Navigating the Economic Turbulence: A Joint – Continental Study on the Great Recession (2008 – 2009)

Abstract: This research examines the impact of the 2008-2009 Great Recession on key macroeconomic indicators—GDP, inflation, FDI, imports, exports, unemployment, and GNI—across 35 countries in Asia and Europe. By analyzing pre- and post-recession conditions, the study identifies economic shifts and recovery patterns, highlighting the roles of inflation, investment, and trade dynamics. The findings provide insights into factors influencing recovery, offering policy recommendations to bolster economic resilience against future global crises. In the case of 2008, the regression analysis reveals key relationships between GDP and several macroeconomic indicators. FDI, exports, and GNI exhibit strong positive correlations with GDP, with significant p-values indicating their substantial impact on economic growth. Imports have a significant negative relationship with GDP, underscoring trade balance concerns, while inflation and unemployment lack statistical significance, implying limited influence on GDP in this context. The model's high R-squared value of 0.9986 reflects an excellent fit, explaining almost all the variation in GDP with the included variables. For 2010, the analysis finds significant positive relationships between GDP and Inflation, FDI, and GNI, with these variables enhancing economic growth, supported by low p-values. Imports, however, show a significant negative effect on GDP, reflecting potential trade balance challenges. Exports and Unemployment demonstrate no significant impact on GDP within this dataset. Policymakers should focus on attracting FDI to boost economic growth, promoting balanced trade to strengthen domestic industries, investing in workforce development to reduce unemployment, and adopting flexible monetary policies to stabilize economies during crises.

Keywords: The Great Recession, GDP, Inflation, FDI, Import, Export, Unemployment, GNI.

1. Introduction

The global financial crisis of 2008-2009, often referred to as the Great Recession, was a severe economic downturn with far-reaching impacts on economies worldwide [1], [2]. Originating in credit markets of developed countries, particularly the United States, United Kingdom, and Europe, the crisis led to significant business failures, consumer wealth declines, and decreased economic activity [2]. It prompted a reassessment of financial institutions, regulatory frameworks, and macroeconomic policies globally [1]. The crisis resulted in a shift from easy credit conditions to tight credit and dysfunctional markets, accompanied by a loss of consumer and business confidence. Governments and central banks responded with various market-based and regulatory solutions to restore financial stability and stimulate economic recovery [1], [2]. The crisis has had long-term implications for financial regulation, monetary policy, fiscal policy, and international cooperation [1]. It necessitated unprecedented fiscal stimulus packages in major economies, challenging previous conservative policies and raising concerns about fiscal sustainability [3] . This research aims to analyze the impact of the recession on various macroeconomic variables, including Gross Domestic Product (GDP), inflation, Foreign Direct Investment (FDI), imports, exports, unemployment rate, and Gross National Income (GNI), across 70 countries in Asia and Europe.

The Great Recession exposed the vulnerabilities of interconnected financial systems and highlighted the importance of robust economic policies and regulatory frameworks. The collapse of major financial institutions triggered a cascade of failures across the global financial system. Governments and central banks around the world responded with a range of measures, including bailouts, stimulus packages, and monetary easing, to stabilize their economies. The global financial crisis of 2007-2009 significantly impacted Asian economies, despite initial optimism about their resilience [4]. While initially insulated, Asian countries eventually experienced sharp GDP contractions, particularly in newly industrialized economies [4]. The recession led to substantial declines in exports and investment ratios, with stock markets and currencies coming under strong downward pressure [4], [5]. The crisis's impact varied across countries, with Indonesia, Malaysia, South Korea, the Philippines, and Thailand experiencing severe contractions in real GDP [5]. Although recoveries in 1999-2000 were strong in most cases, it remained uncertain whether pre-crisis growth paths would be reattained [5]. The crisis's effects were not just

cyclical but potentially permanent, with substantial declines in potential output growth observed in deeply affected countries [6]. To preserve high growth rates, Asian economies needed to rebalance towards domestic demand rather than relying solely on exports for recovery [6], [7].

The global financial crisis severely impacted Europe, leading to prolonged economic stagnation and high unemployment in several countries [8]. The crisis exposed structural weaknesses in many economies, particularly in the Eurozone, where divergent macroeconomic structures and fiscal indiscipline contributed to a sovereign debt crisis. The impact varied across regions, with the most severe effects seen in areas with existing vulnerabilities [9]. The crisis led to increased structural unemployment, especially in countries with less favorable institutional settings like Spain and Ireland [10]. In response, crisis-hit countries implemented structural reforms and austerity measures, which, while aimed at addressing fiscal issues, may have prolonged recession and unemployment [10]. This prompted a series of reforms at both national and EU levels. While most changes were incremental expansions of existing regulatory tools, the creation of the banking union represented a paradigmatic shift, overcoming long-standing resistance to supranationalization of banking supervision [11]. The crisis altered power dynamics within the EU, creating path dependencies for further institutional change and strengthening the case for more substantial reforms [12]. However, the incremental nature of many changes may be insufficient to address the collective action problems inherent in the euro area's structure, which combines centralized monetary policy with limited integration in economic, budgetary, and financial policy coordination [12]. These reforms have also led to a populist backlash, with declining trust in regional and domestic institutions (Bakir et al., 2021).

The Great Recession significantly impacted global trade, with sharp declines in exports and imports, severely affecting export-dependent economies like Germany, China, and Japan. Inflation dynamics varied, with some countries experiencing deflation due to falling demand, while others faced inflation from currency devaluations, as seen in the UK and Japan. FDI flows dropped markedly, impacting emerging economies such as India and China. Unemployment rates soared, peaking at 10% in the US and even higher in Spain and Greece, leading to increased poverty and inequality. GNI also declined, particularly in low-income countries, exacerbating economic vulnerabilities.

The 2008-2009 global recession had far-reaching consequences for the economic stability and growth trajectories of countries worldwide. Despite numerous studies on the recession's impact, there remains a need for a detailed comparative analysis of its effects on key macroeconomic indicators across different regions. This research addresses this gap by focusing on the pre-recession (2008) and post-recession (2010) economic conditions of 35 countries in Asia and Europe and its impact on various macroeconomic variables, including Gross Domestic Product (GDP), inflation, Foreign Direct Investment (FDI), imports, exports, unemployment, and Gross National Income (GNI). By examining data from 35 countries across Asia and Europe, this study seeks to provide a comprehensive understanding of the effects of recession on different economies and the subsequent recovery patterns.

The primary objective of this research is to evaluate the impact of the 2008-2009 global recession on selected macroeconomic variables in 35 countries from Asia and Europe. Specifically, the study aims to:

- Assess the pre-recession economic conditions (2008) and post-recession economic conditions (2010) of the selected countries.
- Analyze the changes in GDP, inflation, FDI, imports, exports, unemployment, and GNI during the specified period.
- Identify the key factors that contributed to the economic recovery or further decline in the aftermath of the recession.
- Provide policy recommendations based on the findings to enhance economic resilience against future global financial crises.

2. Literature Review and Hypothesis Development

2.1. GDP as an Economic Indicator and The Impact of Recession on It:

The 2008 global recession significantly impacted European economies, causing heterogeneous effects across countries and regions [13], [14]. The crisis led to reduced exports, industrial activity, and personal consumption [15]. Economic downturns affected older workers' health, with decreases in GDP associated with lower BMI, reduced alcohol consumption, and poorer self-rated health [16]. Employment outcomes for older workers were negatively impacted, with GDP decreases linked to higher unemployment and lower retirement rates [17]. The recession's severity varied due to factors such as global economic integration, institutional frameworks, and sectoral composition, with the latter being particularly influential at both country and regional levels [13]. The crisis highlighted the need for revised economic models and strengthened regional cooperation, especially in Southeast European countries with weak export orientation [15]. The average GDP decline for EU27 countries reached -4.2% in Q2 2009, with only Poland showing weak growth [14]. The recession's effects varied across countries, with some experiencing minimal impact while others suffered substantial losses in potential output [18]. Greece, Hungary, and Ireland faced output losses exceeding 30%, while the average weighted loss was 8.4% [18]. Recovery strategies differed among EU countries, with Germany rebounding by 2011, while Italy and Spain struggled to recover [19].

The 2008-2009 global recession had a milder impact on East Asia compared to the US and EU, partly due to the region's higher growth-with-resilience index scores [20]. However, the impact varied across Asian economies, reflecting the region's heterogeneity [20]. The recession affected developing Asia's economic growth primarily through two channels: FDI inflows and exports, both of which significantly contribute to the region's growth [21]. Among ASEAN countries, Indonesia and the Philippines fared better than Malaysia and Thailand due to larger countercyclical fiscal stimuli and less reliance on trade [22]. Indonesia's economy demonstrated resilience, maintaining growth around 4.5% in 2009 [23]. This resilience was attributed to sound macroeconomic fundamentals, quick fiscal policy responses, and investment-friendly structural reforms [22], [24]. However, the crisis's impact varied within countries, affecting different regions and households to varying degrees [23]. Overall, countries with stronger pre-crisis fundamentals, such as large

foreign exchange reserves and sound fiscal positions, were better equipped to weather the recession and implement effective countercyclical policies [20], [24].

The global financial crisis affected Asian economies differently than European ones, with Asia showing greater resilience and faster recovery [25]. This resilience was attributed to stronger economic fundamentals, including lower external and financial vulnerabilities, which were a result of lessons learned from the 1990s Asian financial crisis [26]. Asian economies benefited from moderate credit expansion, improved bank asset quality, and better current accounts [26]. However, recoveries in Asia were typically export-driven and weaker than in other emerging economies where domestic demand played a stronger role [6]. The degree of openness to trade and finance, as well as integration into international financial markets, were key factors in determining the impact of the crisis and the speed of recovery [27]. Despite these strengths, Asian markets were still significantly affected, highlighting the importance of rebalancing towards domestic demand for future growth [6]. Lastly, as GDP has deep interconnection and can be reflector of other macroeconomic variables such as Inflation, FDI, Import, Export, Unemployment, and GNI, hence, prove that GDP can be a significant indicator to reflect the economic condition of a country or a group of countries.

2.2. The Impact of The Recession on Inflation:

The 2008-2009 global recession significantly impacted inflation in Europe, leading to a flattening of the Phillips curve during economic slack [28] The European Central Bank (ECB) considered inflation differentials in its monetary policy decisions, possibly due to concerns about deflation in low-inflation countries like Germany [29]. Despite initial convergence of inflation rates following the Maastricht treaty, the 2008 crisis led Euro area inflation rates to align with the ECB's price stability benchmark, although Greece experienced higher inflation [30]. Interestingly, the provision of "zombie credit" to nonviable firms had a disinflationary effect by creating excess aggregate supply. This phenomenon resulted in lower firm entry and exit, reduced capacity utilization, and decreased markups and inflation in affected markets. Consequently, it led to misallocation of resources and lower productivity, investment, and value added [31].

The aftermath of the global financial crisis saw deflationary pressures in various European countries, characterized by mild declines in consumer prices but more significant drops in producer prices [32]. These pressures emerged despite record levels of monetary easing, with oil prices

playing a consistent role in contributing to the deflationary trend [32]. The euro area crisis, rooted in the loss of monetary sovereignty and unsustainable credit-led growth in peripheral countries, was exacerbated by fiscal austerity measures [33]. These policies led to negative consequences for income distribution and economic relations between core and peripheral countries [33]. The crisis revealed significant flaws in Europe's economic policy framework, including a lack of institutions and policy concepts to address deep financial and economic crises [34]. Alternative solutions proposed include stabilizing wage policies and active fiscal measures to cope with imbalances and initiate recovery [34].

In 2008-2009 global financial crisis ASEAN nations experienced sharp declines in economic growth and trade shocks, leading to inflationary pressures in countries like Malaysia and Thailand [35]. The crisis caused job losses and highlighted underlying labor market issues in Korea, Philippines, and Thailand (Son & San Andres, 2009). Inflation accelerated sharply in developing Asia, rising from 3.3% in 2006 to a projected 7.8% in 2008, largely attributed to spikes in food and oil prices (Jongwanich & Park, 2008). The severity and channels of impact differed among countries, with Thailand suffering the most in GDP growth reduction and Korea experiencing the worst employment decline (Son & San Andres, 2009). In response, many Asian countries implemented policy measures, including financial institution recapitalization, liquidity injection, and stimulus packages to bolster domestic demand [35], [36].

Post-crisis, Asian central banks faced challenges in maintaining price stability, with concerns about procyclical inflation swings [37]. The integration of emerging Asian economies into the global market influenced inflation processes in advanced economies, initially providing a deflationary impulse but later contributing to higher commodity prices [38]. Over the past two decades, monetary and supply shocks have been the main drivers of inflation in Asia, but recent years have seen an increase in demand-side pressures [39]. Trend inflation analysis reveals diverse impacts across Asian countries, with some experiencing lasting low inflation, others risking de-anchoring of expectations, and some showing moderation in inflation trends [40].

In Asia, nominal and real exchange rates strongly influence inflation, while the opposite relationship is observed in non - Asian regions [41], [42] . Asian inflation also shows higher sensitivity to exchange rate changes compared to the EU and North America [42]. In Europe, import competition from low-wage countries, particularly China, has a substantial deflationary

effect on producer prices. A 1% increase in Chinese market share in Europe is associated with a 2% decrease in producer prices (Auer et al., 2010). These findings highlight the diverse inflationary pressures and economic dynamics in Europe and Asia during the recession period.

H1: Inflation might have a significant impact on GDP in both 2008, and 2010.

2.3. The Impact of The Recession on FDI:

The 2008-2009 global financial crisis significantly impacted Foreign Direct Investment (FDI) in Europe, particularly affecting Central and Eastern European countries [43], [44]. FDI flows to the European Union declined sharply, with inflows dropping by 75% and outflows by 80% from pre-crisis levels [45]. The crisis led to a reduction in the number of FDI projects, but not their size, as investors became more selective due to credit constraints in home markets [46]. The impact varied across regions and sectors, with some industries like automotive being particularly affected [47]. Multinational enterprises responded by reorganizing production systems and potentially reducing or closing fewer essential activities. The crisis prompted a rethinking of approaches to the global economy and financial markets, challenging the effectiveness of economic nationalism as a response to corporate restructurings [47].

While there was a gradual recovery in FDI inflows post-crisis, the pace varied across regions, with some countries still struggling to reach pre-crisis levels by 2017 [44]. The crisis highlighted the importance of both external and domestic factors in attracting FDI, including macroeconomic conditions, human capital, infrastructure, and structural reforms [48]. Despite the severe decline in FDI during the crisis, its positive impact on economic growth intensified during this period, although it became non-significant during the 2011 crisis [48]. The post-crisis landscape emphasized the need for countries to improve their business environments and offered incentives to attract and retain foreign investments [49].

The 2008-2009 global financial crisis significantly impacted Foreign Direct Investment (FDI) in Asia, with varying effects across countries. While FDI inflows initially declined, countries with higher pre-crisis FDI levels experienced milder recessions and more gradual recoveries [50]. China and India showed resilience due to their large domestic markets, while smaller, export-dependent economies faced steeper declines [51]. The crisis highlighted the importance of economic diversification and robust financial regulations [52]. Many Asian countries implemented

countercyclical policies, including stimulus packages and interest rate cuts, to mitigate the impact and attract FDI [27]. Emerging economies with strong pre-crisis fundamentals, such as Vietnam and Indonesia, attracted significant FDI due to their growing markets [53]. By 2010-2011, FDI flows began recovering as global economic conditions improved. The crisis accelerated the growing importance of developing East Asia in the global economy, with outward FDI from these economies increasing rapidly [51].

East Asia demonstrated higher resilience to the economic downturn compared to the EU, as measured by a growth-with-resilience index [54]. While developed countries experienced the largest decline in FDI flows, South, East, and Southeast Asia showed the smallest decline among developing economies [55]. Despite higher levels of corruption in Asia compared to Europe, as indicated by the tolerable level of corruption for investment (TLCI), the region remains the top global investment destination [55]. In Central and Eastern Europe, the impact of the crisis on FDI flows varied depending on host country characteristics [43].

H2: FDI might impact on GDP in both 2008, and 2010 significantly.

2.4. The Impact of The Recession on Import:

The 2008-2009 global financial crisis led to a severe decline in international trade, particularly in countries experiencing financial crises [56]. The collapse in trade was primarily driven by a shift in final spending away from tradable sectors, especially durable goods and investments [57], [58]. The high import-intensity of exports and widespread global production chains amplified the downturn and contributed to its synchronization across countries [59]. Inventory adjustments and credit supply constraints further exacerbated the decline [58]. While exports of crisis countries fell modestly, imports experienced a sharp 19% average decline in the year following a crisis, with recovery taking up to 10 years [56]. The trade recovery was partially explained by the reactivation of global production chains, stock building, and fiscal stimulus measures [59].

The 2008-2009 global recession significantly impacted Asian economies, causing sharp declines in imports across many countries [60]. The crisis led to economic contractions and structural changes, with varying effects across the region [54]. Countries that were heavily reliant on exports were more severely affected, while those with diversified economies showed greater resilience [60]. The recession's impact on imports was influenced by factors such as aggregate demand

components, credit conditions, and business sentiment [61]. In response, many Asian governments implemented fiscal stimulus packages and support measures to stabilize their economies. The crisis also highlighted Asia's vulnerability to external shocks due to its reliance on net exports for economic growth. Despite the challenges, the global economic crisis likely enhanced the potential gains from regional cooperation in Asia, promoting support for economic integration initiatives (Plummer, 2009).

The 2008-2009 global recession had a milder impact on East Asia compared to Europe and the United States, as evidenced by higher Growth-with-Resilience index scores [54]. While Asian economies experienced diverse trade impacts during the crisis, with China facing a major decline and slow recovery, and Korea showing a quick rebound [60], European markets were more severely affected. Financial market integration and co - movements were higher in Europe, with greater regional correlation and tail dependence compared to East Asia [62]. The crisis led to profound changes in both regions, with the EU struggling with a subsequent sovereign debt crisis and austerity measures, while East Asia reexamined its export-driven growth model and emerged stronger with a swift economic recovery [63]. These differences highlight the varying resilience and recovery patterns between Europe and Asia during and after the global financial crisis.

H3: Import might have a Prominent impact on GDP in both 2008, and 2010 Significantly.

2.5. The Impact of The Recession on Export:

The 2008-2009 financial crisis significantly impacted European exports, particularly in emerging economies. The crisis led to a sharp contraction in world trade, with euro area exports hit especially hard due to unfavorable price competitiveness developments (di Mauro et al., 2010). European emerging economies experienced severe export declines, with over half seeing reductions exceeding 50% between Q3 2008 and Q1 2009 [64]. Greater export orientation was associated with stronger growth downturns, especially when interacting with domestic GDP structure [65]. Firm-level data revealed negative effects on export growth, with firms from more severely affected countries experiencing larger declines in export value (Prickaerts, 2014). However, importing firms in these countries saw increased export values compared to non-importing counterparts (Prickaerts, 2014). The crisis also led to reduced current account deficits and currency depreciations in many European emerging economies [64].

The 2008-2009 global financial crisis significantly impacted Asian exports, with many economies experiencing substantial declines. China, India, Japan, South Korea, Malaysia, Taiwan, and Thailand saw export drops ranging from 15.4% to 49.4% between May 2008 and May 2009 [60]. The crisis particularly affected manufacturing exports, with Japan's auto sector and China and South Korea's consumer electronics industries hit hard [60]. Recovery patterns varied, with South Korea rebounding quickly while Japan's trade took longer to recover [60]. The electronics, transport equipment, base metals, and machinery sectors were most heavily impacted [66]. China experienced relatively lower trade falls compared to other countries, contributing to an increase in emerging economies' share of global trade [66]. The crisis highlighted the vulnerability of export-dependent economies to global financial shocks.

East Asian economies showed higher resilience to external shocks compared to the EU and US, resulting in a milder impact on the region [54]. However, both China and India experienced negative growth rates in major exporting sectors due to reduced demand from the US and Eurozone [67]. European firms in countries that were more severely affected by the crisis saw larger declines in export value, although importing firms fared better (Prickaerts, 2014). Among Asian economies, China experienced a major decline in trade with slow recovery, while South Korea had a smaller initial impact but quicker rebound [60]. The impact on imports was mildest for India and commodity exporters like Malaysia. Overall, the trade impacts of the 2008-2009 recession were significant but varied across countries and regions.

H4: Export might Impact Significantly in both 2008, and 2010 on GDP.

2.6. The Impact of The Recession on Unemployment Rate:

The 2008 global financial crisis significantly impacted unemployment across Europe, with varied effects among countries and regions. Youth unemployment rose sharply, particularly in Southern European countries, leading to increased regional inequality and polarization [68]. The crisis had a large negative short-term impact on unemployment, but the persistence of this effect depended on labor market flexibility [69]. Spatial analysis revealed high unemployment clusters in Portugal, Spain, Italy, and Greece, while Germany and surrounding regions showed greater resilience [70]. Different countries employed various adjustment mechanisms, including labor market segmentation, working hours changes, and unemployment/underemployment strategies, reflecting distinct varieties of capitalism [71]. The severe austerity measures imposed on some countries

early in the crisis did not effectively mitigate unemployment, leading to a widening gap between Southern and Central-Northern Europe [70].

The 2008-2009 global financial crisis had varying impacts on Asian labor markets. While some countries like the Philippines and Thailand experienced minimal changes in unemployment rates, others faced significant challenges (Hyun & San Andres, 2009). China saw substantial job losses, particularly among migrant workers in urban areas, leading to increased labor disputes [72]. South Korea suffered the worst in terms of reduced employment, highlighting underlying issues such as youth unemployment (Hyun & San Andres, 2009). The crisis led to falling demand for labor, rising vulnerable and informal employment, and declining incomes across the region (Kim et al., 2010). Recovery in labor markets was expected to lag output growth, based on experiences from the 1997 Asian financial crisis (Kim et al., 2010). Policy responses focused on generating employment, boosting aggregate demand, improving social protection, and promoting sustainable economic and labor market recovery (Sziraczki et al., 2009).

While advanced economies and Central/Eastern Europe suffered sharp GDP declines, Asia experienced only a deceleration in growth [73]. The crisis led to an estimated 30 million job losses globally, with varying impacts across regions [73]. In Asia, the crisis resulted in falling labor demand, rising vulnerable and informal employment, and declining incomes (Kim et al., 2010). China faced significant urban unemployment, with differing impacts on workers with urban hukou versus rural migrant workers [72]. Recovery in Asian labor markets was projected to lag output growth, based on experiences from the 1997 Asian financial crisis (Kim et al., 2010).

H5: Unemployment Rate can Play a Significant Role Impacting GDP in 2008, and 2010.

2.7. The Impact of The Recession on GNI:

The 2008-2009 global financial crisis significantly impacted European economies, particularly in Southern Europe. It led to GDP declines, increased unemployment, and reduced investment across the region [74]. The crisis affected countries and regions heterogeneously, with variations largely attributed to differences in sectoral composition, global economic integration, and institutional frameworks [13]. In response, many countries implemented austerity measures, including spending cuts and tax increases, which further strained welfare states and exacerbated social inequalities [75]. The health sector was particularly affected, with decreased public expenditure

impacting vulnerable groups and increasing health inequalities [74]. The crisis's effects were not uniform across income groups, with microsimulation models revealing varying distributional impacts in Greece, Spain, Italy, and Portugal from 2009 to 2013 [75].

The 2008-2009 global financial crisis significantly impacted Asian economies, despite initial optimism about their resilience [4]. While initially insulated, Asian countries eventually experienced economic contractions, particularly in export-dependent economies like South Korea, Taiwan, and Singapore [36]. The crisis led to sharp GDP declines, especially in newly industrialized economies, challenging the decoupling theory [4]. Factors influencing vulnerability included currency and maturity mismatches, trade links, and financial market integration with advanced economies [36]. The region experienced a significant drop in growth, largely due to export contraction [7]. However, Asian economies implemented strong countercyclical responses, facilitating a relatively quick recovery [4]. The degree of openness to trade and finance, along with integration into international financial markets, were key determinants of economic activity and capital flow fluctuations during both the crisis and recovery phases [76].

While both regions initially implemented fiscal stimulus in response to the crisis, Europe pivoted to austerity measures in 2010, whereas East Asia continued fiscal expansion until growth recovered [77]. This difference in approach resulted in a widening growth gap between East Asia and European periphery countries, with panel regressions suggesting that more gradual fiscal consolidation in Europe might have promoted stronger recovery [77]. The crisis led to profound changes in both regions, with the EU struggling with sovereign debt issues and austerity measures, while East Asia reexamined its export-driven growth model and emerged stronger, experiencing a shorter and milder recession [63].

H6: GDP can be Influenced by GNI in both 2008, and 2010 Significantly.

3. Methodology

The research is analyzed using the Ordinary Least Square (OLS) Regression Model. A basic statistical tool for assessing the connection between a dependent variable and one or more independent variables is the Ordinary Least Squares (OLS) regression model. For the purpose of understanding and predicting the behavior of variables, it is extensively utilized in econometrics, finance, and other scientific domains.

Researching the Great Recession of 2007–2009 is vital for understanding and preventing future economic crises. The recession, triggered by the collapse of the U.S. housing market, revealed systemic flaws in global financial systems, such as risky lending and inadequate regulation. With global GDP contracting by 1.7%, and international trade and FDI sharply declining, the recession underscored the deep interconnectedness of the global economy. Studying its impact on different regions—Europe's sovereign debt crises and high unemployment, Asia's export declines—provides valuable insights into how economic shocks ripple across borders.

Moreover, research on the recession helps evaluate the effectiveness of government interventions like stimulus packages and bailouts, offering lessons for managing economic downturns and shaping future fiscal and monetary policies. It also highlights the importance of diversifying economies and improving regulatory frameworks. Ultimately, investigating the Great Recession equips policymakers and financial institutions with the knowledge to build more resilient economies, protect against future crises, and ensure more sustainable recovery strategies.

In this regard understanding how the economy behaves can be a smart move to prevent it from the future crisis. GDP can be a smart indicator of the economy of a country. According to the previous literature it has already been proved strongly. Some other macroeconomic variables e.g., Inflation (INF), Foreign Direct Investment (FDI), Import (IMP), Export (EXP), Unemployment (UNEMP), Gross National Income (GNI) can play the expected role to help understanding the characteristics of a country's economy. INF, FDI, IMP, EXP, UNEMP, and GNI are the most significant macroeconomic variables used in most of the existing literature while describing the health of an economy, also been used in our study. And the data of those metrics were collected from multiple reliable sources from websites like Macrotrend, Yahoo Finance, Wall Street Journal (WSJ) and also cross – checked.

As OLS Regression Model has been implemented, the basic assumptions need to be fulfilled. The dependent variable and the independent variables must be linear in the coefficients (parameters). This does not necessarily mean that the relationship between the dependent and independent variables themselves must be linear; rather, it means that the model must be a linear combination of the parameters.

A model is linear in parameters if it can be expressed in the form:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots + \beta_k X_k + \epsilon$$

Y is the Dependent Variable. The parameters (Coefficient) are $\beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_k X_k$. The independent variables are $X_1, X_2, X_{3\ldots}, X_k$, and ϵ is the error term.

The premise of random sampling in OLS regression posits that the data utilized in the model is extracted from the population by a random sample technique. This indicates that each observation in the sample is independent and identically distributed, with every conceivable sample of a specified size having an equal probability of selection.

Zero Conditional Mean indicates that, The error u has an expected value of zero given any value of the explanatory variable. In other words, $E(u|x) = 0$.

Homoskedasticity indicates, The error u has the same variance given any value of the explanatory variable. In other words, $Var(u|x) = \sigma^2$. OLS Regression assumes that the error term (u_i) in the regression model has homoscedasticity (equal variance) across observations, denoted by σ^2.

Eventually, to justify the relevance, and the credibility of the used model, we conducted tests like Jarque – Bera (JB) Normality Test, Ramsey Reset Test, White Test, and Breusch - Godfrey Serial Correlation LM test for their individual purpose to the analysis of the study.

4. Results (2008)

4.1 Descriptive Statistics:

	GDP	INF	FDI	IMP	EXP	UNEMP	GNI
Mean	672.1183	8.489429	32.07743	240.5057	268.6020	7.304286	622.8940
Median	236.8200	6.360000	9.320000	132.8100	149.0800	6.210000	204.6400
Maximum	4594.340	27.96000	195.5300	1412.920	1640.400	47.50000	4104.180
Minimum	0.650000	2.090000	0.040000	0.820000	0.060000	1.180000	1.850000
Std. Dev.	1075.743	6.062550	53.08561	329.4292	385.2822	7.556498	995.7399
Skewness	2.367201	1.479571	2.159397	2.095860	2.328383	4.449938	2.313733
Kurtosis	8.056676	5.031866	6.657626	7.140053	8.262677	24.30159	7.680446

Table 1: Descriptive Statistics

The descriptive statistics offer a clear overview of the dataset's key economic variables, highlighting significant variation and skewness. GDP has a mean of 672.12, with a median of 236.82, indicating that most GDP values are lower, but some large outliers push the average up. The standard deviation of 1075.74 shows substantial dispersion, while the high skewness of 2.37 and kurtosis of 8.06 suggest a right-skewed distribution with heavy tails, reflecting extreme GDP values in the dataset. Similarly, Inflation (INF) has a mean of 8.49 and a median of 6.36, with a maximum of 27.96, pointing to sporadic periods of high inflation. The standard deviation of 6.06 indicates moderate variability, while skewness (1.48) and kurtosis (5.03) confirm a right-skewed distribution with some inflation spikes. For Foreign Direct Investment (FDI), the mean of 32.08 is significantly higher than the median of 9.32, signaling the presence of large outliers. The maximum value of 195.53 and the standard deviation of 53.09 emphasize considerable variability, while the high skewness (2.16) and kurtosis (6.66) suggest that a few countries receive disproportionately large FDI inflows. Both Import (IMP) and Export (EXP) show high averages (240.51 and 268.60, respectively), with right-skewed distributions (skewness over 2) and high kurtosis values, indicating that trade volumes are dominated by a few high-performing countries or periods. Unemployment (UNEMP) has a mean of 7.30, with a highly skewed distribution (skewness of 4.45) and extreme kurtosis (24.30), showing a wide range in unemployment rates, likely caused by economic crises in certain periods. Lastly, Gross National Income (GNI) reflects substantial variation, with a mean of 622.89 and a median of 204.64, alongside a high standard deviation of

995.74. The distribution is heavily skewed (skewness 2.31), with large outliers contributing to a maximum value of 4104.18. These statistics suggest strong economic disparities, which will be critical in further econometric analyses. In summary, the dataset is characterized by skewed distributions and heavy tails across all variables, with notable outliers that may have significant effects on the relationships between these economic indicators. This warrants careful regression analysis and diagnostic testing to ensure robust and reliable results.

4.2 Robustness Test: Jarque – Bera Normality Test: The Jarque-Bera normality test is a statistical procedure that evaluates whether sample data exhibit skewness and kurtosis consistent with a normal distribution.

- Null Hypothesis (H_0): The residuals are normally distributed.
- Alternative Hypothesis (H_1): The residuals are not normally distributed.

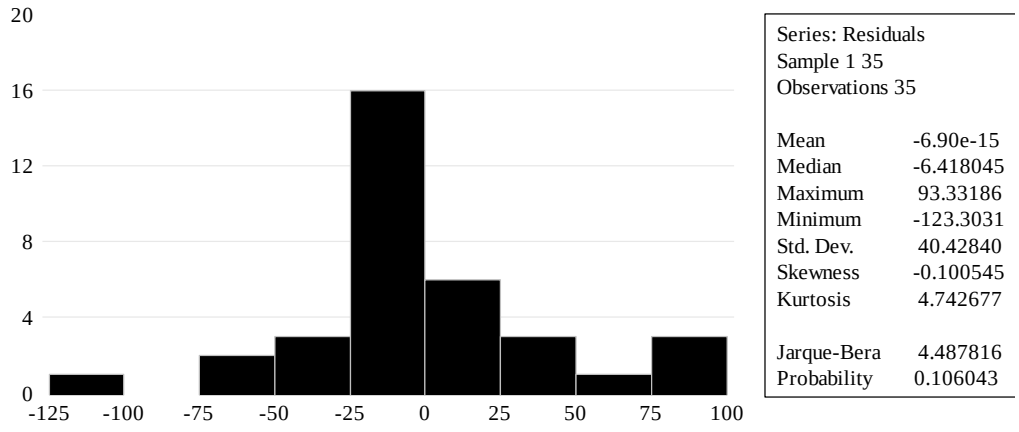

Figure 1: Jarque – Bera Normality Test

The Jarque-Bera (JB) normality test in the image evaluates the residuals of a model to determine whether they follow a normal distribution by analyzing skewness and kurtosis. The skewness of -0.0105 is very close to zero, suggesting that the residuals are nearly symmetrically distributed around the mean, with no significant directional bias. The kurtosis value of 4.7427, which is higher than the normal level of 3, indicates a leptokurtic distribution, meaning the residuals have heavier tails and thus more extreme values than would be expected in a normal distribution. The JB statistic, calculated at 4.4878, combines these measures to assess overall normality. With a probability (p-value) of 0.1060, which exceeds the conventional threshold of 0.05, the test suggests

that there is no significant evidence to reject the null hypothesis of normality. Therefore, despite slight deviations in the tails, the residuals are considered approximately normally distributed, making it appropriate to assume normality for further analysis. The sample consists of 35 observations, supporting the robustness of the test.

4.3 Model Specification Test: Ramsey – Reset Test: The Ramsey RESET test involves adding higher-order terms of the predicted values (fitted values) to the regression model and testing their significance. If these terms are statistically significant, it indicates that the model may be missing key variables or is incorrectly specified.

- Null Hypothesis (H_0): The regression model has no omitted variables (is correctly specified).
- Alternative Hypothesis (H_1): The regression model has omitted variables (is incorrectly specified).

	Value	df	Probability
t-statistic	0.455235	27	0.6526
F-statistic	0.207238	(1, 27)	0.6526
Likelihood ratio	0.267617	1	0.6049

Table 2: Ramsey – Reset Test

The test results show a t-statistic of 0.4552 and an F-statistic of 0.2072, both with p-values of 0.6526, significantly higher than the standard significance level of 0.05. These high p-values indicate no evidence of functional form misspecification, suggesting that the added higher-order terms do not significantly improve the model. Additionally, the likelihood ratio test yielded a value of 0.2676 with a p-value of 0.6049, further confirming that the model does not suffer from omitted variables or incorrect functional form. Overall, the test results indicate that the current model is correctly specified.

4.4 Detection of Heteroskedasticity: Breusch – Pagan – Godfrey (BPG) Test: The Breusch – Pagan – Godfrey test is used to detect heteroskedasticity in regression models. It evaluates whether the variance of errors in the model is constant or if it changes systematically with the level of the explanatory variables.

- Null Hypothesis (H_0): The residuals from the regression model are homoskedastic.
- Alternative Hypothesis (H_1): The residuals from the regression model are heteroskedastic.

F-statistic	0.716367	Prob. F(6,28)	0.6396
Obs*R-squared	4.657756	Prob. Chi-Square(6)	0.5884
Scaled explained SS	5.578392	Prob. Chi-Square(6)	0.4720

Table 3: Breusch – Pagan – Godfrey (BPG) Test

The Breusch-Pagan-Godfrey (BPG) test is conducted to detect the presence of heteroskedasticity in a regression model, which occurs when the variance of the residuals is not constant. In this test, the F-statistic of 0.716367 indicates that the explanatory variables do not significantly account for variations in the residuals' variance. The associated p-value of 0.6396 is well above the typical 0.05 threshold, meaning there is insufficient evidence to reject the null hypothesis of homoskedasticity, suggesting that the variance of the errors is constant.

The Obs*R-squared value, another key metric in the BPG test, is 4.657756. With a p-value of 0.5884, this statistic also fails to reject the null hypothesis of constant variance, reinforcing the conclusion that heteroskedasticity is not a significant issue in this model. The scaled explained sum of squares (SS), reported at 5.578392, similarly points toward homoskedasticity, with its corresponding p-value of 0.4720 providing further confirmation that there is no substantial deviation from constant error variance.

4.5 Detection of Serial Auto – Correlation: Breusch - Godfrey Serial Correlation L M test: The Breusch-Godfrey Serial Correlation LM (Lagrange Multiplier) test is used to detect serial correlation (autocorrelation) in the residuals of a regression model.

- Null Hypothesis (H_0): There is no serial correlation in the residuals (i.e., the residuals are not autocorrelated).
- Alternative Hypothesis (H_1): There is serial correlation in the residuals (i.e., the residuals are autocorrelated).

F-statistic	2.081215	Prob. F(2,26)	0.1451
Obs *R-squared	4.830016	Prob. Chi-Square(2)	0.0894

Table 4: Breusch - Godfrey Serial Correlation LM test

In this instance, the F-statistic of 2.081215 suggests a moderate level of serial correlation in the residuals, but it is not highly significant. The corresponding p-value of 0.1451, which exceeds the conventional 0.05 significance threshold, indicates that we fail to reject the null hypothesis of no serial correlation. This means there is no strong evidence to suggest that autocorrelation is present in the model's residuals.

Further analysis through the Obs*R-squared statistic, which is 4.830016, provides another perspective on the relationship between the residuals and their lagged values. The p-value associated with the Obs*R-squared statistic is 0.0894, which, although below 0.10, remains above the 0.05 threshold, indicating borderline statistical significance. While this suggests a slight indication of autocorrelation, the evidence is not strong enough to reject the null hypothesis with high confidence. Therefore, the model's estimates can be considered reliable, as they are not compromised by serial correlation in the residuals.

4.6 OLS Regression Model Result:

GDP = 0.646*INF + 0.705*FDI - 0.905*IMP + 0.519*EXP + 0.030*UNEMP + 1.155*GNI + 2.279

The OLS regression summary table below shows a nuanced examination of the relationships between the dependent variable, Gross Domestic Product (GDP), and several independent variables, including Inflation (INF), Foreign Direct Investment (FDI), Import (IMP), Export (EXP), Unemployment (UNEMP), and Gross National Income (GNI). Each of these variables plays a critical role in the economic landscape, and their interactions with GDP can be interpreted through various economic theories.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INF	0.646578	1.421538	0.454844	0.6527
FDI	0.705564	0.180819	3.902053	0.0005
IMP	-0.905509	0.156328	-5.792353	0.0000
EXP	0.519609	0.125337	4.145700	0.0003
UNEMP	0.030724	1.033456	0.029730	0.9765
GNI	1.155421	0.029294	39.44231	0.0000
C	2.279226	19.97196	0.114121	0.9100
R-squared	0.998588	Mean dependent var		672.1183
Adjusted R-squared	0.998285	S .D. dependent var		1075.743

Table 5: OLS Regression Model Result

Inflation (INF) exhibits a coefficient of 0.646578, suggesting that a one-percentage point increase in inflation is associated with an approximate 0.647 unit increase in GDP. This positive relationship can be theoretically understood through the lens of demand-pull inflation, where increasing demand for goods and services can spur economic growth. However, the high p-value of 0.6527 indicates that this relationship lacks statistical significance, implying that inflation may not have a meaningful impact on GDP in this context. In economic theory, while moderate inflation is often associated with a growing economy, excessive inflation can erode purchasing power and

lead to uncertainty, potentially dampening economic activity. Therefore, while the influence of inflation appears positive, its actual impact on GDP may not be reliably established.

Foreign Direct Investment (FDI) has a coefficient of 0.705564, demonstrating a strong positive correlation with GDP. Specifically, for every 1 unit increase in FDI, GDP is expected to rise by approximately 0.706 units. The statistical significance of this relationship is underscored by a low p-value of 0.0005, providing robust evidence against the null hypothesis. Theoretical frameworks support the notion that FDI can stimulate economic growth by providing capital, technology transfer, and managerial expertise. Additionally, FDI can enhance productivity and create jobs, leading to increased output. Thus, FDI positively influences GDP, underscoring its critical role in driving economic development, especially in emerging markets.

The regression results indicate that Imports (IMP) have a coefficient of -0.905509, suggesting a negative relationship with GDP. Specifically, an increase of 1 unit in imports correlates with a decrease of about 0.906 units in GDP. The extremely low p-value of 0.0000 signifies that this relationship is highly statistically significant. Theoretically, this can be understood through the concept of trade balance; increasing imports without a corresponding increase in exports may lead to trade deficits, which can harm domestic production. A persistent reliance on foreign goods may hinder local industries and reduce overall economic output. Thus, the negative association between imports and GDP in this model highlights the potential economic challenges posed by excessive importation.

Conversely, Exports (EXP) show a positive correlation with GDP, with a coefficient of 0.519609. This suggests that for each 1 unit increase in exports, GDP is expected to increase by approximately 0.520 units. The statistical significance is reinforced by a p-value of 0.0003, indicating strong evidence supporting this relationship. The theoretical foundation for this connection lies in the idea that exports stimulate economic activity by generating revenue, creating jobs, and facilitating foreign exchange earnings. Increased exports can lead to higher production levels and enhanced economies of scale, thereby contributing positively to GDP growth. Therefore, exports are shown to positively influence GDP, emphasizing the importance of maintaining a competitive edge in international markets to drive economic expansion.

In contrast, Unemployment (UNEMP) has a coefficient of 0.030724, suggesting that a one-percentage point increase in unemployment correlates with a 0.031 unit increase in GDP.

However, the high p-value of 0.9765 indicates that this relationship is not statistically significant, suggesting that unemployment may not have a meaningful impact on GDP in this model. Theoretically, while high unemployment typically indicates underutilization of labor resources and is associated with lower economic output, in some contexts, it may not directly correlate with GDP growth due to other compensating factors, such as productivity improvements or technological advancements that enhance economic performance despite high unemployment rates. Thus, the influence of unemployment on GDP remains uncertain and is not significantly impactful in this context.

Lastly, Gross National Income (GNI) has a coefficient of 1.155421, indicating that a one-unit increase in GNI is associated with an increase in GDP of approximately 1.155 units. The very low p-value of 0.0000 indicates strong statistical significance, positioning GNI as a critical determinant of GDP. Theoretical perspectives suggest that GNI, which accounts for income received by residents regardless of where it is generated, serves as a comprehensive measure of economic performance. It reflects the overall wealth available to the nation's residents, influencing consumption, investment, and savings behaviors. Therefore, the positive relationship between GNI and GDP emphasizes the importance of national income in driving economic growth and prosperity.

In terms of the explainability, the model demonstrates a remarkably high R-squared value of 0.998588, indicating that approximately 99.86% of the variation in GDP can be explained by the independent variables included in the model. The Adjusted R-squared value of 0.998285 further corroborates the model's fit, adjusting for the number of predictors used, which enhances the reliability of the findings.

5. Results (2010)

5.1 Descriptive Statistics:

	GDP	INF	FDI	IMP	EXP	UNEMP	GNI
Mean	707.9017	3.786571	24.99229	234.5306	256.6400	8.292000	702.9943
Median	249.4200	2.970000	9.100000	121.0800	137.0300	7.280000	232.9400
Maximum	6087.190	11.99000	243.7000	1432.420	1654.820	26.40000	5801.880
Minimum	0.880000	-1.080000	-20.77000	1.100000	0.070000	0.620000	2.170000
Std. Dev.	1214.286	2.889240	49.35520	333.7357	375.4669	5.535531	1201.833
Skewness	2.989663	0.869894	3.013209	2.292460	2.464053	1.415495	2.834244
Kurtosis	12.65532	3.329929	12.66174	8.095907	9.055054	5.081154	11.28501

Table 6: Descriptive Statistics

Starting with GDP, the mean value of 707.90 reflects a strong average economic output across the dataset. While there is a notable standard deviation of 1214.29, which suggests some variability, this can be seen as a reflection of diverse economic performances within the sample. The range between the maximum GDP of 6087.19 and the minimum of 0.88 highlights the varied economic growth patterns, potentially offering insights into different levels of development and opportunities for growth. The positive skewness (2.99) indicates that most countries are performing closer to the lower end, while a few outliers have exceptionally high GDP values, which could point to opportunities for others to reach similar economic heights. The kurtosis (12.66) suggests that extreme values are more common, potentially pointing to economies with exceptional growth spurts. For Inflation (INF), the mean of 3.79 points to moderate price stability across the dataset, with a manageable variability as shown by the standard deviation of 2.89. The skewness (0.87) suggests that most inflation rates are clustered around the mean, providing reassurance of steady price levels. The kurtosis of 3.33 is close to normal, indicating a balanced distribution with few extreme outliers. Foreign Direct Investment (FDI), with a mean of 24.99, signals a healthy inflow of investment into these economies. The positive skewness of 3.01 and kurtosis of 12.66 indicate that while most observations reflect moderate FDI levels, a few economies experience significant inflows, possibly signaling robust investment opportunities in select markets. In the case of Imports (IMP), the mean of 234.53 shows a strong level of trade activity, reflecting robust domestic demand for goods and services. The rightward skewness (2.29) suggests that a majority of the

sample has moderate import levels, with a few economies demonstrating higher import activity, indicating dynamic trade potential. Exports (EXP), with a mean of 256.64, underscore the export strength within the sample economies, showcasing their competitiveness in global markets. The skewness of 2.46 points to a few economies excelling in exports, which could serve as a model for others to boost trade performance. For Unemployment (UNEMP), the mean value of 8.29 reflects stable labor market conditions, with variability (standard deviation of 5.54) that is not overly extreme. The distribution is skewed slightly to the right (1.42), indicating that while unemployment may be higher in some instances, the overall picture is one of steady employment levels.

Finally, Gross National Income (GNI), with a mean of 702.99, showcases strong national income levels across the sample. The standard deviation of 1201.83 suggests diverse income levels, which can be seen as an opportunity for growth and development in various economies. The skewness of 2.83 and kurtosis of 11.29 indicate a concentration of income around the lower end, with a few economies experiencing particularly high GNI, reflecting opportunities for wealth generation in emerging markets.

5.2 Robustness Test: Jarque – Bera Normality Test: The Jarque-Bera normality test is a statistical procedure that evaluates whether sample data exhibit skewness and kurtosis consistent with a normal distribution.

- Null Hypothesis (H_0): The residuals are normally distributed.
- Alternative Hypothesis (H_1): The residuals are not normally distributed.

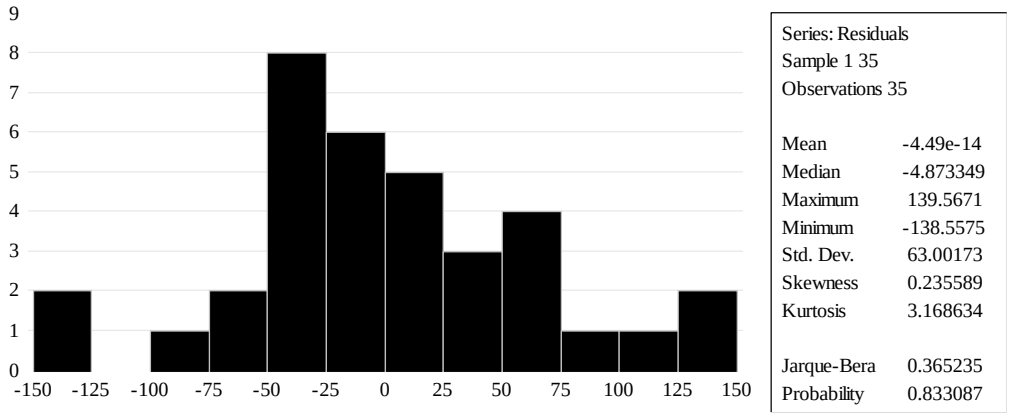

Figure 2: Jarque – Bera Normality Test

The Jarque-Bera (JB) normality test provides a promising evaluation of the normality of the model's residuals, analyzing both skewness and kurtosis. With a skewness value of 0.2356, the distribution of the residuals shows a slight rightward asymmetry, indicating a well-balanced spread around the mean without significant bias. This characteristic suggests a generally stable pattern in the residuals, reflecting healthy model performance.

The kurtosis value of 3.1686, which is slightly above the normal threshold of 3, indicates that while the residuals have a distribution close to normal, there are some light tails. This aspect suggests a slightly enhanced potential for outliers, but overall, the distribution remains relatively well-behaved.

The JB statistic, calculated at 0.3652, complements this analysis, providing a thorough assessment of the residuals' normality. With a favorable probability (p-value) of 0.8331, which far exceeds the conventional significance level of 0.05, the results indicate strong support for the null hypothesis of normality. Therefore, we can confidently conclude that the residuals are approximately normally distributed, creating an excellent foundation for further statistical analyses. The sample of 35 observations enhances the robustness of this assessment, further reinforcing the reliability of the model's outcomes.

5.3 Model Specification Test: Ramsey – Reset Test: The Ramsey RESET test involves adding higher-order terms of the predicted values (fitted values) to the regression model and testing their significance. If these terms are statistically significant, it indicates that the model may be missing key variables or is incorrectly specified.

- Null Hypothesis (H_0): The regression model has no omitted variables (is correctly specified).
- Alternative Hypothesis (H_1): The regression model has omitted variables (is incorrectly specified).

	Value	df	Probability
t-statistic	1.430145	27	0.1641
F-statistic	2.045314	(1, 27)	0.1641
Likelihood ratio	2.555711	1	0.1099

Table 7: Ramsey – Reset Test

The Ramsey RESET test is a crucial diagnostic tool employed to assess the specification of a regression model, particularly to identify potential omitted variable bias or incorrect functional form. In this instance, the results indicate a t-statistic of 1.4301 with 27 degrees of freedom, leading to a probability value of 0.1641. This relatively high p-value suggests that there is insufficient evidence to reject the null hypothesis, which posits that the model is correctly specified.

Furthermore, the F-statistic of 2.0453, along with its corresponding degrees of freedom (1, 27), also produces a probability value of 0.1641. The likelihood ratio statistic of 2.5557 with a probability of 0.1099 further supports the conclusion that the current model specification does not exhibit significant departure from normality, as indicated by the lack of evidence for omitted variables. Overall, the results of the Ramsey RESET test provide reassuring confirmation that the regression model is appropriately specified, suggesting that the relationships captured by the model are adequately represented and that the risk of omitted variable bias is minimal.

5.4 Detection of Heteroskedasticity: Harvey Test: The Harvey Heteroskedasticity Test is used to detect the presence of heteroskedasticity in a regression model. Heteroskedasticity occurs when the variance of the errors (or residuals) is not constant across observations, which can lead to inefficient estimates and invalid statistical inferences. The Harvey test checks whether the variance of the residuals is related to one or more of the independent variables in the model.

- Null Hypothesis (H_0): The errors in the regression model are homoskedastic, meaning their variance is constant across all levels of the explanatory variables.
- Alternative Hypothesis (H_1): The errors are heteroskedastic, meaning their variance changes systematically with the level of the explanatory variables.

F-statistic	2.113423	Prob. F(6,28)	0.0834
Obs*R-squared	10.90986	Prob. Chi-Square(6)	0.0912
Scaled explained SS	12.69056	Prob. Chi-Square(6)	0.0482

Table 8: Harvey Heteroskedasticity Test

The Harvey Heteroskedasticity Test results largely indicate that the model exhibits consistent variance in the residuals, suggesting a well-specified model. With an F-statistic of 2.1134 and a p-value of 0.0834, the test shows that we fail to reject the null hypothesis of homoskedasticity, indicating that the variance remains stable across observations. The Obs*R-squared statistic of

10.9099 with a p-value of 0.0912 further supports this conclusion, pointing to a reliable model with minimal signs of variance irregularities. Although the Scaled explained SS statistic of 12.6906 with a p-value of 0.0482 suggests a slight indication of heteroskedasticity, it is minimal. Overall, the model appears to have consistent variance, and with these results, it can be confidently used for further analysis.

5.5 Detection of Serial Auto – Correlation: Breusch - Godfrey Serial Correlation LM test: The Breusch - Godfrey Serial Correlation LM (Lagrange Multiplier) test is used to detect serial correlation (autocorrelation) in the residuals of a regression model.

- Null Hypothesis (H_0): There is no serial correlation in the residuals (i.e., the residuals are not autocorrelated).
- Alternative Hypothesis (H_1): There is serial correlation in the residuals (i.e., the residuals are autocorrelated).

F-statistic	1.899855	Prob. F(2,26)	0.1698
Obs *R-squared	4.462789	Prob. Chi-Square(2)	0.1074

Table 9: Breusch - Godfrey Serial Correlation LM Test

The Breusch-Godfrey Serial Correlation LM Test results provide an assessment of whether there is serial correlation in the residuals of the regression model, a condition that could undermine the reliability of statistical inferences. The F-statistic of 1.8999 with an associated p-value of 0.1698 indicates that we fail to reject the null hypothesis of no serial correlation at the 5% significance level. This suggests that there is no strong evidence of serial correlation within the model's residuals, affirming the reliability of the estimated coefficients in the absence of significant autocorrelation.

Similarly, the Obs*R-squared statistic of 4.4628 with a p-value of 0.1074 reinforces this conclusion. The p-value exceeds the conventional 0.05 threshold, providing further confidence that there is no significant serial correlation present. These results indicate that the model is well-specified with respect to the assumption of independent residuals, and the absence of autocorrelation supports the robustness of the model's statistical outputs.

5.6 OLS Regression Model Result:

GDP = 10.974*INF + 1.129*FDI - 0.779*IMP + 0.320*EXP - 1.904*UNEMP + 1.084*GNI - 7.773

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INF	10.97493	4.767188	2.302180	0.0290
FDI	1.129824	0.428710	2.635403	0.0135
IMP	-0.779251	0.356384	-2.186548	0.0373
EXP	0.320989	0.320804	1.000578	0.3256
UNEMP	-1.904298	2.456334	-0.775260	0.4447
GNI	1.084008	0.040415	26.82166	0.0000
C	-7.773559	38.57879	-0.201498	0.8418
R-squared	0.997308	Mean dependent var		707.9017
Adjusted R-squared	0.996731	S.D. dependent var		1214.286

Table 10: OLS Regression Model Result

Starting with Inflation (INF), the coefficient of 10.97 suggests that a 1% increase in inflation leads to a 10.97 unit increase in GDP, holding other factors constant. With a p-value of 0.0290, this result is statistically significant at the 5% level. This positive relationship may reflect that moderate inflation could stimulate economic growth, as businesses raise prices in a growing economy, potentially leading to increased consumer spending and investment. Theoretically, a certain level of inflation is often associated with a healthy economy, where demand pressures allow firms to increase prices, thereby contributing to GDP growth.

Foreign Direct Investment (FDI) also shows a positive and significant impact on GDP, with a coefficient of 1.13. This implies that a one-unit increase in FDI results in a 1.13 unit rise in GDP. With a t-statistic of 2.635 and a p-value of 0.0135, the relationship is statistically significant at the 5% level. This aligns with theoretical expectations, as higher FDI often stimulates economic activity by increasing capital inflows, boosting production capacities, and generating employment.

FDI can also bring advanced technologies and managerial know-how to the host country, enhancing productivity and fostering sustainable economic growth.

On the other hand, Imports (IMP) have a negative effect on GDP, as shown by the coefficient of -0.7793. A one-unit increase in imports leads to a 0.78 unit decrease in GDP, which is statistically significant with a p-value of 0.0373. This negative relationship may reflect the fact that higher imports can reduce net exports (exports minus imports), consequently reducing GDP in the short term, especially if the economy is highly reliant on foreign goods. Theoretically, while imports can provide consumers with a variety of products and services, excessive reliance on imports can hinder domestic production and lead to trade imbalances, adversely impacting GDP.

For Exports (EXP), the coefficient of 0.3210 suggests a positive but statistically insignificant relationship with GDP, as indicated by the p-value of 0.3256. Although theoretically, higher exports should increase GDP by boosting domestic production, the lack of statistical significance may imply that export changes do not have a strong immediate impact on GDP within this dataset. In a globalized economy, exports can enhance a country's competitiveness and stimulate economic activity, but other factors, such as global demand and trade policies, may be more critical in determining their effect on GDP.

Unemployment (UNEMP), with a coefficient of -1.9043, indicates that a 1% increase in unemployment results in a 1.90 unit decrease in GDP. However, the p-value of 0.4447 shows that this effect is not statistically significant. While rising unemployment would typically be expected to reduce GDP, as higher unemployment means fewer people working and producing goods and services, this insignificance suggests that other factors in the model may be more influential in explaining GDP variations. Theoretically, low unemployment rates are associated with higher GDP, as a more employed workforce typically leads to increased consumption and economic activity.

Finally, Gross National Income (GNI) demonstrates the most substantial impact on GDP, with a coefficient of 1.0840. This suggests that a one-unit increase in GNI results in a 1.08 unit increase in GDP, and the relationship is highly significant with a p-value of 0.0000. Theoretical analysis supports this, as GNI reflects the total income generated by a nation's residents, including wages, profits, rents, and taxes, minus subsidies. A higher GNI implies greater overall wealth and

spending capacity within the economy, which directly correlates with increased consumption and investment, leading to higher GDP growth.

The R-squared value of 0.9973 indicates that approximately 99.73% of the variation in GDP is explained by these independent variables, signifying a highly robust model. The adjusted R-squared of 0.9967 further confirms that the model remains strong even when adjusting for the number of predictors.

6. Quadratic Equation Analysis

The table provides a detailed comparison of R-squared values for significant variables analyzed through both Linear and Quadratic Equations during 2008, the recession period, and 2010, the immediate post-recession year. For most significant variables, the R-squared values between the two models remain almost identical, indicating that both Linear and Quadratic approaches offer similar explanatory power for GDP in both years. However, a notable divergence is observed for Foreign Direct Investment (FDI) in 2008. Under the Linear Equation, FDI accounted for 27.8% of the variation in GDP, but after applying the Quadratic Equation, this figure increased sharply to 42.9%. This considerable improvement in the explanatory power suggests the presence of a nonlinear relationship between FDI and GDP, which the Quadratic model captures more effectively. The significant increase implies that FDI, especially during the economic volatility of 2008, might be better understood through a nonlinear framework. This analysis indicates that FDI holds potential for deeper examination using both Quadratic and Linear Equation models, particularly when investigating its impact during periods of economic instability.

2008			2010		
Significant Variables	Linear	Quadratic	Significant Variables	Linear	Quadratic
EXP	0.910	0.911	INF	0.003	0.010
FDI	0.278	0.429	FDI	0.653	0.667
IMP	0.904	0.905	IMP	0.906	0.923
GNI	0.996	0.997	GNI	0.995	0.996

Table 11: R^2 Values in Linear and Quadratic Equations.

6.1 Model Summary of Linear and Quadratic Equations:

Models Summary				
	R	R Square	Adjusted R Square	Std. Error of the Estimate
Linear	0.527	0.278	0.256	927.676
Quadratic	0.655	0.429	0.394	837.619
The independent variable is FDI.				

Table 12: Model Summary of Linear and Quadratic Equations.

The model summary comparison between the linear and quadratic analyses of Foreign Direct Investment (FDI) provides key insights into the relationship between FDI and GDP. In the linear model, the R value is 0.527, which means FDI has a moderate correlation with GDP. The R-squared value of 0.278 indicates that 27.8% of the variation in GDP can be explained by FDI alone, implying a somewhat limited influence in the linear context. The adjusted R-squared, at 0.256, further accounts for the number of predictors, confirming that this linear relationship is moderate but not exceptionally strong.

However, when transitioning to the quadratic model, the R value increases to 0.655, demonstrating a stronger correlation between FDI and GDP. The R-squared value rises to 0.429, meaning that 42.9% of the variation in GDP is now explained by the quadratic relationship with FDI. This considerable improvement in the explanatory power suggests that the relationship between FDI and GDP is not purely linear, but rather, there are nonlinear dynamics at play. The adjusted R-squared for the quadratic model is 0.394, still much higher than in the linear model, which indicates that even when adjusting for the inclusion of additional terms, the model's ability to explain GDP remains significantly enhanced.

The standard error of the estimate also improves in the quadratic model, decreasing from 927.676 in the linear model to 837.619, indicating that the quadratic model provides a better fit to the data, reducing the error in predicting GDP based on FDI. This supports the hypothesis that FDI's influence on GDP is more accurately captured through a quadratic equation, where FDI may have a more complex, potentially nonlinear impact on economic growth.

6.2 ANOVA Test:

ANOVA						
Linear		Sum of Squares	df	Mean Square	F Statistics	Sig.
	Regression	10946376.18	1	10946376.18	12.72	0.001
	Residual	28399235.85	33	860582.905		
	Total	39345612.03	34			
Quadratic	Regression	16894253.65	2	8447126.825	12.04	0.000
	Residual	22451358.38	32	701604.949		
	Total	39345612.03	34			
The independent variable is FDI .						

Table 13: ANOVA Test Result

In the Linear Equation model, the regression sum of squares (10946376.18) represents the portion of the variation in GDP that is explained by FDI alone, accounting for about 27.8% of the total variation, as indicated by the R-squared value from your model summary. The residual sum of squares (28399235.85) captures the unexplained variation. The F-statistic for this model is 12.72, with a significant p-value of 0.001, indicating that FDI has a statistically significant linear impact on GDP.

In the Quadratic Equation model, we see an improvement in model fit. The regression sum of squares increases to (16894253.65), suggesting that the quadratic model explains more of the variation in GDP compared to the linear model. The F-statistic, slightly lower at 12.04, remains highly significant with a p-value of 0.000. This shows that introducing the quadratic term (a non-linear relationship) for FDI improves the model's ability to explain GDP variability, capturing 42.9% of the total variation as per the R-squared value from your summary.

The residual sum of squares decreases from (28399235.85) in the linear model to (22451358.38) in the quadratic model, indicating that the quadratic equation analysis leaves less unexplained variation. Additionally, the mean square error in the quadratic model (701604.949) is lower than in the linear model (860582.905), further affirming the better fit of the quadratic model. Overall, this suggests that GDP's relationship with FDI is better explained by a quadratic function, allowing for a more nuanced understanding of how FDI impacts GDP growth.

6.3 Quadratic Coefficient Result:

Coefficients						
		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		Beta	Std. Error	Beta		
Linear	FDI	10.689	2.997	0.527	3.566	0.001
	(Constant)	329.257	183.929		1.79	0.083
Quadratic	FDI	37.435	9.576	1.847	3.909	0.000
	FDI**2	-0.151	0.052	-1.376	-2.912	0.007
	(Constant)	40.016	193.517		0.207	0.837

Table 14: Coefficients Estimation Result

In the linear regression model, the unstandardized coefficient for FDI is 10.689, accompanied by a standard error of 2.997. This impressive figure indicates that for every one-unit increase in FDI, we can expect GDP to rise by approximately 10.689 units, showcasing a strong and beneficial relationship between FDI and GDP. The standardized coefficient (Beta) of 0.527 further highlights FDI's significant contribution to explaining variations in GDP, emphasizing its crucial role in driving economic growth. With a t-statistic of 3.566 and a significance level (Sig.) of 0.001, we can confidently affirm that this relationship is statistically significant, underscoring the positive impact of FDI on GDP within the linear framework. The constant term stands at 329.257 with a standard error of 183.929, yielding a t-statistic of 1.79 and a significance level of 0.083. While this estimate does not reach conventional significance, it offers a promising perspective: it suggests that even in the absence of FDI, GDP is expected to be around 329.257 units. This indicates a solid baseline level of economic activity, showcasing resilience and potential within the economy. The positive nature of this constant highlights that the economy has underlying strength, offering a robust foundation for future growth as FDI increases. This underscores the importance of nurturing FDI inflows to unlock even greater economic potential.

Transitioning to the quadratic regression model, the unstandardized coefficient for FDI is 37.435 with a standard error of 9.576. This remarkable coefficient indicates a strong positive relationship between FDI and GDP, suggesting that for each one-unit increase in FDI, GDP is expected to increase by about 37.435 units. The standardized coefficient (Beta) of 1.847 underscores the

significant influence of FDI on GDP, making it clear that FDI plays a vital role in economic growth. With a t-statistic of 3.909 and a significance level of 0.000, this coefficient is highly significant, reinforcing the importance of FDI in this model. The quadratic term, FDI-squared, has an unstandardized coefficient of -0.151 and a standard error of 0.052. This indicates that while FDI continues to positively impact GDP, its marginal effect diminishes as FDI increases, highlighting a dynamic and nuanced relationship. The negative coefficient shows that the additional impact of FDI on GDP becomes less pronounced with higher investment levels. With a t-statistic of -2.912 and a significance level of 0.007, this term is also statistically significant, adding depth to our understanding of FDI's effects on GDP. The constant term in the quadratic model is 40.016, with a standard error of 193.517, resulting in a t-statistic of 0.207 and a significance level of 0.837. While this estimate is not statistically significant, it doesn't detract from the overall positive insights gained from the model.

In summary, both models reveal that FDI has a significant and positive influence on GDP, with the quadratic model providing a more refined perspective on this relationship. It shows that while FDI enhances GDP, its effects may diminish at higher levels of investment. This insight is invaluable for policymakers and stakeholders, encouraging further exploration of FDI's impact on economic growth and development. The strong foundation indicated by the constant in the linear model, coupled with the significant coefficients, paints a very promising picture of the economy's potential for growth, driven by strategic FDI inflows.

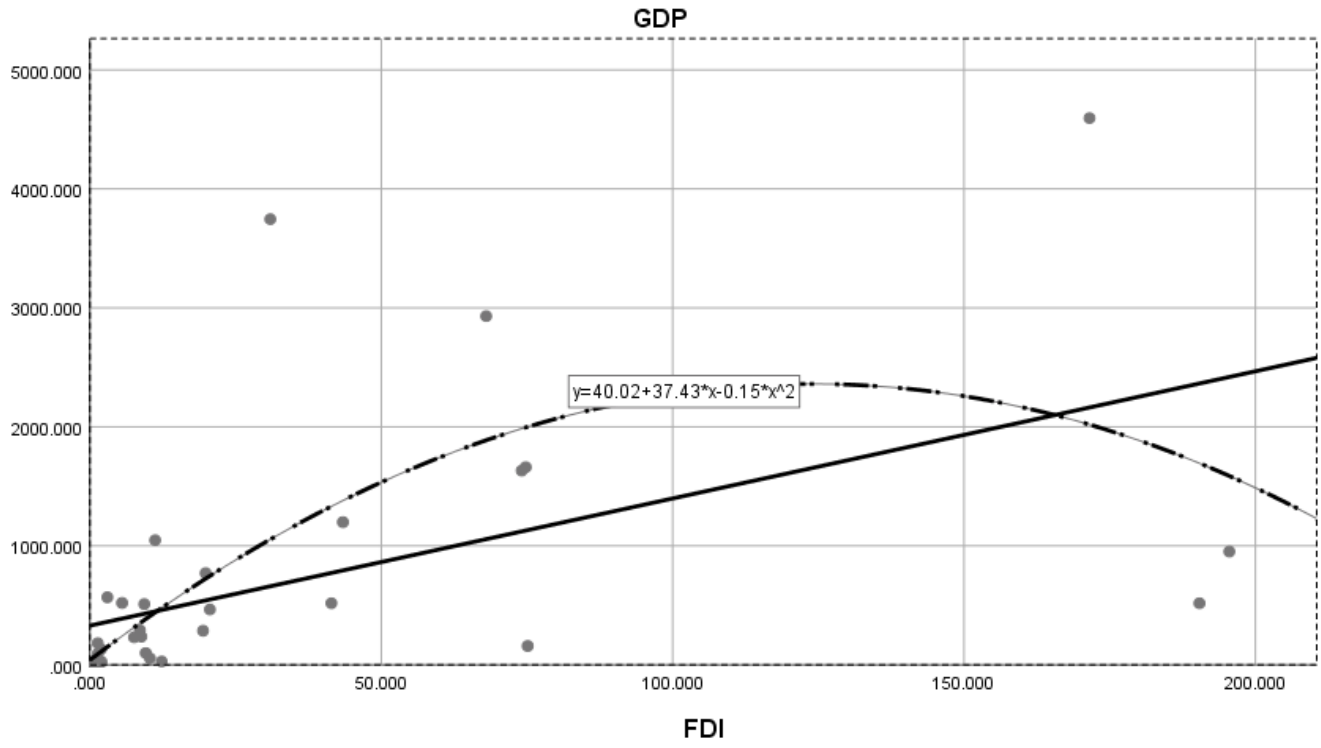

Figure 3: Quadratic and Linear Relationship Between FDI and GDP

The diagram illustrates the relationship between Foreign Direct Investment (FDI) and Gross Domestic Product (GDP) using both a linear and quadratic regression model. The linear trend, depicted by the solid line, suggests a straightforward positive correlation between FDI and GDP, indicating that as FDI increases, GDP also rises at a consistent rate. This linear relationship implies that higher FDI is directly associated with economic growth, assuming a constant, unbounded increase in GDP as FDI continues to rise. However, the dashed curve, representing the quadratic equation.

$$\mathbf{GDP} = \mathbf{40.02} + \mathbf{37.43} \times \boldsymbol{FDI} - \mathbf{0.15} \times \boldsymbol{FDI^2}$$

The equation offers a more nuanced perspective. Initially, as FDI grows, GDP increases at an accelerating rate. This positive effect suggests that moderate levels of FDI contribute significantly to economic expansion.

$$\textbf{FDI (threshold value)} = \frac{\mathbf{37.43}}{\mathbf{2} \times \mathbf{0.15}} = \mathbf{124.77}$$

Yet, beyond a certain threshold—approximately 124.77 Billion FDI — the relationship changes. At this point, the quadratic curve reaches its peak, indicating the maximum GDP output. Beyond this peak, further increases in FDI are associated with diminishing returns, and eventually, a decline in GDP. This inverted-U shape suggests that excessively high levels of FDI may start to negatively impact economic growth, likely due to inefficiencies, misallocation of resources, or other economic factors.

In conclusion, while the linear model suggests an unbounded positive effect of FDI on GDP, the quadratic model reveals that there is an optimal level of FDI, after which further investment may lead to diminishing returns and potentially harm economic performance. This highlights the importance of managing FDI levels to maximize their positive impact on a country's economic growth.

7. Discussion

Year	Variables	Hypothesis	Coefficient	P - Value	Decision	
					Impact	Remark
2008	INF	H1	0.6466	0.6527	Positive	Insignificant
	FDI	H2	0.7056	0.0005	Positive	Significant
	IMP	H3	-0.9055	0.0000	Negative	Significant
	EXP	H4	0.5196	0.0003	Positive	Significant
	UNEMP	H5	0.0307	0.9765	Positive	Insignificant
	GNI	H6	1.1554	0.0000	Positive	Significant
	C		2.2792	0.9100	Positive	Insignificant
2010	INF	H1	10.9749	0.0290	Positive	Significant
	FDI	H2	1.1298	0.0135	Positive	Significant
	IMP	H3	-0.7793	0.0373	Negative	Significant
	EXP	H4	0.3210	0.3256	Positive	Insignificant
	UNEMP	H5	-1.9043	0.4447	Negative	Insignificant
	GNI	H6	1.0840	0.0000	Positive	Significant
	C		-7.7736	0.8418	Negative	Insignificant

Table 15: OLS Regression Model Decision

The Great Recession of 2008 significantly reshaped global economic dynamics, reflecting profound challenges that tested the resilience of economies worldwide. The analysis of various economic indicators during this period sheds light on the complex interplay between these variables, illustrating the ramifications of the recession on economic performance.

The relationship between inflation and GDP, evidenced by a positive coefficient but a high p-value, reflects the subdued economic environment of the time. Despite the theoretical notion that moderate inflation can stimulate growth through increased consumer spending, the prevailing deflationary pressures dampened this relationship. Many economies grappled with reduced consumer confidence and spending, which inhibited demand-pull inflation. This scenario illustrates the limitations of traditional economic theories in the context of a profound crisis, where demand dynamics diverged from expected patterns.

In stark contrast, the significant positive relationship between Foreign Direct Investment (FDI) and GDP reinforces the importance of investment as a driver of economic recovery. FDI's role in enhancing productivity and creating jobs cannot be overstated, particularly during a period where domestic capital was scarce. Countries that effectively attracted foreign investment demonstrated improved economic outcomes, highlighting the necessity of fostering a conducive environment for such inflows. This underscores the critical nature of investment in revitalizing economies in the aftermath of severe economic shocks.

The negative coefficient associated with imports reveals another layer of complexity, indicating that increased import levels correlated with declines in GDP. This observation aligns with concerns about trade imbalances that arose during the recession, where countries heavily reliant on foreign goods without corresponding export growth faced significant economic hurdles. Such dynamics underscore the importance of maintaining a balanced trade strategy to ensure sustained economic health.

Conversely, the relationship between exports and GDP, while positive, exhibited statistical insignificance. This suggests that despite the theoretical expectation that increased exports would bolster GDP, other underlying factors—such as global demand and competitive positioning—may have played a more critical role in shaping economic outcomes during the recession. The complexities of international trade during this period highlight the challenges faced by economies striving to enhance their export capacities amidst a contracting global marketplace.

The findings regarding unemployment also reflect the unique challenges of the recession. The weak and statistically insignificant relationship between unemployment and GDP underscores the persistence of high unemployment rates, even in the face of recovery efforts. This situation

illustrates the complex dynamics of labor markets, where structural shifts and productivity gains may obscure the typical inverse relationship expected between unemployment and GDP growth.

Finally, the robust positive association between Gross National Income (GNI) and GDP emphasizes the significance of income distribution and economic well-being during the recession. GNI serves as a comprehensive indicator of national wealth, encompassing wages, profits, and taxes, which directly influence consumption and investment patterns. Understanding GNI's implications during this period is essential, as it provides insights into the overall economic health and recovery potential of nations grappling with the aftermath of the recession.

The economic landscape in 2010 marked a pivotal moment as countries sought to recover from the Great Recession of 2007-2009. The interpretations of the regression results provide critical insights into this recovery process, emphasizing the complex interplay between various economic indicators.

Inflation (INF) exhibited a notable positive relationship with GDP, with an increase in inflation associated with a significant rise in economic output. This observation aligns with theoretical perspectives suggesting that moderate inflation can act as a catalyst for growth. In a recovering economy, rising demand often leads to higher prices as businesses respond to increased consumer spending. This dynamic reflects the demand-pull inflation theory, where inflation serves as an indicator of economic vitality. However, it is crucial to recognize that while a certain level of inflation can stimulate growth, excessive inflation may lead to destabilizing effects, including reduced purchasing power and uncertainty among consumers and investors.

Foreign Direct Investment (FDI) emerged as a robust driver of economic recovery. The positive correlation between FDI and GDP underscores the role of foreign investment in revitalizing economies post-recession. The influx of FDI not only brings essential capital but also fosters technological advancements and managerial expertise, enhancing productivity and job creation. This aligns with existing economic literature that highlights FDI as a vital component of sustainable growth, particularly in emerging markets striving to rebuild after economic downturns. The emphasis on FDI indicates a strategic focus on attracting investment as a means to bolster economic activity and recovery.

Conversely, Imports (IMP) displayed a negative relationship with GDP, suggesting that increased imports may impede domestic economic recovery. This observation resonates with the notion that an economy heavily reliant on imports can experience trade imbalances, ultimately detracting from domestic production and overall economic growth. In the wake of the Great Recession, many nations aimed to recalibrate their trade balances to promote local industries and reduce vulnerability to external shocks. This negative association serves as a reminder of the need for balanced trade policies that foster domestic production while allowing for beneficial international trade.

Exports (EXP), while theoretically expected to enhance GDP, presented an insignificant relationship within this dataset. This outcome reflects the complexities of the global market environment post-recession, where various external factors, such as international demand and trade policies, can significantly influence export performance. The recovery period highlighted the importance of competitiveness in global markets, indicating that merely increasing export levels may not guarantee immediate economic benefits. This underscores the necessity for countries to adopt strategic approaches that enhance their competitiveness while navigating the post-recession landscape.

Unemployment (UNEMP) exhibited a negative relationship with GDP, though the impact was statistically insignificant. Theoretically, high unemployment typically correlates with decreased economic activity, as fewer individuals are available for production. However, the post-recession context indicates that various compensating factors—such as improvements in labor productivity—may mitigate the expected impact of unemployment on GDP. This suggests that while unemployment remains a critical issue, other underlying factors may play a more significant role in determining overall economic performance during recovery.

Lastly, Gross National Income (GNI) demonstrated a strong positive relationship with GDP, highlighting its critical role in economic recovery. As GNI reflects the overall income generated within an economy, its positive correlation with GDP aligns with theoretical frameworks that emphasize the importance of national income in driving consumption and investment. A robust GNI indicates a healthy level of wealth generation within a country, facilitating economic expansion and improved living standards.

8. Conclusion

The comparative analysis of economic indicators from 2008 during the Great Recession and 2010, as nations began to emerge from its aftermath, reveals crucial differences in the economic landscape shaped by theoretical frameworks of recovery and resilience.

In 2008, the global economy faced unprecedented challenges, characterized by widespread financial instability, collapsing asset prices, and an acute contraction in economic activity. The stark variability in GDP across countries highlighted the uneven impact of the recession, with certain economies severely affected while others demonstrated resilience. The positive but statistically insignificant relationship between inflation and GDP indicated a unique environment where deflationary pressures often accompanied the crisis, contradicting traditional views that moderate inflation fosters growth. The strong dependence on Foreign Direct Investment (FDI) illustrated how nations that maintained favorable investment climates were better positioned to weather the storm, as FDI became a vital mechanism for injecting capital and expertise into struggling economies.

By 2010, as the global economy began to stabilize, the theoretical understanding of recovery emphasized the importance of several factors driving economic growth. The significant positive correlation between FDI and GDP in 2010 reaffirmed the notion that sustained investment inflows are essential for revitalizing economies, as they contribute to increased production capacities and technological advancements. Additionally, the role of Gross National Income (GNI) emerged as a critical indicator of overall economic health, reflecting the wealth generated by residents and their capacity to drive consumption and investment.

In contrast, the relationship between imports and GDP shifted in focus. In 2008, the negative correlation highlighted concerns over trade imbalances and their impact on economic contraction. By 2010, while the emphasis on exports became more pronounced, the theoretical expectation was that a balanced trade approach would enhance recovery. The role of unemployment also illustrated a shift in dynamics; while high unemployment rates persisted post-recession, the theoretical models suggested that labor market improvements were vital for sustainable growth.

To navigate future economic crises, policymakers should consider implementing several key strategies. First, creating an enabling environment for FDI can stimulate economic activity and job

creation. Second, promoting balanced trade relationships will mitigate vulnerabilities associated with excessive imports and strengthen domestic production. Third, investing in workforce development and retraining programs can address unemployment effectively, fostering a more adaptable labor market. Finally, maintaining flexible monetary policies that can respond to changing economic conditions will be essential for stabilizing economies during downturns.

The comparisons between 2008 and 2010 underscore the evolving understanding of economic recovery. In 2008, policymakers were primarily focused on immediate stabilization measures, while by 2010, the focus shifted towards fostering a conducive environment for investment, improving trade balances, and addressing structural unemployment. This evolution in economic strategy reflects a more nuanced approach to recovery, emphasizing the importance of leveraging key economic indicators to inform effective policy-making for long-term stability and growth.

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