignificant across the methods used in the analysis. Similar challenges of multidimensional nature have been encountered by Firat (2013) and Viera, Holland, Gomes de Silva, and Bottecchia (2013) in their explorations of the interplay between growth, REER, and its volatility across different countries and firms. This underscores the complexity of addressing these challenges within the model specification.

The investigation into the FE and RE within the model specification highlights the necessity of comprehensively addressing the multifaceted issuee that arise. Cross-

sectional, autocorrelation, and heteroskedasticity analyses contribute to a deeper understanding of the underlying problems. These findings supplement prior research on the impact of REER and its volatility on long-term economic growth within the OECD. The study adds value by employing dynamic panel data analysis, generating estimates that are both impartial and consistent. While the volatility of the REER presents itself as a dynamic and systemic disturbance, financial institutions within the OECD effectively utilize dynamic hedging strategies to manage systemic risk. This dynamic approach is crucial for handling shocks from global markets and optimizing the use of prudential policies to mitigate the impact of volatility shocks on financial development and overall capital formation in the economy. In addition, the study reveals a negative and statistically significant relationship between inflation rate and growth within the OECD in the FE specification, while give an insignificant relationship with the DRK approach. This highlights the importance of prudent economic governance in monetary policy to maintain optimal inflation rates that support economic growth. Similarly, the negative relationship between population growth rate and economic growth (in FE estimates) underscores a potential demographic risk that the OECD must address to ensure sustainable growth in the future. By controlling for employment as proxied by population growth, the study reinforces these findings. The timeframe of this study encompasses multiple episodes of idiosyncratic shocks emanating from the global economy. It examines how these countries respond through fiscal and monetary policies to align their REER and enhance their balance of payments. This strategic positioning aids them in managing heterogeneous macroeconomic shocks arising from the global economy, thereby fostering financial stability and sustainable economic growth within the OECD.

In its concluding remarks, this study offers policy recommendations tailored to OECD economies. The path of real economic growth within the OECD remains uncertain, contingent upon numerous factors that could sway it in either a positive or negative direction. Demographic trends, technological advancements, global economic conditions, climate change, and environmental sustainability stand out as the primary drivers shaping prospective economic growth within the OECD. The aging of populations across several OECD countries poses a notable challenge to real economic growth due to potential declines in the labor force and productivity. However, the potential mitigation of these effects through immigration and the influx of educated youth remains a possibility. The accelerating pace of technological

advancement is likely to introduce more efficient production methods and new industries, fostering future economic development. As the global economy remains interconnected, changes in one nation's economic landscape can reverberate globally, thus influencing the trajectory of real economic growth in OECD countries.

In its conclusion, this study also provides policy recommendations for OECD economies. The future of real economic growth in the OECD is uncertain and subject to a number of factors that could have either a positive or negative effect on growth in the coming years. Demographic trends, technological advancements, global economic conditions, climate change, and environmental sustainability are some of the main drivers of prospective economic growth in the OECD. The aging of populations in a number of OECD countries is likely to continue to pose a significant threat to real economic growth, as it can contribute to a decline in the labor force and a sluggishness in productivity growth. Nevertheless, immigration and the influx of youthful, educated employees may mitigate some of the negative effects of aging populations. It is probable that the rate of technological advancement will continue to quicken, resulting in new, more efficient production methods and the emergence of new industries and occupations. This could fuel future real economic development in the OECD. The global economy is interdependent, and changes in one country's economic conditions can have ripple effects on the rest of the globe. Consequently, the future trajectory of the global economy will play a significant role in determining the future of real economic growth in OECD countries. Changes in the climate and environmental sustainability will continue to play a significant role in determining the future of real economic growth in the OECD.

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