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THE MEASUREMENT OF POLITICAL INSTABILITY AND ITS LINK WITH MACROECONOMIC PERFORMANCE, FOOD SECURITY AND INCOME INEQUALITY

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ABSTRACT

Political instability has long been at the centre of international debates in terms of its dimensions, reasons, and consequences. The issue of an unstable political environment is highly important due to its link with socio-economic problems that political instability brings to the people of a country. But before these connections are observed, the measurement of political instability should be correctly defined. Therefore, the first step of studies dealing with political instability should include a comprehensive explanation of what is meant by "political instability", considering the possibility that different dimensions of political instability may have different consequences.

In this context, this thesis claims that political instability cannot be fitted into a single mould and it has more than one dimension. When the crucial issue of how to measure political instability is settled, this thesis empirically investigates both the connections between political instability and macroeconomic performance and the nexus between political instability, food security and income inequality.

The thesis starts with the *Introduction* part, which introduces the aim of the study and data and quantitative methods that will be exploited in the next chapters. In addition, this part also displays the general findings, main contribution to existence literature, constraints and future research. *Chapter I*, in which the dimensions of political instability is determined, is the cornerstone of the thesis, since the next two chapters employ these identifications of political instability. *Principal Component Analysis (PCA)*, which is a dimensionality reduction method, is used as a tool to identify the measurement of political instability by using 11 political risk variables taken from the International Country Risk Guide dataset (The PRS Group 2014) observed on 117 countries. The results suggest that

the first two principal components are selected and named as *Structural Defect* and *Disorder of Polity Quality*, respectively. Furthermore, Chapter I also shows how these two aspects of political instability are characterized by the following three government forms: Parliamentary System, Presidential System, Semi-Presidential System. In addition, *Hierarchical Clustering by using Ward's linkage algorithm* is performed to divide countries into smaller clusters based on their similarities in terms of *Structural Defect* and *Disorder of Polity Quality.*

Chapter II and *Chapter III* use *panel Vector Autoregression Analysis (panel VAR)* in *generalized methods of moment (GMM)* over the period of 2008-2017. While *Chapter II* analyzes the link between political instability and macroeconomic performance in the set of considered countries, *Chapter III* deals with the nexus between political instability, food security and income inequality. In both chapters, the results suggest that the direction and significance of these links sometimes change according to two different dimensions of political instability. That means that different aspects of political instability produce different results. Additionally, there is always an adverse relationship between two different aspects of political instability and other variables in the analysis. Furthermore, both *Chapter II* and *Chapter III* analyze the *impulse response functions (IRFs)* to better understand the reaction of variables to each other (aftershocks). Finally, these chapters further examine the *forecast-error variance decompositions (FEVDs)* to show the proportion of movements in the dependent variables that are due to their own shocks versus shocks to the other variables.

Keywords: Political Instability, Macroeconomic Performance, Food Security, Income Inequality, Principal Component Analysis (PCA), Panel Vector Autoregressive Model (panel VAR)

INTRODUZIONE

L’instabilità politica é stata a lungo al centro dei dibattiti internazionali in termini di dimensioni,ragioni e conseguenze. La questione di un ambiente politico instabile riveste molta importanza per il suo legame con i problemi socio-economici che l'instabilità politica arreca alle persone di un paese. Ma prima che queste connessioni siano osservate, la misura dell'instabilità politica dovrebbe essere definita correttamente. Pertanto, la prima fase degli studi che si occupano di instabilità politica dovrebbe includere una spiegazione esauriente di cosa si intende per "instabilità politica", considerando la possibilità che diverse dimensioni dell'instabilità politica possano avere conseguenze diverse.

In questo contesto, questa tesi si propone di approfondire il tema dell'instabilità politica partendo dall’idea che si tratti di un concetto complesso e multidimensionale. La tesi si propone, in primo luogo, di riuscire a misurare tale concetto individuandone le necessarie dimensioni ed indicatori che la caratterizzano. Dopo aver risolto la questione cruciale della misurazione dell'instabilità politica, la tesi propone un’analisi delle connessioni tra l’instabilità politica e la performance macroeconomica ma anche tra instabilità politica, sicurezza alimentare e disuguaglianza di reddito.

La tesi inizia con la parte introduttiva, che introduce l'obiettivo dello studio e dati e metodi quantitativi che verranno utilizzati nei capitoli successivi. Inoltre, questa parte mostra anche i risultati generali, il contributo principale alla letteratura, i vincoli e la ricerca futura. *Il Capitolo I*, in cui si determinano le dimensioni dell'instabilità politica, è la pietra angolare della tesi, in quanto i due capitoli successivi impiegano i risultati ottenuti in tale capitolo. *L’analisi delle Componenti Principali (ACP),* che è un metodo di riduzione della dimensionalità, viene utilizzato come strumento per misurare l'instabilità politica

utilizando 11 variabili di rischio politico tratte dal dataset della *International Country Risk Guide* (The PRS Group 2014) osservato in 117 paesi. I risultati suggeriscono che le l'instabilità politica debba essere declinata in due componenti, denominate rispettivamente come *Il Difetto Strutturale* e *Il Disordine della Qualità Politica.* Inoltre, *il Capitolo I* mostra anche come questi due aspetti dell'instabilità politica siano caratterizzati dalle seguenti tre forme di governo: Sistema Parlamentare, Sistema Presidenziale, Sistema Semi-Presidenziale. Inoltre, *il Clustering Gerarchico,* utilizzando l'algoritmo di collegamento di *Ward,* viene eseguito per dividere i paesi in gruppi omogenei rispetto alle componenti dell'instabilità precedentemente indivduate, *Il Difetto Strutturale* e *Il Disordine della Qualità Politica.*

Il Capitolo II e il *Capitolo III* utilizzano la *panel Vector Autoregression Analysis (panel VAR)* nei *generalized methods of moment (GMM)* nel periodo 2008-2017. Mentre *il Capitolo II* analizza il legame tra instabilità politica e performance macroeconomica dei paesi considerati, *il Capitolo III* si occupa del nesso tra instabilità politica, sicurezza alimentare e disuguaglianza di reddito. In entrambi i capitoli, i risultati suggeriscono che la direzione e il significato di questi legami a volte cambiano in base alle due diverse dimensioni dell'instabilità politica. Questo significa che diversi aspetti dell'instabilità politica producono risultati diversi. Per di più, c'è sempre una relazione avversa tra i due diversi aspetti dell'instabilità politica e altre variabili nell'analisi. Inoltre, sia *il Capitolo II* che il *Capitolo III* analizzano *la Funzione di Risposta Impulsiva (IRFs)* per comprendere meglio la reazione delle variabili tra loro (scosse di assestamento). Infine, questi capitoli esaminano ulteriormente *la Scomposizione della Varianza* dell'*errore di Previsione (FEVDs)* per mostrare la proporzione dei movimenti nelle variabili dipendenti che sono dovuti ai propri shock rispetto agli shock delle altre variabili.

Parole Chiave: Instabilità Politica, Performance Macroeconomica, Sicurezza Alimentare, Disuguaglianza di Reddito, Analisi dei Componenti Principali *(PCA)*

Contents

List of Tables

List of Figures

INTRODUCTION

Political instability has always been a leading concern throughout history. However, the effects of political instability have spread fast across the world in the past decades, and it does not seem to blow itself over the next few decades. This growing issue not only leads to disrupting macroeconomic balances of countries but also socio-economic situations of people such as household's food security or income distribution. Thus, an ongoing unstable political environment increases uncertainty in the countries. So what is the concept of political instability that creates a smokescreen over countries, which leads to shortening policymakers' future actions? To understand the dynamic interrelationships, identifying the term of political instability is crucial.

Measuring political instability is not easy work. Because it is highly intangible and challenging to grasp. Hence, it is conceptualized. The well-known research about political instability studied by Jong A-Pin (2008) highlights that since the level of political instability in a country is not directly measurable, many scholars have difficulty identifying it. The general argument focuses on that political instability can be viewed in two ways as executive instability and social unrest/political violence (Alesina and Perotti, 1995). The first approach points out that some countries face an increasingly higher political instability due to government changes/government stability (Alesina et al. 1996; Lipset 1960). These changes can be "constitutional" within democratic ways or" unconstitutional" like coups d'etat. Policy uncertainty emerges under these circumstances, and then it highly likely causes an unstable political environment (Gasiorowski 1995; Blanco and Grier 2008). Secondly, some studies do not focus on only executive changes and allege that several countries also come across this issue through social unrest or political violence. (De Hann et al. 1996; Annett 2000; Brunetti 2006; Jong A-Pin 2008).

In the light of these studies in the literature, since the identification of political instability changes in different studies, this thesis assumes that political instability has multiple determinants

and is required comprehensively analysed. Principal Component Analysis (PCA) is used as a tool to measure political instability by synthesizing a set of political risk indicators considered as determinants of political instability (Pearson 1901). The analysis results are highly important since the selected components represent the concept of political instability in the following two chapters of the thesis. The way of how the political instability dimensions obtained from the PCA are integrated into the following analysis is explained in the methodology and data section and literature review of Chapter I.

After measuring political instability, the next analysis focuses on the dynamic relationship between macroeconomic performance and political instability. In this context, political instability is deemed a "toxic brew" due to shortening policymakers' future actions and causes the escalation of uncertainty regarding future economic policies (Carmignani 2003; Aisen and Vega 2009; Kempe 2019). The broad literature finds the negative relationship between political instability and macroeconomic performance (Alesina et al. 1992; De Haan and Sierman 1996; Aisen and Vega 2011). However, some studies, albeit few, reject the existence of this relationship in the literature (Londregan and Poole 1990; McKinlay and Cohan 1975). Those different results can depend on how researchers define the dimensions of political instability.

The final analysis of this thesis deals with the nexus between political instability, food security, income inequality. Unlike the studies focusing on the relationship between macroeconomic outlook and unstable political environment, few studies empirically measure the dynamic relationship between political instability, food security, and income inequality (Weezel 2018; Kaitibie and Irungu 2019; Swinnen 2015). However, these issues are top of the UN Sustainable Development Goals (SDGs) agenda since they have been deemed as the rising global dangers in recent decades. Central to the 2030 Sustainable Development Goals (SDGs) is the concept that *"No one will be left behind" and to "endeavour to reach the furthest behind first"*. (United Nations General Assembly 2015). Notably, of the 17 global risks targeted to be reduced

significantly by the United Nations by 2030, three goals (Goal 2, Goal 10 and Goal 16) are directly related to food security, income inequality and political instability, respectively[i]. In this context, inequality may threaten food insecurity. Then, high inequality may have a direct or indirect nexus with conflict, leading to political instability. On the contrary, the incidence of political instability may exacerbate income inequality and put food security at risk.

This thesis synthesizes various quantitative methods. After the issue of how to measure political instability is settled, it attempts to draw a framework better understanding of connections between political instability and macroeconomic performance and the dynamics between political instability, food security and income inequality. The aim of the study is discussed below.

Aim of Study

This thesis consists of three chapters, which perform various quantitative methods to conceptually identify the measurement of political instability and its nexus with macroeconomic outlook and food security, income inequality.

Chapter I aims to measure political instability and investigate how the form of government established in a set of countries is related to this/these measures of political instability. The empirical analysis is based on a set of 11 political risk variables taken from the International Country Risk Guide dataset (The PRS Group 2014) observed in 117 countries. First of all, this research attempts to build a more comprehensive and weighting representative measure of political instability. It tries to find an answer to whether the concept of political instability can be identified by more than one dimension and how the following three different forms of government are characterised by such dimensions of political instability: parliamentary system, presidential system, semi-presidential system. Based on broad theoretical knowledge, this research assumes that political instability has a multidimensional nature and cannot be identified with only one dimension. When the measurement issue is settled, this study

investigates which government forms are well represented by which dimension of political instability. In addition, it goes beyond and divides 117 countries into smaller clusters based on their similarities in respect to political instability.

Chapter II aims to measure the link between political instability and macroeconomic performance. It investigates how various dimensions of political instability and macroeconomic performance indicators interact simultaneously, allowing bi-directional causality. This chapter deals with two different models using two different aspects of political instability, considering the results in Chapter I. The purpose of building these two models is to observe whether the dynamic relationship between macroeconomic performance and political instability changes in different political instability dimensions. Furthermore, to provide depth-in analysis, it is investigated the main economic transmission channels contributing to the links between political instability and macroeconomic performance in the robustness check. In this context, the transmission channels for each macroeconomic variable are determined as a result of the extensive theoretical reviews. Hence, it is evaluated whether transmission channels change in different two models separated based on two different political instability concepts.

Chapter III investigates the dynamic relationship between food security, income inequality, political instability. What prompts me to perform this analysis stems from my most profound curiosity about the dynamic relationship among these variables that pose a global risk. Eventually, it attempts to ask whether those connections change according to different aspects of political instability.

In addition, both Chapter II and Chapter III also produce a set of impulse response functions (IRFs) and forecast error decomposition (FEVDs), even if this is not the first aim of these chapters. Hence, this study draws a picture of reactions of variables and variance after a shock along a specific time horizon.

Methodology and Data

Principal Component Analysis (PCA) represents the reference methodology of Chapter I. PCA, which is a dimensionality reduction method, is performed as a tool to identify the measurement of political instability by using 11 political risk variables taken from the International Country Risk Guide (ICRG) dataset (The PRS Group 2014). Furthermore, to provide depth-in analysis, Hierarchical Clustering, using Ward's linkage algorithm on PCA, is performed to divide 117 countries into smaller clusters by their similarities regarding their political instabilities. Identifying the measurement of political instability is an essential step of this thesis since the quantification of political instability will be used in the following two chapters, which perform Panel Vector Autoregression Analysis (PVAR).

However, this thesis is aware that PCA is a static data synthesis technique; and the next two analysis PVAR is dynamic analysis. Static data technique can not be observed over the period, while dynamic analysis investigates the connections among variables over the period. Due to this dual structure, this thesis closely follows previous studies' path that first produces dimension(s) using PCA and then uses this dimension(s) in panel data analysis (Aisen and Veiga 2011; Berggren Bergh and Bjornskov 2012; Barugahara 2014; Bielskis 2016; Hira 2017; Hyeon-Seung 2019; Nicolay and Valladeres 2021). In this context, when performing PCA analysis, this study takes 10-years averages of 11 political risk data covering the period of 2008-2017 for each country included in the analysis. Thus, in this thesis, the political instability dimension(s) obtained from PCA reflects a general concept of political instability belonging to the 2008-2017 period. Then, the dynamic connections of this dimension(s) with macroeconomic performance and food security, income inequality are questioned for the period 2008-2017 through PVAR in the following two chapters.

Both Chapter II and Chapter III apply Panel Vector Autoregression Analysis (PVAR), which is the main analysis of these chapters (Abrigo and Love 2015). In Chapter II, three main macroeconomic indicators representing macroeconomic performance are adopted to observe the relationship between political instability and macroeconomic performance over the period 2008-2017 in 117 countries. These variables are the growth rate of real GDP per capita, growth rate of unemployment and inflation rate. The data are extracted from The World Bank, International Labour Organization (ILO) and International Monetary Fund (IMF) databases. Furthermore, the robustness test is carried out to find the transmission channels between political instability and each macroeconomic variable. In this context, the transmission channels for economic growth are observed within Solow and Endogenous Growth Theories framework. The combination of Political Business Cycle Theory (Nordhaus 1975) and Friedman dictum is used while checking the robustness of the relationship between inflation and political instability. Finally, this study benefits from the combination of ethnicity and conflict arguments (Collier 2000; Miguel 2007) and Youth Buldge Theory (Fuller and Goldstone 1995; Urdal 2006) while performing the robustness test of the nexus between unemployment and political instability.

Chapter III addresses the food security issue in the following three pillars suggested by the World Health Organization (WHO): Food Availability, Food Accessibility, Food Utilization[ii]. These data are extracted from Food and Agriculture Organization of United Nations (FAO) and World Bank databases. The Gini index represents income inequality, and Standardized World Income Inequality Database (SWIID) is adopted in this study. As in Chapter II, Chapter III also builds the analysis onto the two different models, which are separated according to the two different aspects of political instability obtained from Chapter I. While explaining the links between two different aspects of political instability, income inequality and food security, it is

benefited from the Marxist Conflict Theory and class-based arguments and Ethnic Mobilization and Conflict theories (Strichouser 2016 (Marx 1904, cited in Schock 1996).

Besides all, Chapter II and Chapter III apply impulse response functions (IRFs) and forecast error variance decompositions (FEVDs). Whereas the impulse response function shows the responses of a dependent variable to other variable shocks, the FEVDs investigate the contribution of each endogenous variables shock to the determination of the other variables' forecast error variance (Zouaoui and Zoghlami 2020).

General Findings of the Thesis

In Chapter I, Principal Component Analysis (PCA) suggest that the first two dimensions of political instability should be extracted, and they are labelled as "Structural Defect" and "Disorder of Polity Quality," respectively. However, according to the results, Structural Defect (first dimension) is much more important than Disorder of Polity Quality (second dimension). Nevertheless, this research adopts both aspects. In addition, the parliamentary system much more stands out than other forms of government with respect to its characterization on two different aspects of political instability. It is highly characterized by the first component, namely Structural Defect. Finally, Hierarchical Clustering on PCA results suggests that the optimal cluster number should be 3 for 117 countries. That means 117 countries are divided into 3 clusters based on their similarities in political instability. The results are shown in section 1.5.

In Chapter II, estimated results suggest that the relationship between macroeconomic performance and two different aspects of political instability (Structural Defect and Disorder of Polity Quality) is almost similar. The most prominent result is that both political instability variables have a significant relationship with each macroeconomic variable, including in the analysis. However, there is a one-way relationship running from political instability to macroeconomic indicators. In addition, various transmission channels are selected for each

macroeconomic variable to investigate how the interconnections between political instability and included macroeconomic indicators are established.

Human Capital Accumulation, Total Factor Productivity and Physical Capital Accumulation are selected as transmission channels to observe the relationship between political instability and economic growth. While the causal and significant (negative) relationship running from Structural Defect to Human Capital Accumulation, there is a relationship from Disorder of Polity Quality to Total Factor Productivity. The other results are discussed in sections 2.5 and 2.6.

In Chapter III, the most central point of the results is that although Food Accessibility is the most endogenous variable compared to others, it has no link with GINI (income inequality). However, Food Accessibility is impacted by all the other variables in this analysis. Structural Defect and Disorder of Polity Quality differentiate in terms of their connections with food security and income inequality. It should be highlighted that there is no significant and causal relationship between Structural Defect and income inequality. At the same time, Disorder of Polity Quality has a causal and significant impact on income inequality. Unlike Structural Defect, Disorder of Polity Quality negatively impacts food utilization (the third pillar of food security). Detailed results are discussed in sections 3.5 and 3.6.

In Chapter II and Chapter III, impulse response functions (IRFs) and forecast error variance decompositions (FEVDs) show that all variables are largely explained with their own shocks and changes within themselves for 4-year forecast horizon. In Chapter II, the results belonging to the two models are similar to each other. However, in Chapter III, both IRFs and FEVDs results change in different models separated based on two different political instability concepts. The results are discussed in 2.5.2;2.5.3 and 3.5.2; 3.5.3.

Main Contributions

Chapter I, conducted by Principal Component Analysis (PCA) and Hierarchical Clustering Analysis (HCA), provides a comprehensive analysis concerning both measuring the dimensions of political instability and grouping countries based on their similarities with respect to political instability. Further, PCA results draw a picture of how selected dimensions of political instability characterize different government forms.

A further original contribution is provided in Chapter II, which examines the relationship between macroeconomic outlook and political instability from a broad perspective. Firstly, this is the first study, which observes the dynamic relationship between political instability and various macroeconomic variables using Panel Vector Autoregressive Analysis (PVAR). Secondly, this research investigates not only a direct link but also an indirect relationship, which states that variables simultaneously interact with each other through various channels. It explains these dynamic connections based on a broad theoretical framework. In addition, the results of impulse response functions and forecast variance error decompositions will contribute the future policy formulation.

Chapter III provides a broad investigation. Firstly, as a result of an extensive literature review, this is the first study, which observes how political instability, food security and income inequality that are on the global risks agenda of the United Nations, interact together simultaneously, allowing for bi-directional causality. Secondly, the analysis is performed not only on one pillar of food security but also all three pillars of food security defined by the World Health Organization (WHO). Finally, the results of impulse response functions and forecast variance error decompositions will help the future policy formulation.

Constraints and Future Research

The most important limitation of this research is the absence of data on food security and income inequality. However, the analysis is conducted by accessing the largest possible dataset, which is appropriate for the sample of this research.

This thesis is performed over the period 2008-2017. The connections may change if the analysis is performed at a different period. It would be interesting to extend the study when further data is available. Moreover, this thesis conducts all analyzes within a global framework. Hence, future studies can approach the issue from a regional perspective. Since regions' internal dynamics may differ, the link between food security, political instability, and income distribution may vary among regions. It is believed that this thesis will comprise a basis for such future studies.

The initial empirical investigation of this thesis starts with Chapter I that Principal Component Analysis (PCA) and Hierarchical Clustering using Ward's algorithm is performed. Chapter II, which analyzes the link between political instability and macroeconomic performance. Chapter III that the nexus between political instability, food security and income inequality is investigated. Finally, the general concluding remark summarizes the whole thesis' results. It is hoped that this thesis, which uses various quantitative methods, would make an important contribution to existing literature and shed light on further academic research.

CHAPTER I

A POSSIBLE MULTIVARIATE STATISTICAL METHODS TO MEASURE POLITICAL INSTABILITY

1.1 Introduction

The terms of political instability have a broad definition from the unstable government to ethnic conflicts, or from political violence to the socio-economic situation, etc. In early studies, the phenomenon of political instability has been commonly divided into two categories. One category is government changes, both constitutional and unconstitutional ways. The second category is socio-political unrest in countries/societies. However, more recent studies have approached this issue with a broader perspective that the multidimensional nature of political instability requires much more political indicators (Carmignani 2003), thus considering more than one political risk factor.

The ideal situation is that political instability should be related to not only executive stability in countries but also events triggering a fragmentation of societies/countries, such as internal conflicts, religious and ethnic unrest, etc. On the one hand, the downfall of law and order in societies may also create chaos and adverse effects on political stability. On the other hand, a decline of the social conditions of countries or deterioration of the structure of institutions can give rise to an unfavourable impact on political stability (Acemoglu,2008). To sum up, the standardized measures are the sorts of political and social structure plus incidences of violence and conflicts. So, indices applied for these kinds of studies should be comprehensive.

This chapter initially uses Principal Component Analysis (PCA) as a tool to identify the measurement of political instability on 117 countries. In addition, it investigates how these (this) measures (measure) of political instability characterize forms of government established in the 117

countries. Firstly, this study asks a two-fold question: Can the concept of political instability be identified by more than one dimension (determinant)? How do these (this) dimensions (dimension) characterize the following government forms: parliamentary system, presidential system, semi-presidential system?

This research conducts the analysis with 11 political risk variables taken from the International Country Risk Guide (ICRG) dataset, which provides country risk data and country reports on political, financial and macroeconomic trends around the world (The PRS Group 2014). This analysis only adopts the political risk variables, which much more reflect the political instability faced by countries since financial and macroeconomic data mainly measure economic outcomes.

PCA is the important step of this thesis since the measurements of political instability obtained through PCA will be used in the next two chapters in this thesis. That means that the political instability dimension(s) extracted from PCA represents the political instability proxy of this thesis. After the measurement of political instability is settled, it is investigated which government forms are well represented by which dimension of political instability. These analysis results will make an important contribution to existing literature and further academic research as it is the first research on this topic.

After performing PCA, Hierarchical Clustering Analysis on PCA by using Ward's linkage algorithm is conducted. It helps to visualise and group 117 countries by their similarities in respect to their political instabilities. The contribution is that no studies have been conducted on countries' political instability using Hierarchical Clustering on PCA. Hence, it is believed this research fills this gap in the literature.

The following section explains the literature review. Section 1.3 deals with presenting the data, and Section 1.4 represents methodology. Section 1.5 displays the empirical results, and finally, Section 1.6 represents the conclusion of this chapter.

1.2 Literature Review

Extensive literature has investigated the determinants of political instability in countries for many years. Researchers point out measuring political instability is quite challenging. However, they conceptualize and operationalize with the various methods, especially PCA.

This study starts with the literature, which first uses PCA as a tool to measure political instability or other political issues and then adopts this measurement in panel data analysis. This thesis performs Panel Vector Autoregression Analysis (PVAR) in Chapter II, Chapter III. However, as the dimension(s) obtained from PCA is used in the next chapters, the literature review of this section is also essential for the next chapters. In this context, this research cares previous studies, which uses the similar path to this study.

Using PCA, Aisen and Veiga (2011) creates five indexes that are associated with regime stability. They adopt cabinet changes as the primary proxy of political instability. They claim that political instability is a multi-dimensional phenomenon and not well captured by just one variable as cabinet changes. They select the first principal component for each of the five groups of variables. Later, the authors use these indexes in their dynamic panel data analysis to measure the relationship between political instability and economic growth over the five years from 1960 to 2004.

Bergreen et al. (2012) study institutional instability by using PCA. They construct measures of institutional quality and uncertainty by adopting the political risk index of the ICRG. In line with the results, three dimensions labelled as legal, policy, tension are created. Then, they find that all these components have a positive impact on growth.

Barugahara (2014) decides the political instability dimensions by using Principal Component Analysis (PCA). According to the results, the state failure index, constructed from revolutionary and ethnic wars, genocides, and the state fragility index based on legitimacy and

effectiveness, is adopted. Later, the author uses the GARCH model to measure the link between inflation and political instability, presented by the state failure index, in a panel of 49 African countries.

Hira (2017) creates political instability index using PCA. The first component is selected as a proxy for political instability, composed of different factors like strikes, assassinations, riots, demonstrations, government longevity, government change and regime type. Then, with this political instability, the ARDL model is conducted to measure the nexus among political instability, stock market returns and stock market volatility in Pakistan over the period 1998-2012.

Using PCA to define the dimensions of political instability on the ICRG political risk dataset, Nicolay and Valladares (2021) accept the first three components. They name them as governance failure, partner attitude and cultural conflict. Later, they show that a higher level of political risks triggers an increase in inflation in 90 countries over the period 1990-2016. Adopting the ICRG dataset, this study determines political instability measures by using Principal Component Analysis and performs dynamic panel data analysis to observe the linkages.

Bitar et al. (2019) use the International Country Risk Guide (ICRG) political risk indicators and then group the variables into three categories to proxy political instability. Cukierman, Tabellini and Edwards (1991) argue that the occurrence of political instability is highly associated with government changes in countries. They highlight both regular and irregular government changes as a proxy of political instability in their probit model.

Hibbs (1973) uses PCA to choose the dimensions of mass political violence. According to PCA results, mass political violence includes six events variables. These are riots, anti-government demonstrations, political strikes, assassinations, armed attacks and deaths from political violence.

Using PCA, Blanco and Grier (2007) construct a composite of political instability focusing on Latin America. They decide the first principal component consisting of nine variables:

assassinations, coups, government crises, anti-government demonstrations, riots, strikes, purges, guerrilla activity and revolutions.

Alesina and Perotti (1996) observe the socio-political situation, indicating political violence and social unrest as a political instability dimension. For this reason, they construct an index (SPI) by using the principal component analysis. They capture the idea of political instability viewed as a threat to property rights. Thus, they consider two variables as assassinations and deaths.

Annett (2001) captures the following different dimensions of political instability in a country: communal and political victims, civil wars, assassination, coups, revolutions, riots, government crisis, cabinet changing and constitutional structures. Generally, all factors measure political instability along various dimensions, which threatens the survival of the present government in some way. Campos and Nugent (2001) find that political instability has three dimensions: the number of political assassinations per million people, revolutions and successful coups d'états.

Toft (2008) studies with ICRG dataset to measure political risk. Based on its result, the first three principal components are extracted. Ndokang and Tsambou (2015) apply a PCA on five indicators (observed variables) of political instability: 1) number of political assassinations, 2) the number of political arrests and attempted political assassinations, 3) number of coups, 4) guerrilla actions, 5) military spending, in reference to the Central Africa Republic. More recently, using the same technique (PCA), Brito and Estafania (2016) consider three political instability indexes: 1) democratic stability, 2) regime stability 3) government stability.

Thus far, we have attempted to summarise the broad range of studies, which use PCA in the literature. The following literature review is related to the Hierarchical Clustering Analysis

(HCA), which is the second analysis of this research. We apply Ward's linkage algorithm to group the individuals (countries in this part) based on their similarities. The optimal grouping is found, where similar observations are grouped together as clusters while the different clusters are separated from one to another.

HCA is widely applied to classify countries. Cui (2005); Arnaud and Bernard (2003); Franzoni (2008); Lee and Ku (2007) perform HCA to research similarities and differences between welfare regimes. Wolfson et al. (2004) use this technique to identify national types based on countries' politics, economics, and conflict. Gugiu and Centellas (2013) apply it to determine a new democracy index called the Democracy Cluster Classification index.

Grein et al. (2010) perform PCA considering the corruption level of countries and employ HCA. They consider 39 countries' annual datasets over the period from 1995 to 2000 by using Transparency International's Corruption Perception Index. They also merge two analyses by keeping three components from PCA. Summary tables of the literature review for Principal Component Analysis (PCA) and Hierarchical Clustering (HCA) can be found in Appendix A and Appendix B, respectively.

1.3 Data Description

This study uses 11 political risk variables from the Country Risk Guide (ICRG), which produces country risk data in political, financial, and macroeconomic fields. Herein, we consider political instability from the political risk perspective because these risk variables are highly associated with the factors creating political instability compared to the other two categories in ICRG dataset. The primary reason why this research contains this dataset is that these variables provide greater knowledge on the key concept of political instability/stability compared to other data sources. ICRG dataset dates to 1984 and covers 140 countries. So, it also presents relatively broad coverage of countries and years compared with other measures of political instability

indices. Secondly, in favour of the ICRG data, they are applied by widely cited academic works dealing with political stability issues (Keefer and Knack,1995). According to ICRG, higher (lower) scores indicate lower (higher) risk and higher (lower) political risk, which refers to political instability in this analysis. Actually, the ICRG dataset includes 12 political risk indicators, but we use 11 variables after excluding *Government Stability (GS).* The detailed explanations can be found after Table 1.1.

Nevertheless, we display PCA results with *GS* in the appendix. Therefore, the description of *GS* is also presented below. In the following, the list of the considered 12 indicators (labels showed in the brackets are used in result tables and graphs) is provided:

a) Government Stability (GS): That is an appreciation not only of the government's ability to carry out its declared program(s) but also its ability to stay in office. It is measured by government unity, legislative strength, popular support. The maximum score is 12.

b) *Socio-economic Conditions (S_EC):* This is an assessment of the socioeconomic pressures at work in a society that could constrain government action or fuel social dissatisfaction. The maximum score is 12.

c) Investment Profile (IP): This is an assessment of factors affecting the risk to investment in the countries. Risk factors include the extent of contract expropriation, profit repatriation, payment delays. The maximum score is 12.

d)Internal Conflict (IC): This is an assessment of political violence and its impact on governance. The highest rating is given to countries with no armed or civil opposition to the government and which does not indulge in arbitrary violence, direct or indirect, against their own people. The lowest rating is given to countries embroiled in ongoing civil war. It depends on and is measured by civil war/coup threat, terrorism/political violence, civil disorder. The maximum score is 12.

e) *External Conflict (EC):* This is an assessment measuring the risk to the incumbent government from foreign action, ranging from non-violent external pressure (diplomatic pressures, withholding of aid, trade restrictions, territorial disputes, sanctions, etc.) to violent external pressure (cross-border conflicts to all-out war). External conflicts can adversely affect foreign business in many ways, ranging from restrictions on operations to trade and investment sanctions, to distortions in the allocation of economic resources, to violent change in the structure of society. It depends on and is measured by war, cross-border conflict, foreign pressures. The maximum score is 12. Low values indicate higher risk, while high values mean lower risk.

f) Corruption (COR): This is an assessment of corruption within the political system. Such corruption is a threat to foreign investment for several reasons: it distorts the economic and financial environment, reduces the efficiency of the government and businesses by enabling people to assume positions of power through patronage rather than ability; and, last but not least, introduces an inherent instability into the political process. The maximum score is 6. Low values indicate higher risk, while high values mean lower risk.

g) *Military in Politics (MP):* It assesses the degree of interference and involvement of the military establishment in politics. Therefore, even at a peripheral level, its involvement in politics is a diminution of democratic accountability. However, it also has other significant implications. The military might, for example, become involved in the government because of an actual or created internal or external threat. Such a situation would imply the distortion of government policy to meet this threat, for example, by increasing the defence budget at the expense of other budget allocations. The maximum score is 6. Low values indicate higher risk, while high values mean lower risk. More specifically, lower risk ratings highlight a greater degree of military participation in politics and a higher level of political risk.

h) *Religious Tension (RT):* It measures the domination of society and/or governance by a single religious group seeking to replace civil law by religious law and to exclude other religions from the political and/or social process; the desire of a single religious group to dominate governance; the suppression of religious freedom; or the desire of a religious group to express its own identity, separate from the country as a whole. The maximum score is 6.

i) *Law and Order (LO):* It measures the degree of strength, independence, and unbiasedness of the legal system and people's observance of the law. The maximum score is 6.

j) *Ethnic Tension (ET):* This component assesses the degree of tension within a country attributable to racial, nationality, or language divisions. Lower ratings are given to countries where racial and ethnic tensions are high because opposing groups are intolerant and unwilling to compromise. Higher ratings are given to countries where tensions are minimal, even though such differences may still exist. The maximum score is 6.

k) *Democratic Accountability (DA):* This is a measure of the responsiveness of government to its citizens. The maximum score is 6.

l) *Bureaucracy Quality (BQ):* The institutional strength and quality of the bureaucracy is another shock absorber that tends to minimize policy revisions when governments change. Therefore, high points are given to countries where the bureaucracy has the strength and expertise to govern without drastic changes in policy or interruptions in government services. In these low-risk countries, the bureaucracy tends to be somewhat autonomous from political pressure and have an established recruitment and training mechanism. The maximum score is 4.

The ICRG provides annual data on 144 countries from 2008 to 2017. The proposed analysis is based on 10-year averages of the available indicators published by ICRG. Countries are divided into three groups based on their forms of government, such as parliamentary, semi-presidential or presidential systems. However, some countries are not positioned in any of these three main systems. Therefore, these 27 countries are excluded from 144 countries which is limited to 117 countries. The countries to be investigated in our analysis are listed below (Table.1.1)

A parliamentary system is a system of government in which the executive is dependent on the direct or indirect support of the legislature, often expressed through a vote of confidence. A presidential system is a form of government in which the president is the chief executive and is elected directly by the people or by the electoral college members. The president selects some ministers as the Secretary and forms a small Cabinet assisting in governing the country. This form of government can be found in the United States of America, Brazil and Argentina. A semi-presidential system of government represents a republic ruled by an elected president, a prime minister and a cabinet. This system of governance can be various forms in different countries. While some countries adopt that the president and prime minister have equal powers, in other countries, either the prime minister or the president exhibits more executive powers than the other. Examples of countries that practise a semi-presidential system of governance are France, Portugal, Romania and Guyana.

Table 1.1

Countries and Forms of Government Classification

Parliamentary System			
Albania	Austria	Australia	Bangladesh
Bahrain	Belgium	Bahamas	Botswana
Bulgaria	Canada	Czech republic	Croatia
Denmark	Estonia	Ethiopia	Finland
Greece	Germany	Guyana	Hungary
Iceland	India	Ireland	Israel
Italy	Japan	Jamaica	Jordan
Lebanon	Latvia	Luxembourg	Malta

Malaysia	Morocco	Moldova	Netherlands
New Zealand	Norway	Pakistan	PapuaNewGuinea
Poland	Serbia	Slovenia	Slovak Republic
Spain	South Africa	Singapore	Sweden
UnitedArab Emirates	United Kingdom	Thailand	Trinidad Tobago
Turkey			
Presidential System			
Algeria	Angola	Argentina	Azarbaijan
Belarus	Bolivia	Brazil	Burkino Faso
Chile	Colombia	Costa Rica	Côte'dIvoire
Congo Republic	Cyprus	Dominican Republic	Ecuador
El Salvador	Egypt	Gabon	Gambia
Ghana	Guatemala	Guinea	Honduras
Hong Kong	Indonesia	Kazakhstan	Kenya
Malawi	Mexico	Mozambique	Myanmar
Namibia	Nicaragua	Nigeria	Panama
Paraguay	Peru	Philippines	Senegal
South Korea	Sri Lanka	Suriname	Syria
Tanzania	Uganda	United States	Uruguay
Venezuela	Zambia	Zimbabwe	
Semi-Presidential System			
Cameroon	CongoDemocratic Republic	China[iii]	France
Guinea Bissau	Iran Islamic Republic[iv]	Lithuania	Madagacar
Portugal	Romania	Russia	Ukraine
Taiwan			

Note: Countries are categorized considering Central Intelligence Unit: https://www.cia.gov/about-cia. and Bağçe 2017. Additional categorization for some countries indicated with roman numbers in the table can be found in the Notes.

Table 1.2 illustrates the main univariate statistics for the considered variables. According to the different ranges of the variables, the results show that most of the means vary between a low score (reflecting higher risk) and a middle score (moderate risk) (Bitar et al. 2020). Moreover, the mean and median values of each variable are pretty similar to each other. Whereas *S_EC* stands out with its highest variation and lowest skew, *GS* has the lowest variation and the highest skew among other variables. Skewness simply measures symmetry, or more precisely, the lack of symmetry. The skewness for a normal distribution must be zero, and symmetric data should be around zero. If the skewness has negative values, data are skewed to the left-side; if it has positive, the data are skewed to the right-side. The statistical models included in skewed data may not work, or more precisely, these kinds of data can dominate the results in PCA (Sharma 2019; Holland

2019). Skewed distributions are found to be sceptical by most of the researchers in terms of the process of estimating a *typical value.* It is indicated that the typical value is certain, when the distribution is symmetric; namely, it is a well-defined centre of the distribution. If the data are unpleasantly distributed -such as highly skewed-, it can be challenging to interpret the component plot. The standard solution is to drop such variables from the analysis (Baxter 1995). That is the path followed by this analysis.

In this analysis, GS shows a different behaviour with respect to the other variables. It explains a latent factor completely different and uncorrelated with the first factor. In this context, skewness may also cause low correlations with the other variables. Therefore, the reason for the different correlation of GS with other variables may be that it is skewed data. Hence, all these explanations can be a basis for the reason why we perform our analysis by excluding *GS.* We conduct the research with 11 variables instead of 12. Nevertheless, we show all the results with GS in Appendix I-J-K-L. Particularly Appendix K clearly displays why GS is not considered in this analysis. This factor graph can explain that GS has different behaviour compared to the other variables.

Table 1.2

Descriptive (univariate) Statistics of the Political Risk Indicators

Var.	S_EC	IP	IC	EC	COR	MP	RT	L_O	ET	DA	BQ
S_EC	1										
IP	0.740	1									
IC	0.543	0.550	1								
EC	0.251	0.445	0.598	1							
COR	0.737	0.746	0.558	0.381	1						
MP	0.643	0.653	0.732	0.544	0.642	1					
RT	0.269	0.289	0.585	0.315	0.314	0.474	1				
L_O	0.697	0.588	0.481	0.179	0.736	0.613	0.210	1			
ET	0.377	0.345	0.464	0.289	0.291	0.379	0.419	0.259	1		
DA	0.471	0.526	0.524	0.363	0.565	0.622	0.331	0.452	0.171	1	
BQ	0.727	0.671	0.526	0.346	0.762	0.622	0.255	0.656	0.260	0.612	1

Figure 1.1 and Figure 1.2 show multiple box-whisker plots in a single plot. The first graph displays multiple boxplots belonging to the first five political instability variables; the second graph indicates the other seven variables. Variables are divided into two plots according to a similar range. We also generate normal distribution with the same mean and standard deviation and visualize them side by side to compare them within each other (red boxplots). Basically, a boxplot is a standardized way of visualizing the data distribution considering the following five synthetic measures: *minimum, first quartile (Q1), median, third quartile (Q3),* and *maximum*. It provides details about outliers and their values.Furthermore, it also indicates if the data is symmetrical, how tightly the data included in the analysis is clustered, and how the data is skewed. Boxplots have the advantage of taking a small space, which is useful while comparing distributions several variables or the same variable in different. In this context, we use multiple box-and-whisker plots to map our data, as shown below.

Figure 1.1

Multiple Plots for 5 Indicators (orange) and Comparison With a Normal Distribution (red)

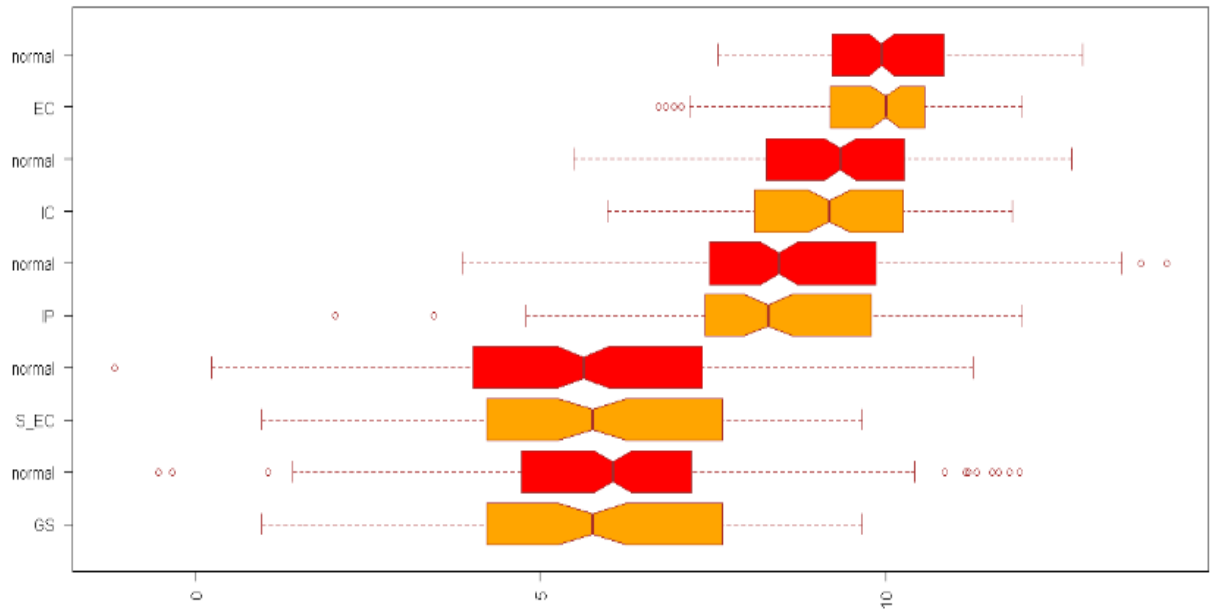
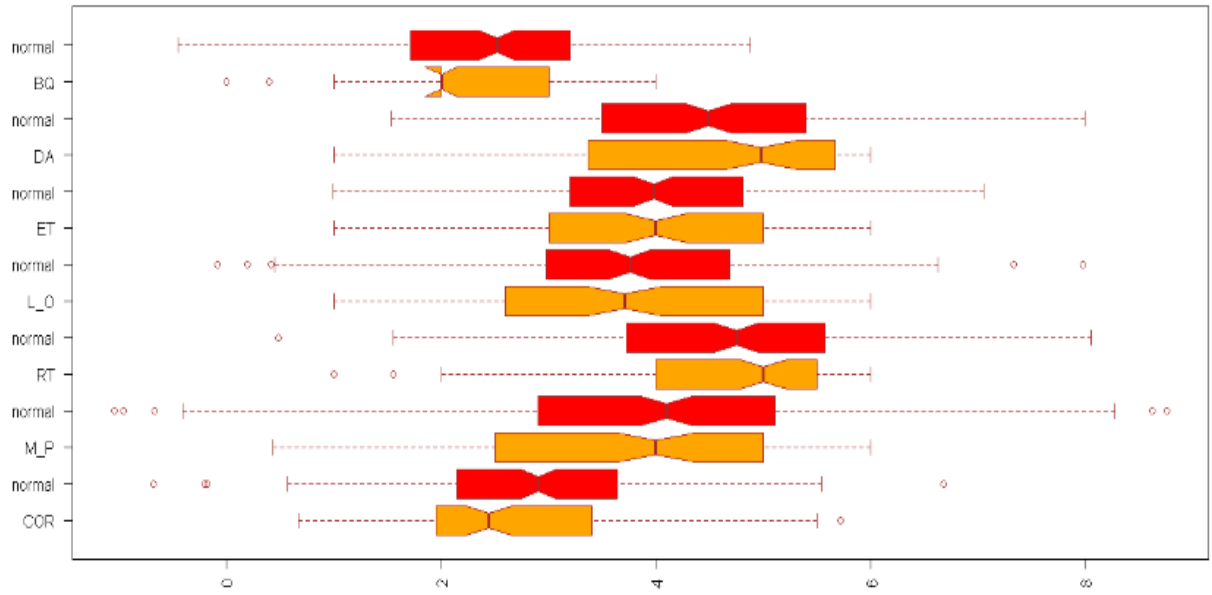


Figure 1.2

Multiple Plots for 7Indicators (orange) and Comparison With A Normal Distribution (red)



The graphs above show the first five and the rest of the seven variables with their normal distribution. These graphs indicate what the range of each political instability variable is and then their medians. In these above graphs, the whiskers show the spread of all the data. While the left-side whiskers indicate the lowest data point in this sample, the ride-side displays the highest political instability. The lines which divided boxplots into two parts are the median of each political instability variable. Whereas the median of *EC* is bigger than the rest of the four variables, the median belonging to GS is the lowest. In Figure1.2, *DA* has a higher median rather than the rest of the six political instability variables.

The considered 117 countries differ according to the government system as detailed in Table 1.3. The following table shows the frequencies and proportions of categorical variables. According to the table, the proportion of the presidential system consisting of 51 countries is about

43%. Whereas parliamentary systems compose of 45% in categorical variables, and semi-presidential systems represent about 11%.

Table 1.3

Distribution of Countries According to the Government System (Absolute and Percentage Values)

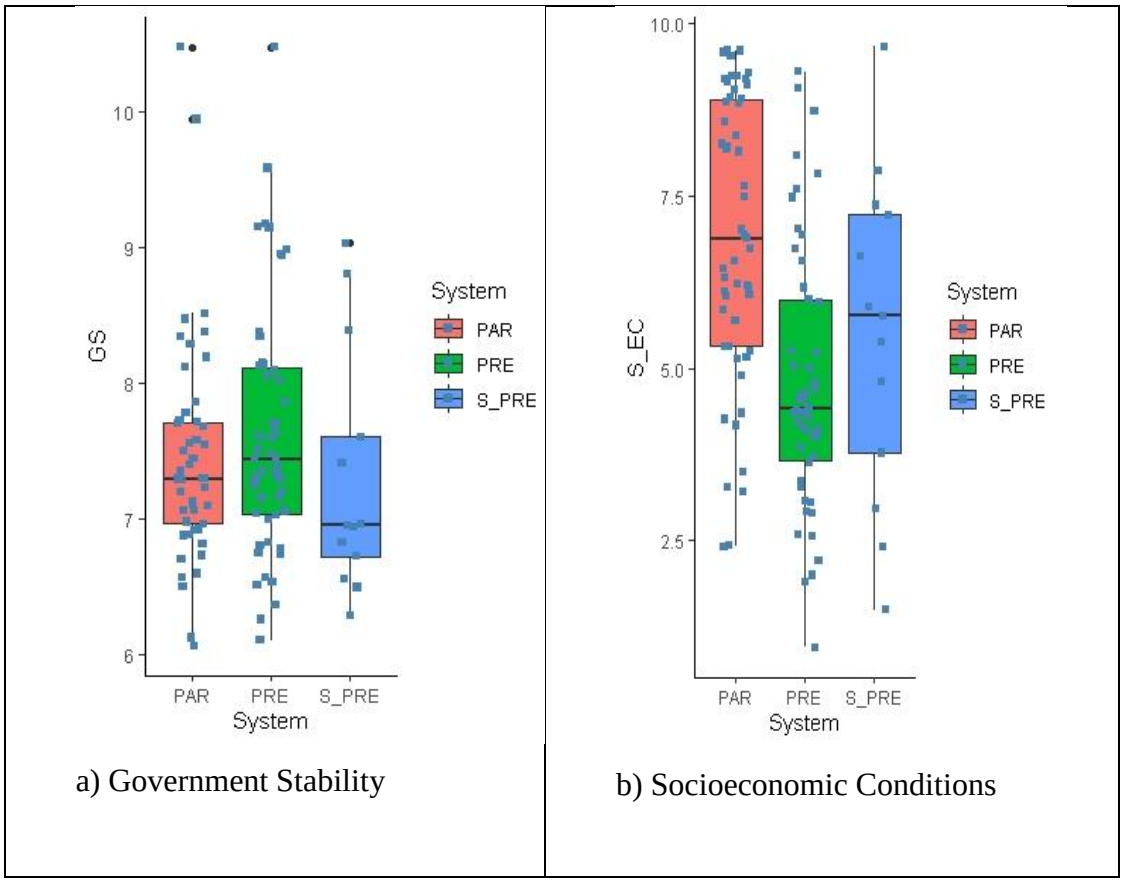
System	Frequency	%
Presidential	51	43.59
Parliamentary	53	45.30
Semi-Presidential	13	11.11

This research draws a deep framework to understand better the variables' distribution in three forms of government. Following 12 boxplots enables us to compare the total variation (variation within-variation between) and median of each political instability variable in different forms of government. It can be clearly seen that the median of *EC* is higher in each form of government (Figure 1.3).

Three forms of government do not differ too much with respect to the Government Stability, Religious Tensions and Democratic Accountability. However, parliamentary systems are characterised by a lower risk with respect to Socioeconomic Conditions, Investment Profile, Internal Conflict, Corruption, Military in Politics, Ethnic Tensions, Law and Order, Bureaucracy Quality**.** The presidential system is commonly characterised by very high risk in terms of Socioeconomic Conditions, Corruption, Bureaucracy Quality. However, it includes low risk with respect to Internal and External Conflicts. Finally, the semi-presidential system is characterised by very low risk in terms of Internal and External Conflicts. In contrast, the semi-presidential system is much more characterised by high risk with respect to Bureaucratic Quality and External Conflict.

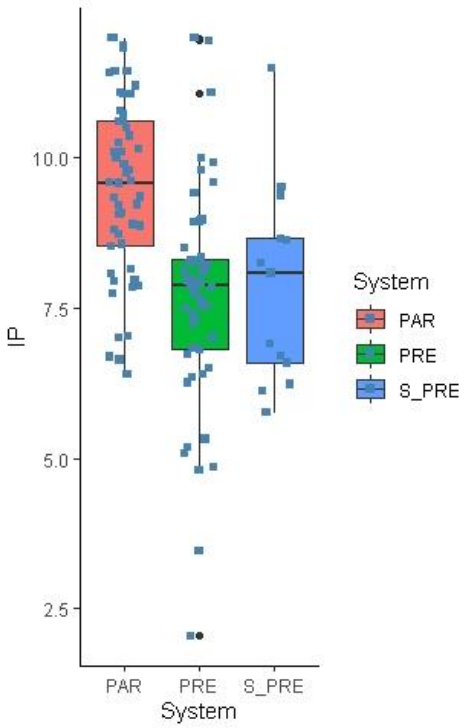
Figure 1.3

Boxplots of Political Instability Variables in Different Forms of Government

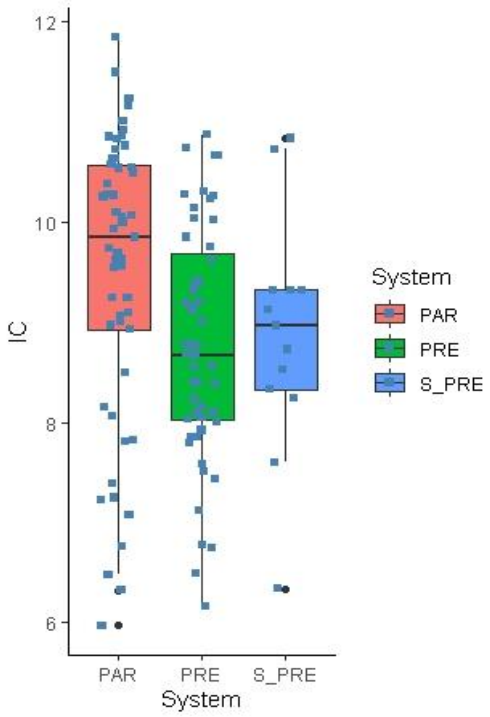


a) Government Stability

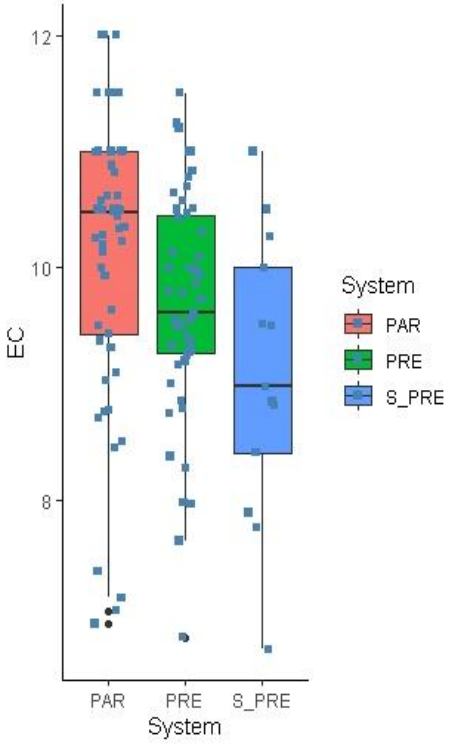
b) Socioeconomic Conditions



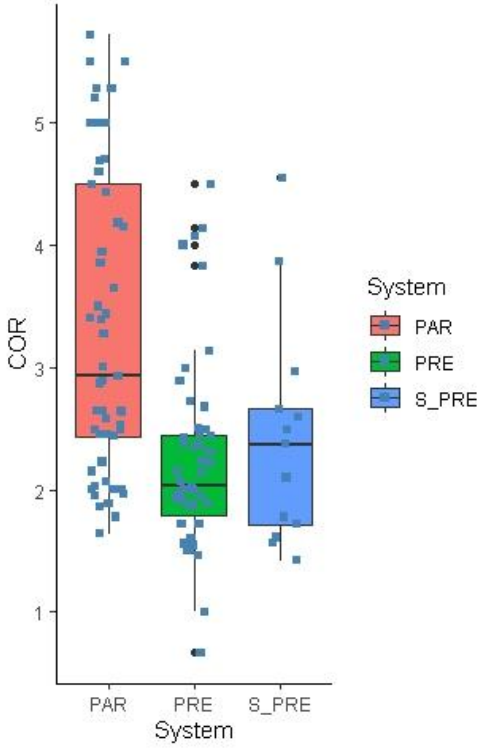
c)Investment Profile



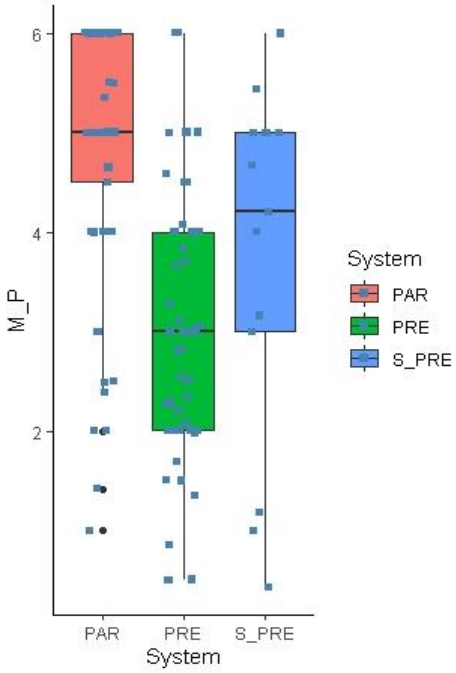
d)Internal Conflict



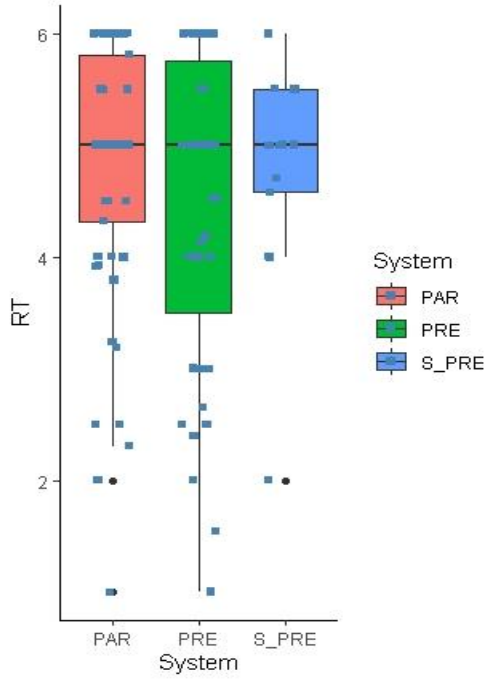
e)External Conflict



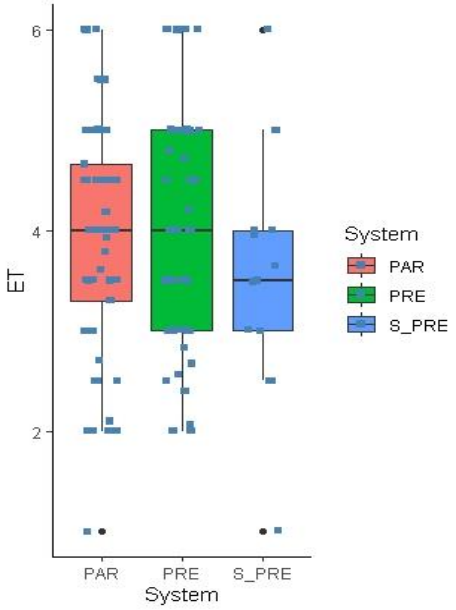
f)Corruption



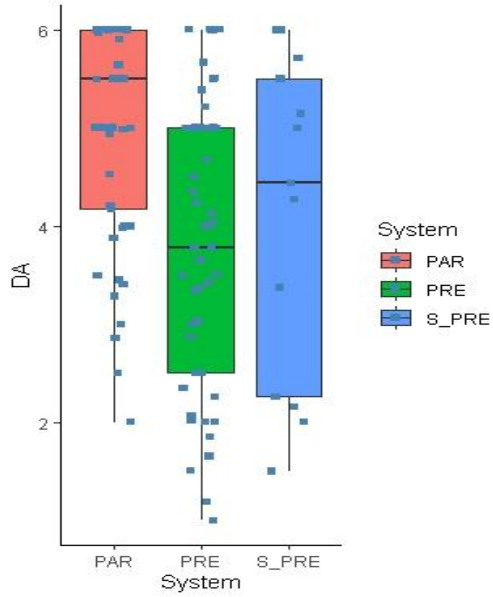
g)Military in Politics



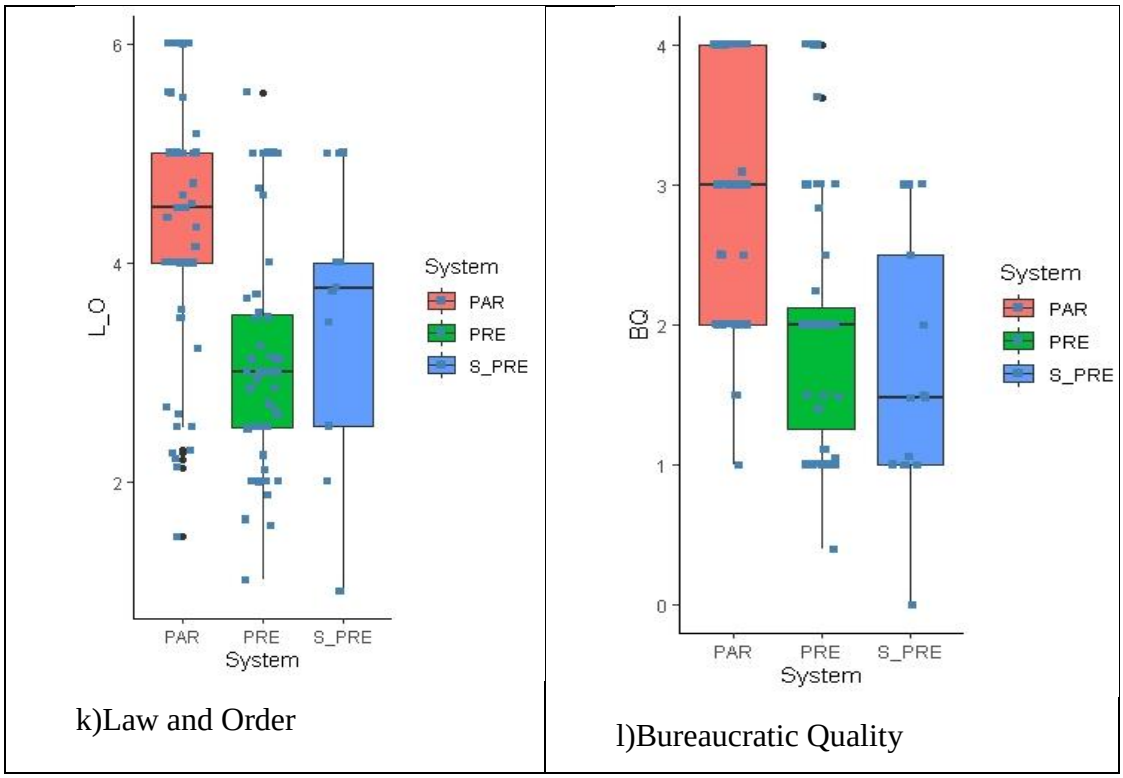
h)Religious Tensions



ı)Ethnic Tensions



j)Democratic Accountability



k)Law and Order

l)Bureaucratic Quality

*Note:*Pink box plot represents parliamentary system, which is labelled as "PAR". Green box plot represents presidential system, which is labbelled as "PRE".Blue box plot represents semi-presidential system, which is labelled as "S_PRE".

Furthermore, after a descriptive analysis is done, we also measure whether there are any statistically significant differences between the means of three different forms of government. To do so, we perform one way-ANOVA test, which is a statistical method that allows a comparison of more than two groups to understand their relationship with each other. The result of the ANOVA formula, the F Statistic, provides for the analysis of multiple groups of data to determine the variability between samples and within samples. The result tables belonging to ANOVA for each variable of political instability can be found in Appendix F. For each variable, the null hypothesis is that the means in the groups are equal.

According to the results, the p-value of only nine political instability variables is less than 0.05, whereas three variables are higher than this significance level. That is the mean of nine political instability variables that change in different forms of government, whereas different government forms have no significant effect on the remaining two variables, *RT (Religious Tension), ET (Ethnic Tension).* As a result, H_1 is accepted only for those nine variables, although

it is rejected for two political instability variables. Nevertheless, the ANOVA test does not say which groups are different from one to another. For this reason, we apply a post-hoc comparison. Tukey Honest Significant Difference (HSD) is commonly used to do pairwise comparisons of groups. Herein, we test which government forms have significant differences in terms of political instability variables. In the table, *diff* shows mean difference, and the columns of *lwr* and *upr* provide lower and upper confidence intervals displayed. The last column in Appendix G, *p adj*, shows p-values of comparison groups. According to the results, significant differences are found in the comparisons of presidential and parliamentary systems for most of the political instability indicators except of *RT, ET.* In addition, when semi- presidential and parliamentary systems are compared to each other, these comparisons are statistically significant for *COR, MP, BQ,* respectively. In the comparison of the semi-presidential and presidential systems, there is no statistical difference between these groups in terms of any political instability variable. The results tables belonging to the Tukey test can be found in Appendix G.

The final step of ANOVA analysis is that the variance of groups must be homogeneous. In an ANOVA, one assumption is the homogeneity of variance (HOV) assumption. Bartlett test is widely applied for this purpose. We first show our hypothesis:

H_0: $\sigma_1^2 = \sigma_2^2 = \sigma_3^2 \ ... = \sigma^2{}_k$ (1)

H_1:Variances are not homogeneous (2)

The test results indicate that variances are homogeneous since p-values are bigger than 0.05, except of *Corruption (COR)*. The results can be found in Appendix H.

1.4. Methodology

This section attempts to describe Principal Component Analysis (PCA) and Hierarchical Clustering Analysis (HCA) from the methodological point of view. PCA is the cornerstone of this chapter and the whole thesis because the dimension(s) obtained from PCA represents the political

instability proxy in the next two chapters of the thesis, in which Panel Vector Autoregression Analysis (PVAR) is performed. PCA is commonly used to reduce multiple variables into fewer elements. In this thesis, the primary reason for applying the PCA method is to define the dimensions of political instability conceptually. The second reason, since countries are grouped based on their forms of government and each group of countries are observed within their group, factors that trigger the rise of political instability may vary in different forms of government. Namely, different government forms may be characterized by different dimensions of political instability.

The second analysis is performed by HCA to divide countries into smaller clusters based on their similarities. Basically, clustering analysis is divided into two methods as Hierarchical Clustering and Non-Hierarchical Clustering methods (Gülağız and Şahin, 2017). Non-Hierarchical Clustering methods are divided into four sub-classes: partitioning, density-based, grid-based and other approaches (Taşkın and Emel, 2010). Such algorithms generally change centres until all points are related to centres[iii]. Hierarchical Clustering methods have two categories. These are Agglomerative and Divisive hierarchical algorithms, respectively. Divisive algorithm is frequently defined as a "top-down" approach, which means that all the observations start in one cluster, and splits are performed recursively as one moves bottom the hierarchy (Kuo et al. 2002). Agglomerative Clustering is the most common type of Hierarchical Clustering used to group objects into clusters, and it is frequently called "bottom-up" (Gülağız and Şahin, 2017). It consists of five types of algorithms: Maximum or Complete Linkage, Minimum or Single Linkage, Mean or Average Linkage, Centroid Linkage and Ward's Minimum Variance criterion. One of the most reliable algorithms among agglomerative clustering is Ward's criterion (Hands and Everitt,1987; Ferreira and Hitchcook, 2009). In this thesis, Ward's algorithm, which minimizes the total within-cluster variance, is used[iv].

This study statistically follows the approach set out by Alboukadel Kassambara (2017) in the book *Practical Guide to Principal Component*. He applies both PCA and Hierarchical Clustering on PCA in the R software package. In addition, in terms of PCA, this study follows previous studies' path that first produces dimension(s) using PCA and then uses this dimension(s) in panel data analysis (Aisen and Veiga 2011; Berggren et al. 2012; Barugahara 2014; Hira 2017; Nicolay and Valladares 2021).

1.4.1 Principal Component Analysis (PCA)

PCA is an exploratory method used to analyse a set of p quantitative variables observed on n units. The objective is to eliminate the redundancy in considering a series of elementary variables correlated within each other, replacing them with a smaller number of latent variables that are not correlated and can provide a sufficient share of the overall information contained in the original variables. In essence, PCA identifies a set of latent variables, named principal components, composite indicators or factors, linear combinations of the original variables and uncorrelated. The latter feature allows to visualize both the units and the variables in reduced subspaces where each axis is a factor and the axes are orthogonal. Namely, they explain a different (and also decreasing) part of the variability of the phenomenon.

Before using PCA, which means before constructing composite indicators, the data has to be standardized to eliminate the effect of a different variability and simultaneously analyse variables expressed in different units of measurement. Standardization is a process of centring and scaling of the data included in the analysis[v]. A common standardization method is to transform all the data to have a zero mean and unit standard deviation as in the following:

$$\frac{X-\mu}{\sigma} \qquad (3)$$

In equation (3), μ and σ are the mean and standard deviation of the x variable.

A data matrix X with *p* variables and *n* observations can be visualised as the following (Emara and Chiu 2016):

$$X=\begin{bmatrix} X_{1,1} & \cdots & X_{1,p} \\ X_{1,2} & \dots & X_{2,p} \\ . & \cdots & . \\ X_{n,1} & \dots & X_{n,p} \end{bmatrix} ;\ \text{where } i = 1 \dots . n, j = 1 \dots p \quad (4)$$

Mathematically, PCA aims to reduce the data matrix X from *p* dimensions to a fewer dimension *k*, where $k < p$, simultaneously keeping as much information (i.e., variance maximization) as possible in this dimension-reduced data matrix with the size *n* x *k* . PCA replaces a large number of correlated variables (X_1, …, X_p) with a smaller number of uncorrelated variables (Principal Components; PC_1, …, PC_k) (Emara and Chiu 2016). Uncorrelated variables (orthogonal) means that PCA measures different statistical dimensions in the data.

In the end, the first principal component is a linear combination of the observed variables from X_1 to X_p that account for the largest variance among them (Emara and Chiu 2016):

$$PC_1 = a_1 X_1 + a_2 X_2 + \dots + a_p X_p \quad (5)$$

In equation (5), the vector of coefficient a_j (j = 1…*p*) is entitled loading vector. Furthermore, it is normalized to avoid augmenting the variance of PC_1. The second principal component (PC_2) is another linear combination of the X variables, accounting for the largest variance among them. However, with a constraint, PC_2 is required to be orthogonal to PC_1, and it identifies what is not captured by the PC_1. The variances of the principal components are called eigenvalues and are used to choose the number of meaningful PCs to be retained for interpretation. More specifically, several criteria such as Kaiser criterion (Eigenvalue-One-Criterion), Scree Test,

Cumulative Percent of Variance are amongst the commonly used (Othman et al. 2017). Kaiser criterion is probably widely adopted by researchers performing PCA. It indicates that for standardized data, principal components corresponding to eigenvalues larger than 1 are retained; only components that bring more than original variables are adopted. The Scree test criterion selects meaningful PCs by observing the Scree plot that is a plot of eigenvalues versus the number of PCs. The elbow point where the slope of the scree plot changes decides the number of PCs (Saporta and Niang 2009). The cumulative percentage of total variance arranges the number of PCs by considering a pre-selected cumulative variance threshold, which is widely accepted between 70%-99 % (Othman et. al 2017). This criterion keeps PCs that build up a cumulative percentage of total variance equal to or further than the designated threshold.

The advantage of the PCA is that it allows for determining weighted linear combinations of the original variables, which explains most of the variability, where the weights are the eigenvectors. In the literature, to identify several political instability dimensions, Principal Component Analysis is commonly used by researchers to avoid imposing a one-dimensional structure with a potentially arbitrary weighting scheme on the data. Using this method, variation and avoiding testing partially correlated indices against each other are maximized. In this thesis, PCA is proposed as a useful data reduction method to identify the components of political instability according to the ICRG indicators in this analysis. After the original data are transformed by PCA, a cluster analysis is performed on the selected components. According to Kasambara (2017), the combination of principal components and hierarchical clustering analysis provides several advantages when working with a multidimensional data set containing multiple continuous variables. In this context, PCA can reduce the data dimension into a few continuous variables containing the most critical information in the data. In this analysis, since we primarily deal with the extraction of dimensions, which are a better identification of the political instability, by performing PCA, Hierarchical

Clustering Analysis, which is built on principal components, groups countries more accurately in terms of their similarities in political instability. It strengthens the result of the analysis.

1.4.2 Hierarchical Clustering on PCA: Ward's Method

In this study, we perform Ward's algorithm, which is amongst the most widely used in hierarchical clustering whose aim is to group similar objects (in our case: countries) into clusters. Hierarchical clustering begins by treating each observation as a separate cluster. Then, it repeatedly tries to find the closest pair of clusters, merges them until there is only one cluster.

Before running Hierarchical Clustering by using Ward's algorithm, it is necessary to calculate the distances among all the observations (Murtagh et al. 2011). In the literature, Euclidean and Manhattan distances are commonly used by researchers while performing hierarchical clustering. Euclidean distance or Euclidean metric gives the shortest distance between two points in the Euclidean space. Yet, Manhattan distance always gives a longer distance. However, the default distance measure is the Euclidean distance in many software packages. We also perform Euclidean distance while running Ward's algorithm in the hierarchical clustering.

This Ward algorithm is based on the Huygens theorem, which decomposes the total inertia (total variance) in between and within-group variance. The total inertia can be decomposed: with x_{iqk} ,the value of the variable *k* for the individual *i* of the cluster *q*, $\overline{X_{qk}}$ the mean of the variable k for cluster q, $\overline{X_k}$ the overall mean of variable *k* and *Iq* the number of individuals in cluster *q*.

$$\sum_{k=1}^{K}\sum_{q=1}^{Q}\sum_{i=1}^{lq}(X_{iqk}-\overline{X_k})^2=\sum_{k=1}^{K}\sum_{q=1}^{Q}lq(\overline{X_{qk}}-\overline{X_k})^2+\sum_{k=1}^{K}\sum_{q=1}^{Q}\sum_{i=1}^{lq}(X_{iqk}-\overline{X_{qk}})^2$$

Total inertia = Between inertia + Within inertia

Ward's method consists of aggregating two clusters such that the growth of within-inertia is minimized (in other words minimizing the reduction of the between-inertia) at each step of the algorithm. The within inertia characterizes the homogeneity of a cluster. The hierarchy is represented by a dendrogram, which is indexed by the gain of within-inertia. As previously mentioned, Hierarchical Clustering is performed on the principal components.

1.5 Empirical Results

As mentioned above, to define the components of political instability among ICRG political risk variables, this study uses PCA. It is done without much loss of information by considering most of the variance found in the ICRG political risk variables.

The primary purpose of PCA can be sorted in the following way: identify hidden patterns in a dataset; to reduce the dimensionality of the data by removing the noise and redundancy in the dataset.

Therefore, PCA helps to diminish this redundancy and transform the original variables into smaller variables. The correlation among variables should be calculated to determine whether this dataset is appropriate for applying PCA before running the analysis. If correlations of variables are equal to zero, using PCA would not be meaningful. That is, if none of the variables correlates, the variables themselves will be the main components. To sum up, this technique removes the correlation and creates a shorter list of uncorrelated variables.

The pairwise correlation coefficients of the political instability indicators can be found in Table 1.4. The indicators refer to *S_EC(Socioeconomic Condition); IP (Investment Profile); IC(Internal Conflict); EC(External Conflict); COR(Corruption); MP(Military in Politics); RT(Religious Tensions); L_O(Law and Order); ET(Ethnic Tensions); DA(Democratic Accountability); BQ(Bureaucracy Quality).* It is thus established that all political instability indicators can be included in the PCA, and there is enough correlation among the variables to

justify the use of PCA. That is, it is possible to achieve a smaller number of significant composite variables.

Table 1.4

Correlation Among Variables

Var.	S_EC	IP	IC	EC	COR	MP	RT	L_O	ET	DA	BQ
S_EC	1										
IP	0.740	1									
IC	0.543	0.550	1								
EC	0.251	0.445	0.598	1							
COR	0.737	0.746	0.558	0.381	1						
MP	0.643	0.653	0.732	0.544	0.642	1					
RT	0.269	0.289	0.585	0.315	0.314	0.474	1				
L_O	0.697	0.588	0.481	0.179	0.736	0.613	0.210	1			
ET	0.377	0.345	0.464	0.289	0.291	0.379	0.419	0.259	1		
DA	0.471	0.526	0.524	0.363	0.565	0.622	0.331	0.452	0.171	1	
BQ	0.727	0.671	0.526	0.346	0.762	0.622	0.255	0.656	0.260	0.612	1

The next step is to find the number of components to be extracted from the whole dataset. After determining the dimensions of political instability, we perform which government forms are well represented by which dimension of political instability.

1.5.1. Principal Component Analysis (PCA) on 117 Countries and Government Forms Characterization

This analysis is carried out in two phases. The first phase is wholly related to the composition of principal components and their selections. The following statistical criteria are applied to extract the proper number of components in the PCA: Eigenvalue one (Kaiser's rule), Percentage of Cumulative Variance and Scree Test Criterion (Cattell 1976). The second phase is about the supplementary qualitative variable, represented by System (government form) in our analysis, and individuals represented by countries in this study.

The first method is the Eigenvalue method, which can define the number of principal components to retain after PCA (Kaiser 1961). Kaiser's rule is based on the principal of retaining components, which are higher or equal power to explain the data than a single variable (Rea and Rea 2016). PCs account for more variance than considered by one of the original variables in standardised data. This is commonly used as a cut off point for which PCs are retained (Kassambara 2017). The second one is the cumulative variance method, according to which a cumulative variance of approximately 70% is quite satisfactory. The third method is based on the Scree plot, the plot of eigenvalues ordered from largest to the smallest (Jolliffe 2002, Peres-Neto, Jackson, and Somers (2005). It is based on observing a change in behaviour in the plot of the variance explained. However, the first two methods commonly stand out for the selection of components.

Table 1.5 shows the list of the eleven components, which allows us to identify different dimensions of political instability. Recall that Government Stability (GS) is omitted from the analysis because it highly differentiates from other variables. Furthermore, we assume that the reason why GS does not correlate with other variables may stem from its skewness. And working with skew data is not favourable. In this context, since the analysis is performed with 11 political risk indicators, 11 principal components are produced by PCA.

The proportion of variation explained by each eigenvalue is given in the third column (for example, the first component explains 55% of variability obtained by dividing 6.044 by 11) . The cumulative percentage is shown in the last column.

Table 1.5

Results of the PCA: For Each Component (first column) Eigenvalues, Percentage of Variability (second column) and Cumulative Percentage of Variability

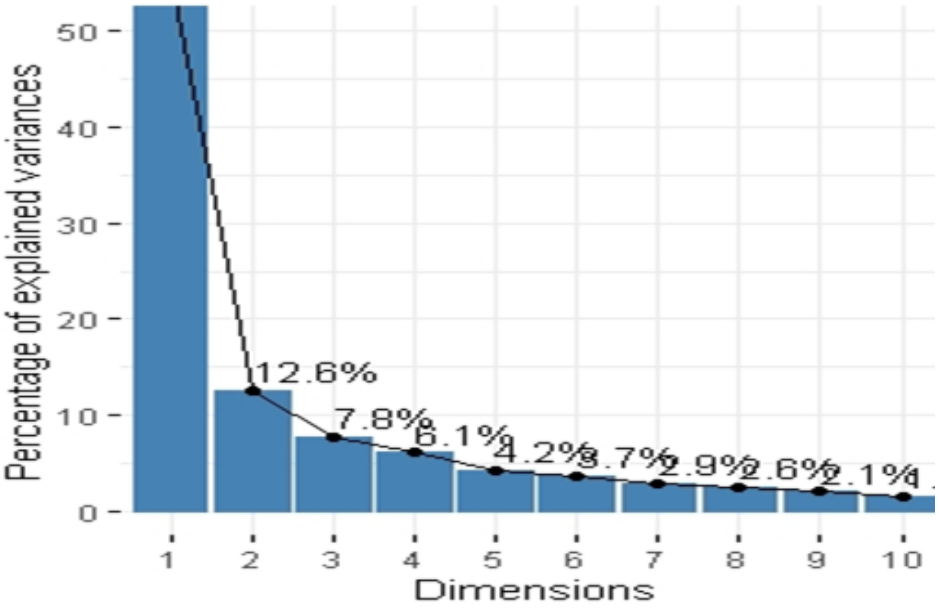
INITIAL EIGENVALUES			
Principal Components	Eigenvalue	Variance (%)	Cumulative Variance (%)
PC_1	6.04	54.94	54.94
PC_2	1.37	12.49	67.44
PC_3	0.86	7.87	75.31
PC_4	0.67	6.10	81.42
PC_5	0.46	4.25	85.66
PC_6	0.40	3.64	89.31
PC_7	0.32	2.91	92.22
PC_8	0.28	2.58	94.80
PC_9	0.22	2.08	96.88
PC_{10}	0.18	1.60	98.48
PC_{11}	0.17	1.52	100.00

The first two principal components explain about 67.4 % of the variation, an acceptable percentage when looking at the table. However, the first principal component has very high variability. As to eigenvalues, the first two principal components' eigenvalues are higher than one. By considering both eigenvalue and cumulative variance percentage, the first two components should be employed in this analysis.

The Scree Plot (Figure 1.4) confirms that PC_3 could also be considered. Based on the graph, after the third component, the curve has started to become straight; that is to say, unique variance starts to dominate the components after that point. However, the percentage of variability explained by PC_3 is very limited, and the choice of the first two components is confirmed by both eigenvalue and cumulative variance criteria.

Figure 1.4

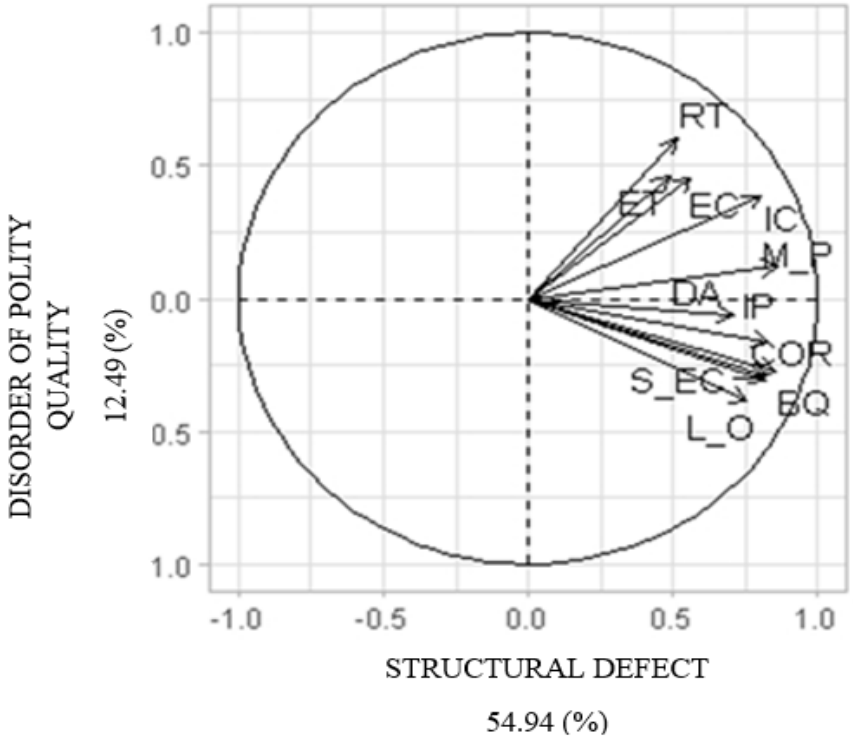
Scree Plot of the Percentage of Variability Explained by the Principal Components



Variables can be visualized on the first factorial plane, considering that, in the case of standardised variables, the coordinates on each factor represent the correlation between each variable and the considered principal component (Abdi and Williams 2010). The correlation plot (Figure 1.5) explains that positively correlated variables are grouped together; negatively correlated are positioned on opposed quadrants. Furthermore, the distance between variables and origin is highly important for interpreting this graph. As long as the variables become distant from the origin, it means that they are well-represented on the factor map graph. Besides, we consider which original variables have the highest correlations with the principal component to determine a subset of variables from a larger dataset.

Figure 1.5

Variables Factor Map (PCA)



In the figure, the first two principal components are shown together on the factor map. According to the factor map and looking at the first component, all the variables are positively correlated with this factor, but *IC, M_P, COR, IP, S_EC, BQ* show the highest correlations. The second component counterposes two groups of variables and is much more correlated to *RT, ET, EC, L_O, BQ*.

Table 1.6. shows the correlations between variables and the first two principal components. The higher the coordinate is, the higher is the correlation with the factor and the importance of the variable.

Table 1.6

Correlations Between Variables and Factors

Variables\Components	PC_1	PC_2
S_EC	**0.823**	-0.293
IP	**0.830**	-0.164
IC	**0.801**	0.384
EC	0.561	**0.452**
COR	**0.857**	-0.275
MP	**0.863**	0.125
RT	0.514	**0.602**
L_O	0.753	**-0.387**
ET	0.486	**0.457**
DA	0.707	-0.060
BQ	**0.822**	**-0.307**

*Note:*Bold numbers indicate the selected features.

PCA is used as a data reduction method to measure political instability based on the selected variables. With this aim, the two principal components must be interpreted according to the role played by the variables (coordinates or correlations, as previously pointed out). The first component can be interpreted as a factor of instability. It can be evaluated as a size effect separating between countries based on their low or high political instability. The first component is much more important in identifying political instability than the second component since it retains a very high variability. According to Table 1.6, the following six political instability variables generate PC_1 (*Internal Conflict(IC), Military in Politics (MP),Corruption (COR), Investment Profile (IP), Socioeconomic Conditions(S_EC), Bureaucratic Quality (BQ). They* reflect a broad range of structural deterioration, unease causing political instability in the society. We name this factor as *Structural Defect*.

The second component can be considered as a shape factor, highlighting how countries differentiate according to different aspects of the instability. It counterposes two groups of

variables: *Religious Tension (RT),Ethnic Tension (ET), External Conflict (EC), Internal Conflict (IC),Military in Politics(M_P) to Democratic Accountability (DA), Investment Profile (IP), Corruption (COR),Bureaucratic Quality (BQ), Socioeconomic Conditions (S_EC), Law and Order (L_O)*. The following five political instability variables much more characterize the second component: *Religious Tension (RT),Ethnic Tension (ET), External Conflict (EC) and Law and Order (L_O), Bureaucratic Quality (BQ)*

Before giving a label for the second component, it is essential to present the way that it is interpreted. *External Conflict (EC), Religious Tension(RT), Ethnic Tension (ET)* highly reflect a social disturbance, and they lead to an unstable political climate in countries. They can stem from the inability to produce analytical policies in societies. Ethnic Tension (ET) and Religious Tension (RT) may be due to the absence of a set of inclusive laws and rules across all the segments of societies. More specifically, if a government does not enact protective rights for religious minorities living in a country; and, if there are no laws and policies, which guarantee the interests of ethnic minorities by ignoring the multi-ethnic structure, all these reasons may lead to the escalation of religious and ethnic tensions (RT and ET).

Moreover, in foreign affairs, improper steps and policies implemented by the government, the existence of legal gap leads to an external conflict (EC). Note that the term of external conflicts includes not only cross-border conflicts and war but also diplomatic pressures. Each of these circumstances can lead to political instability in the end. As to inefficient Bureaucracy Quality (*BQ), Law and Order(L_O)* are highly related to the quality of rules. If bureaucracy is inefficient, laws will be implemented slowly (Gratton et. al. 2017). In addition, a weak legal and judicial system (namely weak law and order) already characterize the law gap in societies. If they are not resolved, they can lead to political instability in the end. These two points of political instability meet on common ground. They are related directly or indirectly to *Disorder of Polity Quality* in societies. This is referred to the second component. Considering that the second component is

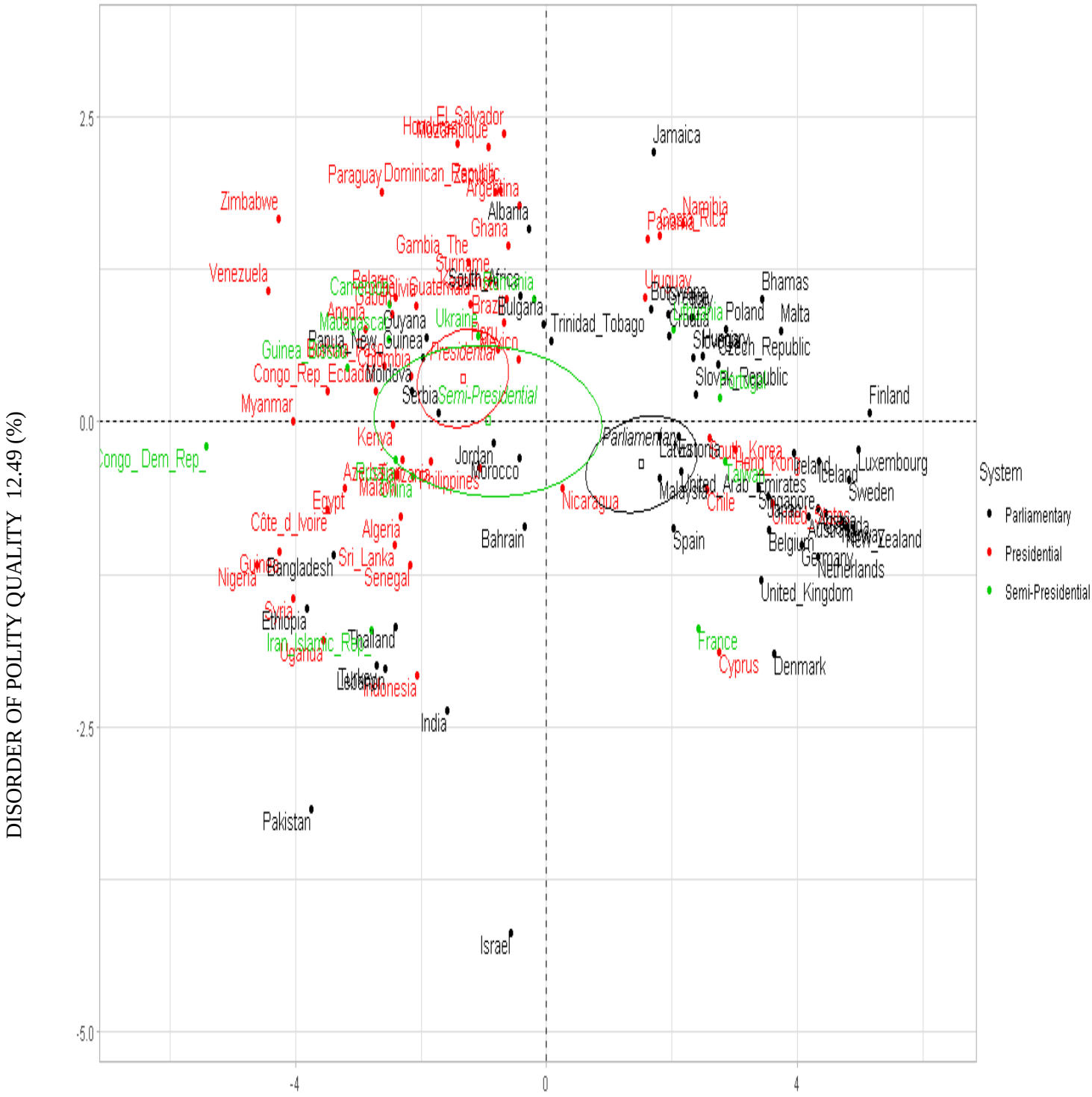
explained within the framework of the law gap, Disorder of Polity Quality is a suitable name. Because it is often conceived that law and polity are closely linked, the law is a product of the polity (Cappeletti et al. 1986:4; Dehousse and Weiler 1990:243, cited in Augenstein and Dawson 2012). In essence, these kinds of law gaps leading to political instability can be examined under the lack of polity.

The difference between the second component and the first one is that *Disorder of Polity Quality* can be solved and regulated with the help of the enhancement in polity quality, negotiations and diplomacy. By doing so, the Disorder of Polity Quality aspect of political instability can be stabilized in a shorter time than the Structural Defect, which better identifies political instability according to PCA results. However, the Structural Defect aspect of political instability reflects relatively strict issues causing political instability in the end, and it may take much longer to resolve. For instance, the following factors of political instability such as the military playing an active role in politics (MP), a huge gap in socioeconomic conditions (S_EC), the investment profile of countries(IP) or internal conflicts (IC) - terrorist attacks, coup threats- etc. represents the more rigid and inflexible sides of political instability. More precisely, since the first component characterizes structural issues in the countries, it is named as Structural Defect in this study.

After determining the dimensions, this study also investigates which government form is characterized by what dimension of political instability. In this step, the government form is included in the analysis as a categorical supplementary variable. The visualisation of the link among individuals (countries), variables (political instability variables), supplementary categories (government forms) can be found in the following figure.

Figure 1.6

Individuals and Government Forms Factor Map (PCA)



In Figure 1.6, Parliamentary System is highly characterized by the first component; that is *Structural Defect.* It is characterized by a positive coordinate on the *Structural Defect*, unlike that of the two systems. Furthermore, countries with a Parliamentary System are characterized by a different *Disorder of Polity Quality* (some of them have positive correlations and others negative); however, this is not as much as higher than *Structural Defect*. Presidential System is characterized by a negative coordinate on the *Structural Defect*. The countries governed by Semi-Presidential System are more or less equally distributed in all the quadrants, as confirmed by the position of the barycenter near the origin of the axes. The group of countries with a Presidential System is characterized by different features of *Disorder of Polity Quality*.

Recall that we have attempted to ask whether different forms of government are characterized by different aspects of political instability. Therefore, it can be commented that the main difference seems to be between parliamentary and presidential systems and mainly according to *Structural Defect*.

1.5.2. Exploring Countries Similarities with Respect to Political Instability

In this part, we perform Hierarchical Clustering Analysis (HCA) and use the complementariness between clustering and principal component methods to highlight the main features of the dataset. Considering the results of PCA, we will adopt the first two principal components as input variables for a Hierarchical Clustering. We will investigate countries similarities/dissimilarities based on the political instability, namely in terms of *Structural Defect and Disorder of Polity Quality.*

As indicated above, the Ward algorithm minimises the total within-cluster variance, and researchers do not determine optimal cluster numbers. It is based on the average distance of the observation located in the centre of a cluster from other observations in the same group. In this analysis, the determination of clustering depends on the result of the investigation; unlike that of

non-hierarchical clustering, Clusters are formed by maximising intra-cluster homogeneity. As a measure of homogeneity, the sum of squares within the group is used (Cryder et al., 2001: 756-765). One of the main advantages of this method is that it gives much clearer results for clustering. The rule of thumb for this method is that it is not known in advance how many clusters will be formed, unlike that of the non-hierarchical clustering method where the researcher defines this number. The dendrogram in Figure 1.7 suggests that the best partition should be in two classes. Notwithstanding this, we decide to explore the partition into three classes to have more balanced classes from the point of view of the number of countries and more details. The distribution of the countries in the three groups can be found in Figure 1.7, and contingency tables belonging to each three government forms are shown in Table 1.8.

According to Figure 1.7, Cluster 1 (with 45 countries) is represented by black, whereas Cluster 2 (with 26 countries) and Cluster 3(with 48 countries) are respectively shown by red and green colours. Countries are ordered from left to right based on their order in a hierarchical cluster dendrogram.

Figure 1.7

Hierarchical Cluster Dendrogram and Partition in 3 Clusters

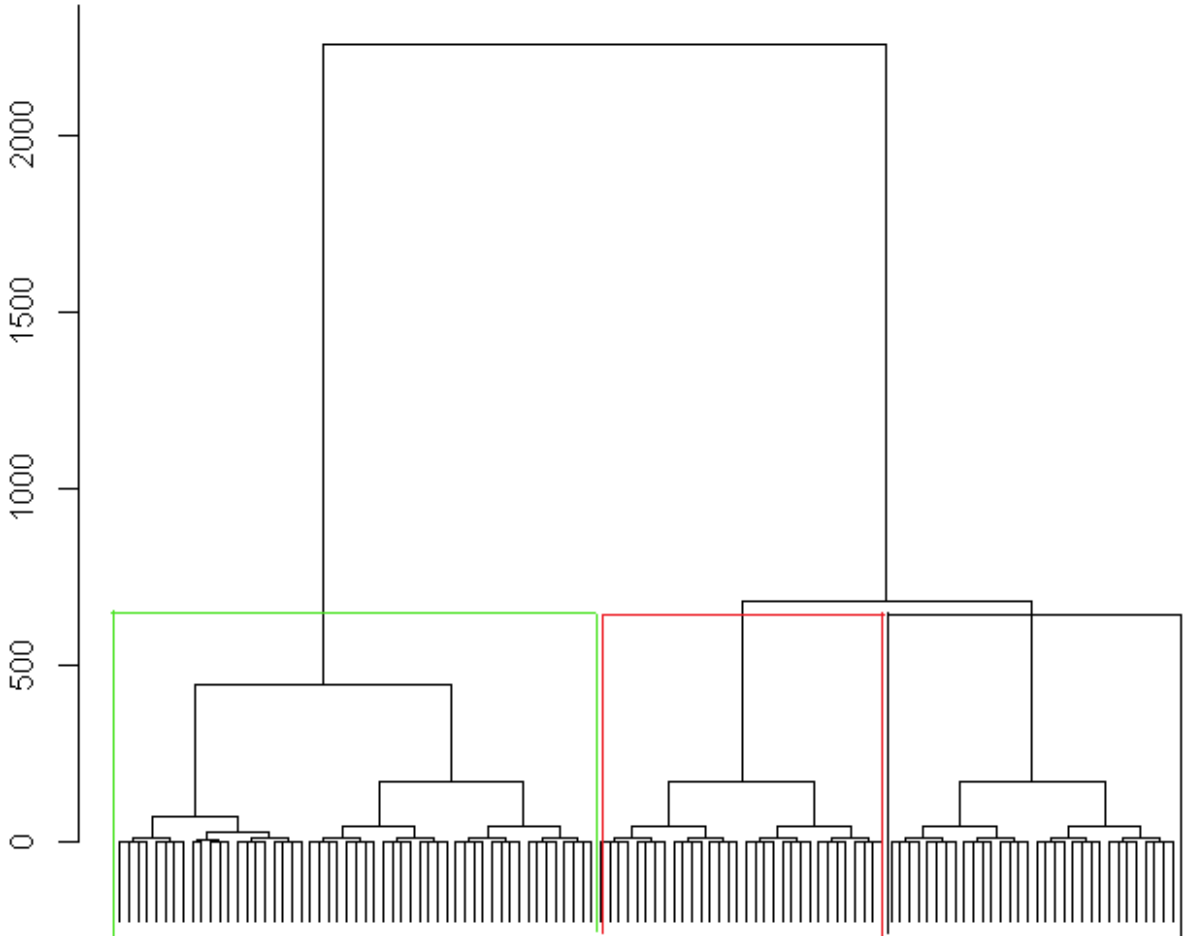


Table 1.7

Countries in 3 Clusters

Cluster 1						
Bolivia	Papua New Guinea	Guyana	Serbia	Colombia	Moldova	Paraguay
Belarus	Cameroon	Gabon	Angola	Ecuador	Burkina Faso	Madagascar
Senegal	Sri Lanka	Algeria	China	Tanzania	Kenya	Malawi
Russia	Azerbaijan	Bangladesh	Cote d'Ivore	Egypt	Myanmar	Congo Republic
Guinea Bissau	Israel	Thailand	Iran Islamic Rep.	Turkey	Lebanon	Indonesia
India	Pakistan	Nigeria	Guinea	Uganda	Syria	Ethiopia

Congo Democratic Rep.	Venezuela	Zimbabwe				
Cluster 2						
Philippines	Jordan	Nicaragua	Morocco	Bahrain	Ghana	Albania
Argentina	Honduras	Zambia	Dominican R.	Mozambique	El Salvador	Bulgaria
Trinidad Tobago	S.Africa	Romania	Gambia	Guatemala	Ukraine	Peru
Mexico	Suriname	Brazil	Kazakhstan	Jamaica		
Cluster 3						
Finland	Sweden	Luxembourg	Ireland	Iceland	Norway	New Zealand
Austria	Canada	Netherlands	Germany	Australia	France	Cyprus
Belgium	Singapore	Japan	United States	United Kingdom	Denmark	Portugal
Namibia	Panama	Costa Rica	Uruguay	Botswana	Italy	Greece
Croatia	Lithuania	Latvia	Spain	Estonia	UnitedArab Emirates	Malaysia
Latvia	Bahamas	Malta	Taiwan	Hong Kong	Chile	South Korea
Slovakia	Slovenia	Hungary	Poland	Czech Rep.		

Table 1.8

The Government Forms' Frequencies and Percentage in 3 Groups

Frequencies of Government Forms in 3 Groups				
	1	2	3	Row Total
Parliamentary	12	7	34	53
Presidential	26	16	9	51
Semi-presidential	6	3	4	13
Column Total	44	26	47	117

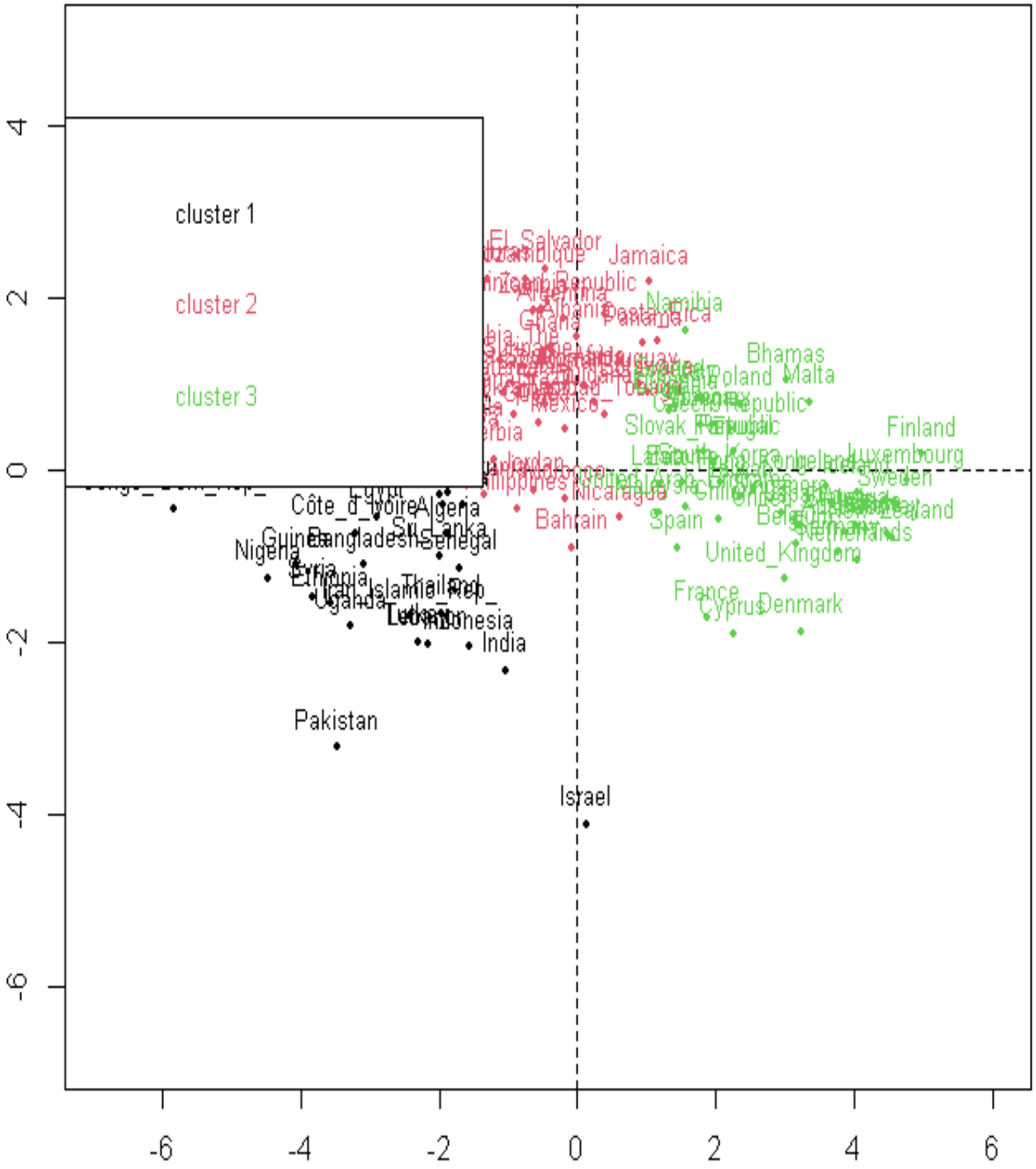
Percentages of Government Forms in 3 Groups				
	1	2	3	Row Total (%)
Parliamentary	22.6	13.2	64.2	100.0
Presidential	51.0	31.4	17.6	100.0
Semi-presidential	46.2	23.0	30.8	100.0

Furthermore, this research also shows the distribution of each three government forms into these three clusters considering above Table 1.8. Regarding the distribution of the Parliamentary System into three clusters, the countries belonging to Parliamentary System are mostly distributed –about 64%- to Cluster 3. The countries governed by Presidential System are highly included– about 51%- in Cluster 1 with respect to the rest of the clusters. The distribution of Semi-Presidential System in three clusters is much more distributes –around 46 %- to Cluster 1.

The following Figure shows the countries coloured according to the group they belong. As long as total inertia decreases, individuals become more standardized. As seen on the graph, whereas individuals in the first cluster are much further away, individuals in the second and third groups gradually become closer. These clusters are more homogeneous than the first group (Figure 1.8).

Figure 1.8

Representation of the Clusters on the Map Induced by First Two Principal Components



So far, it has been shown three clusters, which are suggested as an optimal number by Ward's algorithm. Table 1.9 describes the three clusters through the political instability indicators. The average of each indicator in the cluster is compared with the overall mean of the whole set of 117 countries. The last column shows the p-value.

From a very general perspective, political instability gradually rises from Cluster 1 to Cluster 3. However, Cluster 1 is mainly characterized by a low Structural Defect, cluster 2 by a higher Disorder of Polity Quality and cluster 3 by higher Structural Defect and a heterogeneous Disorder of Polity Quality. Hence, it is better to label the clusters according to their characterization by two dimensions of political instability. More clearly, they should be re-named based on their associations with Structural Defect (first dimension of political instability) and Disorder of Polity Quality(second dimension of political instability). In this context, *Cluster 1* is characterized by *Low Structural Defect Instability*. In contrast, *Cluster 2* is characterized by *High Disorder of Polity Quality Instability*, and *Cluster 3* refers to *High Structural Defect Instability*, respectively. It can be found how clusters can be associated with axes, namely Structural Defect and Disorder of Polity Quality, in Table 1.10. Thus, the reason for the new cluster tags can be understood more clearly in Table 1.10, which comes after Table 1.9.

Table 1.9

Political Instability Variables Describing Most Each Cluster

Variables	Mean category	Overall mean	p-value
Cluster 1 (Low Structural Defect Instability)			
L_O	3.02	3.72	2.84e-04
ET	3.01	3.90	2.92e-07
BQ	1.75	2.40	1.38e-05
COR	1.92	2.76	9.31e-07
RT	3.29	4.65	1.35e-13
S_EC	4.38	5.83	1.35e-05
EC	8.72	9.81	1.95e-10
DA	3.21	4.38	4.93e-08
IP	6.90	8.52	8.04e-09
IC	7.60	9.10	5.41e-14
MP	2.21	3.97	3.44e-13

Cluster 2 (High Disorder of Polity Quality Instability)			
RT	5.12	4.65	2.53e-03
BQ	1.94	2.40	2.21e-04
S_EC	4.74	5.83	8.91e-05
COR	2.24	2.76	3.01e-04
L_O	2.96	3.72	2.57e-06
Cluster 3 (High Structural Defect Instability)			
COR	3.93	2.76	2.1e-16
M_P	5.49	3.97	6.21e-14
S_EC	8.05	5.83	1.24e-15
IC	10.28	9.10	1.16e-12
IP	10.23	8.52	3.31e-13
BQ	3.38	2.40	7.75e-15
L_O	5.02	3.72	5.17e-16
DA	5.43	4.38	5.65e-09
EC	10.40	9.81	4.38e-05
ET	4.41	3.90	5.08e-04
RT	5.26	4.65	8.76e-05

In Table 1.9, Law and Order(L_O), Ethnic Tension(ET),Bureaucracy Quality (BQ), Corruption(COR), Religious Tension(RT),Socioeconomic Conditions(S_EC), External Conflict (EC), Democratic Accaountability (DA), Investment Profile (IP), Internal Conflict (IC), Military in Politics(M_P) are most significantly associated with the Cluster 1. Religious Tension(RT), Bureaucracy Quality (BQ), Socioeconomic Conditions(S_EC), Corruption(COR), Law and Order*(L_O)* are significantly associated with *Cluster 2* , and Corruption(COR, Military in Politics(M_P), Socioeconomic Conditions(S_EC), Internal Conflict (IC), Bureaucracy Quality (BQ) , Investment Profile (IP), Law and Order(L_O), Democratic Accaountability (DA), External Conflict (EC), Ethnic Tension(ET),, Religious Tension(RT),are significantly associated with *Cluster 3*.

As stated above, Table 1.10 explains why clusters are labelled with these names. The link between principal components and clusters is represented in table 1.10. The averages of the first two principal components, Structural Defect and Disorder of Polity Quality, are compared inside each group and in the whole sample. In line with the results, whereas *Cluster 1* has high coordinates on both *Structural Defect* and *Disorder of Polity Quality*, countries in *Cluster 2* and *Cluster 3* have high coordinates on *Disorder of Polity Quality and Structural Defect*, respectively

Table 1.10

Principal Components Associated with Clusters

Components	Mean category	Overall mean	p-value
Cluster 1 (Low Structural Defect Instability)			
Disorder of Polity Quality	-0.86	5.07e-15	6.73e-07
Structural Defect	-2.70	7.39e-15	1.09e-13
Cluster 2(High Disorder of Polity Quality Instability)			
Disorder of Polity Quality	0.91	5.07e-15	3.66e-10
Structural Defect	-0.62	7.39e-15	4.13e-02
Cluster 3 (High Structural Defect Instability)			
Structural Defect	2.74	7.39e-15	2.07e-19

. In addition, it is also calculated the paragons and individuals of clusters. The following table highlights each cluster using individuals (countries) specific to that cluster. It merely illustrates two different kinds of specific individuals, such as *paragons* and particular *individuals (*Husson et al.,2010). While paragons define the individuals, which are closest to the centres of the clusters, specific individuals define the individuals, which are furthest from the centres of the groups. The aim of applying these calculations is to indicate which individuals have the best

representation. Paragons and specific individuals of groups are shown in Table 1.11 and Table 1.12, respectively.

Table 1.11

The Specific Individuals of Clusters

Cluster 1				
Congo Dem Rep.	Pakistan	Israel	Nigeria	Guinea
5.57	5.15	4.74	4.59	4.17
Cluster 2				
El Salvador	Argentina	Mozambique	Albania	Dominican Rep
3.42	3.15	3.15	3.04	3.00
Cluster 3				
Finland	Luxembourg	NewZealand	Sweden	Norway
5.41	5.27	5.23	5.15	5.14

Table 1.12

Paragons of Clusters

Cluster 1				
Egypt	Russia	Malawi	Azerbaijan	Kenya
0.46	0.49	0.51	0.60	0.62
Cluster 2				
Kazakhstan	Brazil	South Africa	Suriname	Peru
0.60	0.15	0.26	0.35	0.40
Cluster 3				
Hong Kong	Taiwan	Portugal	SouthKorea	Singapore
0.16	0.33	0.41	0.50	0.57

In line with results, Congo Democratic Rep., El Salvador and Finland are the specific individuals of Clusters 1;2;3 , respectively. That is to say, those individuals furthest from the centres of other clusters.

Egypt, Kazakhstan and Hong Kong are the paragons of Cluster 1;2;3, respectively. These individuals are closest to the centre of their clusters.

1.6 Conclusion

The proposed study aims to observe different aspects of political instability and focuses on different forms of government. The analysis combines PCA and Hierarchical Clustering on the results of the PCA. Different aspects of political instability are conceptually determined by performing the PCA on the 11 indicators (Structural Defect and Disorder of Polity Quality). Furthermore, Hierarchical Clustering, performed on the selected principal components, measures how countries can be grouped based on their similarities in respect to political instability. Whereas Principal Component Analysis draws a general frame of dimensions of political instability, Hierarchical Clustering Analysis clusters countries and it selects the optimal dimensions for each cluster involved in the analysis.

According to PCA, the first principal component represents a *size effect* discriminating between countries according to their low or high political instability. It is named as *Structural Defect* since it represents a broad range of structural deterioration causing political instability. The second component is the *shape factor* of the analysis and it is referred to as *Disorder of Polity Quality* since all the variables stem from the failure of polities. They are the reasons for political instability sooner or later. These findings are the cornerstone of this thesis, as they will be used as a representation of political instability in the next two chapters.

Moreover, this research also investigates how three government forms are characterized by these two different aspects of political instability. To do so, it is measured and visualized the correlations of these government forms with dimensions. Parliamentary System stand out; it is highly characterized by a positive coordinate on the Structural Defect, while Presidential System is characterized by a negative coordinate on the Structural Defect. The

countries governed by Semi-Presidential System are more or less equally distributed in all the quadrants. Note that the Presidential System has positive coordinate on Disorder of Polity Quality unlike the rest of the systems.

With Hierarchical Clustering on PCA, the 117 countries' similarities/dissimilarities are observed, and a proper number of groups are identified based on their political instability. And this research also shows how these three different forms of government distribute into clusters. The results show that countries can be divided into three optimal clusters. The countries belonging to *Cluster 1* have low-level Structural Defect, and thus they are labelled as *Low Structural Defect Instability*. A high-level Disorder of Polity Quality characterizes the countries in Cluster 2, and so it is named as *High Disorder of Polity Quality Instability*. *Cluster 3* is mainly characterized by higher Structural Defect and a heterogeneous Disorder of Polity Quality. Since high-level Structural Defect much more characterizes it, it is referred to as *High Structural Defect Instability*. When observing each form of government distribution into to the clusters, the countries belonging to Parliamentary System are mainly distributed to Cluster 3, that is to say, *High Structural Defect Instability*. Presidential and Semi-Presidential System's distribution within clusters is mostly found in Cluster 1, which symbolizes *Low Structural Defect Instability*. In the final step, the correlations of each three clusters are shown with the first two principal components. The countries grouped under the Cluster 1 have a high correlation with the *Structural Defect* and the *Disorder of Polity Quality*, respectively.

This research presents in-depth analysis by using different techniques. Due to the lack of such a comprehensive study, this research can contribute to the literature. However, it is essential to state that this analysis is carried out by using 117 countries. We have tried to investigate this analysis with as many countries as possible according to access the data. Furthermore, since it is still a controversial issue about what the countries government forms

are in the political science literature, we consider the identifications in "The World Factbook" of Central Intelligence Agency (CIA), which is the reliable source in the literature.

Apart from the contribution to literature, this section is the basis of this thesis, since it will use *Structural Defect* and *Disorder of Polity Quality* as two different aspects of political instability in the following two chapters, which deal with the nexus between political instability and macroeconomic outlook, and the relationship between political instability, food security and income inequality.

Notes

[i] 17 Sustainable Development Goals (SDGs), which were adopted by all United Nations Member States in 2015, are an urgent call for action by all countries in a global partnership. These goals designed to be a "blueprint to achieve a better and more sustainable future for all". In this context, of 17 goals, Goal 2, Goal 10 and Goal 16 are highly associated with the issues discussed in the final chapter of this thesis. Goal is designed to end hunger, achieve *food security* and improve nutrition and promote sustainable agriculture. Goal 10 calls for reducing all forms of inequalities both in income and age, sex, disability, race, ethnicity, origin, religion, economic or other specific status within a country. Goal 16 claims that sustainable development cannot be hoped for without peace, justice, stability and effective polity. This goal is associated with Structural Defect and Disorder of Polity Quality, which reflects two different aspects of political instability in this study.

[ii] The World Health Organization (WHO), food security is comprised of three main pillars, Food and Agriculture Organization of United Nations adds another pillar, which is stability of these three pillars over time. This study adopts the definition of WHO, since the stability pillar is much more related to political stabilization. The other reasons are discussed in Chapter III.

[iii] Non-Hierarchical Clustering is not the focus of this research since Hierarchical Clustering is performed in this chapter. However, detailed information can be found in the article published by Gülağız and Şahin,2017.

[iv] Retrieved from: https://www.stat.cmu.edu/~cshalizi/350/lectures/08/lecture-08.pdf.

[v] Retrieved from: https://www.itl.nist.gov/div898/handbook/eda/section3/eda33e6.htm

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1.7Appendix

Appendix A.

Summarize Literature Review Table for Principal Component Analysis (PCA)

AUTHOR	MODEL	MEASUREMENT	DATABASE	VARIABLES	DIMENSIONS
Alex Cukierman, Sebastian Edwards,Guido Tabellini (1983)	Probit Model	Political Instability (1971-1982)	CharlesL. Taylor& DavidA. Joidece	•Dummy variable •Violent Riots, Repressions, Executive Adjustments, Attempts	•Government Change •Political Events
Nicholas Bitar,Mohamad Hamadeh,Roy Khoueiri(2019)	Principal Component Analysis (PCA)	Political Instability (2007-2018)	International CountryRisk Guide (ICRG)	•Bureaucracy Quality, Democratic Quality, EthnicTensions, Law and Order, Internal Conflicts, Religious Tensions •Corruption, External Conflict • Government Stability, Investment Profile, Militaryin Politics,Sociecono mic Conditions	•Cohesion •Quality of Institutions • Governance
Alberto Alessina, Roberto Perotti(1995)	Principal Component Analysis (PCA)	Political Instability (1960-1985)	Gupta(1990),J odice and Taylor(1988)	• Assassinations Death,Coups, Democracy	• Socio-political Instability(SPI
Douglas Hibbs(1973)	Principal Component Analysis (PCA)	Mass Political Violence (1948-1967)	Yale World Data Analysis Program	•Riots, ArmedAttack Events, Political Strikes, Assassinations, Deathfrom Political Violence, Antigovernment Demonstrations	•Mass-Political Violence
Luisa Blanco,Robin Grier (2008)	Principal Component Analysis (PCA)	Political Instability (1971-2000)	Cross-National Time Series	• CoupD'etat, Government Crisis, Revolution,	•Political Instability Index

			Database(CNTS)	Anti-government Demonstration, Riots, General Strike, Guerilla Warfare, Purge, Assassinations	
Ari Aisen,Francisco Jose Veiga (2011)	Principal Component Analysis (PCA)	Political Instability (1960-2004)	Cross-National Time Series Database(CNTS)	• Cabinet Changes, Executive Changes	• Regime Instability Index-I
Anthony Annett (2001)	Principal Component Analysis (PCA)	Political Instability	Easterly and Levine (1997)	• Communal and Political Victims, Civil Wars, Assassination, Coups, Revolutions, Riots, Government Crisis, Cabinet Changing and Constitutional Structures	• Political Instability Index
NauroF. Campos, JeffreyB. Nugent (2001)	Principal Component Analysis (PCA)	Sociopolitical Instability (1960-1965)	PolityIII Dataset	• Political Assasinations, Revolutions, SuccesfulCoups D'Etat	• Sociopolitical Instability
Sara Moller Toft (2008)	Principal Component Analysis (PCA)	Political Risk (1984-2005)	International Country Risk Guide(ICRG)	• Bureaucratic Quality, Corruption, Democratic Accountability, Social Conditions, Law and Order, Militaryin Politics	• Qualityof Institutions
				• Ethnic Tensions, Religious Tensions, External Conflicts, Internal Conflicts	• Conflict & Tensions
				• Government Stability, InvestmentProfile	• Policy Quality
Esone Ludwick Ndokang, André Dumas Tsambou(2015)	Principal Component Analysis (PCA)	Political Instability	BEAC documentation Service,Unescodatabase,CD-ROM of the World Bank (WDI)	• Political Assasinations, Political Arrests and Attempted Political Assasinations, Coups,Guerilla Actions, Military Spending	• Political Instability Index

Niclas Berggren, Andreas Bergh,Christian Bjornsko(2012)	Principal Component Analysis (PCA)	Institutional Instability	International Country Risk Guide (ICRG)	• Religious Tensions, Law and Order, Democratic Accountability, Military in Politics, Socioeconomic Conditions, Corruption, Bureaucratic Quality	• Legal
				• Investmen Profile, Government Stability, Socioeconomic Conditions	• Policy
				• External Conflict, InternalConflict, ReligiousTension Ethnic Tensions, Law and Order	• Tensions

Appendix B.

Summarize Literature Review Table for Hierarchical Clustering Analysis

AUTHOR	MODEL	MEASUREMENT	DATABASE	VARIABLES	CLUSTERS
Sébastien Saint-Arnaud, Paul Bernard (2003)	Hierarchical Cluster Analysis (Ward's Algorithm)	Welfare Regimes in Advanced Countries (1980-1990)	Esping-Andersen and Leib-friend-Bonnoli-Ferrera	• Social programmes, Social situations,Political Participation	• Social-Democratic regimes • Liberal regimes • Conservative regimes • Latin regimes
Xiaohui Cui,Thomas E. Potok,Paul Palathigal (2005)	Hierarchical Cluster Analysis (Ward's Algorithm)	Document Clustering	Text Retrieval Conference (TREC)	• The number of docement ranges from 204 to over 800, and the number of terms ranges from over 5000 to over 7000	• Dataset1 • Dataset2 • Dataset3 • Dataset4
Juliana Martinez Franzoni (2008)	Hierarchical Cluster Analysis	Welfare Regimes in Latin America (1999-2004)	IDB, ECLAC, WB, PAHO,UNESCO, UNDP,ILO,	• Labor Market Participation, Unemployment,	• Commodification

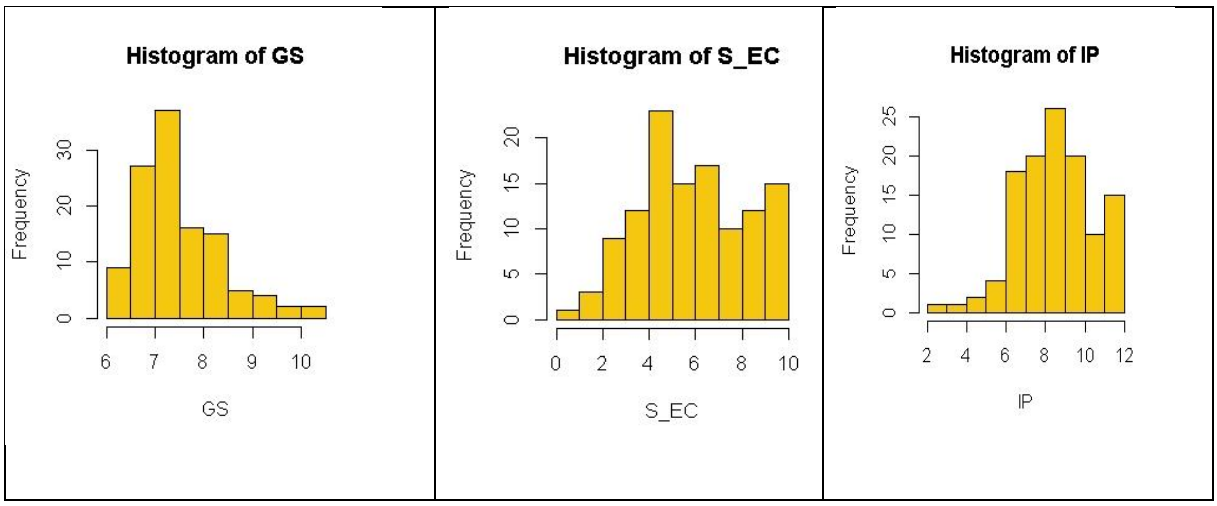
		Arrigada,CELADE, UNICEF	Female Economically Active Population, Children Participating in Labor Force, Occupied Salaried EAP(%), Unqualified Independent Workers(%), GNP(per capita), Poverty, Income inequality, Remittances (as % of GNP), Rural Population	
			• Private Expenditures on Health Care, Enrollment in Private Education (%), Private Consumption, Public Servants, Expenditures in Health Care, Expenditures in Education, Overall Social Expenditure, Overall Social Expenditures, Salaried Workers with Social Insurance	• Decommodification
			• Extended and Compound Families, Economically Active Women in Reproduce years(15-34), Female Heads of Households, Nuclear Families	• Defamiliarization

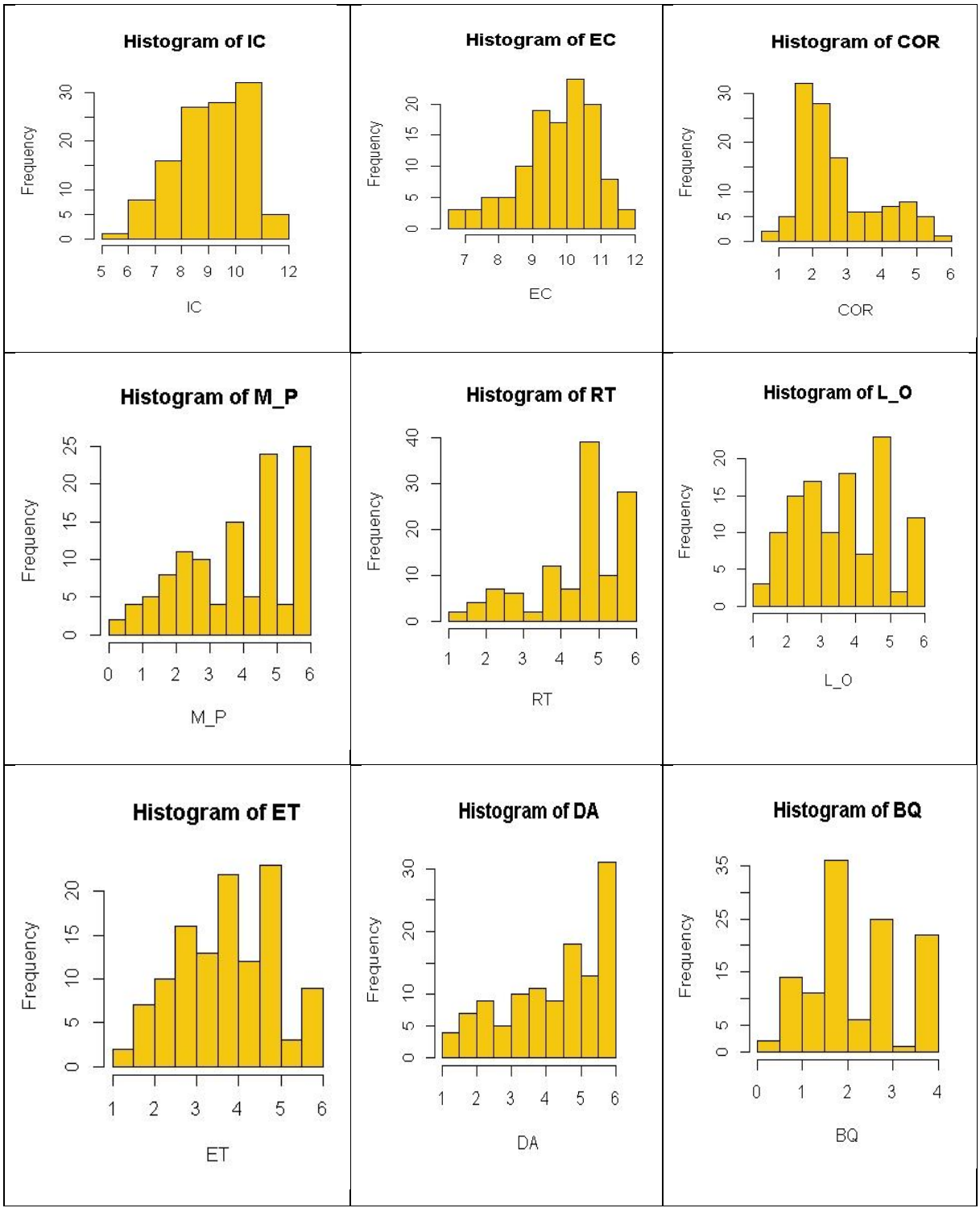
				Spouses with Unpaid Work(%), Domestic Servants, Population under 12 yrs Old, Population over 65 yrd old, Dependent Population 12-64 yrs old	
				• Infant mortality, Homicides (per 100.000 people), Gender Human Development Index, School Life Expectancy	• Performance
Yih-Jiunn Lee,Yeun-wen Ku(2007)	Hierarchical Clustering (Ward's Algorithm)	Welfare Regimes in East Asian (1980-1990)	Esping-Andersen and Leib-friend-Bonnoli-Ferrera	• Social Programmes, Social Stuations, Political participation	• Social-Democratic regimes • Liberal regimes • Conservative regimes
Murray Wolfson,Zagros Madjd-Sadjadi,Patrick James (2004)	Hierarchical Clustering (Ward's Algorithm)	(1967,1974,1981, 1988,1995)	Dataset on National Attributes	Politics, Economics, Conflict	• Advanced States (wealthy democracies with low conflict,high GDP and capital/labor ratio) • Poor States (anocratic with low conflict involvements, low GDP and capital/labor ratio) • Poor States (autocracies with low conflict involvements)
Mihaiela Ristei Gugiu, Miguel Centellas (2013)	Hierarchical Clustering (Ward's Algorithm)	The Democracy Cluster Classification (1980-2010)	Freedom House, PolityIV, Vanahanen's index of democratization, Cheibub et al.'s index of democracy and dictatorship, and the Cingranelli-Richards Index of	FH (2011); Cheibub, Gandhi, and Vreeland's index of democracy and dictatorship (2009)	• Democracy Cluster Classification (DCC)

			electrol self-determination)	(henceforth, DD); the Polity IV index (Marshall, Gurr, and Jaggers 2011); Vanhanen's index of democratization (2011); and the Cingranelli-Richards index of electoral self-determination (2011) (henceforth CIRI), formerly known as the index of politica	
Andreas F. Grein,S.Prakash Sethi, Lawrence Tatum (2008)	Hierarchical Clustering (Ward's Algorithm)	Country Clusters: the role of corruption and implications for global firms (1995-2000)	Transparency International, United Nations Statistically YearBook,Freedom House	• Economic, Technological ,Cultural Demographic, Quality of Life	Corruption

Appendix C.

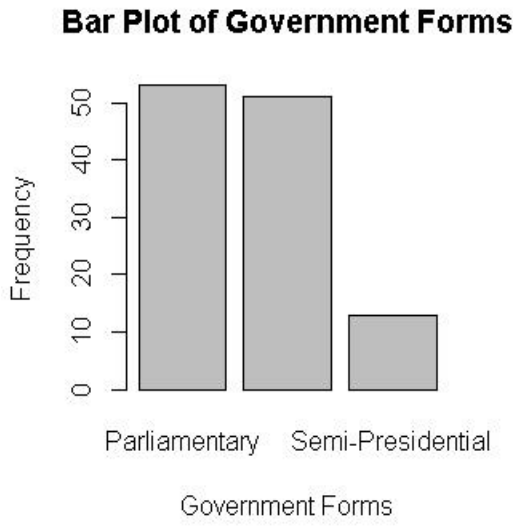
Histograms of Political Instability Variables




Histogram of IC
Frequency
IC
Histogram of EC
Frequency
EC
Histogram of COR
Frequency
COR
Histogram of M_P
Frequency
M_P
Histogram of RT
Frequency
RT
Histogram of L_O
Frequency
L_O
Histogram of ET
Frequency
ET
Histogram of DA
Frequency
DA
Histogram of BQ
Frequency
BQ

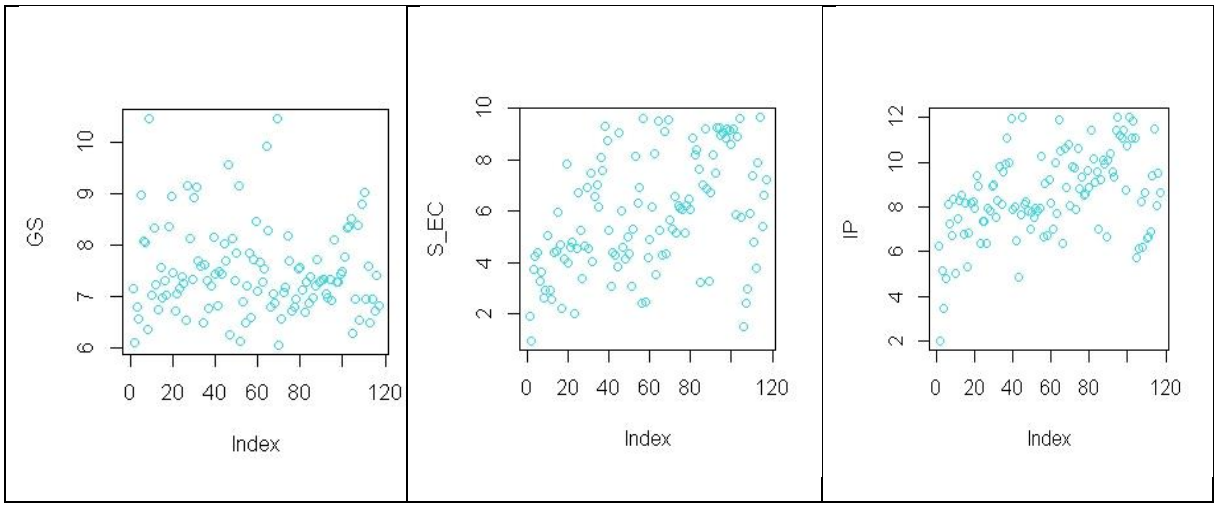
Appendix D.

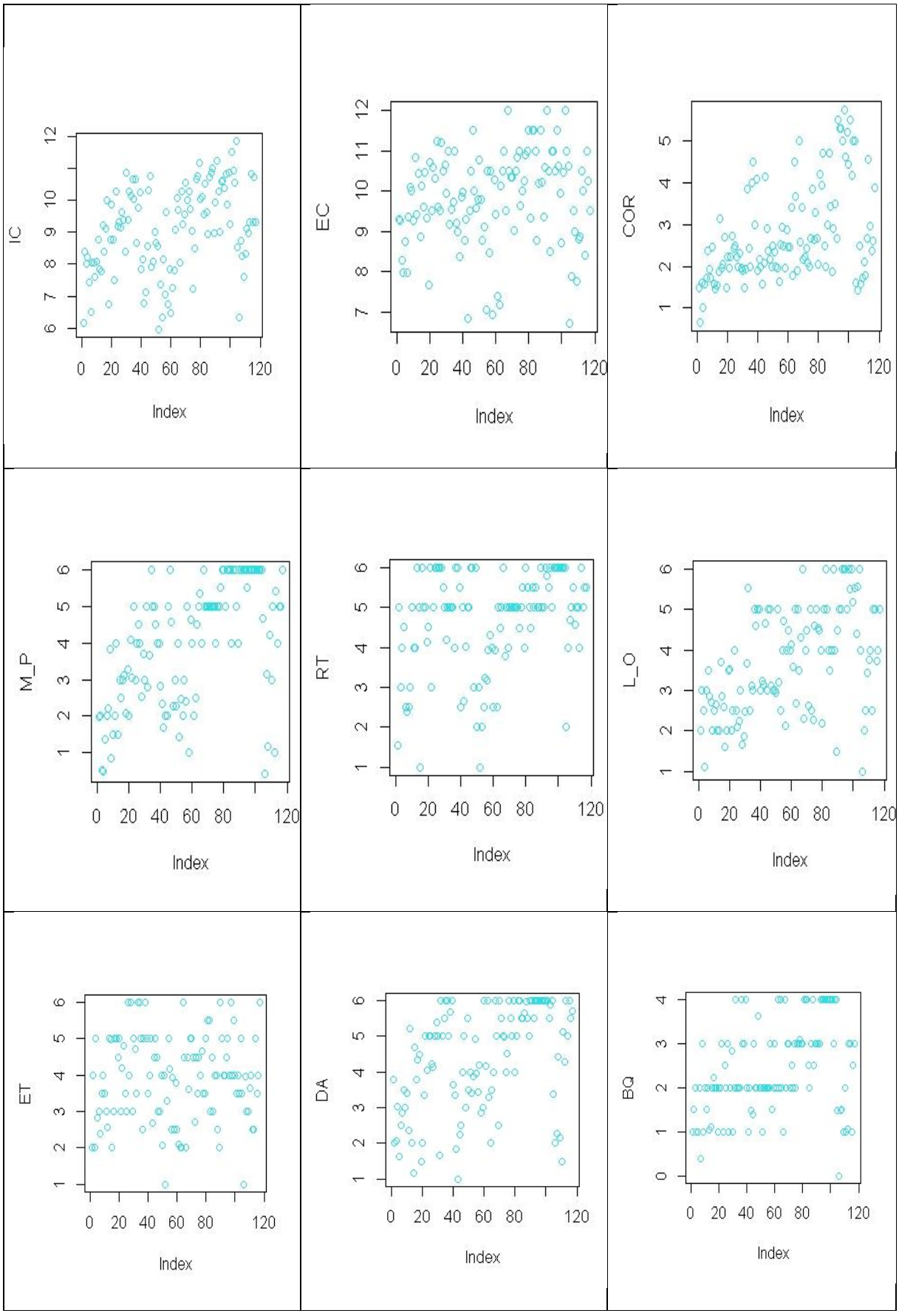
Barplot of Government Forms



Appendix E.

Scatter Plots of Polical Instability Variables




IC
EC
COR
M_P
RT
L_O
ET
DA
BQ
Index
0 20 40 60 80 120

Appendix F.

ANOVA Test Results

S_EC	Df	Sum Sq	Mean Sq	F value	Pr(>F)
System	2	116.5	58.26	14.08	3.42e-06***
Residuals	114	471.6	4.14		

IP	Df	Sum Sq	Mean Sq	F value	Pr(>F)
System	2	89.6	44.82	15.53	1.08e-06***
Residuals	114	329.0	2.89		

IC	Df	Sum Sq	Mean S	F value	Pr(>F)
System	2	14.05	7.02	4.07	0.02*
Residuals	114	196.60	1.72		

EC	Df	Sum Sq	Mean Sq	F value	Pr(>F)
System	2	12.87	6.43	4.08	0.007**
Residuals	114	144.36	1.26		

COR	Df	Sum Sq	Mean Sq	F value	Pr(>F)
System	2	33.68	16.84	15.96	7.78e-07***
Residuals	114	120.34	1.05		

M_P	Df	Sum Sq	Mean Sq	F value	Pr(>F)
System	2	84.74	42.37	21.25	1.44e-08***
Residuals	114	227.34	1.99		

RT	Df	Sum Sq	Mean Sq	F value	Pr(>F)
System	2	2.88	1.43	0.92	0.41
Residuals	114	177.75	1.55		

L_O	Df	Sum Sq	Mean Sq	F value	Pr(>F)

System	2	43.67	21.83	16.46	5.25e-07 ***
Residuals	114	151.25	1.32		

ET	Df	Sum Sq	Mean Sq	F value	Pr(>F)
System	2	2.48	1.24	0.89	0.41
Residuals	114	157.75	1.38		

DA	Df	Sum Sq	Mean Sq	F value	Pr(>F)
System	2	44.14	22.07	12.51	1.22e-05***
Residuals	114	201.09	1.76		

BQ	Df	Sum Sq	Mean Sq	F value	Pr(>F)
System	2	32.94	16.46	21.65	1.07e-08***
Residuals	114	86.70	0.76		
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*Note: Signif. Codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1.*

Appendix G.

TUKEY Test Results

S_EC	diff	lwr	upr	p adj
Presidential-Parliamentary	-2.1	-3.04	-1.15	0.00
Semi-Presidential-Parliament	-1.42	-2.92	0.06	0.06
Semi-Presidential- Presidenti	0.67	-0.82	2.17	0.54

IP	diff	lwr	upr	p adj
Presidential-Parliamentary	-1.79	-2.58	-1.00	0.00
Semi-Presidential-Parliament	-1.61	-2.86	-0.36	0.01
Semi-Presidential- Presidenti	0.17	-1.07	1.43	0.94

IC	diff	lwr	upr	p adj
Presidential-Parliamentary	-0.71	-1.32	-0.10	0. 02
Semi-Presidential-Parliament	-0.60	-1.56	0.36	0.30
Semi-Presidential- Presidenti	0.11	-0.85	1.07	0.96

EC	diff	lwr	upr	p adj
Presidential-Parliamentary	-0.48	-0.96	0.07	0.11
Semi-Presidential-Parliament	-1.03	-1.86	-0.20	0.00
Semi-Presidential- Presidenti	-0.59	-1.42	0.23	0.21

COR	diff	lwr	upr	p adj
Presidential-Parliamentary	-1.11	-1.59	-0.63	0.00
Semi-Presidential-Parliament	-0.91	-1.66	-0.15	0.02
Semi-Presidential- Presidenti	-0.20	0.55	0.95	0.80

M_P	diff	lwr	upr	p adj
Presidential-Parliamentary	-1.79	-2.45	-1.13	0.00
Semi-Presidential-Parliamentary	-1.19	-2.23	-0.15	0.02
Semi-Presidential- Presidential	0.59	-0.44	1.64	0.36

RT	diff	lwr	upr	p adj
Presidential-Parliamentary	-0.32	-0.90	0.25	0.38
Semi-Presidential-Parliamentary	-0.05	-0.97	0.86	0.99
Semi-Presidential- Presidential	0.27	-0.64	1.19	0.76

L_O	diff	lwr	upr	p adj
Presidential-Parliamentary	-1.28	-1.82	-0.75	0.00
Semi-Presidential-Parliamentary	-0.84	-1.68	0.00	0.05
Semi-Presidential- Presidential	0.44	-0.40	1.29	0.43

ET	diff	lwr	upr	p adj
Presidential-Parliamentary	0.07	-0.47	0.62	0.94
Semi-Presidential-Parliamentary	-0.41	-1.27	0.45	0.49
Semi-Presidential- Presidential	-0.48	1.35	0.38	0.38

DA	diff	lwr	upr	p adj
Presidential-Parliamentary	-1.28	-1.90	-0.66	0.00
Semi-Presidential-Parliamentary	-0.94	1.92	0.02	0.059
Semi-Presidential- Presidential	0.33	-0.64	1.31	0.69

BQ	diff	lwr	upr	p adj
Presidential-Parliamentary	-0.99	-1.39	0.58	0.00
Semi-Presidential-Parliamentary	-1.28	-1.92	- 0.64	0.00
Semi-Presidential- Presidenti	-0.29	0.94	0.34	0.51

Appendix H.

BARTLETT Test Results

S_EC by System	Barlett's K-squared	df	p-value
	0.9438	2	0.62

IP by System	Barlett's K-squared	df	p-value
	0.9123	2	0.38

IC by System	Barlett's K-squared	df	p-value
	2.637	2	0.27

EC by System	Barlett's K-squared	df	p-value
	3.207	2	0.20

COR by System	Barlett's K-squared	df	p-value
	10.38	2	0.00

M_P by System	Barlett's K-squared	df	p-value
	2.1528	2	0.34

RT by System	Barlett's K-squared	df	p-value
	2.3257	2	0.31

L_O by System	Barlett's K-squared	df	p-value
	1.0244	2	0.60

ET by System	Barlett's K-squared	df	p-value
	0.044221	2	0.98

DA by System	Barlett's K-squared	df	p-value
	4.7543	2	0.10

BQ by System	Barlett's K-squared	df	p-value
	0.18152	2	0.91

Appendix I.

Correlation Among Variables With " GS"

	GS	*S_EC*	*IP*	*IC*	*EC*	*COR*	*MP*	*RT*	*L_O*	*ET*	*DA*	*BQ*
GS	1.00											
S_EC	0.21	1.00										
IP	0.35	0.78	1.00									
IC	0.22	0.52	0.61	1.00								
EC	0.05	0.36	0.51	0.69	1.00							
COR	0.25	0.76	0.74	0.57	0.37	1.00						
MP	0.08	0.56	0.63	0.82	0.77	0.59	1.00					
RT	0.09	0.21	0.31	0.70	0.43	0.39	0.67	1.00				
L_O	0.09	0.73	0.61	0.41	0.23	0.79	0.44	0.26	1.00			
ET	0.25	0.51	0.53	0.43	0.38	0.39	0.50	0.33	0.42	1.00		
DA	-0.45	0.31	0.26	0.43	0.29	0.44	0.50	0.40	0.43	0.09	1.00	
BQ	0.10	0.76	0.69	0.54	0.39	0.83	0.63	0.36	0.67	0.36	0.58	1.00

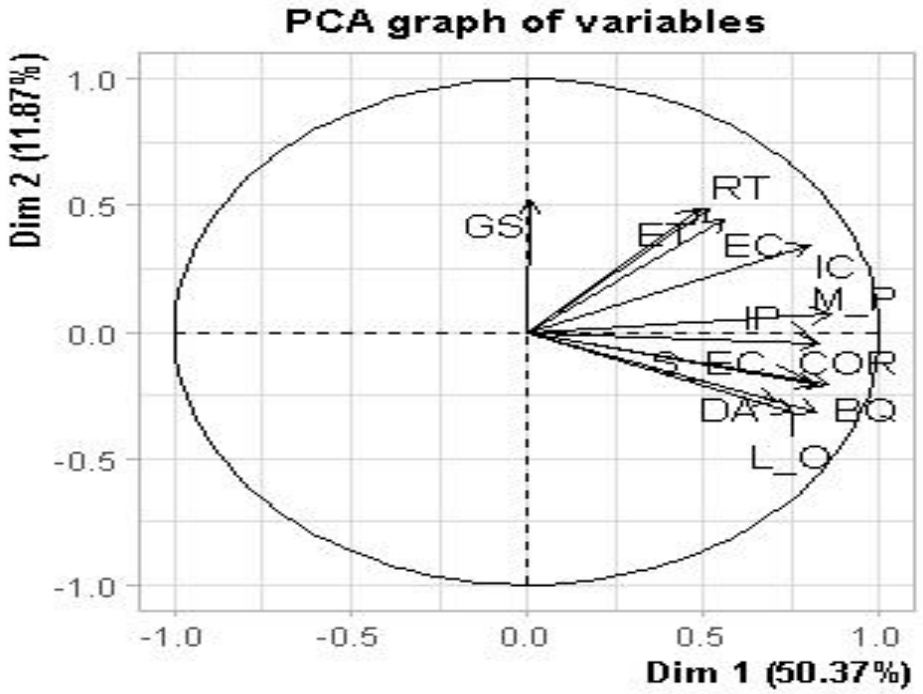
Appendix J.

Eigen Vector of Variables With "GS"

	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	PC9	PC10	PC11	PC12
GS	0.004	0.435	-0.700	0.169	0.252	-0.115	-0.206	-0.277	0.230	0.160	0.126	0.037
S_EC	0.335	-0.173	-0.229	-0.207	-0.066	-0.064	-0.055	0.559	0.173	-0.106	0.630	-0.026
IP	0.338	-0.036	-0.245	0.118	-0.089	-0.449	-0.230	0.246	-0.379	-0.174	-0.470	-0.305
IC	0.326	0.286	0.162	0.063	0.110	0.305	-0.093	0.099	0.512	-0.552	-0.300	0.031
EC	0.228	0.372	0.126	0.628	-0.326	0.136	0.326	0.007	-0.207	0.032	0.289	-0.201
COR	0.349	-0.174	-0.178	0.022	0.085	-0.086	0.352	-0.258	-0.276	-0.301	0.022	0.666
MP	0.351	0.059	0.128	0.099	0.058	0.324	-0.396	0.242	-0.139	0.564	-0.152	0.402
RT	0.209	0.411	0.328	-0.302	0.622	-0.239	0.240	0.052	-0.193	0.115	0.103	-0.152
L_O	0.306	-0.264	-0.218	-0.195	0.156	0.588	-0.001	-0.332	-0.240	-0.013	0.037	-0.460
ET	0.198	0.404	0.017	-0.586	-0.617	-0.058	-0.045	-0.248	-0.021	0.064	-0.016	0.045
DA	0.287	-0.233	0.385	0.182	0.019	-0.340	-0.462	-0.487	0.154	-0.031	0.292	-0.066
BQ	0.334	-0.263	-0.055	0.027	-0.063	-0.185	0.482	-0.053	0.504	0.447	-0.266	-0.131

Appendix K.

Correlation Factor Map With “GS”



Appendix L.

Correlation Between Variables and Factors With “GS”

	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	PC9	PC10	PC11	PC12
GS	0.009	0.519	0.777	0.155	0.192	-0.074	-0.118	-0.154	0.120	0.075	0.052	0.015
S_EC	0.823	-0.206	0.253	-0.190	-0.050	-0.041	-0.031	0.309	0.090	-0.050	0.260	-0.011
IP	0.830	-0.043	0.271	0.108	-0.068	-0.290	-0.132	0.136	-0.198	-0.082	-0.194	-0.125
IC	0.800	0.342	-0.179	0.058	0.084	0.197	-0.053	0.055	0.267	-0.260	-0.124	0.013
EC	0.561	0.445	-0.140	0.575	-0.248	0.088	0.186	0.004	-0.108	0.015	0.119	-0.082
COR	0.857	-0.207	0.197	0.020	0.064	-0.055	0.201	-0.143	-0.144	-0.142	0.009	0.272
MP	0.863	0.070	0.142	0.091	0.044	0.209	-0.227	0.134	-0.073	0.266	-0.063	0.164
RT	0.513	0.491	0.364	-0.277	0.473	-0.155	0.137	0.029	-0.101	0.054	0.043	-0.062
L_O	0.753	-0.315	-0.241	-0.179	0.118	0.380	-0.001	-0.184	-0.125	-0.006	0.015	-0.188
ET	0.486	0.483	0.019	-0.536	-0.469	-0.038	-0.026	-0.138	-0.011	0.030	-0.007	0.018
DA	0.706	-0.278	0.428	0.166	0.015	-0.220	-0.264	-0.270	0.080	-0.015	0.121	-0.027
BQ	0.821	-0.314	-0.061	0.025	-0.048	-0.120	0.276	-0.029	0.263	0.210	-0.110	-0.053

Appendix M.

Political Instability Variables Avaraged 10 Years (2008-2017)

Countries	S_EC	IP	IC	EC	COR	M_P	RT	L_O	ET	DA	BQ
Nigeria	1.89	6.26	6.16	9.29	1.5	1.97	1.55	2	2	3.78	1
Zimbabwe	0.95	2.04	8.4	9.25	0.67	2.01	5	3	4	2.02	1.5
Guinea	3.72	5.18	8	8.28	1.61	0.51	3	2.5	2	2.07	2
Venezuela	4.23	3.46	8.23	7.98	1	0.5	4	1.1	5	3.03	1
Myanmar	4.37	4.8	7.43	8.74	1.56	1.35	4.53	3	2.83	1.64	1
Uganda	3.28	8.1	6.5	7.96	1.72	2	2.5	3.5	3	2.5	2
Côte_d_Ivoire	3.62	7.23	8.05	9.37	2.38	2.2	2.4	2.85	2.4	2.87	0.4
Malawi	2.59	6.73	8.04	10.09	1.92	3.83	2.5	2.71	3.5	3.51	3
Congo_Rep_	2.9	8.34	7.59	10	1.72	0.85	3	2	4	3	1
Ecuador	5.03	5.07	8.1	9.27	2.46	1.5	5	2.5	3.5	3.42	2
Angola	2.92	7.48	8.76	10.83	1.56	2	4	2.65	3	2.35	1.5
Kenya	2.56	8.3	7.85	9.41	1.47	4	4	2	2.56	5.21	2
Paraguay	4.37	8.5	7.79	10.43	1.55	1.5	6	2	5	2	1.05
Belarus	4.42	6.81	9.2	8.85	1.87	3	5	3.71	4.99	1.18	1.11
Indonesia	5.96	8.19	8.4	10.13	3.14	2.5	1	2.85	2	4.68	2
Bolivia	4.7	5.32	9.11	9.61	1.96	3	6	2.6	3	3.78	2.24
Honduras	2.21	6.84	10.02	10.46	2.03	3.11	5	1.59	5	4.35	2
Colombia	4.12	8.2	6.75	9.33	2.68	2.08	5	2	5	4.5	2
Azerbaijan	7.82	8.25	8.78	7.65	1.5	3.28	4.14	3.5	4.5	1.5	1
Gambia_The	4	7.93	9.85	10.7	2.22	2.01	4.53	3.54	5	2	2
Guatemala	4.6	9.42	8.77	9.5	1.95	4.08	6	2	3	3.34	2
Philippines	4.81	8.94	7.51	10.58	2.23	3.05	3	2.5	4.2	5	3
Zambia	2	6.4	10.26	10.31	2.73	5	5	4	4.8	4.04	1
Ghana	4.55	7.39	9.19	11.24	2.43	3	6	2.5	3.5	5	2.5
Brazil	6.73	7.36	9.32	9.6	2.5	4	6	2.1	3	5	2
Argentina	5.23	6.35	9.14	9.5	2.22	4.5	6	2.24	6	4.23	3
Mozambique	3.35	7.94	9.62	11.2	2	4	6	3	4	4.13	1
El_Salvador	4.65	7.85	9.38	10.5	2.31	2.54	6	1.65	6	5	2
Mexico	6.93	8.93	8.4	10.64	1.95	3.71	5.5	1.88	3	5.39	2.83
Dominican_Republic	4.55	8.97	10.87	9.94	1.89	3	5	2.48	5	5	1
Kazakhstan	7.48	7.53	9.4	11	1.5	5	4.19	3.68	4.71	1.65	2
Nicaragua	4.04	8.3	10.28	9.16	1.93	2.8	5	5.55	3.5	6	4
Uruguay	6.55	9.8	10.14	9.55	3.83	3.67	5	2.5	6	5	2
Costa_Rica	7.01	8.12	10.66	9.73	2.44	6	5	3.12	6	5.5	2
Panama	6.17	9.59	10.04	11	2	5	5	3	5	6	2
Cyprus	8.08	9.93	10.67	9.2	4	5	4	5	2.5	6	4
Chile	7.6	11.08	8.67	9	4.5	4.5	6	4.61	5	5	3
South_Korea	9.3	10	9.75	8.38	3	4	6	5	6	5.67	3
United_States	8.73	11.95	10.24	9.86	4.08	4	5.5	5	5	6	4
Algeria	5.24	7.87	7.85	9.96	1.89	2.82	2.5	3	3.5	3.65	2
Burkina_Faso	3.07	8	8.15	8.78	2.15	2.34	5	3.24	4	3.36	1
Egypt	4.39	6.5	6.77	9.3	2	1.69	2.65	3.14	5	1.85	2
Syria	4.29	4.85	7.12	6.82	1.56	2	4.01	4.67	2.67	1	1.48
Gabon	3.85	7.67	8.55	9.5	2.06	2	5	3	4.5	2.25	1.4
Hong_Kong	9.05	11.99	10.31	10.5	4.14	5	5	5	5	2.5	3
Namibia	6	8.1	10.74	11.5	2.89	6	6	5	4.5	4	2

Peru	4.61	8.22	7.92	10	2.36	4.59	6	3.12	3	5	2
Senegal	4.13	7.83	8.1	9.56	2.15	2.28	3	3	3	3	3.62
Suriname	5	7	9	9.8	2	3	6	3	4	5.5	2
Sri_Lanka	4.36	7.74	8.67	10.78	2.5	2.27	2	2.93	2.07	3.49	2
Tanzania	3.06	7.54	8.56	9.78	2.35	4	3	5	4	4	1
Pakistan	5.32	7.97	5.97	8.78	2	1.42	1	3.21	1	3.4	2
Thailand	8.14	7.85	7.38	9.1	1.97	2.48	2	2.5	3.3	3.88	2
Lebanon	6.32	7.95	6.32	7.05	1.64	2	2.5	4	5	4.93	2
Bahrain	6.92	10.25	8.16	10.48	2.53	3	3.24	4.72	4.18	3.97	2
Bangladesh	2.41	6.67	7.07	8.45	2.93	2.39	3.18	2.13	2.5	3.45	2
Malaysia	9.61	9.05	9.62	10.5	2.5	5	3.92	4	3.92	4.2	3
Ethiopia	2.44	6.7	6.76	6.94	1.95	1	4.32	4.5	2.5	2.85	1.5
Jordan	4.17	9.22	7.83	10.28	2.87	4.65	4	4	3.79	3	2
India	4.89	8.15	6.48	9.43	2.45	4	2.3	4.14	2.5	6	3
Turkey	6.18	7	7.25	7.39	2.45	2	3.93	3.57	2.1	4.17	2
Israel	8.25	10	7.81	7.16	3.39	2.5	2.5	5	2	6	4
Papua_New_Guinea	3.5	7.73	9.09	10.13	1.78	4.5	5	2.68	2	3.28	2
Singapore	9.52	11.86	10.07	10.5	4.5	5	4.5	5	6	2	4
Botswana	5.25	10.5	9.69	11	3.65	5.35	5	3.5	4.5	3.5	2
Moldova	4.26	6.4	8.06	9.5	1.89	4	6	4.32	2	4	1
Netherlands	9.11	10.61	10.27	12	5	6	3.79	6	4.5	6	4
South_Africa	4.35	8.87	9.25	10.5	2.58	5	5	2.29	3.61	5	2
United_Arab_Emirates	9.58	10.78	9.55	10.35	3.4	5	4	4	5	2.5	3
Greece	5.68	8.07	10.55	10.33	2.15	5	5	4.5	5	6	3
Bulgaria	5.31	9.8	10	9.03	2.23	5	5	2.62	4.5	5.5	2
Latvia	6.55	9.75	10.26	10.5	2.44	5	5	5	2.7	5	2.5
Albania	5.16	7.87	9.73	10.82	2.06	5	5	2.5	4.5	4.98	2
Trinidad_Tobago	6.22	10.6	9.06	11	2	5	5	2.26	3.5	4	3
Morocco	6.11	8.81	7.23	9.63	2.65	4	5	4.61	4.5	4.52	2
Spain	6.05	9.35	8.5	10	3.85	5	4.5	5	4	6	3
Croatia	5.13	8.53	10.64	10.25	2.63	5	5	4.54	4.66	5.5	3
Slovenia	6.2	8.57	10.76	10.88	3.28	5.5	5.5	4.5	3.5	5	3.09
Slovak_Republic	6.45	9.62	11.16	11	2.65	6	4	4	3.5	6	3
Jamaica	6.06	8.89	10.05	11.5	2.03	6	6	2.2	5	4	3
Japan	8.85	11.45	10.1	9.32	4.18	5	5.5	5	5.5	5	4
Ireland	8.18	10.14	9.56	11.5	3.94	6	5	6	5.5	6	4
Belgium	8.38	9.09	10.5	11.5	4.7	6	4.5	5	3	6	4
Italy	7.64	9.59	9.64	11	2.5	6	5.5	4	4.5	5.5	2.5
Serbia	3.21	7.04	8.93	8.76	2	4	5	3.5	3	5.5	2
Hungary	7.01	9.21	10.73	10.19	3	6	5.5	4	4	5.64	3
Austria	9.23	10.09	10.87	11.5	4.69	6	5	6	4	5.96	4
Estonia	6.88	9.89	11.01	10.23	3.44	5	5	4	2.5	5.5	2.5
Guyana	3.28	6.64	8.97	9.37	1.86	4	6	1.5	2	5	3
Poland	6.73	10.1	9.93	10.58	2.89	6	5	4.5	6	6	3
Malta	8.21	10.37	11.24	12	3.5	6	5	5	5	6	3
Czech_Republic	7.48	9.58	10.27	10.5	2.65	6	6	5	4	5.5	3
Denmark	9.24	9.34	9.01	8.5	5.5	6	5.81	6	4	6	4
Norway	9.28	11.45	10.57	11	5.28	6	5.5	6	4.5	6	4
Sweden	8.93	12	10.63	11	5.28	5.5	6	6	5	6	4
Germany	9.03	11.2	10.39	10.5	5	6	5	5	4	6	4
Finland	8.86	11.06	10.83	11.5	5.72	6	6	6	6	6	4
Australia	9.19	11.41	9.85	10.61	4.6	6	6	5.5	4	6	4
Iceland	9.15	8.73	10.85	9.93	5.2	6	6	6	5.5	6	4

United_Kingdom	8.58	10.74	9.25	8.7	4.44	6	6	5.18	4	6	4
New_Zealand	9.2	12	11.5	10.45	5.5	6	6	5.55	3.5	6	4
Bhamas	5.84	11.08	10.92	12	4.15	6	6	4.41	4	5.5	3
Canada	8.9	11.83	10.54	11	5	6	6	5.56	3.5	5.9	4
Luxembourg	9.6	11.06	11.85	10.62	5	6	6	6	5	6	4
Iran_Islamic_Rep_	5.76	5.76	8.53	6.72	1.61	4.67	2	4	3.5	3.37	1.48
Congo_ Dem_Rep_	1.5	6.12	6.34	7.89	1.42	0.43	4	1	1	2	0
Cameroon	2.4	8.24	8.73	9.51	2.49	3.16	4.7	2	3.95	2.26	1.48
Guinea_Bissau	2.97	6.23	8.25	8.98	1.56	1.18	5	2.51	3	4.44	1.5
Russia	5.89	8.66	7.6	7.76	1.72	4.21	5.5	3.45	3	2.15	1
China	7.36	6.59	8.33	8.81	2.1	3	4.58	3.77	3.65	1.5	2
Ukraine	4.8	6.69	9.12	8.85	1.78	5	5	4	4	5.14	1
Madagascar	3.77	6.9	8.97	10.5	2.66	1	5	2.5	2.5	4.27	1.06
France	7.87	9.38	9.32	10	4.55	5.43	4	5	2.5	6	3
Taiwan	9.66	11.5	10.84	8.41	2.97	4	6	5	5	5	3
Romania	5.39	8.08	9.32	11	2.37	5	5	3.73	3.49	6	1
Lithuania	6.62	9.51	10.73	10.26	2.59	5	5.5	4	4	5.5	2.5
Portugal	7.23	8.62	9.32	9.5	3.87	6	5.5	5	6	5.71	3

Note: 10-year avarages of the data are calculated considering ICRG's annual political risk data.

CHAPTER II

THE RELATIONSHIP BETWEEN POLITICAL INSTABILITY AND MACROECONOMIC ENVIRONMENT

INTRODUCTION

What nexus, if any, is there between political instability and macroeconomic performance? This question has been one of the most prominent research fields both in economics and contemporary political science. The fact that national-international economics and political relations have become an increasingly holistic structure has made it challenging to evaluate them separately.

This study attempts to answer three questions. The first is to examine whether there is a causal relationship between different dimensions of political instability and macroeconomic performance. The second is to research how various dimensions of political instability and macroeconomic performance indicators adopted by this study interact simultaneously by allowing bi-directional causality. The third is to observe not only a direct link but also an indirect relationship, which states that variables interact with each other through various channels. This study performed a Panel Vector Autoregression (panel VAR) approach in a generalized method of moments (GMM) over 2008-2017 for 117 countries. Two separate models based on two different dimensions of political instability are built[i].

Moreover, this part of the thesis adopts "Structural Defect" as the first aspect of political instability and "Disorder of Polity Quality" as the second aspect. It observes the relationship between two dimensions of political instability and three macroeconomics performance indicators. It employs the following macroeconomic indicators as the proxies of economic

performance: Real GDP per capita growth rate (GDPpc growth rate), Inflation rate, Unemployment growth rate. Moreover, in the robustness check, the main analysis is tested through transmission channels assigned to each macroeconomic indicator used in the main analysis. With these channels, this research examines indirect links, which contribute to the existence of the relationship in the main analysis. In this way, it is tested whether transmission channels change according to different concepts of political instability. In sum, at the end of the research, it is investigated what the main transmission channels contributing to the links between political instability and macroeconomic performance is[ii]. That is the significant contribution of this study to the literature.

In addition, the impulse-response(IRFs) and forecast error variance decomposition (FEVDs) are computed for a deeper analysis of the relationship between political instability and macro economic environment. The IRFs explain the response of an endogenous variable over time to a shock in another variable in the system, and FEVDs measure the contributions of each source of shock to the (forecast error) variance of each endogenous variable at a given forecast horizon. Although IRFs and FEVDs are not the first targets of this study, showing them is important in terms of understanding future dynamics between macroeconomic performance and political instability. These are other contributions to this study to literature.

In the literature, the general argument running through these studies is to support the existence of such a relationship. And, the broad literature finds the negative relationship between political instability and macroeconomic performance indicators (Alesina et al. 1996; De Haan and Sierman 1996; Gupta 1998; Gasirowski 1998). Nonetheless, some studies, albeit few, reject the existence of this relationship in the literature (Londregan and Poole 1990; McKinlay and Cohan 1975). Those different results can depend on how researchers define the dimensions of political instability.

A large body of empirical studies defines political instability as an "executive instability", including both constitutional and unconstitutional changes (Lipset 1960, Londregan and Poole 1990; Tullock 1974). However, some researchers adopt "social unrest-political violence", which includes the number of assassinations, death caused by mass violence, coups (Alesina and Perotti 1996; Gupta 1990; Douglas 1973). In addition, some studies depict political instability as external and internal conflicts (Campos et al. 1999; Brada et al. 2006) or internal law and order (Paldam 1998).

It is seen that there is as yet no consensus on what the proxies of political instability should be employed. The dimensions of political instability may also vary according to the dynamics of societies; countries' regions; that is, the identification of political instability can be changed according to the sample countries selected for the analysis. Therefore, in the previous chapter, the dimensions of political instability for 117 countries by using Principal Component Analysis (PCA) have been selected. In this chapter, these results are adopted as the dimensions of political instability.

According to the findings, political instability has two different aspects. The first dimension of political instability, named Structural Defect, has much better identification of political instability than the second dimension of political instability, referred to as Disorder of Polity Quality. However, the second dimension of political instability is also adopted since this study aims to show the nexus between macroeconomic performance and different aspects of political instability. Structural Defect are associated with the stereotyped structural deterioration in societies/countries, and they all reflect one of the aspects of political instability [iii]. Disorder of Polity Quality represents the second aspect of political instability, which stems from the lack of law tied to the polity in the countries (Krisch 2011)[iv]. The importance of this broad identification, namely the contribution of the previous chapter to this chapter, is that it

enables us to measure the relationship between macroeconomic outlook and unstable political environment with more dimensions of political instability.

The rest of the paper is organized as follows. Section 2, which refers to the Literature Review, is examined under the following two subtitles: Theoretical Perspective, which summarizes transmission channels, and Review of Empirical Studies. Section 3 presents the Data Description, and Section 4 deals with the Methodology. Section 5 provides the Empirical Results. Section 6 offers Robustness Check of the analysis with different variables. Section 7 shows the Conclusion.

2. Literature Review

2.1. Theoretical Perspective

Before explaining the theoretical perspective, recall that the main purpose of the thesis is to question the relationship between macroeconomic performance and political instability- even though the internal dynamics of economic variables with each other are also observed -. Note that the following three macroeconomic variables, which reflect a general economic outlook of countries, are adopted in this study as macroeconomic performance indicators: Real GDP per capita growth rate (GDPpc growth rate), Inflation rate, Unemployment growth rate. Note that the Real GDP per capita growth rate represents economic growth. Namely, the macroeconomic environment consists of the synthesis of these three variables in this research. Therefore, in order to better understand the relations, the theoretical background of the link between each economic variable and political instability should be examined in detail. In this context, this thesis approaches the issue with three different theories, which set off the relationship between each of the three macroeconomic performance indicators and political instability.

The first theory of this study is related to the presence of a negative relationship between economic growth and political instability. An unstable political environment leads to uncertainty and raises the risk landscape over the countries. This uncertain climate impacts on economic growth. What are the main transmission channels that affect this nexus? This possibility is checked through three transmission channels: Physical Capital Accumulation (PCA) and Human Capital Accumulation(HCA), and Total Factor Productivity (TFP). Indeed, the origin of those transmission channels bases on Neo-classical (Solow) and Endogenous Growth Theory (New Growth Theory). The Solow-Swan model is an economic model of long-run economic growth set within the framework of neoclassical economics. Solow growth depicts that economic growth is a function of savings, capital accumulation, and growth (Solow 1956). However, the Endogenous Growth Theory emphasises skills and training in technology and human capital (Romer 1986; Lucas 1988).

Alesina et al. (1992), Alesina and Perotti (1996), Aisen and Vega (2011) are the proponents of the idea that uncertainty shortens the horizons of governments, disrupting long term economic policies. So, this turns the governments into a myopic structure. As long as this prevailing uncertainty continues, the probability of government change raises. Eventually, this situation likely causes physical capital flight and also potential investors avoiding investing in those countries. Besides, Barro (1991), Kuznets (1955) discuss that such a risky and uncertain environment jeopardize property rights, and hence this situation also reduces the attractiveness of investments in the countries. Consequently, decreases in investments may result in reduce physical capital accumulation over time.

Furthermore, this study represents a broad definition of political instability. So, in this context, it also estimates that some additional dimensions of political instability may affect economic growth through physical capital. For instance, Structural Defect and Disorder of Polity Quality, which are two aspects of political instability in this study, may threaten property

rights. These dimensions may decrease the attraction of investments, consequently, Physical Capital Accumulation.

Political instability affects economic growth through Human Capital Accumulation. An uncertain future causes people to either avoid education investments or causes people to tend to seek opportunities abroad. Eventually, it may result in human capital flight and brain drain. There may also be reverse effects. For instance, a decrease in qualified Human Capital Accumulation or a rise in brain drain due to any reason may lead to exacerbating a politically unstable environment caused by Structural Defect and Disorder of Polity Quality. Aisen and Veiga (2011) find that political instability negatively impacts Human Capital Accumulation.

Similarly, De Haan and Siermann (1996) show that an unstable political environment leads to brain drain and capital flight. In previous studies, the actions aiming to overthrow the government through constitutional and non-constitutional ways are commonly considered the measurement of political instability. Nevertheless, in this chapter, it is estimated that different dimensions of political instability may affect growth by reducing Human Capital Accumulation, stemming from brain drain. This study assumes that brain drain is not only linked to the lack of opportunity but also drives by all reasons, which stem from extensive structural deterioration in the societies such as military intervention in politics, corruption etc.; that is Structural Defect. Further, actions that escalate ethnic and religious discrimination, external conflict, etc., which consist of Disorder of Polity Quality, may force people to move to other countries.

Finally, political instability may impact economic growth through Total Factor Productivity (TFP), which measures countries' economic efficiency. Acemoglu and Zilibotti (2001) explain that even when all countries have access to the same set of technologies, there are large cross-country productivity differences. And TFP represents the residual portion of output growth not explained by changes in inputs. In this context, political instability may lead

to the misallocation of resources. Aisen and Veiga (2011) study that political instability, which occurs through cabinet changes- both constitutional and unconstitutional way- adversely affect productivity.Furthermore, internal conflicts, including political violence, civil war, may deteriorate the operation of firms and markets. In this study, it is hypothesized that higher political instability is associated with lower productivity. Structural Defect and Disorder of Polity Quality may lead to a negative impact on productivity.

The second theory of this study is that there is a positive relationship between inflation and political instability. Economists most commonly indicate that high inflation is one of the most harmful factors hindering the development of countries, society's welfare. However, the reasons behind the high inflation rates sometimes cannot be explained solely based on economic factors. An unstable political environment may also adversely affect inflation. Although this study's main analysis measures direct relationships, the robustness test checks the analysis through various transmission channels. Before explaining the theory, this research first attempts to ask the following question: which inflation indicator does this study cover?

Various studies consider the inflation indicators as the rate of inflation, the volatility of inflation, or one-two period of lag inflation as inertia. Paldam (1987) studies the relationship between political instability and inflation by using the Consumer Price Index (CPI) as an indicator of inflation. Gasiorowski (1998) examines the relationship between economic performance and political instability by using the natural logarithm of the annual inflation rate and one period of lag inflation as inflation indicators. Smith and Hogan (2014) investigate the impacts of war on economic performance in the US. by comparing Fed and pre-Fed periods. Regarding inflation indicators in their studies, they adopt the following two different inflation as economic performance criteria: the inflation rate and the inflation volatility.

Some scientists provide a broad definition, and they start their investigations by dividing inflation into two categories: monetary inflation and non-monetary inflation. The monetary

inflation model inclines to Friedman's dictum that "inflation is always and everywhere a monetary phenomenon", and is commonly based on the theory of Political Economy Monetary Prices (PEMP). Nevertheless, non-monetary inflation is argued under the Fiscal Theory of Price Level (FTPL) framework and alongside additional other factors like political indicators (Khani Holari et al., 2014). Khan and Saqib (2008) combine with the FTPL determination and PEMP literature using the GMM estimators for regression analysis. In their studies, the hypothesis is that considering only monetary factors does not explain the inflation in Iran and Pakistan, respectively. There are also several studies, which investigate the roots of inflation through FTPL. Carlstrom and Fuerst (1999-2000) assume that price level and hence inflation profoundly relate to budgetary policies. At that point, they divide the definition of FTPL into two categories: weak-form FTPL and strong-form FTPL. They consider the monetary phenomenon as the weak-form FTPL; that is, the main reason behind the inflation is excessive money growth dictated by government authorities. But, the strong-form FTPL is stated in their studies that fiscal policy independently impacts the inflation rate, changes in money growth and dependence on the changes in public debt or the budget deficit. These studies aim to show that the indicators of the monetary model demonstrated without political instability cannot provide an adequate explanation of inflation. Therefore, this assumption paves the way for the necessity of observing inflation with non-monetary indicators, which consist of the combination of both political factors and fiscal indicators.

This study does not attempt to investigate which one between non-monetary (including political factors) or monetary models provides a better explanation for defining inflation. So, this study deals with the combination of monetary and non-monetary inflation indicators in the same model, unlike that of Khani Holari and Khan's studies. Because they generate two different models, which consist of non-monetary and monetary, separately, however, this

research aims to display how all the inflation indicators included in the model and the variables of the dimension of political instability interact together simultaneously by using Panel VAR.

After giving a broad explanation of the inflation variables that researchers commonly use, this research tries to find an answer to the following question: How should the combination of these two forms of inflation be linked to political instability?

Political Business Cycle Theory (Nordhaus 1975) can be used as a tool to explain this relationship under the framework of Budget Deficit, Money Growth, External and Internal Borrowing (Public Debt). This study accepts the theory, but it also extends by considering the definition of political instability. The assumption of this theory is the tendency of governments to adopt expansionary fiscal policies, and often monetary policies as well, for re-election. According to the idea, incumbent parties are inclined to change their production preference in the best composition to direct voter preferences in line with politicians' own interests. The politician who is uncertain whether they will be re-elected may lead to misallocation of resources. Upward public expenditures during the election period drive down or eliminate private sector investment due to the Crowding-Out Effect (Friedman 1978). The investment-expenditures decisions of governments change, and they decide on public expenditure instead of public investment (Person and Tabellini,1998). Hence, these public expenditures lead to huge budget deficits. Alesina and Tabellini (1990) refer to it as "political instability and deficit bias". The deficit bias is higher in an unstable political environment.

Whether the increasing Budget Deficit burden creates inflation may also vary depending on how the deficits are financed. It is commonly preferred Money Growth or External and Internal Borrowing (public debt). First, this research follows the Friedman dictum, which claims that each increase in Budget Deficit leads to a rise in money supply and hence upward trends in the general price level. Since the general level of prices immediately absorbs fiscal shocks, each increase in budget deficit causes an increase in money supply and thus inflation.

Second, on the one hand, in underdeveloped countries where capital markets are not sufficiently developed, and domestic borrowing facilities are limited, external borrowing is used for financing budget deficits. External savings inflow is equivalent to the expansionary fiscal policy. The expansionary policies lead to *demand-pull- inflation.* The fact that prices are more flexible than supply means that the general level of prices increases in the short term. Hence, external borrowing plays a role in rising inflation in the short term. On the other hand, the current economic and political uncertainties cause short-term and higher-interest borrowing and internal borrowing, which is commonly used as a financing method of the budget deficit.

Furthermore, under this situation, inflationary expectations are uncertain. An increase in these expectations shortens debt maturity and leads to a boost in the cost of borrowing. All these, eventually, lead to *cost-push inflation*.

Recall that this study identifies political instability as a Structural Defect and Disorder of Polity Quality. The rent-seeking steps of the government may cause structural and polity quality disruption. For instance, when interpreted in terms of Structural Defect, government lobbyists are hired to sway public policy to benefit their companies and punish their competitors. It may cause the socioeconomic conditions to worsen only for a segment of society, or corruption and poor bureaucratic quality may increase. Considering the Disorder of Polity Quality, if there is too much polarization and turmoil among different ethnic and religious groups in the societies, the incumbent government may be willing to engage in rent-seeking from these groups by attempting populist policies. Considering rent-seeking, all these concerns leading to political instability may increase inflation through any transmission channels.

The third theory of this study is a positive relationship between the unemployment rate and political instability. Related literature commonly deals with youth unemployment; however, this study focuses on the nexus between both youth and total unemployment. First,

this analysis assumes that unemployment cannot be explained by only factors leading to political instability.

The hypothesis of this study stems from the combination of the following studies. It does not attempt to follow only one paper since this study considers various dimensions of political instability. It adopts the following leading theories carried out by Collier (2000); Miguel (2007). Collier (2000) argues that unemployment triggers motives for joining a conflict. Miguel (2007) indicates that the rise of ethnic tensions by unemployed people exposed to discrimination due to their ethnicities escalates ethnic tensions in countries. He hypothesises that the causality drives from the unemployment rate to ethnic tensions, which is included in the second aspect of political instability, Disorder of Polity Quality, in this study. Additionally, American political scientists Fuller (1995), Goldstone (2002) and Urdal (2006) argue that the relationship between internal conflicts, which is one of the political indicators included in Structural Defect, and unemployed young people in point of burgeoning youth populations, which is so-called *Youth Bulge* in literature. It mainly indicates that growing young populations frequently end up with rampant unemployment and many dissatisfied youths prone to join rebel or terrorist groups.

These theories are possible, but they explain this relationship based on one aspect of political instability. This research extends their views with different aspects of political instability. Considering Disorder of Polity Quality, in societies that are polarized by religious and ethnic tensions, such turmoils can cause minorities to be unable to find jobs. Increasing tensions due to the gap in polity quality can make it challenging to employ minorities. In addition, external conflicts, the lack of law and order, bureaucratic quality can adversely affect employment. As to Structural Defect, high-level corruption within the political system threatens the economic and financial environment. It may lead to a decrease in government and business efficiency; or, the military involvement in politics can limit the practical function of

government. Therefore, a foreign business can decrease due to an unstable environment, and it may lead to a rise in the unemployment rate. In addition, internal conflicts, low bureaucratic quality, distortion of socioeconomic conditions worsen the investment profile and may also cause an increase in the unemployment rate.

2.2. Review of Previous Empirical Studies

As explained in the previous section, the theoretical basis of the linkage between the political environment and macroeconomic outlook dates back a long time. However, studies explicitly examining this relationship became prominent after the 1990s. Most of them mainly focus on observing the relationship between political instability and economic growth rather than the nexus between inflation, unemployment and political instability in the literature of both the 1990s and 2000s. However, the concept of political instability became more diversified in the 2000s. While the studies from the 1990s generally adopt coups, revolutions as proxies for political instability, the latter observations also consider institutional quality, socio-economic conditions etc., in addition to those kinds of non-democratic government changes. Hence, it can be indicated that the studies carried out in the last decades are more comprehensive.

Moreover, the authors generally consider country groups instead of using a single state as a sample of countries. Nevertheless, the selected country groups also vary according to the purpose of the researcher conducting the analysis. Whereas some studies draw a global picture of the link between political instability and macroeconomic environment, others select sample countries based on geographic regions or international communities to which countries are affiliated. A summary of the studies can be found in Appendix A.

This study chooses the largest sample of countries for which data are available and interprets results from a global perspective. However, the details about the sample covering 117 countries can be found in the next section.

Before explaining the existing literature, it should be noted that this research follows the way of Aisen and Veiga (2011) in terms of addressing the issue. First of all, like in this thesis, the authors construct the political instability indexes by applying Principal Component Analysis. Then, they use them as the measurement of political instability while performing panel data to observe the relationship between economic growth and political instability. They aim to show a global outlook on a sample covering up to 169 countries. Furthermore, their analysis also investigates what the main transmission channels are between political instability and economic growth. For this reason, they consider the following three transmission channels: human capital growth, physical capital growth and total factor productivity growth. They find that political instability adversely affects economic growth by lowering total factor productivity growth, physical and human accumulation. The idea of using transmission channels in the robustness test of this chapter is based on their study. Although Aisen and Veiga deal with the transmission channels between political instability and economic growth, the robustness check of this analysis also examines the transmission channels for inflation and unemployment, besides economic growth. What these channels are is explained in detail in the previous section.

Highlighting the importance of transmission channels, one of the studies are written by Abdelhameed and Rashdan (2021). They aim to investigate the nature of the relationship between political instability and economic growth during the period 1994-2019 in selected countries (Egypt, Tunisia, Algeria, Sudan, Brazil, Turkey, Indonesia). They observe whether political instability plays an essential role in different dimensions of economic growth measured by human development index, gross domestic product and gross fixed capital formation. According to the results, political instability harms economic growth through the human development index and gross capital formation.

One of the well-known studies of the 90s which investigate the relationship between macroeconomic outlook and political instability is written by Londregan and Poole (1990). In

that study, coups d'etat is conceptualised as a measurement of political instability. In line with the results obtained using a two-equation model, low economic growth spawns coups in a sample of 121 countries for the period 1950-1982. However, coups do not have any economic effects; that is, the direction of this relationship drives from growth to political instability. Similarly, Zablotsky (1996) shows that low economic growth leads to coups in a sample classified into the first world and non-first world countries. Muller and Weede (1990) claim that a deterioration in economic growth, which they deem as a proxy of macroeconomic conditions, adversely affect political violence representing political instability.

Alesina et al. (1992) adopt Londregan and Poole's simultaneous equations technique, but they consider the following broader definition of government changes as the measurement of political instability: a) every government change; b) major changes in government including all the coups besides fraction of major constitutional cases of government changes; c) coups d'etat. They find that political instability reduces economic growth in a sample of 113 countries over the period from 1950 to 1982. The results show that political instability harms GDP growth, whereas there is no dependency in the opposite direction, unlike that of Londregan and Poole's study.

Alesina and Perotti (1996) review the literature on the political economy of growth, focusing on the intersection of the endogenous growth literature and the new political economy concept. They construct their socio-political index from data on a nation's number of politically motivated assassinations, the number of people killed in mass domestic violence, the number of successful and attempted coups. They cluster into the countries according to their level of development, and they find that since emerging countries are significantly unstable, this environment leads to a decrease in investment activities. Therefore, it reduces growth. However, they find that weak economic growth does not impact political instability.

Barro (1991) reveals that the relationship between an unstable political environment and growth negatively correlated for 98 countries in 1960-1985. This study considers revolutions, coups and the number of assassinations per year as the measurement of political instability. Similarly, Tullock (1974), Silver (1974), Mbaku and Paul (1989) comment on the relationship between uncertainty and economic growth stemming from coups.

Fosu (1992) studies political instability, governments' instability, regimes and communities within a nation, and growth in sub-Saharan African countries. The author shows the adverse effect of political instability on economic growth by using OLS regression.

De Haan and Sierman (1996) examine whether the empirical relationship between political instability and political freedom and economic growth by using data for a sample of 97 different regional groups of countries for the period 1963-1988. Their measures of political instability are based on the total number of government changes. According to the results, political instability both directly and through its effect on capital growth hampers economic growth in Africa, unlike Asia and Latin America. In Latin America, political instability reduces investment; however, there is also some mixed evidence that political repression leads to a decrease in economic growth. Besides, political instability and growth positively correlate in Asia. Nevertheless, they do not attempt to explain causality.

Similarly, Campos and Nugent (2002) empirically test the existence and direction of a causal relationship between socio-political instability (SPI) and economic growth for 1960-1995 in 98 developing countries. They find a similar result, like that of De Haan and Sierman. Only the Sub-Saharan Africa sample seems to be the driving force behind the negative relation between SPI and growth. Also, the direction of this relationship drives from political instability to economic growth.

Feng (1997) also shows that political instability and growth negatively correlate by using a simultaneous equation model for 1960 to 1980 in 96 countries. In this study, political

instability classifies into three dimensions: irregular government change (regime-level change), major regular (within regime) government change, and "minor regular" (within regime) government change.

Gupta et al. (1998) analyze the relationship between democracy, political instability and economic growth in a sample of 120 countries. Using the sociopolitical instability index (SPI), including social unrest, he finds that a higher growth rate reduces political instability. Besides, whereas growth in income per capita positively impacts democracy, the effect on political violence is negative.

Gyimah-Brempong and Traynor (1999) present a negative relationship between unstable political environment and economic growth for Sub-Saharan Africa countries. They divide political instability into two definitions: a) elite political instability, which includes the frequency of government changes; b) non-elite political instability, which summarises the amount of political violence number of and social protests.

Telatar and Telatar (2004) estimate the relationship between economic growth and the probability of political regime changes considering Turkey's economy throughout 1951 – 2001. The results show negative causality going from economic growth to the possibility of political regime changes. In this context, a decrease in economic growth leads to government change through military intervention.

Jong-A-Pin (2008) investigates the four dimensions: politically motivated violence, mass civil protest, instability within the political regime and instability of the political regime. According to the results, all four dimensions of political instability have different effects on economic growth. Among these indicators, just political regime instability has a robust and significant adverse impact on economic growth.

Shahabad (2014) observes the impacts of political stability on economic growth. Using panel data analysis, this study encompasses the time between 1994-2012 for the selected

countries (Ukraine, Romania,Indonesia,Thailand,Ecuador,Brazil). He adopts political violence, conflict, terrorism, and government popularity as a measurement of political instability. The results show that political stability has a long-term significant effect on economic growth. Consequently, economic growth coverege to their long-term equilibrium levels through capital channels.

Brückner and Gradstein (2015) investigate the causal relationship between ethnic polarization as a measurement of political risk and economic growth. They find that political risk that affects income growth is conditional on the countries ethnic composition. Similarly, Annett (2001) presents that ethical and religious dimensions of political instability lead to a decline in economic growth. Montalvo and Querol (2005) stress the importance of political instability on economic growth if countries are inclined to ethnic conflict.

Similarly, Abdelkader (2017) explores the nexus between political instability and economic growth in Egypt over the period 1972 and 2013. This study uses Error Correction Model (ECM). The political instability measurements are the number of years of chief executive, corruption in a political election, the score of polity, respectively.

Baklouti and Boujelbene (2020) study the relationship between democracy and economic growth by considering the role of political instability. The results of this study are estimated by using a dynamic panel data model reckoned in favour of GMM for the period from 1998 to 2011 in 17 Middle Eastern and North African (MENA) countries. The results show that there is a two-way directional causal relationship between democracy and economic growth.

Similarly, Papaioannou (2020) finds that poor economic performance increases Greece's likelihood of political instability. However, he treats political instability as the probability of a political change considering major political turmoils in Greece.

Çela and Hysa (2021) find a positive relationship between political stability and economic growth. They use fixed effect panel data analysis for 13 Central and Eastern European

(CEE) countries. They adopt the political stability index from World Governance Indicators (WGI) database and cabinet changes as a proxy for political instability.

Gasiorowski (1998) observes the relationship between two critical macroeconomic indicators -inflation and economic growth- and four measures of political instability -peaceful unrest, violent unrest, coups d'etat, government changes-. The analysis covers up to 121 countries classified based on their regions and performs it using fixed-effect regression. Although peaceful unrest, defined as demonstrations, general strikes, produces high inflation and low growth, there is no evidence that inflation and growth rates affect peaceful unrest. Coups d'etat reduces inflation, and high inflation reduces the probability of coups. In conclusion, high inflation and slow growth lead to chaos by undermining living standards.

Further, political instability adversely affects the macroeconomy by influencing the actions of government policymakers and private economic actors. Similarly, Robertson (1983), Alesina, Rosenthal (1995) find that high inflation and slow growth impact electoral change in democracies. O'Donnel (1973), Skidmore (1977) show the effect of inflation and growth on political regime change.

Aisen and Veiga (2006) indicate that a higher degree of political instability is associated with higher inflation. The paper also draws on relevant policy implications for the optimal design of inflation-stabilization programs and of the institutions favourable to price stability. Hoolari et al. (2014) focus on the relationship between inflation, political instability, and governance parameters in Iran by using the GMM estimator. They strongly express that the most interesting result of this investigation is the effect of government changes on the inflation rate of Iran. Contrary to what is assumed, government changes lead to a decrease in inflation.

Using the GARCH model, Barugahara (2014) highlights a positive statistically significant effect of political instability on inflation in a panel of 49 African countries. In this study, she decides the political instability dimensions by using Principal Component Analysis

(PCA). According to the results, the author adopts the state failure index, which is constructed from revolutionary and ethnic wars, genocides, and the state fragility index based on legitimacy and effectiveness.

Jan et al. (2021) find that an increase in inflation rate in Pakistan can adversely affect political instability. They use the following three different variables that reflect the political situation of Pakistan: scale weights of the system of government, government crises threatening the current regime and cabinet changes.

Nicolay and Valladares (2021) show that a higher level of political risks increases inflation in 90 countries over the period 1990-2016. Adopting the ICRG dataset, this study determines political instability measures using Principal Component Analysis and performs dynamic panel data analysis to observe the linkages.

Azeng and Yugo (2013) reveal that an increase in youth unemployment cause to increase in the risk of political instability in terms of internal conflict. They use fixed-effects regression with instrumental variables on a sample covering 24 developing countries over the period 1980-2010. Uddin and Uddin (2013) use a descriptive approach of previous research. They allege that youth unemployment causes inter-community clashes, namely internal conflicts and the emergence of groups such as Boko Haram, Niger Delta militants, armed robbery etc.

Germain and Boigny (2021) examine the nexus between youth unemployment and political instability in Cote d'Ivoire with a regional approach. This study reveals a positive and significant relationship between youth unemployment and political instability. They identify political instability as political and military unrest threatening the exercise of power by the ruling regime. Unlike many studies in the literature, they also consider poverty and level of education, namely socioeconomic situations, while composing their political instability index.

Tosun et al. (2008) observe the relationship between political instability and macroeconomic indicators through the instrument of the Malmquist Productivity Index, which consists of investment, inflation, current account, growth. In line with previous results, a decrease in political instability leads to a rise in the Malmquist index, namely macroeconomic performance. Şanlısoy and Çetin (2017) form a macroeconomic performance index, and they find a negative relationship.

3. Data Description

Using a sample comprising 117 countries, this research adopts data from a variety of empirical sources. Countries and data description are shown in Table 2.1 and Table 2.2 and descriptive statistics can be found in Table 2.3. They contain a full description of all variables, including additional variables for robustness analysis. The sources of economic data are The World Bank (WB), Penn World Table (PWT), The Conference Board Total Economy Database (TED), International Labour Organization (ILO), United Nations World Population Prospects 2019. Political instability data are from the International Country Risk Guide (ICRG) and PEW Research Center (PEW).

Table 2.1

Sample Countries

Angola	Azarbaijan	Argentina	Algeria	Albania
Austria	Australia	Belarus	Bolivia	Brazil
Burkino Faso	Bahrain	Bangladesh	Belgium	Botswana
Bulgaria	Bahamas	Côte_d_Ivoire	Congo_Rep_	Colombia
Costa_Rica	Cyprus	Chile	Croatia	Czech_Republic
Canada	Congo_ Dem_Rep_	Cameroon	China	Dominican_Republic
Denmark	Ecuador	Egypt	Ethiopia	Estonia
El_Salvador	Finland	France	Guinea	Gambia_The
Guatemala	Ghana	Gabon	Greece	Guyana
Germany	Guinea_Bissau	Honduras	Hong_Kong	Hungary
Indonesia	India	Israel	Ireland	Italy
Iceland	Iran_Islamic_Rep_	Jamaica	Japan	Jordan
Kenya	Kazakhstan	Lebanon	Latvia	Luxembourg
Lithuania	Myanmar	Malawi	Mozambique	Mexico

Malaysia	Moldova	Morocco	Madagascar	Malta
Nicaragua	New Zeland	Norway	Nigeria	Namibia
Netherlands	Paraguay	Philippines	Panama	Peru
Papua New Guinea	Pakistan	Poland	Portugal	Romania
Russia	South_Korea	Syria	Singapore	South Africa
Spain	Slovenia	Slovak_Republic	Serbia	Sweden
Senegal	Suriname	Sri Lanka	Uganda	Uruguay
		Ukraine	United Kingdom	Venezuela
United_States	United_Arab_Emirates			
Tanzania	Thailand	Trinidad Tobago	Turkey	Taiwan
Zimbabwe	Zambia			

Table 2.2

Description of Variables

Variable	Description	Source
	Macroeconomic Variables	
Real GDP per capita growth	Reel GDP per capita growth (annual %)	The World Bank database (WB)
Inflation rate	CPI, variation (annual)	The World Bank database (WB),World Bank Global Economic Monitor
Unemployment rate	Unemployment, total (annual % of total labor force)	ILOSTAT
Total Factor Productivity growth rate (TFP)	Total Factor Productivity growth rate (annual %)	The Conference Board Total Economy Database(TED)
Physical Capital (PC)	Capital stock at current PPPs in mil. 2011 US$	Penn World Table (PWT)
Human Capital (HC)	Human Capital Index based on years of schooling and returns to education	Penn World Table (PWT)

Broad Money (BM)	Broad money (%annual GDP)	The World Bank (WB)
Government Debt (GD)	Central government debt, total (annual of % GDP)	The World Bank (WB)
Budget Deficit (BD)	Budget Deficit (annual of % GDP)	The World Bank (WB)
Youth Unemployment rate (YU)	Unemployment, youth total (annual %of total labor force ages 15-24)	ILOSTAT
Youth Population (YP)	Total population aged 15-24 years	United Nations World Population Prospects 2019
Political Instability Variables		
Structural Defect (SD)	The first aspect of political instability	International Country Risk Guide (ICRG)
Disorder of Polity Quality (DPQ)	The second aspect of political instability	International Country Risk Guide (ICRG)

Note: Real GDP per capita growth, Total Factor Productivity growth rate, Inflation rate are already in growth rates. Political instability variables (SD and DPQ), Unemployment rate, Human Capital (HC), Physical Capital (PC), Broad Money (BM), Government Debt (GD), Budget Deficit (BD), Youth Unemployment rate (YU) and Youth Population (YP) are converted into growth rate in Stata and their converted values are used in this analysis.

Table 2.3

Descriptive Statistics

Variables	Mean	Std. Dev.	Min	Max
Real GDP per capita growth rate	1.78	3.67	-18.49	18.06
Inflation rate	-0.08	1.16	-7.87	13.55
Total Factor Productivity growth rate	-0.20	3.17	-17.7	15.3
Unemployment rate	7.35	4.80	0	27.46
Unemployment rate (growth rate)	0.01	0.17	-1	1.48
Structural Defect	72.79	135.90	12.41	4612
Structural Defect (growth rate)	0.96	31.12	-0.99	1004
Disorder of Polity Quality	33.82	280.30	5.92	946
Disorder of Polity Quality (growth rate)	0.45	13.40	-0.99	430
Physical Capital	565.50	326.34	1	113
Physical Capital (growth rate)	0.13	0.85	-0.99	12.95
Human Capital	515.04	291.04	1	1007
Human Capital (growth rate)	0.25	5.48	-0.98	177.16
Broad Money	539.52	316.74	1	91
Broad Money (growth rate)	0.62	8.49	-0.99	177.16
Budget Deficit	492.43	292.27	1	999
Budget Deficit (growth rate)	4.521	29.73	-0.99	494
Government Debt	53.54	103.84	0.06	3376
Government Debt (growth rate)	0.79	20.27	-0.98	64
Youth Population	57.34	32.94	1	114

Youth Population (growth rate)	0.56	10.52	-0.99	284
Youth Unemployment rate	16.37	11.02	1.00	96.66
Youth Unemployment (growth rate)	0.02	0.30	-0.89	7.97

Note: Both levels and growth rates statistics of the variables converted into growth rate are shown, and this study is performed considering their growth rates. Recall that Real GDP per capita growth rate, Total Factor Productivity growth rate, Inflation rate are already published in the growth rate.

To the best of my knowledge, the data sources of economic variables included in this analysis are commonly used in the literature. However, to avoid ambiguity in the table, it is necessary to indicate why some data are calculated based on levels, and some are shown at growth rates. In the literature, various data are published as a percentage. Nonetheless, all percentages do not present percentages changes, and a per cent sometimes represents a proportion as in the unemployment rate or government debt, and so on (Arrowhead Center 2010). Real GDP per capita, growth rate, inflation rate (the annual average variation in consumer price index), growth of Total Factor Productivity are already in growth rates. However, it is necessary to calculate the growth rates of the rest of the variables, which are at levels. Thus, the growth rates of these variables are computed in Stata. Their values at levels and growth rates can be found in the descriptive statistics (Table 2.3).

Regarding the variables presenting political instability, it's worth reiterating the criteria by which the indices of Structural Defect and Disorder of Polity Quality, which are the two dimensions of political instability, are formed. Note that the measurements of political instability have been calculated in the first chapter of the thesis by using Principal Component Analysis (PCA). That analysis is performed by International Country Risk Guide (ICRG) political risk variables. ICRG dataset includes the following 12 political risk indicators: Government Stability, Socio-Economic Condition, Investment Profile, Internal Conflict, External Conflict, Corruption, Military in Politics, Religious Tension, Law and Order, Ethnic Tension, Democratic Accountability, Bureaucracy Quality. The main reason this research is

performed by this dataset is that these variables provide greater knowledge on the key concept of political instability/stability compared to other data sources. Therefore, the dimensions produced with this comprehensive data set also define a broad perspective of political instability. ICRG concept is quite broad. ICRG considers many factors that affect political events and categorizes them according to the events they affect. Finally, it gathers them under one heading. For instance, the risk of civil war, coup threat, terrorism, political violence, a civil disorder in a country are merged within the name of Internal Conflict. Furthermore, not only the financial corruption, which adversely impacts on doing business, but also actual or potential corruption in the form of excessive patronage, nepotism, private party fundings etc., are examined under the framework of Corruption. However, recall that PCA has been carried out on 11 political risk indicators in the first chapter since Government Stability has shown a different behaviour with respect to the other variables. It explains a latent factor completely different and uncorrelated with the first factor. Hence, government stability has been dropped out. The detailed explanations can be found in Chapter I (Section 1.3 pg:21-22)

PCA results show that the first two components should be employed in this analysis (see Section 1.5.1: Table 1.5). These two political instability components are respectively labelled as Structural Defect and Disorder of Policy Quality. Structural Defect, which is the first principal component, is characterized by the six political instability variables (Internal Conflict(IC), Military in Politics (MP), Corruption (COR), Investment Profile (IP), Socioeconomic Conditions(S_EC), Bureaucratic Quality (BQ). Structural Defect is composed of the total value of these variables. Disorder of Polity Quality, which is the second principal component, is formed by Religious *Tension (RT),Ethnic Tension (ET), External Conflict (EC), Internal Conflict (IC),Military in Politics(M_P) to Democratic Accountability (DA), Investment Profile (IP), Corruption (COR),Bureaucratic Quality (BQ), Socioeconomic Conditions (S_EC), Law and Order (L_O)*. The value of Disorder of Polity Quality reflects

the total value of these variables. Summarily, these two dimensions of political instability are used in the second chapter of this thesis to measure the relationship between political instability and the macroeconomic environment.

However, some points need to be underlined about the composition of political instability proxies. First of all, we have "conceptually" created the dimensions of political instability and used the comprehensive data, which are believed to cause political instability. Some research selects the data without performing any statistical method and adopts political instability proxies considering previous studies. Others identify political instability at the more statistical level by using exploratory data analysis techniques like PCA, as this thesis does. However, both previous studies using PCA and this thesis are aware that PCA is a static data synthesis technique. In this context, studies that aim to deal with more than one country and more than one year, instead of considering a single year, usually take the average values of the variables in the period to be examined. In particular, after creating a composite index with PCA, the studies that examine the relationship of the composite index with other variables using econometric models such as panel data follow that path. Therefore, political instability is assumed as an average concept of the period included in the PCA in these kinds of studies. As in this research, the annual values of the concept of political instability are then used in the panel data analysis (Aisen and Veiga 2011;Berggren Bergh and Bjornskov 2012; Barugahara 2014;Bielskis 2016; Hira 2017;Hyeon-Seung 2019;Nicolay and Valladeres 2021).

In this context, since this research creates its own political instability dimensions (with PCA) and then observes the relationship between these dimensions (Structural Defect and Disorder of Polity Quality) and macroeconomic performance (with PVAR) , it is expected to contribute to the literature. It should be noted that these results can be changed under different conditions. The nexus between political instability and macroeconomic performance is observed based on the political instability findings of this study.

4. Methodology

This section introduces the dynamic interrelationship between macroeconomic performance and political instability. To do so, the Panel Vector Autoregression (Panel VAR) approach by using a generalized method of moments (GMM) is performed. The sample covers the period from 2008 to 2017. This analysis is divided into three phases: Panel Vector Autoregression Analysis, Impulse Response Functions (IRFs), Forecast-Error Variance Decompositions (FEVDs).

Panel VAR model, previously analyzed by Holtz- Eakin et al. (1988), combines the classical VAR model formulated by Sims (1980), with the panel data method. It is commonly used to estimate the dynamic relationship between endogeneous variables irrespective of apriori limitation. In this study, the first reason to perform Panel VAR is that it treats all the variables in the system as endogeneous, with the panel data approach allowing for unobserved individual heterogeneity as fixed effects. Furthermore, in literature, Sims 1980 and Love and Zicchino identify the Panel VAR technique as an alternative to multivariate simultaneous equation models.

Herein, it is believed that macroeconomic performance and political instability indicators require simultaneous treatment of both relationships; this study performs Panel VAR model to observe the simultaneous effect, which controls for the endogeneity caused by the bidirectional causality between both variables by using GMM estimators. Panel VAR model is described in the following equation (Abrigo and Love 2015):

$$y_{i,t} = a_0 + \sum_{j=1}^{p} a_{1j}\, y_{i,t-j} + \sum_{j=1}^{p} a_{2j}\, x_{i,t-j} + \varepsilon_{1i,t} \qquad (3)$$

$$x_{i,t} = \beta_0 + \sum_{j=1}^{p} \beta_{1j}\, x_{i,t-j} + \sum_{j=1}^{p} \beta_{2j}\, y_{it-j)} + \varepsilon_{2i,t} \qquad (4)$$

where y_{it} is a bidimensional vector of dependent variables in country i and period t; ε_{1it} and ε_{2it} represent error terms; a_j and β_j are a matrix of coefficients to be estimated.

The primary aim of this study is to examine the interaction between macroeconomic performance and each dimension of political instability. This research particularly focuses on observing the possible simultaneity between political instability and macroeconomic performance covering up 117 countries over the period 2008-2017. A common approach to test the direction of causality is by estimating two equations separately.

Recall that this research considers two dimensions of political instability. Since this study does not aim to observe the interrelation of two aspects of political instability on each other, it attempts to generate two separate models composing of the two different aspects of political instability, By doing so; this research investigates how macroeconomic performance indicators interact simultaneously with political instability dimensions.

Firstly, "Model 1" is calculated to measure the relationship between macroeconomic performance and Structural Defect growth rate, which is the first aspect of political instability. Secondly, "Model 2" investigates the relationship between macroeconomic performance and the growth rate of Disorder of Polity Quality, which is the second aspect of political instability. This research generates two models. The first equations identify the impact of political instability on macroeconomic performance. The second equations represent the reverse causality: the effect of the macroeconomic performance on political instability.

Model 1:

$$Z_{it} = a_0 + \sum_{j=1}^{p} a_{1j} Z_{i,t-j} + \sum_{j=1}^{p} a_{2j} \text{Structural Defect}_{i,t-j} + \varepsilon_{1i,t} \quad (3)$$

$$\text{Structural Defect}_{i,t} = \beta_0 + \sum_{j=1}^{p} \beta_{1j} \text{Structural Defect}_{i,t-j} + \sum_{j=1}^{p} \beta_{2j} Z_{it-j} + \varepsilon_{2i,t} \quad (4)$$

Equation (3) examines the impact of political instability on future macroeconomic performance. The vector $\mathbf{Z_{it}}$ contains the three main macroeconomic performance indicators.

The vector consists of the annual growth rate of Real GDP per capita, which is a proxy of the economic growth, Inflation rate, Unemployment growth rate, at time t is a function of its lag, the lagged vector **Structural Defect** in t-j **. Structural Defect$_{i,t}$** represents th*e* growth rate of structural defect identified for country i in period t. Equation(4) explores the other direction of causality: the effects of macroeconomic performance on future political instability, namely structural defect in Model 1. Here **Structural Defect** at time t is a function of its lag, the lagged vector **Z** in t-j. Further, p identifies lag length, $\varepsilon_{1i,t}$ and $\varepsilon_{2i,t}$ are the residuals that represent all other influences on the dependent variable assumed to be orthogonal. The main coefficients of interest are a_1 and β_2 .

Model 2:

$$Z_{i,,t} = \theta_0 + \sum_{j=1}^{p} \theta_{1j} Z_{i,t-j} + \sum_{j=1}^{p} \theta_{2j} \text{Disorder of Polity Quality}_{i,t-j} + \mu_{1i,t} \quad (5)$$

$$\text{Disorder of Polity Quality}_{i,t} = \delta_0 + \sum_{j=1}^{p} \delta_{1j} \text{Structural Defect}_{it-j} + \sum_{j=1}^{p} \delta_{2j} Z_{i,t-j} + \mu_{2,it} \quad (6)$$

Equation (5) examines the impact of the second aspect of political instability named Disorder of Polity Quality on future macroeconomic performance indicators represented by **Z**, at time t is a function of its lag, the lagged **Disorder of Polity Quality** in t-j. **Disorder of Polity Quality$_{i,t}$** represents th*e* growth rate of disorder of polity quality identified for country i in period t. Equation (6) explores the other direction of causality: the effects of macroeconomic performance on future political instability, namely disorder of polity quality in Model 2. Here **Disorder of Polity Quality** at time t is a function of its lag and the lagged macroeconomic performance in t-j. Furthermore, p identifies lag length, $\mu_{1i,t}$ and $\mu_{2i,t}$ are the residuals that represent all other influences on the dependent variable assumed to be orthogonal. The main coefficients of interest of this study are θ_1 and δ_2.

The parameters equations in each model can be estimated using equation-by-equation pooled ordinary least squares (OLS); however, these estimators may cause biased results. The

fixed effects vectors are correlated with the regressors because of the lags of the dependent variables (Nickell 1981 , Holtz-Eakin et al. 1998). This study controls for individual fixed effects by Helmert transformation; that is it is removed the mean of all future observations available for each location i-time t pair. Note that applying standard mean-differencing procedures generates biased estimates as the fixed effects are correlated with the regressors due to auto-correlated dependent variables (Arellano and Bond 1991; Arellano and Bover 1995;Blundell and Bond 1998). The Helmert transformation preserves the orthogonality between the variables and their lags which are essential for the use of lags as instruments in a system (GMM) is proposed by Arellano and Bond (1991) and extended by Arellano and Bover (1995) and Blundell and Bond (1998). While Arellano and Bond (1991) suggest the first-difference transformation, Arellano and Bover (1995) use forward orthogonal deviation (FOD) to remedy for the weaknesses of the first difference transformation when estimating dynamic panel models. Also, since FOD subtracts the average of all available future observations, this transformation method minimises data loss (Abrigo and Love 2016). Hence, this research applies the transformation and uses information criteria to select the optimal lag order.

Also, the following additional analysis is performed: Impulse and Response Functions (IRFs) and Forecast-Error Variance Decompositions (FEVDs). IRFs analyze the response of the deviation to shocks from the other variable in the long-run term. They provide to measure the reaction of one endogeneous variable to the innovation in another endogenous variable. To do so, Cholesky decomposition of the variance-covariance matrix of residuals is used (Hamilton 1994 Abrigo Love 2015; Zouauoui and Zoghlami 2020). FEVDs enable us to observe the proportion of variation of the dependent variable, which is explained by each independent variable. This is considerably important for this research since it shows how much of the future uncertainty of the variables is due to future shocks into the other variables.

5. Emprical Results

This section consists of the three main analyses based on panel VAR: a) Panel VAR and Granger Causality b) Impulse and Response Functions (IRF) c) Forecast-error variance decompositions (FEVD). However, before estimating the Panel VAR model, the stationary state of the main variables is checked. ADF (Dickey and Fuller,1979), Philips-Perron(PP)(Philips and Perron,1988) unit root tests, which are more suitable for the case of unbalanced panel data and guarantee robust results, are performed. The null hypothesis indicates that all panels contain unit roots, while another hypothesis means that at least one panel is stationary. According to Table 2.4, the results show all variables are stationary, indicating the appropriateness of using them in the panel VAR analysis.

Table 2.4

Unit Root Test Results

UNIT ROOT	Real GDP per capita growth	Inflation rate	Unemployment rate	Structural Defect	Disorder of Polity Quality
Fisher Type Augmented Duckey Fuller(ADF)					
Lag	669.67*** (0.0000)	1375.78*** (0.0000)	1677.64*** (0.0000)	558.74*** (0.0000)	1355.05*** (0.0000)
Lag-1	1523.091*** (0.0000)	482.78*** (0.0000)	595.42*** (0.0000)	548.44*** (0.0000)	776.67*** (0.0000)
Fisher Type-Philips Perron (PP)					
Lag	669.67*** (0.0000)	1375.78*** (0.0000)	1677.64*** (0.0000)	558.74*** (0.0000)	1355.05*** (0.0000)
Lag-1	676.114*** (0.0000)	1351.91 (0.0000)***	1690.366*** (0.0000)	594.54*** (0.0000)	1433.76*** (0.0000)

Note: (***), (**)and (*) denote statistical significance at the 1 %,5 %, 10% levels, respectively. P-values are in parentheses.

Section 5.1 shows the Granger causality and Panel VAR results. Furthermore, it is checked the stability condition of the estimated Panel VAR before performing IRFs and FEVDs. In sections 5.2 and 5.3., the results of IRFs and FEVDs are showed.

2.5.1. Panel VAR and Granger Causality

The main results of the baseline panel VAR models are given in Table 2.6. However, before estimating the models, panel VARs are predicated upon determining the optimal lag order. This analysis follows three information criteria for GMM models relied on Hansen'j statistic proposed by Andrews and Lu(2001). These information criteria are the Akaike Information criteria (AIC)(Akaike,1969), the Bayesian Information Criteria(BIC)(Schwartz 1978,Rissanen 1978, Akaike 1977), and the Quasi Information criteria(QIC)(Pan 2001).

Table 2.5

Panel VAR lag selection criteria for Model 1 and Model 2

Lag Selection for Model 1						
Lag	**CD**	**J**	**J value**	**MBIC**	**MAIC**	**MQIC**
1	.9999998	102.8438	.7.21e-06	-174.9272*	-16.843846*	-65.6934*
2	.9999999	47.37584	.0392274	-137.8054	-12.62466	-64.98282
3	.7819344	23.16414	.1094165	-69.42621	-8.835856	-33.01494
Lag Selection for Model 2						
1	.9999996	75.91224	.0062735	-201.8588 *	-20.08776*	-92.62501*
2	.999985	46.47554	.0472247	-138.7052	-17.52446	-65.88263
3	.5952475	19.38922	.2489971	-73.20114	-12.61078	-36.78986

Note: "*" indicates selected lag order.

Based on the information criteria Bayesian (BIC), Quasi Information criteria(MQIC Akaike (AIC), first-order Panel VAR is preferred in both Model 1 and Model 2 since they have the smallest value. However, when estimating the panel VAR model, it is essential to test for its stability condition. The stability condition supposes that the panel VAR has an infinite-order

vector moving average and its invertible (Abrigo and Love, 2016). The well-known way to decide is to calculate the modulus of each eigenvalue of the estimated model. Hamilton (1994) and Lutkepohl (2005) indicate that a Panel VAR model is stable when each of the modulus in the companion matrices is less than one (Compagnucci et al. 2017). If any of the modulus on the eigenvalues are greater than 1, then consequently, there would be no long-run equilibrium, and the values in the future would just continue to rise. Time series are generated by the growth rates of each variable, which are all stable. Hence, both models are estimated with lag (1). The statistical tables and their visualization can be found in Table 2.6 and Figure 2.1, respectively. The stability condition is detailed after the explanation of the estimation of models (Table 2.7).

Table 2.6 represents the results of Panel VAR in a GMM framework. Recall that the former relates the relationship between the Structural Defect dimension of political instability and macroeconomic performance, including Real GDP(pp) growth rate (economic growth), Unemployment growth rate, Inflation growth rate; and the latter model deals with the relationship between the Disorder of Polity Quality dimension of political instability and macroeconomic performance. This research focuses on the relationship between two different political instability dimensions and macroeconomic performance. However, it also shows the interactions within macroeconomic indicators.

In Model 1, which is performed with Structural Defect, the results suggest that the impact of economic growth rate, represented by the growth rate of Real GDP per capita, leads to a decrease (-0.04) in inflation rate at 5% significance level. It is found that there is no significant impact of the growth rate of Real GDP per capita on the growth rates of Unemployment and Structural Defect at any significant level. Model 2, which adopts Disorder of Polity Quality, has the same results as Model 1.

In Model 1, the growth rate of Unemployment has a negative (-7.81) significant impact on the growth rate of Real GDP per capita at 1% significance level. However, this effect is

lower (-7.78) in Model 2 compared to than Model l. The impact of the growth rate of Unemployment has a significant impact on neither the inflation rate nor the political instability variables in both models.

In Model 1, it is found that the Inflation rate has a positive impact (0.31) on the growth rate of Real GDP per capita at 5% significance level, and this impact is slightly different (0.30) in Model 2. Furthermore, the effects of the Inflation rate on the Unemployment growth rate have a negative coefficient (-0.011) at 1% level in both models.

Finally, the growth rate of Structural Defect harms the growth rate of Real GDP per capita (-0.001) in Model 1. In contrast, the growth rate of Disorder of Polity Quality has an adverse impact (-0.008) on Real GDP per capita growth in Model 2. An increase in the growth rates of Structural Defect and Disorder of Polity Quality leads to a slight reduce in the growth rate of Unemployment. Although an increase in Structural Defect growth has a non-significant impact on itself, there is a negative and significant effect of the growth rate of Disorder of Polity Quality on itself. In addition, an increase in Disorder of Polity Quality growth has a positive impact (0.0007) on the Inflation rate in Model 2, and one unit increase in Structural Defect growth has a positive effect (0.0008) in Model 1.

The general conclusion to be drawn from Table 2.6 is that both political instability dimensions have almost similar impacts on macroeconomic indicators. The second standing point is that Real GDP growth rate and Inflation rate are the most endogenous variables in the analysis. They have a bi-directional relationship both in Model 1 and Model 2.

Table 2.6

Panel VAR Estimations for Model 1 and Model 2

	MODEL 1			
Variables	Real GDP per capita growth$_t$	Unemployment rate$_t$	Inflation rate$_t$	Structural Defect$_t$

Real GDP per capita growth $_{t-1}$	0.192 *** (0.064)	0.001 (0.001)	-0.044 ** (0.019)	0.253 (0.257)
Unemployment rate $_{t-1}$	-7.818*** (1.049)	0.189*** (0.055)	0.212 (0.208)	14.858 (15.068)
Inflation rate $_{t-1}$	.0.311** (0.147)	-0.011* (0.005)	0.026 (0.051)	-0.676 (0.069)
Structural Defect$_{t-1}$	-0.001*** (0.000)	-0.000** (6.13e-06)	0.0008* (0.000)	0.000 (0.001)
Number of Observations	676			
Number of Countries	117			
GMM criterion Q(b)	1.23e-30			

MODEL 2

	Real GDP per capita growth$_t$	Unemployment rate$_t$	Inflation rate$_t$	Disorder of Polity Quality $_t$
Real GDPper capita growth $_{t-1}$	0.192 *** (0.064)	0.001 (0.001)	-0.044** (0.019)	-0.100 (0.077)
Unemployment rate $_{t-1}$	-7.784*** (1.051)	0.189*** (0.055)	0.209 (0.208)	-2.763 (2.594)
Inflation rate $_{t-1}$	0.309** (0.147)	-0.011* (0.005)	0.026 (0.051)	-0.147 (0.181)
Disorder of Polity Quality $_{t-1}$	-0.008*** (0.000)	-0.000*** (0.000)	0.0007*** (0.0001)	-0.004** (0.001)
Number of Observations	676			
Number of Countries	117			

GMM Criterion Q(b)	1.59e-30

Note: The results of panel VARs conducting with structural defect can be found in Model 1. The results of panel VARs conducting with disorder of polity quality can be found in Model 2. Number of observations between 2008-2017. Robust standard errors are in parantheses. Panel-specific fixed effects are removed using forward orthogonal deviation or Helmert transformation. The optimal lag selection is at one and decided through the Overall Coefficient of Determination (pvarsoc in Stata). *, **, and *** denote statistical significance at 10 %, 5 %, and 1 % levels, respectively.

Table 2. 7 and Figure 2.1 shows the stability conditions for estimated panel VAR models. The following table reports the eigenvalues for Model 1 and Model 2. The modulus of each eigenvalue is strictly less than one. Figure 2.1 represents the diagram of the eigenvalues relative to estimated Panel VAR models and the complex components at the y-axis and the real component at the x-axis. Figure2.1 shows that eigenvalues are well inside the unit circle for both models. Since the assumption of Panel VAR models indicates that all the variables within the system are endogenous, checking the validity of this condition is a must.

Table 2.7

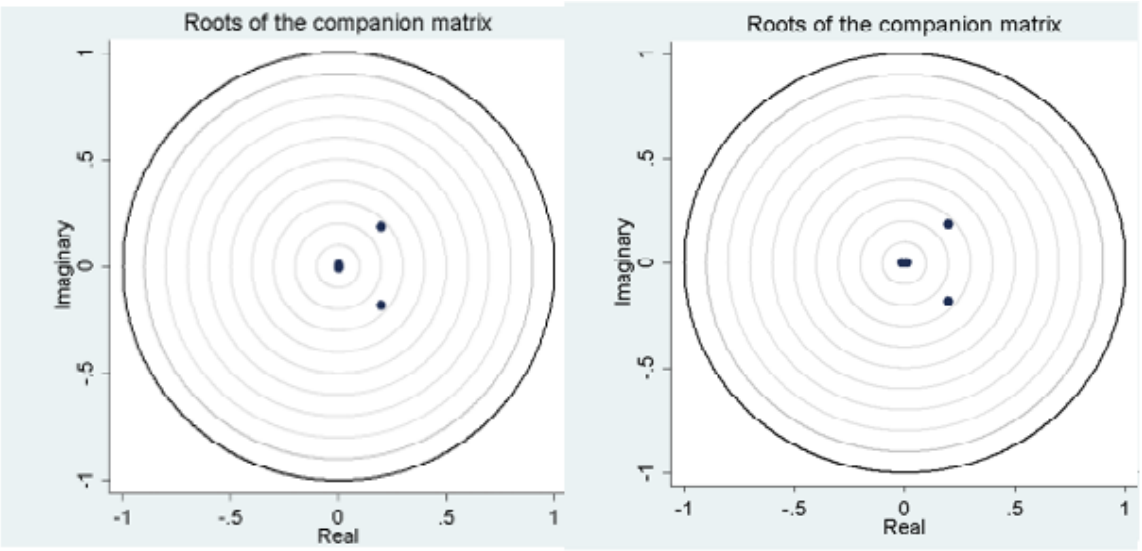
Eigenvalue Stability Condition for Model 1 and Model 2

Model 1		
Eigenvalue		
Real	**Imaginary**	**Modulus**
.2006112	.1830332	.2715621
.2006112	-.1830332	. 2715621
.0042878	-.0073858	.0085402
.0042878	. 0073858	.0085402
Model 2		
.2011265	.1832342	.2720783
.2011265	-.1832342	.2720783
.0108791	0	.0108791
-.0092851	0	.0092851

Note: All the eigenvalues lie inside the unit circle. The estimated panel VAR satisfies the stability condition. (pvarstable in Stata).

Figure 2.1.

Graph of Stability Condition



i. Model 1 ii. Model 2

The following table presents the results of the Granger Causality test. The Wald test's null hypothesis (H0) is that the excluded variable does not Granger-cause the equation variable, while the alternative hypothesis (H_1) is that omitted variables are causes to the equation variables. The granger causality findings support the estimated panel VAR models.

Table 2.8

Granger Causality Walt Test Results

Model 1			
Variables	Null Hypothesis	Chi^2	P value
	• Unemployment rate (excluded) does not granger cause real GDP per capita growth	55.447	0.000***

Real GDP per capita growth	• Inflation rate (excluded) does not granger cause real GDP per capita growth.	4.435	0.035**
	• Structural Defect (excluded) does not granger cause growth rate of real GDP per capita growth.	59.757	0.000***
Unemployment rate	• Real GDP per capita growth. (excluded) does not granger cause unemployment rate	1.076	0.300
	• Inflation rate (excluded) does not granger cause growth unemployment rate	3.811	0.051*
	• Structural Defect (excluded) does not granger cause growth rate of unemployment.	7.989	0.005*
Inflation rate	• Real GDP per capita growth. (excluded) does not granger cause inflation rate.	5.089	0.024**
	• Unemployment rate (excluded) does not granger cause inflation rate.	1.038	0.308
	• Structural Defect (excluded) does not granger cause inflation rate.	3.239	0.072*
	• Real GDP per capita growth. (excluded) does not granger cause the growth rate of structural defect.	0.970	0.325

Structural Defect	• Unemployment rate (excluded) does not granger cause the growth rate of structural defect.	0.972	0.324
	• Inflation rate (excluded) does not granger cause the structural defect	0.957	0.328
	Model 2		
Real GDP per capita growth	• Unemployment rate (excluded) does not granger cause real GDP per capita growth	54.791	0.000***
	• Inflation rate (excluded) does not granger cause real GDP per capita growth	0.403	0.036**
	• Growth rate of disorder of polity quality (excluded) does not granger cause real GDP per capita growth	200.126	0.000***
Unemployment rate	• Real GDP per capita growth (excluded) does not granger cause unemployment rate	1.090	0.296
	• Inflation rate (excluded) does not granger cause unemployment rate	3.824	0.051*
	• Disorder of Polity Quality (excluded) does not granger cause unemployment rate	30.512	0.000**
Inflation rate	• Real GDP per capita growth (excluded) does not granger cause inflation rate	5.084	0.024*
	• Unemployment rate (excluded) does not granger cause inflation rate	1.010	0.315

	• Disorder of Polity Quality (excluded) does not granger cause inflation rate.	30.132	0.000***
Disorder of Polity Quality	• Real GDP per capita (excluded) does not granger cause disorder of polity quality.	1.661	0.197
	• Unemployment rate (excluded) does not granger cause disorder of polity quality.	1.135	0.287
	• Inflation rate (excluded) does not granger cause disorder of polity quality.	0.657	0.418

Note: This table reports the results of the Granger-causality Wald test. These results also support the estimated panel VAR models. The values in the table are the Chi-square and their corresponding p-values. Under the null hypothesis, the excluded variable does not Granger cause the dependent/endogenous variable.*, **, and *** denote significance at the 5 % ,1 % ,%10 level, respectively

Table 2.8 illustrates the granger causality between macroeconomic performance variables and different dimensions of political instability. The standing point is that the causality direction generally drives from political instability variables, namely Structural Defect and Disorder of Polity Quality, to macroeconomic indicators. In addition, there is bi-directional causality between Real GDP per capita growth and the Inflation rate. That is, these variables should be treated as endogenous.

2.5.2. Impulse-Response Functions (IRFs)

For a deeper analysis of the relationship between political instability and macroeconomic environment, the Impulse-Response (IRFs) is computed. The IRFs explains how the variables react to an exogenous shock and the periods it needs to return to its equilibrium. More obviously, IRF returns the dynamic response to a one-standard-deviation shock to each variable in a Panel VAR model. Gaussian approximation based on Monte Carlo

simulation is applied to forecast the confidence bands (Abrigo and Love, 2015). Orthogonalized IRF is computed by taking into consideration Cholesky decomposition. According to Cholesky used for obtaining impulse-response values, errors are orthogonalized and obtained variance-covariance matrix is made orthogonal (Hamilton 1994). More precisely, to isolate shocks to one of the variables in the system, it is essential to decompose residuals performing a method providing their transformation to orthogonal since the actual variance-covariance matrix of the errors is unlikely to be diagonal. Therefore, in studies based on Cholesky, as long as the order of variables changes, impulse-response functions may change. The assumption behind the Cholesky decomposition is variables indicated earlier in the Panel VAR order impact the other variables simultaneously, whereas variables listed later in the Panel VAR order impact those listed earlier only with lag (Boubtane; Coulibaly; Rault, 2012). Summarily, the earlier listed variables are more exogenous, whereas variables listed later are much more endogeneous. Before performing IRFs ordering of variables from exogeneous to endogeneous is a must (Traoré 2018). Therefore, they can sort the following order in Model 1: growth rate of Structural Defect, growth rate of Unemployment, Inflation rate, and growth rate of Real GDP per capita. In Model 2, the variables can be ordered as the growth rate of Disorder of Polity Quality, growth rate of Unemployment, Inflation rate, and Real GDP per capita growth rate. In this analysis, IRFs visualization can be in the following figures, both Model 1 and Model 2, respectively.

For a general evaluation of Figure 2.2 and Figure 2.3, it is first necessary to indicate that the impulse-response of variables against a standard deviation shocks are almost similar. Figure 2 depicts the IRFs plots for the 1-lag Panel VAR model over the next four years. Recall that each of these IRFs is formed by Monte Carlo simulations with 200 repetitions. In both models, the first rows depict the responses from a one standard deviation shock to Real GDP per capita growth rate (GDPPC in figures). A negative shock to the growth rate of Real GDP per capita

leads to a decline in the Inflation rate until the 1st year and an increase in the period 1 to 2, and then this shock is directed to zero from the period 2 to 4. Besides, a standard deviation shock to Real GDP per capita growth rate leads to a gradual increase in the Unemployment rate until the 1st year and then declines from the period 1 to 4. However, the reactions of Structural Defect and Disorder of Polity Quality (SD and DPQ in figures) are different from each other. Although Real GDP per capita shocks have a positive shock on Structural Defect, they have negative effects on Disorder of Polity Quality. While Real GDP per capita shocks on structural defect is directed to zero in the 4th period, Disorder of Polity Quality shocks are directed to zero in the 2nd period and die out. Note that shocks to the Real GDP per capita growth rate create a negative and significant impact on inflation. However, these effects are not significant on the other variables because the bands (CI) contain zero (horizontal axis) then it is not statistically significant.

The second rows depict the responses of variables to the inflation shocks. The inflation shocks have positive shocks on Real GDP per capita growth rate in both models. A standard deviation shock to Inflation rate leads to an increase in Real GDP per capita growth until the 1st year and gradually decreases in the period 1 to 4. Moreover, Inflation shocks have negative shocks on Unemployment, and they lead to reduce in unemployment until the 1st period and increases in the period from 1 to 2. Then it is gradually directed to zero. In addition, these shocks have a negative shock on the Disorder of Polity Quality and Structural Defect. One standard deviation shock to Inflation decreases in both political instability variables until the 1st period, gradually increases from period 1 to 2, and then these shocks are directed to zero. Only Unemployment reactions are significant since the bands (CI) do not contain zero (horizontal axis).

The third rows present the IRFs from one standard deviation shock to Unemployment growth rates. Whereas the responses of political instability variables to Unemployment shocks

vary from each other, the reactions of the macroeconomic performance variables to these shocks are almost similar. A standard deviation shock to Unemployment growth rates leads to a decrease in Real GDP per capita growth rate until the 1st year, an increase in the period from 1 to 3, and then it is stabilized. The unemployment shocks have temporary negative shocks on Real GDP per capita growth rate in both models, and then these shocks are directed to zero. One standard deviation shock to unemployment rate growth leads to an increase until the 1st period, a slight increase from 1 to 2, and the effect towards the last period is zero. Finally, Unemployment shocks lead to a rise in Structural Defect until 1st period before declining between 1st and 2nd , and then they die out. However, these shocks cause a decline in the Disorder of Polity Quality until the 1st year, an increase between 2nd to 3rd . It should be noted that only the reactions of Real GDP per capita growth are significant because the bands do not contain zero line.

The fourth rows in the figures show the responses of the variables to one unit standard deviation shock given to political instability variables. Whereas one unit standard deviation shock to Structural Defect growth leads to a slight decrease in Real GDP per capita growth, a standard deviation shock to Disorder of Polity Quality growth causes an increase in Real GDP per capita growth. The Structural Defect shocks lead to a decline in the Inflation rate until the 1st year, and they are directed to zero. In contrast, one unit standard deviation shock to Disorder of Polity Quality slightly increases until the 1st period, and it is stabilized. Finally, Structural Defect shocks cause a slight increase in Unemployment until 1 st period. However, Disorder of Polity Quality shocks lead to a gradual rise in until the 2nd period, and they are directed to zero. The responses are not significant for both models.

Figure 2.2

Impulse-Response Function (IRF) : Model 1

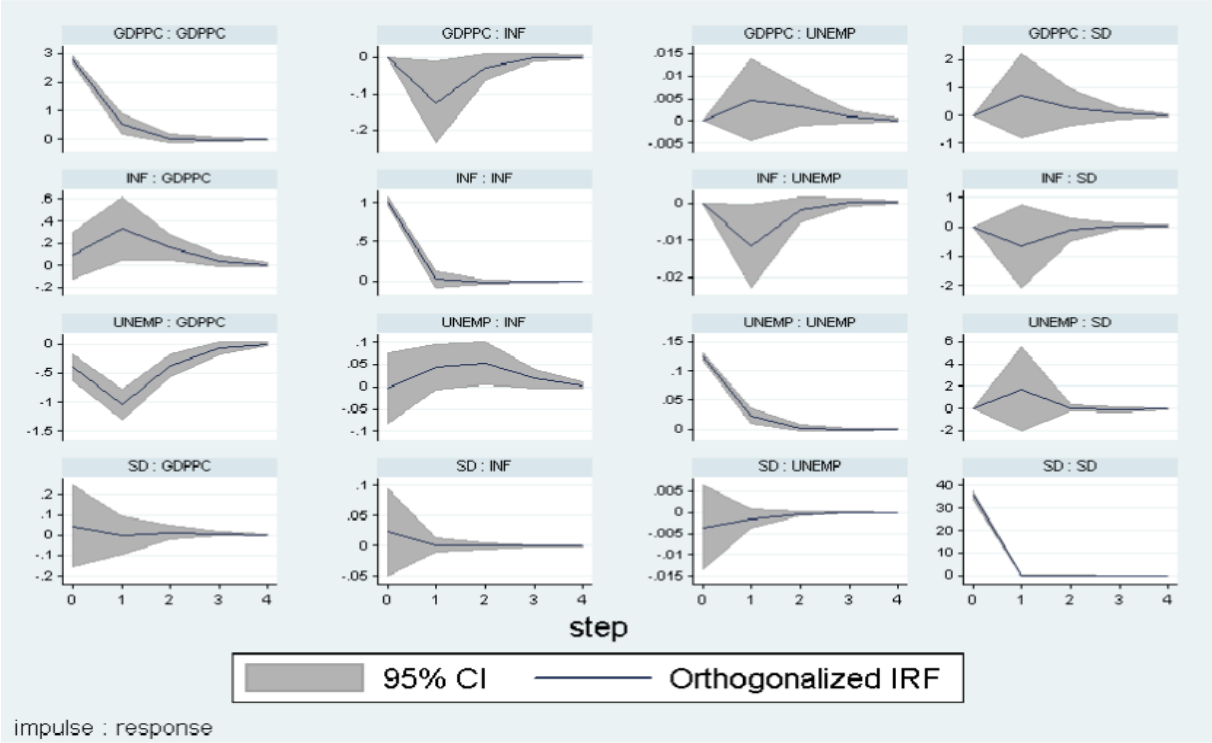
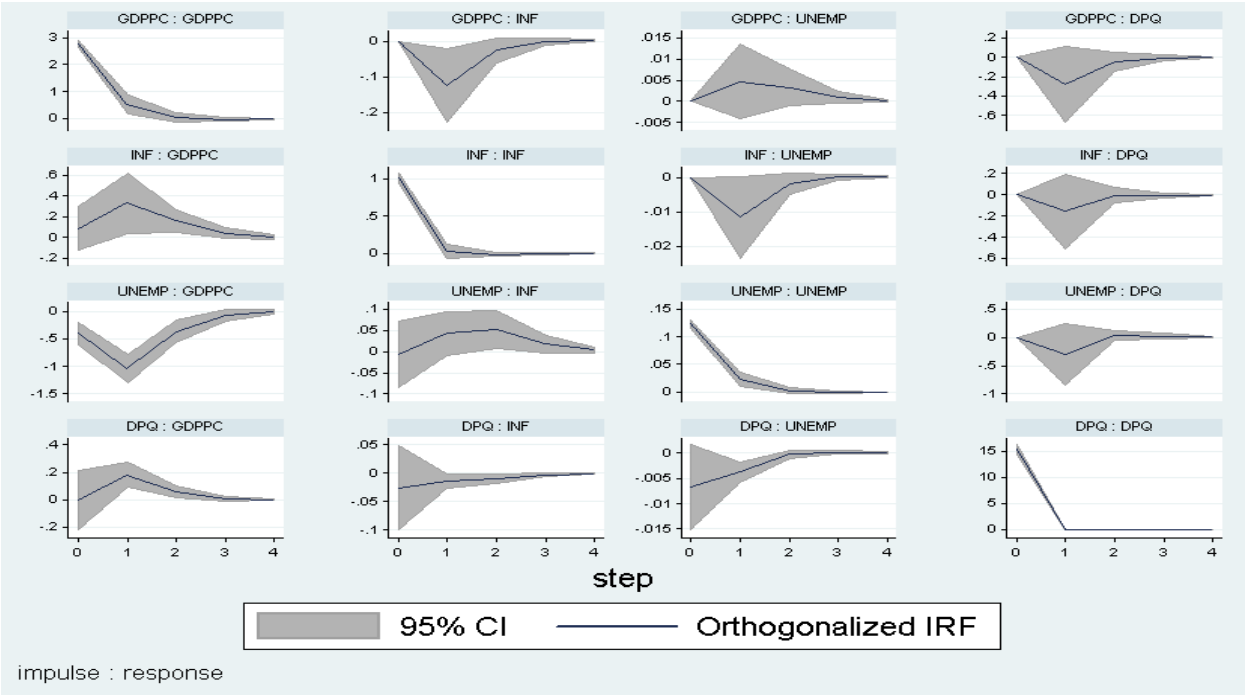


Figure 2.3

Impulse-Response Function (IRF) : Model 2



2.5.3. The Forecast-Error Variance Decompositions (FEVDs)

The Forecast Error-Variance (FEVDs) based on Cholesky decomposition of the residual covariance matrix of the estimated panel VAR models is calculated to complement the impulse-response function. Whereas the IRFs evaluate the responses of a dependent variable to other variable shocks, the FEVDs analyze the contribution of each endogenous variables shock to the determination of the other variables' forecast error variance. The following table shows the FEVDs proportions for four years forecast horizon for Model 1 and Model 2, respectively.

Standard errors and confidence intervals for the FEVD estimations are shown. It is considered Cholesky ordering of the endogenous variables. Recall that the most exogenous variable is political instability in both Model 1 and Model 2. As much as 99 % of the variation in both Structural Defect and Disorder of Polity Quality can be explained by the variables themselves. Almost 98% of fluctuations in the Unemployment growth rate is explained by itelf. In Model 1, Structural Defect growth, Inflation rate, Real GDP per capita growth explain approximately 0.09%,0.87%,0.20% of fluctuations in unemployment, respectively. In Model 2, as much as 0.37% of the change in Unemployment is explained by Disorder of Polity Quality and other explanations for the variation in Unemployment almost the same, that of Model 1. Almost 0.04% and 97% of the variation in the Inflation rate can be described by Structural Defect and the variable itself in Model 1. However, as much as 0.08 of fluctuation in Inflation rate is explained by Disorder of Polity Quality growth in Model 2. The rest of the calculations about FEVDs proportions for 4 years are similar in both models. Finally, about 83% of changes in Real GDP per capita growth is explained by itself in both models. Whereas as much as 0.01% of the variation in Real GDP per capita growth is explained by Structural Defect in Model 1, almost 37% of the variation is described by Disorder of Polity Quality in Model 2.

Table 2.9

Forecast Error-Variance Decomposition Estimations (in %,4 periods ahead)

Response Variable and Forecast Horizon				
		Model 1		
Structural Defect	Structural Defect	Unemployment rate	Inflation rate	Real GDP per capita growth
1	1	0	0	0
2	.9969236	.0023472	.0003415	.0003877
3	.996848	.0023487	.00035	.0004533
4	.9968359	.0023563	.0003505	.0004574
Unemployment rate	Structural Defect	Unemployment rate	Inflation rate	Real GDP per capita growth
1	.0008639	.9991361	0	0
2	.0009689	.9891653	.0084921	.0013736
3	.0009735	.9882942	.0087091	.002023
4	.0009735	.9882375	.008709	.0020801
Inflation rate	Structural Defect	Unemployment rate	Inflation rate	Real GDP per capita growth
1	.0005064	.0000182	.9994754	0
2	.0004989	.0018805	.9828084	.0148121
3	.0004972	.0045385	.9795495	.0154149
4	.0004973	.0048554	.979237	.0154103
Real GDP per capita growth	Structural Defect	Unemployment rate	Inflation rate	Real GDP per capita growth
1	.0002203	.020463	.0009918	.9783248
2	.0001858	.1332271	.012582	.8540052
3	.0001972	.1451032	.0151457	.839554
4	.0001992	.1455056	.0153111	.838984
		MODEL 2		
Disorder of Polity Quality	Disorder of Polity Quality	Unemployment rate	Inflation rate	Real GDP per capita growth
1	1	0	0	0
2	.9991831	.0003806	.000106	.0003303
3	.9991679	.0003862	.0001061	.0003397
4	.9991651	.0003885	.0001064	.00034
Unemployment rate	Disorder of Polity Quality	Unemployment rate	Inflation rate	Real GDP per capita growth
1	.0030109	.9969891	0	0
2	.0037297	.9863798	.008502	.0013886
3	.0037286	.9854928	.0087137	.0020648
4	.0037299	.9854324	.0087135	.0021242

Inflation rate	Disorder of Polity Quality	Unemployment rate	Inflation rate	Real GDP per capita growth
1	.0006445	.0000449	.9993106	0
2	.0007995	.001864	.9825721	.0147644
3	.0008759	.0044935	.9792745	.0153561
4	.0008837	.004806	.978959	.0153514

Real GDP per capita growth	Disorder of Polity Quality	Unemployment rate	Inflation rate	Real GDP per capita growth
1	1.39e-06	.0203714	.0010299	.9785973
2	.0034332	.1319388	.0125068	.8521213
3	.003735	.1436676	.0149681	.8376292
4	.003743	.1440661	.0151258	.837065

FEVDs show the per cent variation in one variable that is explained by the shock to another variable, accumulated over the four years. The variance decompositions display the magnitude of the total effect. According to the results, both models' first standing point is that macroeconomic and political instability variables are explained by their own shocks in the short run. All variables have self-inertia because the change in each variable is better explained by itself.

The following section shows the results of the robustness check.

2.6.Robustness Check

A variety of variables are used to test the robustness of the Panel VAR and Granger causality estimates for each model. Note that the purpose of the main analysis is to test whether there is a causal and significant relationship between variables. However, IRFs and FEVDs are also performed. Therefore, herein, only Panel VAR and Granger causality are performed for robustness check. Considering the literature review based on the macroeconomics theory, this research adopts transmission channels through which political instability affects the following macroeconomic indicators: Real GDP per capita growth rate(economic growth rate), Inflation growth rate, Unemployment growth rate. Recall that, whereas Model 1 measures the nexus

between Structural Defect and macroeconomic performance, Model 2 deals with Disorder of Polity Quality and macroeconomic performance.

The robustness check investigates what the main transmission channels are from political instability to macroeconomic performance, or vice-versa. It is tested the robustness of the relationship between economic growth represented by the growth rate of Real GDP per capita and two different aspects of political instability through the following three different variables: Total Factor Productivity growth rate (TFP), Physical Capital growth rate (PC), Human capital growth rate (HC). Recall that Total Factor Productivity is already in growth rate, but the variables of Human Capital and Physical Capital are translated into growth rate in Stata (Table 2.2). The robustness check for inflation is performed by Broad Money growth rate (BM), Government Debt growth rate (GD) and Budget Deficit growth rate (BD). Finally, the robustness for the relationship between Unemployment and political instability is checked through the Youth Unemployment growth rate (YU) and Youth Population (YP). Recall that the Unemployment rate is frequently published as a percentage, but not all percentages mean per cent changes, and a per cent sometimes represents a proportion as in the unemployment rate (Arrowhead Center 2010). The "youth" term is depicted as the persons aged 15 to 24 years by International Law Organization (ILO). In this context, ILO commonly identifies the Youth Unemployment rate as the number of unemployed 15-24 year-olds expressed as a percentage of the youth labour force[vi]. The growth rate of Youth Unemployment is calculated in Stata in this study since original data is published as the ratio.

To better understand, this research evaluates each transmission channel with each others. To put it more explicitly, this study does not mix the transmission channels, which are set for one macroeconomic data with the transmission channel, which is decided for another macroeconomic data. It does not attempt to measure how transmission channels decided for the three main macroeconomic indicators that are used in the main analysis affect each other.

Therefore, for the robustness check, whichever transmission channels we include in the research, we exclude the main macroeconomic variable they belong to. Still, we keep the other two main macroeconomic variables that we use in the main analysis. Herein, the findings between transmission channels and political instability variables are interpreted because this research aims to draw a picture of their interconnections. However, the relationship among transmission mechanism channels for each macroeconomic indicator can be found in detail in Appendix B -C. The robustness check is performed for both Model 1 and Model 2.

Initially, the robustness test is carried out for Model 1, which includes the first aspect of political instability: Structural Defect. It is first checked the results of the relationship between the growth rate of Structural Defect and the growth rate of Real GDP per capita, namely economic growth, by using three transmission channels. Recall that the Panel VAR is estimated with lag (1). As to robustness tests, the Panel VAR models with lag (1) for each tranmission channel are also estimated. The estimated models satisfy the stability condition. There is no significant and causal relationship running from any transmission channel considered for economic growth (growth rate of Total Factor Productivity, growth rate of Physical Capital, growth of Human capital) to Structural Defect. However, there is a causal and significant relationship running from Structural Defect to the growth rate of Human Capital in Model 1. In Model 2, there is no statistically significant and causal relationship from any transmission channel adopting for the growth rate of Real GDP per capita to growth rate of Disorder of Polity quality. As it can be found in Appendix B , an increase in the growth rates of Structural Defect leads to a decrease (-0.078) in the growth rates of Human Capital at 5% significance level in Model 1. In contrast, one unit increase in the growth rate of Disorder of Polity Quality negatively impacts (-0.008) in Total Factor Productivity growth at 1% significance level in Model 2. These are the transmission channels in the analysis while observing the relationship between economic growth and political instability. The results are consistent with both the

literature review and the expectations of this research for this relationship. Furthermore, the findings, which run from both political instability variables to economic growth in the main analysis, is also supported by the results of robustness check since the direction of the relationship runs from political instability variables to growth rate of Human Capital and growth rate of Total Factor Productivity

Secondly, the relationship between the Inflation rate and the growth rate of Structural Defect is checked. Recall that the main analysis results prove a one-way relationship running from Structural Defect to Inflation. In the robustness test, selected transmission channels for Inflation rate such as the growth rate of Broad Money (BM), the growth rate of Budget Deficit (BD) and the growth rate of Government Debt (GD) do not have any significant relationship with the growth rate of Structural Defect. However, there is a one-way relationship from the growth rate of Disorder of Polity Quality to the growth rate of Budget Deficit at 1% significance level. This result is consistent with the main analysis results showing a causal and significant relationship running from Disorder of Polity quality to the Inflation rate. Recall that Disorder of Polity Quality includes external conflict, religious and ethnic tensions, law and order and bureaucratic quality. Therefore, an increase in any of these indicators, which exacerbate the Disorder of Polity Quality, namely the second aspect of political instability in this analysis, can threaten the growth rate of Budget Deficit. Furthermore, this research shows an increasing Budget Deficit is funded by monetizing in the politically unstable environment in terms of Disorder of Polity Quality. Because a causal and significant relationship from Budget Deficit to Money Growth is found. Hence, in this context, while explaining Inflation, if the Budget Deficit is financed by taking into account the Broad Money growth rate, Inflation is a monetary phenomenon, as Friedman assumed.

Finally, the robustness of the findings of the nexus between the growth rate of Unemployment rate and political instability is checked. The following two transmission

channels are used to check robustness: the growth rate of youth unemployment and the growth rate of the Youth Population. Remember that a causal and significant relationship runs from the growth rates of Structural Defect and Disorder of Polity Quality to the Unemployment growth rate. In the robustness check, although it is estimated that there is a reverse direction compared to the main analysis for Model 1, it is found the same direction for Model 2. In Model 1, which performs the analysis with Structural Defect, the significant and causal relationship running from the growth rate of Youth Population to Structural Defect.

Moreover, there is also a significant relationship between the growth rate of Youth Population and the growth rate of Youth Unemployment. In Model 2, conducting with disorder of polity quality, the causal and significant relationship from Disorder of Polity Quality to Youth Unemployment. Youth Population growth has a causal and significant impact on the Youth Unemployment growth rate like in Model 1. The findings are consistent with the literature review and Youth Bulge Theory, which is acknowledged for this study. In terms of the direction of the relationship, Model 2 coincides with the findings of the main analysis results. That means that Youth Unemployment growth is the transmission channel while observing the relationship between the Disorder of Polity qQality and Unemployment growth rate. The concrete form of the interpretations is shown in the summary table below. Statistical tables can be found in Appendix B- C

Table 2.10

Summary Table

Main Analysis Results		Robustness Check Results
• Real GDP per capita growth ↔Inflation rate ***	Bi-directional Relationship	• Structural Defect→ Human Capital** • Disorder of Polity Quality→Total Factor Productivity growth*

• Structural Defect→Inflation rate * • Structural Defect → Unemployment rate** • Structural Defect → Real GDP per capita growth***	One-way Relationship	• There is no relationship between Structural Defect and any transmission channel
• Inflation rate→Unemployment rate*	One-way Relationship	• Youth Population→ Structural Defect*
• Unemployment rate→ Real GDP per capita growth***	One-way Relationship	
• Disorder of Polity Quality→ Inflation rate*** • Disorder of Polity Quality → Unemployment rate *** • Disorder of Polity Quality →Real GDP per capita growth***	One-way Relationship	• Disorder of Polity Quality →Budget Deficit *** • Disorder of Polity Quality→Youth Unemployment rate*

Note: *, **, and *** denote statistical significance at 10 %, 5 %, and 1 % levels, respectively. It is aimed to show the relationship between political instability(structural defect and disorder of polity quality) and transmission channels determined for macroeconomic performance indicators. Therefore, it is displayed the findings related to structural defect and disorder of polity quality.

2.7.Conclusion

The second chapter of this dissertation builds on the literature investigating whether there is a simultaneous causal relationship between political instability and macroeconomic performance. This chapter also goes beyond the Panel VAR and conducts Impulse-Response Functions (IRFs) and Forecast Error Variance Decompositions (FEVDs). Unlike that of the existing literature, this research performs the analysis by using different aspects of political instability. In the end, this thesis represents whether the relationship between macroeconomic performance and political instability change when using different political instability

dimensions. This study also goes further than the current state of the literature by representing the importance of the transmission channels of this relationship based on a broad theoretical perspective as a robustness check of the analysis.

The baseline estimations indicate that different dimensions of political instability may have different links with macroeconomic performance indicators. Recall that this chapter uses political instability dimensions as a proxy of political instability, produced using Principal Component Analysis (PCA) in the first chapter of this thesis. According to analysis results in the first chapter, the first component, Structural Defect, much more characterizes the political instability. The second component, Disorder of Polity Quality, less identifies the political instability. However, both are selected since they stand out compared to other dimensions of political instability in the first chapter. Then, these two different aspects are employed in this chapter, where Panel VAR is applied to observe political instability and macroeconomic performance. However, the findings of Model 1, built on the Structural Defect aspect of political instability and Model 2, focusing on Disorder of Polity Quality aspect of political instability, are almost similar in the main analysis of this research-even if the significance levels sometimes change when comparing the models-.

In my model, the dual link between economic and political instability variables are observed, which is an issue that has been generally ignored in the recent literature. Existence studies considering two-way relationships use a simultaneous equation model. However, this study aims to measure bi-directional nexus through the Panel VAR model. Hence, this point is important in terms of the contribution of this research to the literature. Nevertheless, the general findings of this chapter show that growth rates of political instability have a causal and significant impact on all the macroeconomic indicators, namely macroeconomic performance. On the contrary, there is a non-significant relationship running from macroeconomic indicators to both political instability dimensions. That means this research supports the one-way

relationship between political instability and macroeconomic performance. These findings are consistent with the previous studies. The general view of the literature review shows the direction of the relationship running from political instability to macroeconomic performance. (Londregan and Poole 1990; Zablotsky 1996; Alesina and Perotti 1996; Aisen and Veiga 2011). In this context, when countries' macroeconomic outlook weakens, policymakers should consider mitigating political instability since both dimensions of political instability lead to a deterioration in macroeconomic performance. However, while shaping macroeconomic policies, unquestionably, the interaction of macroeconomic indicators within themselves should not be ignored. Since this study takes into account this situation, it applies Panel VAR, which treats all data as endogenous. The focal point of this research is to calculate the nexus between macroeconomic performance, which expresses the synthesis of all macroeconomic variables included in the analysis, and political instability. It mainly tries to observe the role of political instability. Nevertheless, the internal dynamics of macroeconomic variables are also discussed below without deviating from the primary purpose of the thesis.

Firstly, the analysis is performed with the growth rates of political instability variables and Real GDP per capita growth rate, which represents economic growth. The results show that there is a one-directional relationship running from political instability growth rate to economic growth. In the analysis, both political instability variables adversely impact economic growth. Although there are studies that reveal the existence of a bidirectional relationship (Alesina et al. 1992; Gasiorowski 1998 etc.), most studies in the literature find a one-way connection from political instability to economic growth. In this context, this study's results agree with the majority of the findings of the earlier studies (John-A-Pin 2006; Aisen 2011; Abdelhameed and Rashdan 2021 etc.). Furthermore, in the robustness test, among transmission channels employing for economic growth, an increase in growth rates of Structural Defect and Disorder of Polity Quality leads to a decrease in the growth rates of Human Capital and Total Factor

Productivity. Recall that Structural Defect includes corruption, socioeconomic condition, internal conflict investment profile etc. For instance, an increase in corruption or an escalation in internal conflict may cause a brain drain, and these issues harm economic growth. In addition, Disorder of Polity Quality includes law and order, bureaucracy quality, external conflict etc. For instance, an escalation in external conflict such as diplomatic and foreign pressures, cross-border disputes etc., may cause a slowdown in Total Factor Productivity. These results regarding the growth rate of Total Factor Productivity and Human Capital are supported by previous studies (Gyimah-Brempong and Camacho 1998; Aisen and Veiga 2011; Abdelhameed and Rashdan 2021). In addition, Aisen and Veiga (2011) also find a significant relationship running from political instability to Physical Capital Accumulation. Since there is no relationship between political instability and physical capital in this thesis, its result differs from the findings of these authors. The underlying reason may be the differentiation of sample countries, period, econometric model between the two analyzes.

Moreover, unemployment and inflation substantially impact economic growth, respectively. A rise in the Unemployment growth rate causes decreasing in Real GDP per capita growth, namely economic growth. In contrast, one unit increase in the Inflation rate leads to a soar in economic growth. To sum up, while shaping economic growth policies, policymakers should form comprehensive policies that approach the issue from macroeconomic and political perspectives.

Secondly, the main findings show that an increase in political instability growth rate triggers a rise in inflation rate. The direction of the relationship runs from political instability to inflation. Both Structural Defect and Disorder of Polity Quality have a statistically positive impact on Inflation rate at 10% and %5 significance level, respectively. Few studies investigate a bi-directional relationship between political instability and inflation in the literature (Gasiorowski 2009). Those research findings commonly reveal the direction from political

instability to inflation (Aisen and Veiga 2006; Barugahara 2014; Jan et al. 2021). Hence, the previous studies support the results of this thesis. The other pillar of this research is to determine the transmission channel between political instability and inflation. Broad Money, Government Debt and Budget Deficit are deemed as transmission channels between political instability and inflation. These channels are created based on an extensive literature review with solid theoretical knowledge (section 2.1). To the best of my knowledge, no study in the related literature explicitely uses the transmission channel between political instability and inflation. Therefore, that can be an important contribution of this study to literature. According to the results, only Disorder of Polity Quality growth leads to an increase in Budget Deficit growth, which is deemed as a transmission channel for the inflation rate. More specifically, recall that Disorder of Polity Quality includes religious and ethnic tensions, external conflict and bureaucratic quality and law and order. The disorders of each of them may lead to a distortion of budget balance. If the deficit is funded by money growth, it may lead to a rise in inflation in the end. To sum up, the policies to be attempted to put pressure on the Disorder of Polity Quality should focus on reducing Budget Deficit in the nexus between Inflation and the Disorder of Polity Quality. In addition, according to results of the dynamics between Inflation rate and other macroeconomic indicators, Inflation and Real GDP per capita,namely economic growth, mutually affect each other. Briefly, inflation policies can be shaped around the actions that pressurize political instability and increase economic growth.

Thirdly, there is a relationship running from political instability to the growth rate of Unemployment. The growth rates of Structural Defect and Disorder of Polity Quality lead to a decrease in the Unemployment growth rate. Furthermore, Their effects on unemployment are similar. They have high significance but low impact. In the case of transmission channels, estimated models are differentiated from each other. While Youth Population growth negatively impacts Structural Defect growth rate , the Disorder of Polity Quality growth rate adversely

affects Youth Unemployment growth. Model 2 conducted by Disorder of Polity Quality supports the findings in the main analysis in terms of the direction of the relationship. For this reason, considering this result of transmission channels employed for the growth rate of Unemployment, the steps taken to mitigate in Disorder of Policy Quality should focus on reducing Youth Unemployment. In the literature, Fuller (1995), Goldstone (2002) and Urdal (2006) argue that the relationship between internal conflicts, which is one of the political indicators included in Structural Defect, and unemployed young people in point of burgeoning youth populations, which is so-called *Youth Bulge* in literature. It mainly indicates that growing young populations frequently end up with rampant unemployment and many dissatisfied youths, who are prone to join rebel or terrorist groups. That theory supports the results of this study. A rise in the Youth Population leads to an increase in Young Unemployment. However, my findings point out that Disorder of Polity Quality affects on Youth Unemployment. Recall that Disorder of Polity Quality includes ethnic and religious tensions, external conflict etc. It does not involve internal conflict. With respect to Fuller, Goldstone and Urdal's theories, this study highlights different political factors and reverse relationships running from Disorder of Polity Quality to Youth Unemployment. These research findings contribute to the literature because they approach the issue with a different perspective in terms of the dynamics between political instability and youth unemployment.

Regarding dynamics between unemployment and other macroeconomic variables, there is also nexus running from the Iinflation rate to the Unemployment growth rate. The inflation rate has a statistically negative impact on the Unemployment growth rate. However, this result is positive from the economics point of view. When the economy overheats and economic growth is faster than the long-run trend rate, the economy can tend to get demand-pull inflation. Firms push up prices because demand is growing faster than supply. This higher growth may cause a lower unemployment rate as firms take on more workers in the short term. To reduce

unemployment, on the one hand, governments can adopt policies ensuring political stabilization. On the other hand, it would be wrong to say that the government directly should resort to policies that increase inflation. Still, it should not ignore the reducing effect of inflation on unemployment from time to time while preparing policies.

Finally, the Impulse Response Functions (IRFs) analysis, which is a specific approach to clarify how variables are affected by one standard deviation shocks, is performed. According to the results, each variable responds to shocks. Both Model 1 and Model 2 have similar results. Later, Forecast Error Decompositions (FEVDs) is showed. In a general perspective, the findings indicate that variations in variables can be explained by the variable itself. It's noteworthy that the third columns of Figures 2 -3 are typical examples of the hysteresis effect in the labor market. The unemployment hysteresis hypothesis proposed by Blanchard and Summers (1986:2) implies that an increase in unemployment rates in the face of any shock affecting unemployment-mostly economic shock- is considered as a natural economic incidence. However, rising unemployment rates do not return to their previous levels after the shocks disappear (Bekmez and Özpolat 2016). Because unemployment depends on its own lag. However, it can be clearly seen that this effect also stems from political shocks, along with economic ones. Political instability shocks lead to an increase in Unemployment growth. However, when the impact of the political shocks wears off, unemployment does not turn to equilibrium until 2nd period. This situation can be taken into consideration in the regulations of the labour market by policy-makers

Consequently, the causal and significant relationship is commonly driven from political instability to macroeconomic performance. In this context, two forms of political instability can be an important tool in shaping macroeconomic policies. However, the links among macroeconomic variables also mean that guidelines should be produced in a coordinated manner covering both macroeconomic policies and political situations. Although this research

includes comprehensive literature, there are still some debates on that. I hope future studies will improve more sophisticated ways to explain the causal relationship between political instability and macroeconomic performance by using different methods and dataset.

NOTES

[i] In the Chapter I, two dimensions of political instability have composed by using Principal Component Analysis (PCA). The analysis with 11 political risk indicators is conducted. According to results, PCA suggests being selected the first two dimensions that it respectively named as Structural Defect and Disorder of Polity Quality. The first two dimensions reflect better identification of the political instability compared to other dimensions produced by PCA, although the first dimension characterizes much more the political instability.

[ii] In the literature, most researches have focused on the direct effect of political instability on economic performance. One well-known study, co-written by Ari Aisen (2011), has also investigated tranmission channels only for the one-way relationship between economic growth and political instability using linear dynamic panel data model on a sample covering up 169 countries. This study also considers transmission channels of unemployment and inflation by allowing for bi-directional causality for which I employ a panel VARs model.

[iii] Structural Defect includes Socioeconomic Conditions (S_EC), Investment Profile (IP), Internal to Conflict (IC), Corruption (COR), Military in Politics (M_P), Bureaucratic Quality (BQ).

[iv]Disorder of Polity Quality consists of Religious Tension (RT), Ethnic Tension (ET), External Conflict (EC),Law and Order (LO), Bureaucratic Quality (BQ).

[v] The identification of youth unemployment rate can be found in the following link: https://www.ilo.org/wcmsp5/groups/public/---dgreports/ stat/documents/publication/wcms_422439.pdf

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2.8.Appendix

Appendix A

Summary Table of Literature Review (Seperated by 90s and 2000s)

The 90s			The 2000s		
Authors	Political Instability Variables and Sample	Model	Authors	Political Instability Variables and Sample	Model
Londregan and Poole (1990)	Coups d'etat + (121 countries)	Two-equation model	Annet (2001)	Communal and political victims, civil wars, assassination, coups, revolutions, riots, government crisis, cabinet changing and constitutional structures + (108 countries)	Cross-sectional regression analysis
Muller and Weede (1990)	Political violence + (131 independent countries 1973-1977)	Two-equation model	Campos and Nugent (2002)	Political assasinations, revolutions, successful coups d'Etat + (98 developing countries grouped by region)	Granger-Causality
Barro (1991)	Revolutions, coups, assassinations + (98 countries)	Cross-sectional regression analysis	Telatar and Telatar (2004)	Military intervention + (Turkey)	Probit model
Alesina et al. (1992)	The propensity of government changes + (113 countries)	Simultaneous equation system	Aisen and Veiga (2006)	Executive changes Economic Freedom Index + (166 countries)	Linear Dynamic Panel Data Analysis
Fosu (1992)	Guerilla warfare, secession movements, political assassinations, revolutions, riots, major, large anti-government demonstrations, strikes + (Sub-Saharan African Countries)	Simultaneous equation system	Tosun et al (2008)	ICRG (Government Stability,Socioeconomic Condition,Investment Profile, Internal Conflict,External Conflict,Corruption,Military in Politics, Religious Tensions,Law and Order,Ethnic Tensions,Democratic Accountability,Bureaucracy Quality + (MENA Countries)	Data Envelopment Analysis
Alesina and Rosenthal (1993)	Electoral changes + United States	Regression model	John-A-Pin (2008)	Mass civil protest, politically motivated aggression, instability within the political regime, instability of the political regime + (128 countries)	Simultaneous equation panel data analysis
Zablotsky (1996)	Non Military factors) + (63 Countries)	Simultaneous equation system	Aisen and Veiga (2011)	Assassinations, Cabinet Changes, Coups, Executive Changes, Government Crises, Elections and Fragmentation Index + (169 countries)	Linear Dynamic Panel Data Analysis
			Azeng and Yugo (2013)	Internal Conflict + (24 developing countries)	

De Haan and Sierman (1996)	Government changes + (97 countries grouped by regions)	Cross-section model	Hoolari et. al (2014)	Cabinet changes, government crisis, political regime characteristics + (Iran)	Cross-sectional regression analysis
Alesina and Perotti (1996)	Politically-motivated assassinations, people killed in mass domestic violence, coups d'etat + (71 countries)	Two-equation model	Barugahara (2014)	-The State Failure Index (revolutionary and ethnic wars,genocide) -The State Fragility Index (effectiveness and legitimacy) + (49 African countries)	GARCH model
			Shahabad (2014)	Political violence, conflict, terrorism and popularity of government + (Ukraine, Romania, Indonesia, Thailand, Ecuador,Brazil)	Panel unit root and panel cointegration analysis
			Abdelkader (2017)	The number of years of chief executive,corruption in political election,polity score + (Egypt)	Error Correction Model (ECM)
Feng (1997)	İrregular government change, major regular government change, minor regular government change + (96 countries)	Simultaneous equation system	Brückner and Gradstein (2015)	Ethnic polarization + (115 countries)	Panel Data Analysis
Gupta et. al (1998)	Social unrest + (120 countries)	Simultaneous equation system	Şanlısoy and Çetin (2017)	ICRG dataset (Government Stability,Socioeconomic Condition,Investment Profile, Internal Conflict,External Conflict,Corruption,Military in Politics, Religious Tensions,Law and Order,Ethnic Tensions,Democratic Accountability,Bureaucracy Quality + (Turkey)	Vector Error Correction Model (VECM)
Gasiorowski (1998)	Peaceful unrest, violent unrest, coups d'etat, government changes + (121 countries grouped by regions)	Fixed effect regression analyses	Baklouti and Boujelbene (2020)	World Governance Index (Regulatory quality, government effectiveness, political stability absence of violence, voice and accountability, rule and law, control of corruption) + (17 MENA countries)	Dynamic Panel Data Analysis
			Papaioannou (2020)	Probability of political change +	Simultaneous equation system

				(Greece)	
Gyimah-Brempong and Traynor (1999)	Coups, guerilla warfare, secession movements, political assassinations, revolutions, riots, major government crisis, constitutional crisis, large scale anti-government demonstrations, strikes, constitutional changes, and plots + (Sub-Saharan African countries)	Simultaneous equation system	Abdelhameed and Rashdan (2021)	Absence of violence,terrorism + (Egypt,Tunisia, Algeria, Sudan, Brazil, Turkey, Indonesia)	Cointegration Analysis and Error Correction (ECM)
			Jan et al. (2021)	System of government, government crises, cabinet changes + (Pakistan)	Regression Analysis
			Çela and Hysa (2021)	World Governance Index (Regulatory quality, government effectiveness, political stability absence of violence, voice and accountability, rule and law, control of corruption) + (CEE countries)	Panel Fixed Effect Model
			Germain and Boigny (2021)	The total score of riots without government reshuffling,riots following governmnet reshuffling,riots leading to fall all kind of regimes and coups, and poverty,level of education + (Cote d'Ivoire subdivided into 11 regions)	Fixed-effect Panel Model
			Nicolay and Valladares (2021)	ICRG dataset (Government Stability,Socioeconomic Condition,Investment Profile, Internal Conflict,External Conflict,Corruption,Military in Politics, Religious Tensions,Law and Order,Ethnic Tensions,Democratic Accountability,Bureaucracy Quality) + (90 Countries)	Dynamic Panel Data Analysis

Appendix B.

Robustness Panel VAR Test Results (with transmission channel)

Model 1

Robustness Test for Economic Growth

Var.	TFP_t	PC_t	HC_t	Unemployment $rate_t$	Inflation $rate_t$	Structural $Defect_t$
TFP_{-1}	0.076 (0.122)	-0.030 (0.027)	-0.001 (0.009)	0.003 (0.002)	0.474 (1.549)	-0.006 (0.015)
PC_{-1}	0.019 (0.336)	-0.130 (0.089)	-0.006 (0.018)	0.007 (0.006)	2.220 (4.875)	0.010 (0.039)
HC_{-1}	0.028 (0.068)	-0.006 (0.015)	-0.026*** (0.004)	0.000 (0.000)	0.428 (1.026)	0.004 (0.008)
Unemployment $rate_{t-1}$	-7.423 (7.787)	-0.718 (1.821)	-0.168 (0.467)	0.217** (0.096)	8.368 (0.226)	0.326 (0.945)
Inflation $rate_{t-1}$	0.555 (1.382)	0.147 (0.319)	0.033 (0.081)	0.002 (0.014)	-8.459 (20.753)	-0.078 (0.166)
Structural Defect $_{t-1}$	-7.179 (0.091)	-0.077 (0.206)	-0.078** (0.079)	-0.022** (0.011)	5.627 (13.363)	-0.113 (0.143)
Number of Observations	669					
Number of Countries	96					
GMM Criterion Q(b)	1.19e-31					

Robustness Test for Inflation Rate

	BM_t	BD_t	GD_t	Real GDP per capita $growth_t$	Unemployment $rate_t$	Structural $Defect_t$
BM_{t-1}	-0.032 (0.040)	0.494 (0.030)	-0.033 (0.410)	0.014 (0.010)	0.000 (0.000)	-0.000 (0.001)
BD_{t-1}	0.004** (0.003)	0.397*** (0.121)	-0.013 (0.015)	0.001 (0.001)	0.000* (0.001)	-0.000 (0.000)
GD $_{t-2}$	0.006 (0.005)	0.265 (0.282)	0.006 (0.033)	-0.022 (0.015)	0.003*** (0.001)	-0.000 (0.002)
Real GDP per capita $growth_{t-1}$	-0.025 (0.046)	1.835 (3.108)	-0.032 (0.125)	0.138** (0.056)	0.001 (0.001)	-0.0130* (0.007)

Unemployment rate$_{t-1}$	1.019 (1.781)	7.287 (6.242)	-0.967 (2.484)	-8.636*** (0.831)	0.234*** (0.045)	-0.119** (0.059)
Structural Defect$_{t-1}$	-0.067 (0.113)	-1.445 (1.268)	0.406 (0.427)	0.160 (0.195)	0.014** (0.006)	-0.170* (0.094)
Number of Observations	777					
Number of Countries	112					
GMM Criterion Q(b)	1.85e-31					

Robustness Test for the Growth Rate of Unemployment

	YP	YU	Real GDPpc	Inflation	Structural Defect$_t$
YP$_{t-1}$	-0.128 (0.124)	-0.003*** (0.001)	0.024*** (0.003)	-0.013 (0.034)	-0.001* (0.000)
YU$_{t-1}$	1.930 (1.823)	0.141*** (0.026)	-2.725 (1.904)	4.144 (5.345)	0.013 (0.050)
Real GDP per capita growth$_{t-1}$	0.215 (0.169)	-0.000 (0.002)	0.215*** (0.063)	0.392 (0.496)	-0.015* (0.009)
Inflation rate$_{t-1}$	-1.164 (0.719)	0.001 (0.004)	-0.105 (0.128)	-2.044 (0.260)	-0.018 (0.019)
Structural Defect$_{t-1}$	-0.449 (0.992)	-0.009 (0.009)	0.228 (0.222)	1.270 (1.436)	-0.160 (0.091)
Number of Observations	805				
Number of Countries	117				
GMM Criterion Q(b)	2.15e-32				

Model 2

Robustness Test for Economic Growth						
Var.	TFP_t	PCA_t	HC_t	Unemployment $rate_t$	Inflation $rate_t$	Disorder of Polity $Quality_t$
TFP_{t-1}	0.077 (0.121)	-0.006 (0.005)	-0.001 (0.010)	0.003 (0.002)	0.477 (0.1.595)	-0.000 (0.020)
PC_{t-1}	0.020 (0.336)	-0.096** (0.037)	-0.006 (0.020)	0.007 (0.006)	2.050* (5.075)	-0.070 (0.076)
HC_{t-1}	-0.028 (0.069)	-0.000 (0.381)	-0.027*** (0.004)	0.000 (0.000)	0.444 (0.091)	0.009 (0.011)
Unemployment $rate_{t-1}$	-7.358 (7.707)	-0.732 (1.289)	-0.177 (0.513)	0.213** (0.103)	9.179 (3.126)	-3.269 (2.901)
Inflation $rate_{t-1}$	0.546 (1.404)	0.151 (0.030)	0.036 (0.091)	-0.004 (0.016)	-8.730 (1.951)	-0.216 (0.248)
Disorder of Polity $Quality_{t-1}$	-0.008* (0.004)	-0.006 (0.001)	-0.000 (0.002)	-0.0001** (0.000)	0.023 (0.071)	-0.004 (0.002)
Number of Observations	531					
Number of Countries	96					
GMM Criterion Q(b)	2.33e-31					

Robustness Test for Inflation Rate						
	BM_t	BD_t	GD_t	Real GDP per capita $growth_t$	Unemployment $rate_t$	Disorder of Polity $Quality_t$
BM $_{t-1}$	-0.032 (0.040)	0.485 (0.786)	-0.0034 (0.041)	0.014 (0.010)	0.000 (0.000)	0.025 (0.030)

BD_{t-1}	0.004**	0.398***	-0.014	0.001	0.000) *	0.008
	(0.003)	(0.122)	(0.016)	(0.021)	(0.000)	(0.010)
GD_{t-1}	0.006	0.271	0.006	-0.022	0.003***	-0.009
	(0.005)	(0.287)	(0.032)	(0.016)	(0.000)	(0.010)
Real GDP per capita growth$_{t-1}$	-0.025	1.796	-0.031	0.137**	0.001	-0.131
	(0.046)	(3.113)	(0.125)	(0.056)	(0.001)	(0.116)
Unemployment rate$_{t-1}$	1.033	-7.812	-1.037	-8.637***	0.236***	-1.457
	(1.795)	(6.242)	(2.519)	(0.833)	(0.046)	(1.390)
Disorder of Polity Quality$_{t-1}$	0.001	0.887***	-0.004	0.008***	-0.000*	-0.001
	(0.001)	(0.058)	(0.005)	(0.000)	(0.000)	(0.002)
Number of Observations	777					
Number of Countries	112					
GMM Criterion Q(b)	1.89e-30					

Robustness Test for Unemployment Rate					
	YP_t	YU_t	Real GDP per capita growth$_t$	Inflation rate$_t$	Disorder of Polity Quality$_t$
YP_{t-1}	-0.128	-0.003	0.024***	0.012***	0.003
	(0.124)	(0.001)***	(0.003)	(0.001)	(0.005)
YU_{t-1}	1.952	0.141***	-2.234	4.080	-0.884
	(1.958)	(0.026)	(1.909)	(5.282)	(1.093)
Real GDP per capita$_{t-1}$	0.215	0.001	0.213***	-0.044**	-0.127
	(0.169)	(0.002)	(0.065)	(0.019)	(0.111)
Inflation rate$_{t-1}$	-1.164	0.001	-0.106	-2.045	0.238
	(0.719)	(0.004)	(0.128)	(2.261)	(0.319)
Disorder of Polity Quality$_{t-1}$	0.001	0.0007***	0.011***	0.002***	-0.003***
	(0.001)	(0.0001)	(0.000)	(0.003)	(0.000)
Number of Observations	805				
Number of Countries	117				

	2.80e-31	
GMM Criterion Q(b)		

Note: The results of panel VARs conducting with Structural Defect can be found in Model 1. The results of panel VARs conducting with Disorder of Polity Quality can be found in Model 2. Number of observations between 2008-2017. Robust standart errors are in parantheses. Panel-specific fixed effects removed using forward ortogonal deviation or Helmert tranformation. The optimal lag selection is at one and decided through Overall Coefficient of Determination (pvarsoc in Stata). *, **, and *** denote statistical significance at 10 %, 5 %, and 1 % levels, respectively.

Appendix C.

Robustness Granger Test Results (with transmission channel)

Model 1			
Robustness Test for Economic Growth			
Total Factor Productivity growth rate (TFP)	• PhysicalCapital (excluded) does not granger cause Total Factor Productivity growth rate	0.003	0.954
	• Human Capital (excluded) does not granger cause Total Factor Productivity growth rate	0.178	0.673
	• Structural Defect (excluded) does not granger cause Total Factor Productivity growth rate	0.009	0.923
Physical Capital (PC)	• Total Factor Productivity growth rate (excluded) does not granger cause Physical Capital	1.245	0.265
	• Human Capital (excluded) does not granger cause Physical Capital	0.819	0.177
	• Structural Defect (excluded) does not granger cause Physical Capital.	0.167	0.683
	• Total Factor Productivity growth rate (excluded) does not granger cause Human Capital.	0.000	0.985

Human Capital (HC)	• Physical Capital (excluded) does not granger cause Human Capital.	0.110	0.740
	• Structural Defect (excluded) does not granger cause Human Capital.	0.984	0.321
Structural Defect	• Total Factor Productivity (excluded) does not granger cause Structural Defect	0.202	0.653
	• Physical Capital (excluded) does not granger cause Structural Defect	0.068	0.795
	• Human Capital (excluded) does not granger cause Structural Defect	3.414	0.04**
Robustness Test for Inflation Rate			
Broad Money (BM)	• Budget Deficit (excluded) does not granger cause Broad Money.	3.100	0.07**
	• Government Debt (excluded) does not granger cause Broad Money.	1.011	0.315
	• Structural Defect (excluded) does not granger cause Broad Money.	0.701	0.402
Budget Deficit (BD)	• Broad Money (excluded) does not granger cause Budget Deficit	0.397	0.529
	• Government Debt (excluded) does not granger cause Budget Deficit	0.883	0.347
	• Structural Defect (excluded) does not granger cause Budget Deficit	0.058	0.810

Government Debt (GD)	• Broad Money (excluded) does not granger cause Government Debt	0.682	0.409
	• Budget Deficit (excluded) does not granger cause Government Debt	0.774	0.379
	• Structural Defect growth (excluded) does not granger cause Government Debt	0.908	0.341
Structural Defect	• Broad Money (excluded) does not granger cause Structural Defect	0.356	0.551
	• Budget Deficit (excluded) does not granger cause Structural Defect	0.201	0.654
	• Government Debt (excluded) does not granger cause Structural Defect	0.193	0.660
	Robustness Test for Unemployment Rate		
Youth Population (YP)	• Youth Unemployment (excluded) does not granger cause Youth Population.	1.121	0.290
	• Structural Defect (excluded) does not granger cause Youth Population.	0.205	0.651
Youth Unemployment (YU)	• Youth Population (excluded) does not granger cause Youth Unemployment	46.067	0.000***
	• Structural Defect (excluded) does not granger cause Youth Unemployment	0.981	0.322
Structural Defect	• Youth Population (excluded) does not granger cause Structural Defect	3.782	0.052*
	• Youth Unemployment (excluded) does not granger cause Structural Defect	0.070	0.791

Model 2			
Robustness Test for Economic Growth			
Total Factor Producitivity growth rate	• Physical Capital (excluded) does not granger cause Total Factor Productivity growth rate	0.004	0.951
	• Human Capital (excluded) does not granger cause Total Factor Productivity growth rate	0.165	0.685
	• Disorder of Polity Quality growth (excluded) does not granger cause Total Factor Productivity growth rate	3.068	0.080*
Physical Capital (PC)	• Total Factor Productivity growth rate(excluded) does not granger cause Physical Capital	1.151	0.283
	• Human Capital (excluded) does not granger cause Physical Capital	0.181	0.671
	• Disorder of Polity Quality growth (excluded) does not granger cause Physical Capital	0.386	0.535
Human Capital (HC)	• Total Factor Productivity growth rate(excluded) does not granger cause Human Capital	0.000	0.985
	• Physical Capital Accumulation (excluded) does not granger cause Human Capital	0.103	0.748
	• Disorder of Polity Quality growth (excluded) does not granger cause Physical Capital	0.004	0.947
Disorder of Polity Quality	• Total Factor Productivity growth rate (excluded) does not granger cause Disorder of Polity Quality	0.653	0.419
	• Physical Capital (excluded) does not granger cause Disorder of Polity Quality	0.295	0.587
	• Human Capital (excluded) does not granger cause Disorder of Polity Quality	0.115	0.735

Robustness Test for Inflation Rate			
Broad Money	• Budget Deficit (excluded) does not granger cause Broad Money	3.111	0.03**
	• Government Debt (excluded) does not granger cause Broad Money	0.619	0.203
	• Disorder of Polity Quality (excluded) does not granger cause Broad Money	1.476	0.224
Budget Deficit	• Broad Money (excluded) does not granger cause Budget Deficit	0.382	0.537
	• Government Debt (excluded) does not granger cause Budget Deficit	0.892	0.345
	• Disorder of Polity Quality (excluded) does not granger cause Budget Deficit	58.518	0.000***
Government Debt	• Broad Money (excluded) does not granger cause Government Debt	0.685	0.408
	• Budget Deficit (excluded) does not granger cause Government Debt	0.777	0.378
	• Disorder of Polity Quality growth (excluded) does not granger cause Government Debt	0.691	0.406
Disorder of Polity Quality	• Broad Money (excluded) does not granger cause Disorder of Polity Quality	0.738	0.390
	• Budget Deficit (excluded) does not granger cause Disorder of Polity Quality	0.675	0.411
	• Government Debt (excluded) does not granger cause Disorder of Polity Quality.	0.734	0.392
Robustness Test for Unemployment Rate			
Youth Population	• Youth Unemployment (excluded) does not granger cause Youth Population	1.140	2.286
	• Disorder of Polity Quality growth (excluded) does not	1.564	0.211

	granger cause Youth Population		
Youth Unemployment rate	• Youth Population (excluded) does not granger cause Youth Unemployment rate	51.067	0.000***
	• Disorder of Polity Quality (excluded) does not granger cause Youth Unemployment rate	46.880	0.000***
Disorder of Polity Quality	• Youth Population (excluded) does not granger cause Disorder of Polity Quality	0.403	0.526
	• Youth Unemployment rate (excluded) does not granger cause Disorder of Polity Quality	0.655	0.418

Note: This table reports the results of the Granger-causality Wald test. These results also support the estimated panel VAR models. The values in the table are the Chi-square and their corresponding p-values. Under the null hypothesis, the excluded variable does not Granger cause the dependent/endogenous variable.*, **, and *** denote significance at the 5 % ,1 % ,%10 level, respectively

CHAPTER III

THE DYNAMICS AMONG FOOD SECURITY, POLITICAL INSTABILITY, INCOME INEQUALITY,

"No one will be left behind"

United Nations, 2015

3.1.Introduction

Throughout history, humanity has struggled with unfair distribution of income, political instability and food insecurity. What's more, these issues have been not only the central importance of underdeveloped and developing countries but also developed nations across the world. They are frequently highlighted as a *global risk* by international organizations, particularly in the past decades. Therefore, these three problems are viewed as an urgent call for action by United Nations Member States and are among the 17 goals to achieve sustainable development by 2030 (SDGs 17).

Inequality may increase the likelihood of severe food insecurity. High inequality may link with conflict because it may encourage people to engage in activities outside the market such as illegal drug trafficking, crime, participation in rebel groups against the government, leading to political instability. On the contrary, the outbreak of political instability may exacerbate income inequality and jeopardize food security. In particular, the outbreak of the 2008 financial crisis and its following food crisis not only put many underdeveloped countries at risk but also adversely affected developed and developing countries. The gap between poor and rich has gradually widened; food security has been endangered, and political instability has rapidly risen worldwide. A recent report drafted by the Food and Agriculture Organization of the United Nations (FAO), the International Fund for Agricultural Development (IFAD), the United Nations Children's Fund (UNICEF), the World Food Programme (WFP) and the World

Health Organization (WHO) on the state of food insecurity and malnutrition across the world estimated the number of people that are undernourished at about 815 million in 2016 (FAO, IFAD, UNICEF, WFP, and WHO 2017, cited in FAO 2018, cited in Van Weezel 2018). Despite the fact that some local and regional improvements cannot be ruled out, existing income inequality and incidents leading to widening the income gap and distortion of political stability endanger food security.

Furthermore, income inequality is a defining issue of our time, and it is sharply rising in nearly half of the countries around the world. The World Economic Forum (WEF) 's annual global risk report (2017) highlights that income disparity is ranked first and third among the underlying risks that would shape the world in the next decade. In addition, income inequality has a strong link to social discontent and sociopolitical instability (Alessina and Perotti 1996). In this context, for instance, the rise of ethnic and religious tensions in Nigeria in the last decade has aggravated the existing income inequality (Odusola et al. 2017). Or the Arab Spring, which is widely believed to have been instigated by the lack of polity quality, can exemplify that income inequality has been accompanied by conflicts and instability (Della Posta 2017). In this context, the severe threat to food security is an inevitable end outcome. FAO, IFAD, UNICEF, WFP and WHO (2017) also report that the estimated rise in food insecurity has been observed most notably in areas/countries affected by political discontent.

This research first attempts to ask the following question: How do these global issues interact with each other? First of all, from both a theoretical and empirical perspective, it is aimed to observe the dynamics of those issues, which have been deemed as global risks by many international organizations, notably by the United Nations, in recent years. Although researchers have long been interested in those crucial global problems facing humanity, there are as yet no empirical studies on how these three global issues (political instability, income inequality, food security) simultaneously interact with each other. The previous studies

frequently deal with the theoretical and historical dynamics of these three issues. This research aims to fill the gap caused by the lack of empirical investigation about the nexus among food security, income inequality, and political instability. It is applied to the Panel Vector Autoregressive (Panel VAR) model, which allows endogeneity for 117 countries over 2008-2017. Secondly, this study endeavours to present reliable research by adopting this topic from a broad perspective. It provides further insights into these global issues compared to previous studies. A large body of investigations commonly approaches this topic within the *internal conflict* framework, which is one of the concepts of political instability. Although this study acknowledges the effects of internal conflict and builds the theoretical perspective on it, it also assumes that the nexus of political instability with food security and income inequality should be relatively comprehensive. For this reason, two different aspects of political instability, which is constructed by using Principal Component Analysis (PCA) in Chapter I, are adopted. These are Structural Defect and Disorder of Polity Quality, respectively. General and chronic structural deteriorations in countries may distort income equality and food security, vice-versa. In addition, poor polity quality may exacerbate income inequality and put food security at risk. It should be noted that Structural Defect much more characterizes the political instability than the Disorder of Polity Quality based on the analysis results. Nevertheless, this study also displays the interaction of both dimensions of political instability with food security and income inequality. It is also be analyzed whether the dynamics change in different definitions of political instability.

Moreover, the analysis is conducted by using different dimensions of food security. While the main analysis of this study deals with the Food Availability and Food Accessibility, defined as the first two pillars of food security by the World Health Organization and Food and Agriculture Organization, the analysis is checked by supplementing the third pillar of food security, referred to as Food Utilization in the robustness test. Furthermore, since all the

variables can be simultaneously treated as endogeneous, this analysis also highlights how the different pillars of food security interact with each other, even if this is not the first aim of this analysis.

Despite the relevance of these particular issues among each other, there are relatively few empirical studies not observing the interconnection of these three global risks nor examining the relationship between two of those three variables. And these investigations commonly focus on the one-way relationship, unlike that of this research. In addition, this study goes beyond the Panel VAR and supplement this investigation by estimating Impulse Response Functions (IRFs) and Forecast Error Decompositions(FEVDs). However, this is not the first aim of this chapter. Nevertheless, it is important to show a deeper understanding of the interactions.

The rest of the paper is organized as follows. Section 3.2, which refers to *Literature Review,* is examined under the following two subtitles: *Theoretical Perspective* and *Review of Empirical Studies.* Section 3.3 presents the *Data Description, and Section 3.4* deals with *the Methodology*. Section 3.5 provides the *Empirical Results*. Section 3.6 deals with the *Robustness Check* of the analysis with different variables. Section 3.7 shows the *Conclusion.*

3.2.Literature Review

3.2.1.Theoretical Perspective

There are various ways of observing theories on the link between political instability, food security and income inequality at a general theoretical framework. Nevertheless, understanding this nexus needs rather in-depth analysis by going to the roots of this relationship. Therefore, it is necessary to investigate when these discussions have started and how they have expanded over time. It is seen that the debates on this topic have proceeded within the framework of *internal conflict*, which is one of the indicators of Structural Defect in this thesis.

Food insecurity, income inequality, political instability have been accepted as the rising global dangers in recent decades, and they are top of the UN Sustainable Development Goals (SDGs) agenda. However, the roots of the debate on this topic date back many years, indeed until the reasons for the French Revolution. Note that the French Revolution's slogan was liberty, equality, and fraternity; however, many of those participating in riots and conflicts were motivated by the high cost of food and food shortages. Income inequality accompanied by food shortages contributed to the rioting that led to the Revolution (Thomson 2017) [i].

From a Marxist perspective, Marxist conflict and class-based theories are historically deemed as an explanation of poverty, unequal distributions of assets, in addition to uncover how poverty and wealth (or food security) can evolve simultaneously (Strichouser 2016). In the case of food insecurity, skewed income distribution ultimately results in an unequal distribution of food. Basically, Marxist theories propose that resources are unequally distributed, leading to conflicts within societies (Turner 2012, cited in Strichouser 2016). Notably, these theories focus on the working class. They highlight that an impoverished labour force experiences lead higher level of discontent. Many of the nation’s working poor, who are unable to secure basic needs like food, tend to create internal conflict such as riots etc. The greater level of income inequality, namely the greater the gap between poor and rich, may increase the discontent experienced by

individuals and groups. Further, the Marxist class-based theories assume a capitalist society, which experiences social and economic inequalities. The theories also indicate that income concentrates to top from bottom, and inequality could rise over time (Chowdhury and Hossain 2018).

Ethnic mobilization and conflict theories, which largely react to economic and political distinction, frequently polarize societies much more than class-based divisions as expected by the Marxist class-based theories. Nevertheless, both approaches indicate that economic modernization, including all-level industrialization of the national economy, is characterized by the assimilation of minority groups into the dominant culture and the eventual disappearance of ethnic conflict (Schock 1996). As to food security, like Marxist theories, Ethnic based theories also indicate that human need (food) evolves since new technology is integrated into society and human need escalates and diversifies with the use of new technology (Marx 1904, cited in Schock 1996).

On the contrary, Neo-Marxist and other economic-based theories of ethnic conflict assert the inverse relationship that modernization in the economy and its impact on inequality have a vital role in escalating ethnic-based struggles. That is to say, the more widespread economic discrimination and huge income inequality, the more that ethnic minorities appear to struggle against the institutionalized system of economic inequality, including wealth and income inequality in the societies (Schock 1996). In this context, food security can be interpreted within the framework of economic modernization as Marxist and ethnic-based conflicts theories do. However, later studies have found insufficient explanations of both Marxist class-based and ethnic mobilization and conflict theories because these theories have neglected the *political context* (Nielsen 1986; Jalali and Lipset 1992-93; Gurr 1993).

It can be clearly seen that the theories are built on intra-state conflicts and ethnic tensions. This study follows the ideas summarized above, but it expands them since the focal

point of this study claims that the interconnection of the three global issues (political instability, income inequality, food security) requires further comprehensive analysis. To do so, this analysis is conducted with more political instability dimensions, and it addresses the issue from a multidimensional perspective.

Recall that this thesis presents two aspects of political instability generated in the first chapter of this thesis. They are Structural Defect and Disorder of Polity Quality, respectively. These dimensions represent two different aspects of political instability. Structural Defect dimension of political instability covers internal conflict based on coup threat (civil war), terrorism (political violence), and civil disorder. This aspect includes not only internal conflict but also bureaucratic quality, corruption, military in politics, investment profile, social and economic conditions. The second dimension of political instability, Disorder of Polity Quality, includes ethnic and religious tension, external conflict, bureaucratic quality, law and order. According to political instability dimensions adopted in this thesis, while *Structural Defect* can be mainly built on Conflict-based theories, Disorder of Polity Quality can be based on Ethnic Mobilization and Conflict theories. However, herein, the scope of analysis is expanded.

In this context, for instance, corruption, which is one of the factors of *Structural Defect* in this thesis, and its connection with food security and income inequality should not be neglected. From this perspective, for instance, corruption, which is one of the most important structural problems of countries, which have weak institutions, may widen the already yawning gap between poor and rich. On the one hand, high and rising corruption may increase income inequality by reducing economic growth, the effectiveness of social spending etc. On the other hand, corruption may be bad for income equality due to distortion of the distribution of asset ownership and unequal access to education (Gupta et al. 1998). Corruption may also hinder social and economic development by impacting attempts adversely by international and regional development institutions working on food security, and so on. In addition, on the one

hand, general structural problems of countries may lead to a decrease in food security in terms of food accessibility. It may hinder equal access to food by all the segments of society. On the other hand, facing the problems about food availability may escalate the internal conflict, which is evaluated in Structural Defect, and so on.

Furthermore, Structural Defect also includes socio-economic condition, which has similar meaning with socioeconomic status (SES), which is a term for individuals or groups based on a combination of occupational, economic and educational criteria[ii]. SES is highly associated with income inequality and food security. Income inequality may widen differences in SES. Moreover, because people who are better off regarding income levels are more likely to have easy access to health services and live in better conditions than a low-income group, they all live under reasonably good socioeconomic conditions.

From the Disorder of Polity Quality perspective, a strong law and order are likely to promote the protection of property rights of goods, food security and small businesses, allowing low-income entrepreneurs to raise their incomes and then decrease income inequality. In addition, improvements of law and order are highly related to democratization, government transparency, regulation etc. Therefore, this study believes that the stronger law and order is, the lower the income inequality. On the contrary, it is seen that the effect of increasing income inequality through entry regulations is moderated or counteracted with the help of law and order (Kpognon 2020). In addition, external conflict, which covers war, cross-border conflict, and foreign pressure, distort income equality. In particular, war-related changes in income distribution are not viewed as a permanent impact but of a temporary perspective (Bircan et al. 2010).

Moreover, the misstep of polity decisions can lead to external conflict. In this case, the lack of food security can stem from economic sanctions or international embargos, which is categorized under the external conflict leading to political instability (International Country

Risk Guide), and cause a widening of income inequality; or, long-run ethnic and religious tensions may lead to a decrease in food utilization because it makes it difficult to have access to water and sanitation for preparing food and maintaining proper hygiene[iii].

The following section is a review of previous empirical studies.

3.2.2. Review of Previous Empirical Studies

Even though many studies investigate the relationship of these two of three variables, many researchers do not empirically measure how these three global risks interact by allowing a bidirectional nexus. In the following, the literature related to political instability, income inequality and food security is presented.

Whereas many researchers assert a causal and significant link between the variables above, some studies' findings are neither significant nor causal. What is striking about the various results, are the differences in the measurement of variables. Hence, according to the literature review for this study, it is seen that the measurement of income inequality and political instability vary in different studies. Gini coefficient is commonly used as a measurement of income inequality by researchers (Sigelman and Simpson (1977); Collier and Hoeffler (2004); Maccullock (2005); Kalay and Çetin (2016); Agnello et.al (2017). However, some use other alternative income distribution or income inequality data such as the income share of the 10% richest countries and the 40% poorest countries (Weede 1981; Alesina and Perotti 1996; Temple 1998; Odedokun and Jeffery 2001).

Recall that different results stem from the diversity of income inequality measures and various political instability criteria. Political instability is sometimes viewed as constitutional or unconstitutional government changes (Cukierman et al 1992; Edwards and Tabellini 1991; Londegran and Poole 1991; Alesina et al. 1996). However, it is also considered as social unrest or socio-political instability (Hibbs 1973; Veneris and Gupta 1986; Gupta 1990; Ozler and Tabellini 1991).

Remarkably diverse literature from ancient to modern studies has coalesced on the assertion that political instability is an essential function of income inequality (Sigelman and Simpson 1977). Many researchers agree that a high degree of inequality triggers violence, protests, coups or other politically unstable climates (Festinger 1954;Muller 1985;Lichback 1989;Schock 1996;Maccullock 2005;Temple 1998).

Sigelman and Simpon (1977) empirically investigate the nexus between income inequality and political violence on a sample covering 49 nations by using the Gini coefficient. They find that political violence has a strong link with income inequality.

Londregan and Poole (1990) point out a reverse nexus between coups and income in 121 countries over the period 1950-1982. However, they display that coups are more likely to occur among the poorest countries than among the richest ones. In addition, Hiroi and Omori (2015) explore the impact of policy changes and coups and income distribution over the period of 1960 to 2007. They find that the risk of a coup considerably rises during the period of notable policy change in the high-level skewed income distribution country. By doing the analysis, they adopt Gini indices of income inequality coming from the Standardized World Income Inequality Database (SWIID) (Solt 2009).

Alesina and Perotti (1995) test the effects of income distribution on investment by considering political instability as the channel linking these two variables. Their sample covers 71 countries for 1960 and 1985. According to the results, income inequality increases social unrest and discontent and then increases policy uncertainty, adversely affecting investment and, consequently, decreases in economic growth. While performing the analysis, they generate the Socio-Political Instability index (SPI) as the proxy of political instability. They use income shares of five quintiles of the population for income distribution data.

Schock (1996) interpreted the relationship between income inequality and political conflict, which is an indicator of political instability. Using multiple regression analysis, that

analysis finds that the positive effects of income inequality and separatist potential of violent and political conflict are enhanced in weak states. Another finding is that the impact of class exploitation on violent political conflict is mitigated by regime structure.

Acemoglu and Robinson (2006) argue that extreme income inequality between groups escalates social unrest and political instability. More precisely, they assume that regime changes are driven by autocratic elites' fear of the relative redistribution costs under the framework of democracy. Hence, in equal societies, the median voter may demand less redistribution. Democratisation is likelier when inequality is at the middle level. However, Boix(2003) claims that democratisation is much more possible in societies with very low inequality.

Dutt and Mitra (2007) find a strong causal relationship between inequality and political instability. They use their own political instability measurement, which captures only movements from dictatorship to democracy and vice versa. They adopt the Gini coefficient and inversely the percentage share of the median quintile in total income-Q3, which are obtained from Dollar and Kraay (2000) and the World Bank.

Shehzadi et al. (2019) study the impact of political instability on economic growth, income distribution, and poverty by applying Heteroscedascity consistent OLS on a cross section of 103 countries during 1984-2011. They analyze by using different aspects of political instability named formal, informal and military coups D'Etat and Gini coefficient as a measure of income inequality. Although they reveal the statistically significant and positive impact of formal and informal political instability on poverty and income inequality, the direct effect of Coups D'Etat on both poverty and income inequality is insignificant.

Some researchers consider the country's geographical regions or development levels while exploring the relationship between political instability and income inequality. Nel (2003) assumes political instability as a transmission mechanism, which links income inequality and economic growth. He performs the OLS technique to analyze the effects of income inequality

and economic growth over 1986-1997 in sub-Saharan Africa. After he finds the negative relationship, he attempts to measure whether income inequality affects political instability. The evidence indicates that a high level of income inequality does not affect political instability at any significant level. Likewise, Weede (1987); Collier (2000) do not find a causal relationship between income inequality and political conflict, an instrument of political instability.

Odedokun and Round (2001) focus on 35 African countries over different periods. They estimate a robust and significant relationship between income inequality on the continent and political instability. They conduct their analysis with four alternative income inequality measurements: Gini coefficient and the share of income with the three income brackets (poorest 40 per cent, next poorest 40 per cent, richest 20 per cent). Political instability is represented by sociopolitical instability, which is composed of social and political unrest. Agnello et. al (2017) explores the impact of income inequality and fiscal stimuli on political instability by using the data for a panel of developed and developing countries. They find that government crisis, which is considered as the measurement of political instability, is often seen when inequality increases. Furthermore, their results also display that increasingly expansionary fiscal stimuli can contribute to a more stable political environment. In addition, the implementation of fiscal stimuli may moderate the impact of inequality on political instability. While performing the analysis, they adopt net Gini inequality index data coming from Standardized World Income Inequality Database (SWIID).

Another example subjected to regional studies is carried out by Stewart (1998). He discusses several case studies which display evidence for a positive relationship between horizontal inequalities and civil conflict in many Latin American countries. Evidence from the Middle East revealed that political unrest (instability) is related to income inequality. Hlasny and Verme (2013), Nimeh (2013), Ncube and Anyanwu (2012), Osborn (2011) find that income inequality is one of the factors behind the Egyptian revolution.

As to food security, the literature is centred around qualitative and descriptive methods. Nevertheless, the increasing availability of high-quality data combined with modern econometric approaches has caused the studies to shift from qualitative to quantitative methods in the past few years. But they still remain underexplored. The studies dealing with the link between food security and uncertain political environment frequently consider conflict issues as a factor deteriorating political stability. One of the most prominent studies is from Weezel (2018). He observes the relationship between armed conflict and food security using data aggregated at the country level for 106 countries between 1961-2011. He aims to examine macro-level trends concerning the food security-conflict nexus. He finds negative a correlation between conflict and food security represented by dietary energy supply (DES) published by FAO.

Similarly, Brück et al. (2016) examine the effect of conflict on food supply levels (food security) by using the error correction model (ECM). They find that countries experiencing low-intensity but highly localized conflict experience statistically significant higher food insecurity. Furthermore, Deaton and Lipka (2015) highlight the importance of political instability on food security, considering the worst performing countries for food security. Teodosjkevic (2003) shows that food security is jeopardized since production levels considerably drop during conflict years in a sample covering 38 countries from 1961-2000. He highlights a 7 per cent decrease in DES. These results are also confirmed by Hitzhusen and Jeantly (2006) in 76 countries between 1970-2002. Devereux (2009) indicates that food security is obtained through three pathways: food production, exchange for food, and food transfer. When these pathways are deteriorated by weak institutions that lead to narrow future expectations, political instability and food security unsurprisingly go hand-in-hand. Kaitibie and Irungu (2019) assess the impact of political instability in food-exporting countries on food

imports in a wealthy Gulf Arab state and the food security of Qatar by using a comprehensive system generalized method of moments (GMM) for dynamic panel data.

Swinnen (2015) stresses that the correlation between income inequality and food security is around 70%. Grzelak (2017) evaluates the relationship between food security and income inequality in OECD countries by performing regression and agglomeration cluster analysis for 2010-2015. According to regression analysis results, the issues related to food security are mainly connected with low-income inequality. Agwu and Oteh (2014) findings show that the age of the head of the household and monthly income are the determinants of household' food security status of farmers in South-Eastern Nigeria, using Abia State. Barlow et al. (2020) examined the association between counties' liberal trade policy and food security in 132 countries for 2014-2017, considering countries' income distribution using a logistic regression model. They also control for multiple covariates, including gross domestic product, democratisation level, and population size. Their findings show that food insecurity differs according to whether individuals are at the bottom of the global household income distribution. Abdullah et al. (2020) observe the impact of political risk and institutions on food security. Using dynamic panel data, their analysis covers 124 countries over the period 1984-2018. Their research employs ICRG dataset as a proxy for political risk, and food security is represented by dietary energy supply (DES). The outcomes of the analysis provide supportive evidence that internal and external conflicts, socioeconomic conditions, corruption, military in politics, religious tensions, ethnic tensions, and poor quality of bureaucracy worsen food security in developed and developing countries.

Soffiantini (2020) focuses on the following three countries, which are highly affected by Arab Spring: Syria, Egypt, Morocco. Using the Process-Tracing Method, this study reveals that rising

food prices increased the pre-existing social unrest, sparking protests in Egypt, Syria and Morocco, and probably also in other MENA countries affected by the riots.

3.3.Data Description

This chapter focuses on estimating the panel correlation between food security, income inequality and two different aspects of political instability for 117 countries throughout 2008-2017. The Panel Vector Autoregressive (PVAR) model is performed. The analysis is conducted by various aspects of food security, suggested by Food and Agriculture Organization (FAO) and World Health Organization (WHO). Furthermore, two different political instability aspects are used, that of the previous chapter. Note that these aspects represent a broad range of the identification of political instability. Finally, the Gini index, which is commonly used as a measurement of income inequality, is adopted.

Recall that political instability dimensions used in this study have already been identified in Chapter II and Chapter I. The first dimension, which more characterizes the political instability, as “Structural Defect” , while the second aspect, which less identifies the political instability, is called “Disorder of Polity Quality”. As one may remember, Chapter II carries out the analysis on two models, separated based on the different aspects of political instability. Herein, these two dimensions of political instability are employed in the study in the same way as in Chapter II. Similarly, Chapter III also designs two models dealing with two different political instability dimensions: Structural Defect and Disorder of Polity Quality. Structural Defect includes the effects of socioeconomic conditions, investment profile, internal conflict, corruption, military in politics, bureaucracy quality. In contrast, Disorder of Polity Quality involves the impact of religious and ethnic tensions, external conflict, law and order, bureaucracy quality. Thus, this research approaches the issue from a broad perspective in terms of political instability.

It should be noted that the structure and concept of this chapter are completely the same as Chapter II. Recall that Chapter II presents how political instability dimensions extracted from Chapter I are integrated into Chapter II and the Panel VAR model .In this context, Chapter III follows the same form in terms of adopting two different aspects of political instability (Structural Defect and Disorder of Polity Quality) and the models used. Hence, avoiding fall into repetition, the detailed explanations can be found in Section 2.3:pg:25.

While observing the nexus among political instability, food security and income inequality, the Gini index is used as a proxy for income inequality. In fact, income inequality can be measured in different ways. One of the most popular measurements is the Gini coefficient, which is used for the main analysis of this chapter. The Gini enables an indication of income inequality among families, groups and the entire population of a nation (Andrews and Leigh 2007; Chakravarty 1990; Lopes el al. 2011, cited in Nir and Kafle 2011). The Gini index was developed by Corrado Gini and published in 1912. It expresses how the total income of society is distributed and ranges between 0 (absence of inequality) and 100 (total inequality) (European Comission 2010). In line with the broad range of empirical studies of income inequality, and because it is the most widely covered by the large –N data collections, this study uses the Gini as the main measure of income inequality. Many sources publish the Gini index as a measurement of income inequality. However, a limited amount of data, particularly for African countries, is the main constraint of income inequality studies.

For this reason, this study adopts one of the most important wide-range data: Standardized World Income Inequality Database (SWIID) table 8.3, which was published on 28th May 2020. This database was created by Solt (2008)[iv], who uses various techniques to estimate the ratios between different types of Gini coefficients. The measurements of SWIID's income inequality are based on multiple Gini indices from published sources such as OECD Income Distribution Database, the Socio-Economic Database for Latin America and Caribbean

created by CEDLAS, World Bank, Eurostat, the World Bank's PovcalNet, the UN Economic Commission for Latin America and the Caribbean, national statistical offices around the world. The data collected and harmonized by the Luxembourg Income Study is employed as the standard. In addition, the SWIID provides much broader coverage than other data sources with 198 countries and from 1960 to the present.

For food security, World Health Organization (WHO) definition is considered. It defines three aspects of food security. The first is food availability, having a sufficient supply of food available on a consistent basis[v] . This food can be either locally produced or imported from other places. For instance, communities may be unable to produce their own food locally due to the lack of agricultural technologies or experiences; or insufficient natural resources or productive land, or health constraints such as HIV/AIDS, that prevent people from engaging in labor[vi] .On the contrary, countries may be unable to import food from other places due to countries' weak national currency, leading to hindering countries' importation etc. This research uses the following two indicators evaluated within the framework of food availability: food import (of merchandise import %) and food supply (kcal/capita/day).

The second aspect of food security is food accessibility, having sufficient resources to obtain appropriate foods for a nutritious diet. Even if an adequate supply of food exists to feed everyone, food accessibility may be still challenging. WHO assumes accessibility is related to affordability. It highlights that the leading causes of hunger and starvation, as stated by the United Nations, are not scarcity of food as one might frequently think, but rather an inability to access food. People need to have sufficient purchase power to access food. In this context, Gross Domestic Product per capita (in purchasing power equivalent) represents food accessibility. This indicator provides information on the possibility of economic access to food market.

The third pillar is food utilization, which refers to the metabolism of food by individuals. This pillar of food security is related to the proper biological use of food, requiring potable water and adequate sanitation, and basic knowledge of nutrition and care for preparing food and maintaining proper hygiene. Utilization, therefore, covers a range of aspects that hinge on the consumer's understanding of what foods to choose and how to prepare and store them (Napoli 2011). Food utilization variables often lacked enough data to make analysis possible. Hence, People Using at Least Basic Drinking Water (%population) and People Using at Least Basic Sanitation Services (%) are used as a proxy for food utilization. These variables provide useful information to access the utilization dimension of food security outcomes.

Moreover, these indicators of food utilization cover quite an extensive number of countries data. However, the main analysis of this chapter is performed using the first two pillars of food security: food availability and food accessibility. Because food utilization is related to food consumption/biological usage. Therefore, this research first attempts to analyse food import, food supply, and gross domestic product (in purchasing power equivalent). The robustness of the analysis is checked by adding the food utilization and perform the study with the three food security pillars suggested by World Health Organization. By doing so, this research will have compared the results to be obtained by excluding the third dimension of food security from the analysis and then including it.

It is noteworthy that the Food and Agriculture Organization of the United Nations (FAO) also adopts those three pillars of food security. However, FAO also adds the fourth pillar referred to as food stability. This chapter of the thesis follows World Health Organization (WHO) definitions of food security because my analysis does not consider the fourth pillar. Food stability is much more about the situation, which leads to a deterioration of people nutritional status such as economic factors, political instability etc. In this context, our analysis already aims to measure the dynamics among food security, income inequality and political

instability; but with a broader perspective and different approach. However, the only difference in terms of definition between FAO and WHO is the fourth column as food stability added later. The meaning of other pillars is the same.

In addition, this comprehensive research also uses a set of control variables, assumed to be exogenous—first, trade openness, which represents globalization. Basically, most attention has been given to the impacts of trade and trade openness on income inequality. The data is taken from Penn World Table (PWT) version 9.1. It is calculated as the ratio of exports and imports to GDP (%).

Another control variable is urbanization, which is associated with industrialization. It is commonly believed that the urbanization process changes the income of individuals and groups, and it results in income inequality both in the short and long terms (Oyvat 2010). Traditionally, urbanization can increase income inequality because of higher wages for urban jobs compared to rural works in the short period, even if there are a probability that the situation may reverse in the long term (Ha et al. 2019)[vii.] .The annual rate of urban population growth for the proxy of *urbanization* is adopted (Cole and Neumayer 2004, Zarzoso 2008).

Furthermore, this study also considers the *population and* extracted from World Bank (WDI), and the *democracy* level of countries using the democracy indicator taken from the Economist Intelligence Unit. This indicator expresses the quality of democracy as a number between 0 and 100. It ranges from authoritarian regimes to full democracy.

Table 3.1

Sample Countries

Angola	Azarbaijan	Argentina	Algeria	Albania
Austria	Australia	Belarus	Bolivia	Brazil
Burkino Faso	Bahrain	Bangladesh	Belgium	Botswana
Bulgaria	Bahamas	Côte_d_Ivoire	Congo_Rep_	Colombia
Costa_Rica	Cyprus	Chile	Croatia	Czech_Republic
Canada	Congo_ Dem_Rep_	Cameroon	China	Dominican_Republic
Denmark	Ecuador	Egypt	Ethiopia	Estonia
El_Salvador	Finland	France	Guinea	Gambia_The
Guatemala	Ghana	Gabon	Greece	Guyana
Germany	Guinea_Bissau	Honduras	Hong_Kong	Hungary

Indonesia	India	Israel	Ireland	Italy
Iceland	Iran_Islamic_Rep_	Jamaica	Japan	Jordan
Kenya	Kazakhstan	Lebanon	Latvia	Luxembourg
Lithuania	Myanmar	Malawi	Mozambique	Mexico
Malaysia	Moldova	Morocco	Madagascar	Malta
Nicaragua	New Zeland	Norway	Nigeria	Namibia
Netherlands	Paraguay	Philippines	Panama	Peru
Papua New Guinea	Pakistan	Poland	Portugal	Romania
Russia	South_Korea	Syria	Singapore	South Africa
Spain	Slovenia	Slovak_Republic	Serbia	Sweden
Senegal	Suriname	Sri Lanka	Uganda	Uruguay
United_States	United_Arab_Emirates	Ukraine	United Kingdom	Venezuela
Tanzania	Thailand	Trinidad Tobago	Turkey	Taiwan
Zimbabwe	Zambia			

Table 3.2

Description of Variables

Variable		Source
	Food Security	
Food Availablity	-Food Import (of merchandise imports %)	The World Bank Database (WB)
	-Food Supply (kcal/capita/day)	Food and Agriculture Organization (FAO) Stats
Food Accessibility	-Gross Domestic Product per capita (GDPpc) (in purchasing power equivalent)	Food and Agriculture Organization (FAO) Stats
Food Utilization	-People using at least basic drinking water services (%population) -People using at least basic sanitation services (% population)	Food and Agriculture Organization (FAO) Stats
	Income Inequality	
Gini Index	-Gini Index as the proxy of income inequality	Standardized World Income Inequality Database (SWIID) Table 8.3
	Political Instability	
Structural Defect		International Country Risk Guide Dataset (ICRG)
Disorder of Polity Quality		International Country Risk Guide Dataset (ICRG)

Exogeneous Variables		
Democracy	-Democracy Index	Economist Intelligence Unit
Population	-Total Population	World Bank (World Development Indicators)
Globalization	-Trade Openness: Exports and imports to GDP(%).	Penn World Table (PWT) version 9.1
Urbanization	- The growth rate of urban population,as a proxy for urbanization	World Bank (World Development Indicators)

Note: Urban population growth is already growth rate. However, the rest of the variables are transformed to growth rate and their growth rates are used in this study.

Table 3.3
Descriptive Statistics

Variables	Mean	Std. Dev.	Min	Max
Food Import	11.64	6.01	0.24	54.94
Food Import (growth rate)	0.09	1.80	-0.97	54.12
Food Supply	29.50	45.06	18.01	38.45
Food Suply (growth rate)	0.00	0.01	-0.12	0.11
Gross Domestic Product Per Capita (in purchasing power equivalent)	2310	190.85	886.3	1135
Gross Domestic Product Per Capita (GDPpc) (in purchasing power equivalent) (growth rate)	0.01	0.03	-0.15	0.23
People using at least basic drinking water services (population %)	89.41	15.44	30.4	100
People using at least basic drinking water services (population %) (growth rate)	0.00	0.00	-0.00	0.06
People using at least basic sanitation services (population %)	70.17	27.47	5.2	100
People using at least basic sanitation services	0.00	0.01	-0.02	0.06

(population %)(growth rate)				
Gini Index	37.92	8.77	23.2	65.8
Gini Index (growth rate)	-0.00	-0.02	-0.43	0.14
Structural Defect	33.15	7.90	12.415	49.5
Structural Defect (growth rate)	-0.00	0.03	-0.24	0.18
Disorder of Polity Quality	35.28	299.08	5.92	946
Disorder of Polity Quality (growth rate)	0.52	14.30	-0.99	430.13
Democracy	63.44	19.77	17.7	99.3
Democracy (growth rate)	0.00	0.04	-0.28	0.39
Population	63.20	190.48	0.3	1452.6
Population (growth rate)	0.01	0.01	-0.04	0.2
Globalization	495.57	287.86	1	994
Globalization (growth rate)	0.71	4.97	-0.99	75.08
Urbanization	515.04	291.04	1	1007

Note: Both levels and growth rates statistics of the variables converted into growth rate are shown and this study is performed considering their growth rates. Recall that Urbanization (urban population growth rate) is already are already published in growth rate.

3.4.Methodology

As indicated in the theoretical perspective section, this study assumes that the nexus between income inequality, political instability, and food security should be observed simultaneously. Hence, these three variables are considered as jointly endogenous (Hausman 1983 cited in Martin 2019). This research is interested in estimating a system of dynamic panel data equations that enable us to analyze the simultaneous determination of political instability and income inequality. In this context, the Panel Vector Autoregression (Panel VAR) approach fits this research's aim (Holtz-Eakin et al. 1998). Furthermore, Impulse and Response Function (IRFs) and Forecast-Error Variance Decompositions (FEVDs) are also conducted.

This chapter applies the Panel VAR model with exogenous variables for 2008 to 2017 for 117 countries by drawing a global picture instead of focusing on specific regions. Panel VAR has the same form as VAR models of multivariate time series. One of the most important advantages of Panel VAR is that it can capture both static and dynamic interdependencies across

economies, regions etc. Furthermore, as Canova and Ciccarelli (2013) indicate in their study, panel VARs can easily involve time variations in the coefficients and in the shocks' variance and account for cross-sectional dynamic heterogeneities (Martin and Villavicencio 2019). According to the principle of panel VARs, each equation has one of our three variables as the dependent variable.

In contrast, the other variable poses on the right-hand side with its lagged form as the explanatory variables (Abdel-Latif et al. 2018). As is indicated above, it is used GMM estimators suggested by Arellano and Bond (1991). Because the presence of the lagged dependent variable among the regressors in the system equations will produce biased and inconsistent OLS estimates (Nickell 1981;Anderson and Hsiao 1982, cited in Martin and Villavicencio 2019).

Our model panel VAR model may be formally represented by the following system of linear equations (Abrigo and Love 2015, cited in Martin and Villavicencio 2019).

$$Y_{it} = Y_{it-}A_1 + Y_{it-2}A2 + \ldots\ldots\ldots + Y_{it-p}Ap + X_{it}B + u_{i+}e_{it} \quad (1)$$

where Y_{it} is a vector of dependent variables, and X_{it} is a vector of exogenous covariates. u_{it} is a vector of dependent variable-specific panel fixed-effects, and e_{it} is a vector of the error term. The matrices $A_1, A_2, \ldots\ldots\ldots\ldots, A_p$ and matrix B are parameters, which will be estimated.

While performing panel VAR, to ensure that the underlying structure is equal for all the countries in the panel, some parameters constraints need to be considered. However, practically, such constraints are highly likely to be violated; the suggested way to eliminate this problem is to allow for individual heterogeneity in all the variables by introducing fixed effects. Yet, the fixed effects are correlated with the regressors because of the lags of the dependent variable. Hence, the individual fixed effects are controlled by forward-mean-differencing (Helmert transformation), which removes the mean of all future observations available for each country and time to preserve the orthogonality between transformed variables and lagged independent

variables (Love and Zicchino 2006). Nevertheless, the differencing may end up with a simultaneity problem because of the correlation between regressors and the differenced error term. Furthermore, the heteroscedasticity problem might also exist due to the maintenance of heterogeneous errors with different countries in the panel. Therefore, after eliminating fixed effects by the Helmert procedure, the panel GMM that lagged regressors is employed as instruments to obtain more consistent results. This point underpins the reason why this research applies the panel GMM.

Also, this chapter goes beyond the estimation of Panel VAR, and it performs Impulse and Response Function (IRFs) and Forecast-Error Variance Decompositions (FEVDs). Both measures are based on the Cholesky decomposition proposed by Sim (1980). Sim assumes that variables in VAR should have a recursive causal ordering based on their degree of exogeneity. Namely, the variables, which come earlier in order, affect the following variables at the same time with a lag, while the variables that come later only affect previous variables with a lag (Love and Zicchino 2016;cited in Časni et al.2016). By taking into account the Cholesky decomposition of the variance-covariance matrix of residuals, IRF measures the response of the deviation to shocks from the other variable in the long-run term. It provides observing the reaction of one endogeneous variable to the innovation in another endogenous variable. (Hamilton 1994, Abrigo Love 2015, Zouauoui and Zoghlami 2018). FEVD enables observation of the proportion of variation of the dependent variable, which is explained by each independent variable. While the Impulse Response Functions measures the responses of a dependent variable to other variable shocks, the FEVDs investigate the contribution of each endogenous variables shock to the determination of the other variables' forecast error variance (Zouaoui and Zoghlami 2020).

Empirical findings of the research is discussed in Section 3.5

3.5.Emprical Results

This paper aims to investigate the dynamic interrelationship between food security, income inequality, political instability by applying Panel Vector Autoregressive model (Panel VAR). This chapter set two models, where two different dimensions of political instability are used. Recall that this study employs the following two different aspects of political instability: Structural Defect and Disorder of Polity Quality. Structural Defect is the first aspect of political instability due to its high characterization. Disorder of Polity Quality is the second aspect of political instability, reflecting a lesser identification of political instability. Model 1 simultaneously measures the nexus between Structural Defect (first dimension of political instability), food security and income inequality, Model 2 deals with the relationship between Disorder of Polity Quality (second dimension of political instability) and other variables,

Before estimating the Panel VAR model, firstly, it should be checked whether the variables of interest are stationary. A Fisher-type unit root test based on the Philips-Perron test and Dickey-Fuller test is conducted. The null hypothesis that all panels contain unit roots is rejected in all significance levels; namely, all variables are stationary at level.

Table 3.4

Unit Root Tests

Variables	**Fisher Type Augmented Duckey Fuller (ADF)**	**Fisher Type Philips Perron (PP)**
Gini Index (Lag-1)	23.0715*** (0.0000)	33.8386*** (0.0000)
Food Import (Lag 1)	16.4125*** (0.0000)	92.9847*** (0.0000)
Food Supply (Lag 1)	14.7559*** (0.0000)	37.9356*** (0.0000)
Gross Domestic Product Per Capita (in purchasing power equivalent) (Lag 1)	25.4550*** (0.0000)	69.8051*** (0.0000)

Structural Defect (Lag 1)	11.5203*** (0.0000)	15.6328*** (0.0000)
Disorder of Polity Quality (Lag 1)	28.4357*** (0.0000)	55.2231*** (0.0000)
Population (Lag 1)	23.6679*** (0.0000)	53.5340 (0.0000)***
Globalization (Lag 1)	41.5609*** (0.0000)	68.2458*** (0.0000)
Urbanization (Lag 1))	26.0488*** (0.0000)	20.1482*** (0.0000)
Democracy (Lag 1)	6.2834*** (0.0000)	13.5416*** (0.0000)

Note: (***), (**),(*) denote statistical significance at the 1%, 5%, 10% levels, respectively. P –values in parentheses.

In section 3.5.1 the Granger causality and Panel VAR results are discussed. Granger test results can be found at the end of the section.Finally, the results of IRF and FEVDs are discussed in the section 3.5.2 and 3.5.3., respectively.

3.5.1. Panel VAR and Granger Causality

The main results of the baseline panel VAR models are given in Table 3.6. The table reports estimates of the coefficients given in equation (1), where the fixed effects have been removed. Note that Panel VAR analysis is based on the choice of the optimal lag order in the Panel VAR specification and the moment condition. This study follows three information criteria for GMM models relied on Hansen'j statistics proposed by Andrews and Lu (2001). These information criteria are the Akaike Information Criteria (AIC)(Akaike,1969), the Bayesian Information Criteria (BIC)(Schwartz 1978,Rissanen 1978, Akaike 1977), and the

Quasi Information Criteria(QIC)(Pan 2001). The evidence shown in Table 3.5 is supportive to the choice of first-order panel VAR (one lag) since this has the smallest MBIC,MAIC and MQIC

Table 3.5

Panel VAR Lag Selection Criteria for Model 1 and Model 2

Lag Selection for Model 1						
Lag	**CD**	**J**	**J value**	**MBIC**	**MAIC**	**MQIC**
1	.9155008	80.44367	.3126687	-364.8715*	-69.55633*	-186.7505*
2	.9416593	56.22236	.253276	-240.6545	-43.77764	-121.9071
3	.8986551	28.2095	.2982994	-120.2289	-21.7905	-60.85521
Lag Selection for Model 2						
1	.9880774	109.3947	.0058804	-335.9205 *	-40.60531*	-157.7995*
2	.9989854	93.73199	.0001774	-203.1448	-6.268011	-84.39744
3	.8853671	27.89304	.3128007	-120.5454	-22.10696	-61.17167

Note: CD is the coefficient of determination.

After the selection of lag order, it should be noted that the model to be estimated should satisfy the stability condition. To do so, this research adopts Lutkepohl (2005) and Hamilton's (1994) assumptions suggesting that the VAR model is stable when all moduli of the composition matrix are strictly less than one. In this case, the estimated panel Var models (lag-1) satisfy the stability condition as all eigen values lie unit circle. However, Table 3. 7 presents the calculations and figures belonging to stability conditions after the panel VAR results . The estimated panel VAR models (lag-1) in GMM framework with exogeneous variables are shown below.

Table 3.6

Panel VAR Estimations for Model 1 and Model 2

Model 1					
Variables	Gini	Food Import	Food Supply	GDPper capita (PP)	Structural Defect
Gini (t-1)	0.044* (0.027)	0.120 (0.012)	-0.008 (0.015)	-0.046 (0.048)	-0.057 (0.055)
Food Import (t-1)	-0.001*** (0.0003)	-0.065 (0.049)	-0.000 (0.000)	0.002*** (0.000)	-0.0009*** (0.0006)
Food Supply (t-1)	-0.002* (0.016)	5.908 (0.427)	-0.026 (0.053)	0.135* (0.071)	-0.057 (0.101)
GDP per capita (PP) (t-1)	-0.061 (0.042)	-2.690 (1.841)	0.056* (0.033)	0.258*** (0.061)	-0.076 (0.056)
Structural Defect (t-1)	0.016 (0.014)	2.749 (0.901)	-0.008 (0.021)	-0.112*** (0.039)	0.391*** (0.046)
Democracy (t-1)	-0.013** (0.006)	-0.219 (0.740)	0.002 (0.019)	-0.0006 (0.024)	-0.065** (0.065)
Population (t-1)	-0.041 (0.028)	0.400 (1.629)	0.068 (0.118)	-0.361** (0.162)	-0.093 (0.153)
Globalization (t-1)	-0.0001** (0.00006)	-0.0001 (0.003)	-0.000 (0.0001)	0.0002 (0.000)	-0.0003 (0.0002)
Urbanization (t-1)	-8.76e-06** (4.28e-06)	0.010*** (0.000)	3.88e-06 (2.81e-06)	0.0002*** (8.84e-06)	-0.000*** (6.19e-06)
Number of Observations	670				
Number of Countries	117				
GMM Criterion Q(b)	9.19e-33				
Hansen test p-value	0.005				
CD	0.988				

Model 2					
Variables	Gini	Food Import	Food Supply	GDP per capita (PP)	Disorder of Polity Quality
Gini (t-1)	0.044	0.386	-0.009	-0.035	-17.911
	(0.027)	(0.984)	(0.015)	(0.048)	(25.745)
Food Import (t-1)	-0.0001***	-0.066	-0.000	0.002***	-0.027
	(0.0000)	(0.050)	(0.000)	(0.000)	(0.032)
Food Supply (t-1)	-0.002*	5.857	-0.026	0.132*	50.865
	(0.016)	(6.392)	(0.053)	(0.071)	(48.749)
GDP per capita (PP)(t-1)	-0.060	-2.270	0.062*	0.274***	8.831
	(0.040)	(1.580)	(0.032)	(0.061)	(9.023)
Disorder of Polity Quality (t-1)	0.000**	0.000	-0.0008***	-0.0001***	-0.003***
	(5.02e-06)	(0.000)	(7.04e-06)	(8.14e-06)	(0.001)
Democracy (t-1)	-0.013**	-0.414	0.002	-0.008	-2.000
	(0.006)	(0.745)	(0.019)	(0.023)	(5.347)
Population (t-1)	-0.041	-0.678	0.076	-0.314**	27.326
	(0.028)	(1.784)	(0.120)	(0.148)	(34.665)
Globalization (t-1)	-0.0001**	-0.0004	-0.000	0.0002	0.006
	(0.0006)	(0.003)	(0.000)	(0.0004)	(0.013)
Urbanization (t-1)	-8.72e-06**	0.010***	3.64e-06	-0.0002***	-0.000
	(4.29e-06)	(0.000)	(2.75e-06)	(8.50e-06)	(0.0008)
Number of Observations	670				
Number of Countries	117				
GMM Criterion Q(b)	3.72e--31				
Hansen test p-value	0.004				
CD	0.988				

Note: The results of panel VARs conducting with Structural Defect can be found in Model 1. The results of panel VARs conducting with Disorder of Polity Quality can be found in Model 2. Number of observations between 2008-2017. Missing data were collected national sources of countries, https://tradingeconomics.com/, https://www.statista.com/. Robust standard errors are in parentheses. Panel-specific fixed effects were removed using forward orthogonal deviation or Helmert transformation. The optimal lag selection is at one and decided through the Overall Coefficient of Determination (pvarsoc in Stata). *, **, and *** denote statistical significance at 10 %, 5 %, and 1 % levels, respectively.

The main analysis of this chapter deals with the first two dimensions of food security (Food Availability and Food Accessibility), while the model supplements the third pillar of food security (Food Utilization) in the robustness test. Although the identification of food security varies in the literature, this study employs the descriptions of the Food and Agriculture Organization (FAO) and World Health Organization (WHO), which are relatively reliable sources. However, recall that the fourth pillar of food security suggested by FAO is not included in this research (see Section 3.3). In this context, this study adopts Food Supply and Food Import for food availability pillar. In addition, food accessibility is represented by Gross Domestic Product per capita (in purchasing power equivalent). Except for urbanization, the rest of the variables are represented by their growth rates. Recall that Model 1 conducts the analysis using Structural Defect, the first aspect of political instability, while Model 2 runs the analysis considering Disorder of Polity Quality, the second aspect of political instability.

In both Model 1 and Model 2, the results suggest that an increase in Food Import growth rate leads to a slight decrease (-0.001) in Gini Index growth at 1% significance level. However, an increase in Food Supply growth rate causes a reduction (-0.002) in the Gini Index growth at %10 significance level. Rising levels of the food availability pillar of food security can contribute to a slight reduction in income inequality. In addition, Food Import growth rate has a significant and positive effect on reducing the Structural Defect growth rate, while Food Supply growth rate has a non-significant impact on Structural Defect growth. On the contrary, there is no statistically significant impact on Disorder of Polity Quality growth rate in Model 2. In addition, in Model 1, neither Structural Defect nor Gini Index significantly impacts Food Supply and Food Import (food availability dimensions of food security). However, an increase in Disorder of Polity Quality growth rate leads to a slight decrease (-0.0008) in Food Supply growth rate. That is, Disorder of Polity Quality can threaten food availability, and in turn, food security.

Recall that Gross Domestic Product per capita is used as a proxy of food accessibility pillar of food security. An increase in the Gross Domestic Product per capita growth rate has a non-significant effect on Gini Index growth and the growth rates of Structural Defect and Disorder of Polity Quality. That means that food accessibility does not impact on income inequality and political instability. Structural Defect and Disorder of Polity Quality growths rates have a statistically significant (negative) impact on Gross Domestic Product per capita (in purchasing power equivalent) at a high significance level. That means that an increase in political instability negatively affects food security in terms of food accessibility. In addition, an increase in Gross Domestic Product per capita growth rate impacts neither Gini Index growth rate nor Structural Defect and Disorder of Polity Quality growth rates.

Furthermore, as shown in Table 3.6, the two models differ in terms of the effects of an increase in political instability. Whereas an increase in Structural Defect growth rate harms only Gross Domestic Product per capita growth rate (food accessibility pillar of food security), an increase in Disorder of Political Quality leads to a slight rise in Gini Index growth rate and a small decline in both Food Supply (food availability pillar) and Gross Domestic Product per capita growth rate (food accessibility). Namely, within the general perspective, political instability leads to a decrease in food security in terms of food accessibility since both aspects of political instability adversely affect Gross Domestic Product per capita growth rates. However, this effect is slightly strong in terms of Structural Defect compared to Disorder of Polity Quality.

Regarding control variables, an increase in the growth rate of Democracy (-0.013) and Urbanization (represented by urban population growth rate)(-8.76e-06) leads to a slight decrease in Gini Index growth rate at 5% significance level. That is, they contribute to narrowing the income gap. In addition, while Democracy and Urbanization have a statistically significant (negative) impact on Structural Defect dimension of political instability, they have

a non-significant effect on Disorder of Polity Quality dimension of political instability. In addition, in the Model 1, Urbanization has a significant impact on the variables other than Food Supply (food availability). Population growth rates significantly decrease (-0.361) in the growth rates of Gross Domestic Product per capita (in purchasing power equivalent) growth rate in both models. That is to say, the food accessibility pillar of food security seems to be influenced negatively by population growth rates. Finally, the Trade Openness growth rate, which is deemed the proxy for globalization, has a significantly lower (negative) impact on Gini Index growth rate; that is, an increase in globalization slightly affects the narrowing of the income gap.

In addition, food availability and food accessibility interact with each other. Food availability, represented by Food Supply and iFood Import, statistically significantly affects food accessibility, which is proxied by Gross Domestic Product per capita (in purchasing power equivalent) . In both models, while an increase in Food Import growth rate leads to a rise (0.002) in Gross Domestic Product per capita (in purchasing power equivalent) growth rate at 1% significance level, Food Supply growth rate has a stronger (0.135) effect on Gross Domestic Product per capita growth rate at 10% significance level. On the contrary, an increase in Gross Domestic Product per capita (in purchasing power equivalent) growth rate leads to a significant rise (0.056) in food Supply growth rate.

The following tables and graphs of eigenvalue confirm that the estimated panel VARs satisfy the condition. Table 3.7 reports the eigenvalues of the estimated panel VAR models and the modulus of each eigenvalue is strictly less than one. Figure 3.1 shows the diagram of the eigenvalues relative to the estimated panel VAR models along with the complex components at the y-axis and the real component at the x-axis. Both figures show that the eigenvalues are well inside the unit circle.

Table 3.7

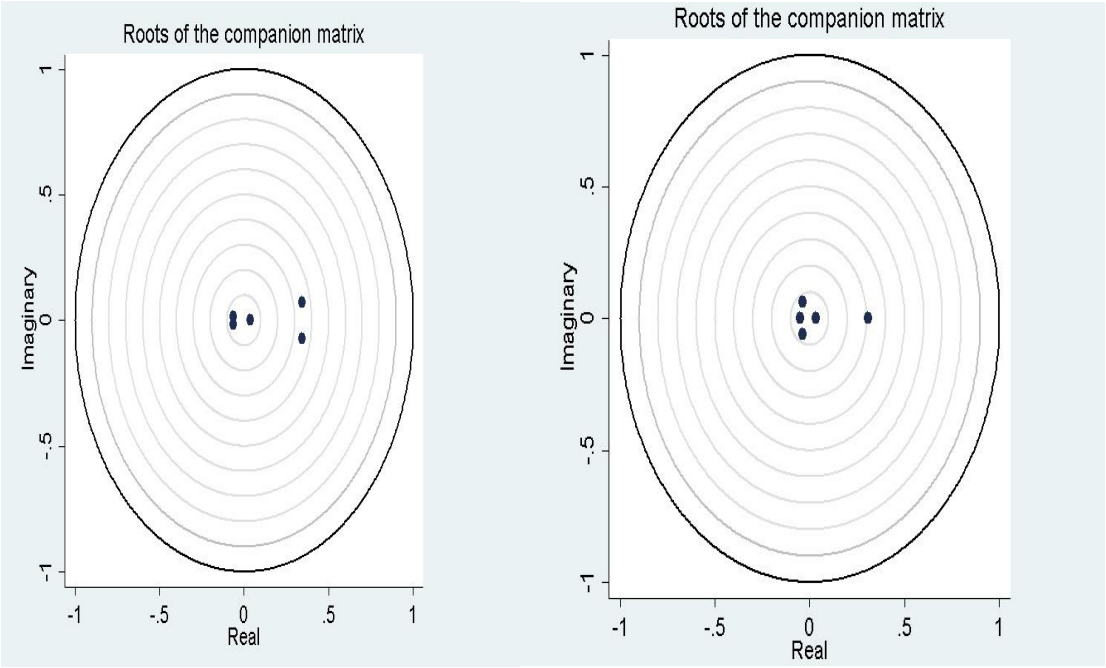
Eigenvalue Stability Condition for Model 1 and Model 2

Model 1		
Eigenvalue		
Real	**Imaginary**	**Modulus**
.3444483	-.0710088	.3516915
.3444483	.0710088	.3516915
-.0621187	.0165444	.0642842
-.0621187	-.0165444	.0642842
.0373818	0	.0373818
Model 2		
.3081811	0	.3081811
-.0356586	.0614357	.0710344
-.0356586	-0614357	.0710344
-.049458	0	.049458
.0348723	0	.0348723

Note: All the eigenvalues lie inside the unit circle. The estimated panel VAR satisfies the stability condition.

Figure 3.1.

Graph of Stability Condition



i. Model 1 ii. Model 2

The following table presents the results of Granger Causality test. The null hypothesis(H_0) of the Wald test is that the excluded variable does not Granger-cause equation variable, while the alternative hypothesis(H1) is that omitted variables cause equation variables. The granger causality findings support our panel VAR estimation results.

Table 3.8

Granger Causality Walt Test Results

Model 1			
Variables	Null Hypothesis	Chi^2	P value
Gini Index	• Food Import (excluded) does not granger cause Gini Index.	32.067	0.000***
	• Food Supply (excluded) does not granger cause Gini Index.	2.871	0.080*
	• GDPper capita (PP) (excluded) does not granger cause Gini Index.	2.126	0.145
	• Structural Defect (excluded) does not granger cause Gini Index.	0.013	0.910
Food Import	• Gini Index (excluded) does not granger cause Food Import	0.018	0.895
	• Food Supply (excluded) does not granger cause Food Import	0.845	0.358
	• GDPper capita (PP) (excluded) does not granger cause Food Import	2.135	0.144
	• Structural Defect (excluded) does not granger cause Food Import	2.091	0.148
Food Supply	• Gini Index (excluded) does not granger cause Food Supply	0.274	0.600
	• Food Import (excluded) does not granger cause Food Supply	0.641	0.423
	• GDPper capita (PP) (excluded) does not granger cause Food Supply	3.315	0.069*
	• Structural Defect (excluded) does not granger cause Food Supply	0.142	0.706
	• Gini Index (excluded) does not granger cause GDPper capita (PP)	0.892	0.345

GDPper capita (PP)	• Food Import (excluded) does not granger cause GDPper capita (PP)	13.714	0.000***
	• Food Supply (excluded) does not granger cause GDPper capita (PP)	3.578	0.059*
	• Structural Defect (excluded) does not granger cause GDPper capita (PP)	8.087	0.004***
Structural Defect	• Gini Index (excluded) does not granger cause Structural Defect	1.125	0.289
	• Food Import (excluded) does not granger cause Structural Defect	221.238	0.000***
	• Food Supply (excluded) does not granger cause Structural Defect	0.322	0.571
	• GDPper capita (PP) (PP) (excluded) does not granger cause Structural Defect	1.839	0.175
Model 2			
Gini Index	• Food Import (excluded) does not granger cause Gini Index.	26.799	0.000***
	• Food Supply (excluded) does not granger cause Gini Index.	2.837	0.092*
	• GDPper capita (PP) (excluded) does not granger cause Gini Index.	2.218	0.136
	• Disorder of Polity Quality (excluded) does not granger cause Gini Index.	4.531	0.033**
Food Import	• Gini Index (excluded) does not granger cause Food Import	0.154	0.695
	• Food Supply (excluded) does not granger cause Food Import	0.840	0.360
	• GDPper capita (PP) (excluded) does not granger cause Food Import	2.053	0.152
	• Disorder of Polity Quality (excluded) does not granger cause Food Import	0.029	0.864
Food Supply	• Gini Index (excluded) does not granger cause Food Supply	0.428	0.513
	• Food Import (excluded) does not granger cause Food Supply	0.503	0.478
	• GDPper capita (PP) (excluded) does not granger cause Food Supply	3.756	0.053*
	• Disorder of Polity Quality (excluded) does not granger cause Food Supply	15.423	0.000***
	• Gini Index (excluded) does not granger cause GDP per capita (PP)	0.524	0.469

GDP per capita (PP)	• Food Import (excluded) does not granger cause GDP per capita (PP)	8.812	0.003***
	• Food Supply (excluded) does not granger cause GDP per capita (PP)	3.488	0.062*
	• Disorder of Polity Quality (excluded) does not granger cause GDP per capita (PP)	4.629	0.000***
Disorder of Polity Quality	• Gini Index (excluded) does not granger cause Disorder of Polity Quality	0.484	0.487
	• Food Import (excluded) does not granger cause Disorder of Polity Quality	0.696	0404
	• Food Supply (excluded) does not granger cause Disorder of Polity Quality	1.085	0.297
	• GDPper capita (PP) (excluded) does not granger cause Disorder of Polity Quality	0.958	0.328

Note: This table reports the results of the Granger-causality Wald test. These results also support the estimated panel VAR models. The values in the table are the Chi-square and their corresponding p-values. Under the null hypothesis, the excluded variable does not Granger cause the dependent/endogenous variable.*, **, and *** denote significance at the 5 % ,1 % ,%10 level, respectively.

Table 3.8 shows the results of Granger Causality Walt test. The findings are consistent with the estimated Panel VARs. In both models, the common point is that there is bi-directional causality between Gross Domestic Product per capita (in purchasing power equivalent) growth rate and Food Supply growth rate. That is two-way causality between food accessibility and food availability (considering food supply). In addition, at first glance, it is seen that Gross Domestic Product per capita (in purchasing power equivalent) growth rates stand out as the most endogenous variable among others. It is noteworthy that the causality direction always drives from other variables to Gini Index growth rate in the both models.

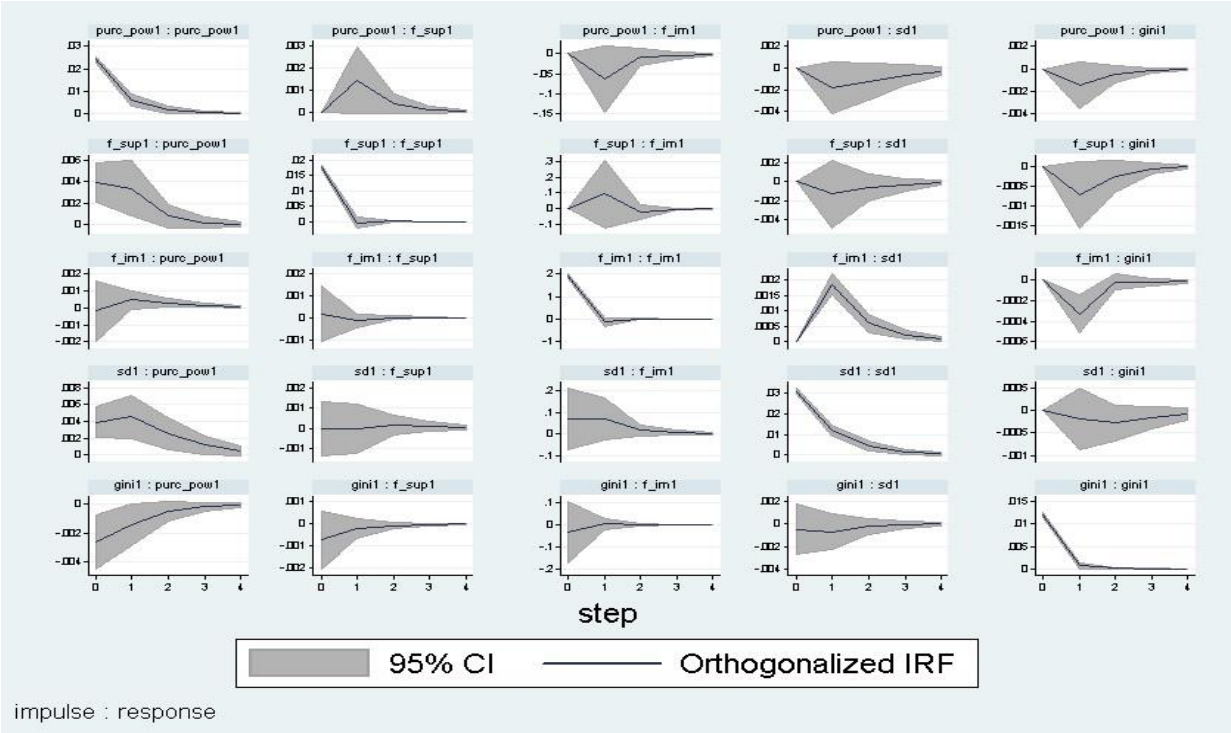
3.5.2.Impulse-Response Function (IRF)

This section shows the results of the Impulse-Response Functions (IRFs), which depict the reaction of one variable in the system to the innovations in another variable in the system,

holding all other shocks at zero. Gaussian approximation based on Monte Carlo simulation is applied to forecast confidence bands (Abrigo and Love, 2015). Orthogonalized IRF is computed by taking into consideration Cholesky decomposition. Note that IRFs are constructed from the estimated Panel VAR coefficients and their "robust" standard errors. This section presents IRFs figures for both Model 1 and Model 2 over the next 4 years in Figure 3.2 and Figure 3.3, respectively. Before performing IRFs, ordering variables from exogeneous to endogeneous is a must (Traoré 2018). Therefore, they can sort the following order in Model 1: Gross Domestic Product per capita, Food Supply, Food Import, Structural Defect, and Gini Index. However, it is the same sort with the estimated Panel VAR, while the order of the variables in Model 2 is different than the estimated Panel VAR for Model 2. In Model 2, the variables can order as Gross Domestic Product per capita (in purchasing power equivalent), Food Supply, Disorder of Polity Quality, Gini Index, Food Import. In this analysis, IRF visualization can be found in the following figures, both Model 1 and Model 2, respectively.

Figure 3.2

Impulse-Response Function (IRF) : Model 1



Note: All variables showed in Figure 3.2 are in growth rates in growth rates. All variables are listed based on their endogeneity. purc_pow1: gross domestic product per capita (in purchasing power equivalent) growth rate; f_sup1:food supply; f_imp1:food import; sd:structural defect; gini1:gini index.

The IRFs in Figure 3.2 show the findings related to Model 1. The first rows depict the responses from a one standard deviation shock to the Gross Domestic Product per capita (in purchasing power equivalent) growth rate (purc_pow1 in figure), namely shocks to food accessibility (the second pillar of food security). One standard shock to Gross Domestic Product per capita (in purchasing power equivalent) growth rate creates a positive and significant response in Food Supply growth rate until the 1st year and its response gradually falls from the 1st to 3rd years and dies out. On the contrary, Food Import negatively responds until the 1st year, but its response is not significant. After the 3rd year, its response is significant but gradually disappears. Structural Defect growth rate has a negative response until the 1st year, and it gradually increases. Although the same response is observed for the Gini Index growth rate, its response disappears earlier than the structural defect to shocks.

The second and third rows depict the responses from a one standard deviation shock to Food Supply and Food Import, which are the food availability pillar of food security. In the second row, Gross Domestic Product per capita (in purchasing power equivalent) growth rate responds positively to Food Supply; however, this positive response conserves its statistical meaningfulness until the 2nd period. The reaction of Gross Domestic Product per capita (in purchasing power equivalent) growth rate falls between the 1st and 2nd periods, and then it disappears by losing its statistical significance. The Food Import responds positively to one standard deviation shock given to Food Supply. After the response reaches a maximum level in the 1st period, it starts to fall down, but its response turns into negative in the 2nd period, and then gradually disappears by increasing the zero level. However, its response is statistically non-significant over the 4 years.

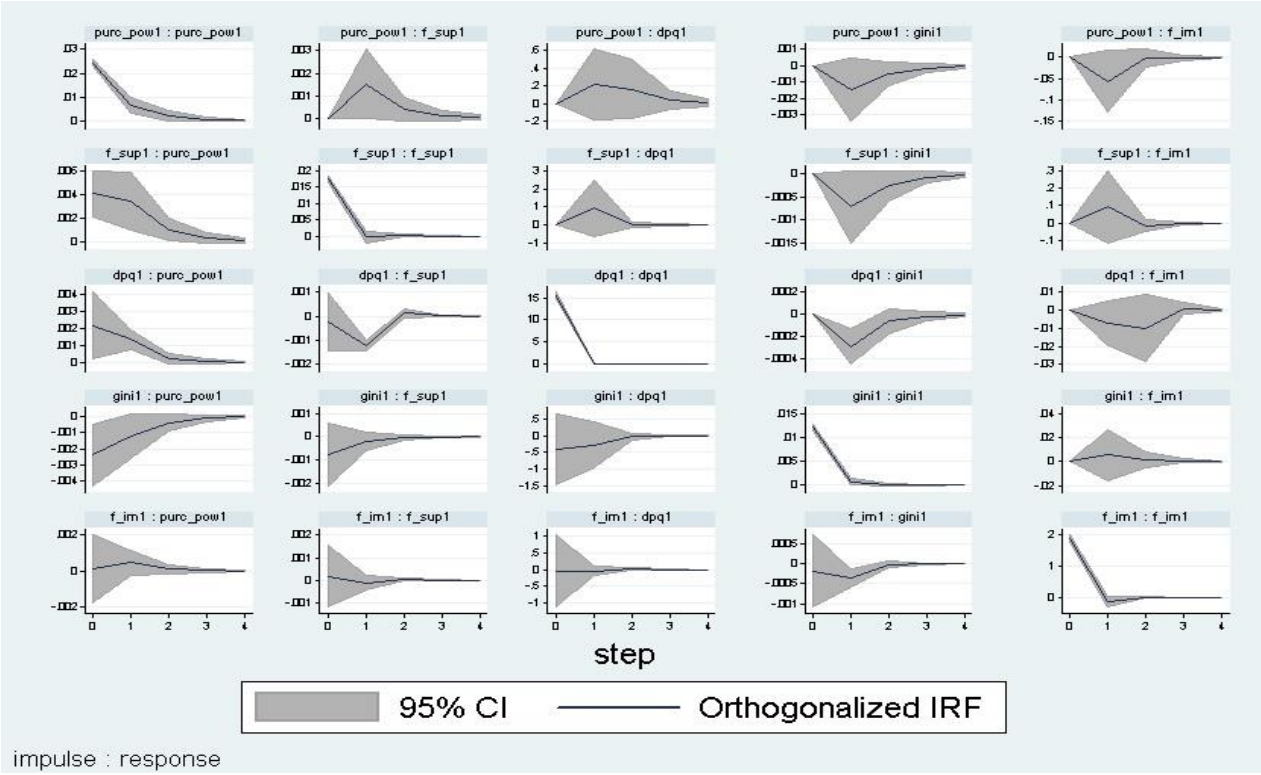
Furthermore, the Gini Index growth rate response to Food Supply growth rate has a higher impact than the response of Structural Defect. In contrast, the response of both of them to Food Supply is negative before disappearing in the 4th period. In the third row, the reactions of Structural Defect growth rate and Gini Index growth rate to one standard deviation shock given Food Import stand out at first glance. While the Structural Defect growth rate positively responds until the 1st period and disappears by decreasing in the 4th period, the reaction of Gini Index is negative. It dies out by increasing after the 2nd period.

The fourth row shows the reaction to one standard deviation shock given to Structural Defect, namely the first aspect of political instability. Whereas the responses of Gross Domestic Product per capita (in purchasing power equivalent) growth rate and Food Import growth rate seem rather obvious, the rest of the variables have much lower responses to shock from Structural Defect. Gross domestic product per capita (in purchasing power equivalent) and Structural Defect positively respond, and its reaction dies out in the 4th period. The response of Food Import growth decrease after the 1st period and disappears after the 2nd period. Finally, Gini Index growth rate negatively responds to one standard deviation shock from Structural Defect, and the reaction is stabilized in the 4th year.

The fifth row depicts the reactions from a one standard deviation shock to Gini index. Gross Domestic Product per capita (in purchasing power equivalent) growth negatively and significantly responds to a shock. After its reaction increases until the 2nd period, it disappears. The responses of both indicators from food availability pillar of food security (Food Supply and Food Import) increase between the 0 and 1st years and then die out. Finally, Structural Defect has a low reaction to shocks from Gini Index, and the response disappears. As a result, the reaction of Gross Domestic Product per capita (in purchasing power equivalent), which is assumed as the proxy for food accessibility, has a relatively apparent response compared to other variables.

Figure 3.3

Impulse-Response Function (IRF) : Model 2



Note: All variables showed in Figure 3.2 are in growth rates in growth rates. All variables are listed based on their endogeneity. purc_pow1: gross domestic product per capita (in purchasing power equivalent) growth rate; f_sup1:food supply; f_imp1:food import; sd:structural defect; gini1:gini index.

Figure 3.3 shows the IRFs belonging to Model 2, which performs the analysis by using Disorder of Polity Quality (the second aspect of political instability). However, it is only interpreted the reactions of variables, which seem different from in Model 1 (Figure 3.2).

It can be started to explain in the first row in which the responses from one standard deviation shock to the Gross Domestic Product per capita (in purchasing power equivalent) growth rate. Compared to the first rows of Figure 3.2 and Figure 3.3, Disorder of Polity Quality in Figure 3.3 positively responds to shock contrary to the negative reaction of Structural Defect in Figure 3.2. Different political instability dimensions react differently to one standard

deviation shock given to Gross Domestic Product per capita (in purchasing power equivalent) growth rate.

The second and fifth rows depict the responses from a one standard deviation shock to Food Supply growth rate and Food Import growth rate, which are the food availability pillar of food security. The order is different compared to Figure 3.2 since the orders of endogenous and exogenous variables change. A standard deviation shock to Food Supply growth rate leads to an increase in Disorder of Polity Quality growth until the 1st year, and a gradual decrease in the period 1 to 2. After the 2nd period, the response disappears. The other food availability proxy is food import, which is shown in the fifth row. However, the reactions from other variables to shock given to Food Import seems very weak. However, only the response of Gini Index and Gross Domestic Product per capita (in purchasing power equivalent) growth rates are relatively obvious. The standing point is that Disorder of Polity Quality is unresponsive to shocks from Food Import, unlike Structural Defect (Figure 3.2 or Model 1).

The third row depicts the IRFs from one standard deviation shock to Disorder of Polity Quality growth rate. A standard deviation shock to Disorder of Polity Quality leads to a decrease in Gross Domestic Product per capita (in purchasing power equivalent) growth until the 2nd year. Its response is positive and significant over the four years. Food Supply negatively responds to shock. Reaching its minimum level in the 1st year, the reaction of Food Supply increases between the period 1 to 2, and dies out.

Furthermore, the response of Gini Index growth rate is positive and significant over the 4 years. Reaching its minimum level in the 1st period, the increase in Gini Index appears between 1 and 2 years, and then the reaction disappears. Finally, one unit standard deviation shock to Disorder of Polity Quality growth rate leads to a decrease in Food Import growth rate, namely one of the two indicators of food accessibility, until the 2nd year and increases in the period from 2 to 3.

Eventually, the fourth row depicts IRFs from one standard deviation shock to Gini Index growth rate. The reactions to one standard deviation shock given to Gini Index growth rate seem moderate as in Model 1. However, when Model 1 and Model 2 are compared, they differ in the responses of dimensions of political instability to Gini Index. In Model 2, one unit standard deviation shock to Gini Index growth rate, leads to an increase in real Disorder of Polity Quality growth until the 2nd year, and then the reaction disappears. Recall that, in the Model 1, the response of Structural Defect (the first aspect of political instability) slightly decreases and increases before disappearing.

3.5.3. The Forecast-Error Variance Decompositions (FEVDs)

The impulse responses inform us about the effect of changes of one variable on another; however, it is important to note that they do not explain the proportions in which shocks on a variable explain the fluctuations of other variables. Hence, this research uses a variance decomposition to estimate the extent of changes in one variable in explaining the changes in other variables. The variance decomposition of Panel VARs presents an alternative way of summarizing the information described by IRFs in Figure 3.2 and Figure 3.3. FEVDs enables us to determine how much of the variability in dependent variable is lagged by its own variance. In addition, it shows which of the independent variables is "stronger" in explaining the variability in the dependent variables over time. Its calculations are based on the Cholesky decomposition of the residual covariance matrix of the underlying Panel VAR model. The FEVDs confidence intervals are computed using 200 Monte Carlo draws based on the estimated model. Table 3.9 reports the FEVDs derived from the orthogonalized impulse-response coefficient matrices for four years forecast horizons for Model 1 and Model 2, respectively.

Table 3.9

Forecast Error-Variance Decomposition Estimations (in %, 4 periods ahead)

Response Variable and Forecast Horizon	Impulse Variables				
	Model 1				
Gini	Gini Index	Structural Defect	Food Import	Food Supply	GDP(pp)
1	1	0	0	0	0
2	.9809718	.0002703	.0007244	.0034574	.0145761
3	.9785511	.0007899	.000724	.0038754	.0160595
4	.9782246	.000979	.0007266	.0038989	.0161709
Structural Defect	Gini Index	Structural Defect	Food Import	Food Supply	GDP(pp)
1	.000219	.999781	0	0	0
2	.0005898	.9917812	.003093	.0015349	.003001
3	.0006064	.9898819	.0033486	.0018487	.0043145
4	.0006059	.9894417	.0033831	.0019335	.0046358
Food Import	Gini Index	Structural Defect	Food Import	Food Supply	GDP(pp)
1	.0003252	.0013757	.9982991	0	0
2	.0003297	.0027201	.9934141	.0023864	.0011497
3	.0003297	.0027884	.9932113	.0024984	.0011723
4	.0003297	.0027958	.9931962	.0024987	.0011796
Food Supply	Gini Index	Structural Defect	Food Import	Food Supply	GDP(pp)
1	.0017855	9.65e-09	.0001041	.9981103	0
2	.0019477	1.41e-06	.0001579	.9911776	.0067155
3	.0019665	.0000984	.00016	.990635	.0071401
4	.0019688	.0001399	.0001604	.9905569	.0071739
GDP(pp)	Gini Index	Structural Defect	Food Import	Food Supply	GDP(pp)
1	.0114645	.0245676	.0000539	.0254048	.938509
2	.0131268	.0516931	.0003597	.0394599	.8953606
3	.0132991	.0601558	.0004792	.0397091	.8863568
4	.0133077	.0620427	.0005106	.0396543	.8844848
	Model 2				
Food Import	Food Import	Gini Index	Disorder of Polity Quality	Food Supply	GDP(pp)
1	1	0	0	0	0
2	.9967249	8.55e-06	.0000138	.0024022	.0008505
3	.9966291	9.09e-06	.0000407	.0024679	.0008531
4	.996627	9.17e-06	.000041	.002468	.0008549

Gini Index	Food Import	Gini Index	Disorder of Polity Quality	Food Supply	GDP(pp)
1	.0002214	.9997786	0	0	0
2	.0010658	.9801025	.0005641	.0034626	.014805
3	.0010658	.9779514	.0005876	.0039109	.0164842
4	.0010661	.9777454	.0005894	.0039466	.0166524

Disorder of Polity Quality	Food Import	Gini Index	Disorder of Polity Quality	Food Supply	GDP(pp)
1	6.10e-06	.0007102	.9992837	0	0
2	.0000121	.0010235	.9952019	.0035683	.0001942
3	.0000124	.0010279	.9950829	.0035709	.0003058
4	.0000125	.0010282	.9950719	.0035727	.0003147

Food Supply	Food Import	Gini Index	Disorder of Polity Quality	Food Supply	GDP(pp)
1	.0001155	.001958	.0001968	.9977297	0
2	.0001446	.0020784	.0049822	.9853599	.0074349
3	.0001511	.0020859	.0050284	.9848514	.0078833
4	.0001511	.0020872	.0050289	.9848107	.0079221

GDP(pp)	Food Import	Gini Index	Disorder of Polity Quality	Food Supply	GDP(pp)
1	.0000227	.0091287	.00752	.0260614	.9572672
2	.0003347	.0104224	.0095732	.0409072	.9387625
3	.0003459	.0105626	.0095644	.0420342	.937493
4	.0003474	.0105753	.0095649	.0421322	.9373802

In both Model 1 and Model 2, the calculations about the variations of Gini Index are almost the same. Therefore, the results belonging to both models can be interpreted together. Gross Domestic Product per capita (in purchasing power equivalent) growth , which is used as a proxy for food accessibility, explains approximately 1.6 % of fluctuations of Gini Index growth rate at the 4-years horizon. The highest variation in the Gini Index growth rate is explained by the variable itself at 97%. The rest of the variables (the growth rates of Structural Defect, Food Import and Food Supply) explains much lower variation in future Gini Index growth rate.

In Model 1, as much as 0.4%, 0.3 and 0.1% of the variation in the Structural Defect (the first aspect of political instability) can be explained by the growth rates of Gross Domestic Product per capita (in purchasing power equivalent), Food Import, Food Supply, respectively. The highest variation in the Structural Defect growth rate is explained by the variable itself at

98%. However, the Gini Index describes the lowest fluctuations of Structural Defect growth rate at 0.06%. In Model 2, as much as 0.3 and 0.1% of the variation in the Disorder of Polity quality (the second aspect of political instability) can be explained by the growth rates of Food Supply and Gini Index, respectively. The rest of the variables (the growth rate of Food Import, Gross Domestic Product per capita (in purchasing power equivalent) explains a much lower variation in future Food Supply growth rate, whereas the variable itself explains the highest variation in the Disorder of Polity quality growth rate at 99%.

In Model 1, as much as 0.27%, 0.24% of the variations in Food Import growth rate can be explained by the growth rates of Structural Defect, Food Supply. The rest of the variables (the growth rates of Gross Domestic Product per capita (in purchasing power equivalent and Gini Index) explain much lower variation in future Food Import growth rate. The highest variation in Food Import growth is defined by the variable itself at 99%. In Model 2, we start with the variations in Food Import growth rate. As much as 0.2% of the variations in Food Import can be explained by Food Supply growth rate. The rest of the variables (the growth rates of Gross Domestic Product per capita (in purchasing power equivalent), Disorder of Polity Quality, Gini index) explains much lower variation in future Food Import growth. The highest variation in Food Import growth rate is defined by the variable itself at 99%.

In Model 1, as much as 0.7% and 0.1% of the variations in Food Supply can be explained by the growth rates of Gross Domestic Product per capita (in purchasing power equivalent) and Gini Index. Although the highest variation in Food Supply growth rate is explained by the variable itself at 99%, the rest of the variables (the growth rates of Structural Defect, Food Import) explains much lower variation in future Food Supply growth rate. In Model 2, as much as 0.7% and 0.5% of the variations in Food Supply can be explained by the growth rates of Gross Domestic Product per capita (in purchasing power equivalent) and Disorder of Polity

Quality. The highest variation in Food Supply growth rate is explained by the variable itself at 98%.

In Model 1, as much as 6.2%, 3.9% and 1.3% of fluctuations in the growth rates of Gross Domestic Product per capita (in purchasing power equivalent) can be explained by the growth rates of Structural Defect, Food Supply and Gini Index, respectively. The variable itself explains the highest variation in the Gross Domestic Product per capita (in purchasing power equivalent) growth at 88%. In Model 2, Food Supply, Gini Index and Disorder of Polity Quality growth rates explain approximately 4.2%, 1.05% and 0.95% of the variations of growth rates of Gross Domestic Product per capita (in purchasing power equivalent), respectively. The variable itself explains the highest variation in the Gross Domestic Product per capita (in purchasing power equivalent) (in purchasing power equivalent) at 93%.

By calculating FEVDs, this research shows the per cent of the variation in one variable explained by the shock to another variable accumulated over the four years. The variance decompositions display the magnitude of the total effect. According to the results, it is noteworthy that all variables are explained mainly with their own shocks in the short term for both models. In the following section, the robustness of the analysis is discussed.

3.6. Robustness Check

Herein, to check the sensitivity of the baseline findings, the robustness analysis is conducted by using different variables. In this context, the new panel VAR models adding the third dimension of food security in addition to the other two pillars are performed. The models are extended by adding the third pillar of food security, referred to as “food utilization”. This research is performed using only two dimensions of food security rather than three pillars in the main analysis because the first two dimensions have much more important for this analysis. Therefore, food utilization, which is the last pillar of food security according to the World

Health Organization (WHO) definition , is included in the baseline model of this research. However, in the robustness check, the new Panel VARs, which show how political instability, income inequality, and food security pillars interact together, are estimated. As performed in the main analysis, the robustness check is conducted for both Model 1 and Model 2. However, the new Panel VAR estimation carried out for Model 1 is named as "Model 1.A", and the model conducted for Model 2 is called as "Model 2.A".

Food utilization means that people make appropriate use of food based on knowledge of basic nutrition and care, and have access to water and sanitation for preparing food and maintaining proper hygiene. Various indicators are used as the proxy for food utilization, such as the percentage of people using at least basic drinking water and basic sanitation services, or prevalence of low birthweight, etc. Because of the limited number of variables, this research adopts a percentage of People Using at Least Basic Drinking Water and Sanitation services. In addition, the link among food security, political instability and income inequality is annually measured. Hence, the country-year data instead of using three-year averages data are considered. While discussing the findings, it is only focused on the results, which are not consistent with the main analysis and each calculation related to food utilization. Nevertheless, detailed statistical calculations can be found in APPENDIX A-B.

In Model 1.A (robustness model for Model 1), there is no statistically significant relationship from food utilization and political instability. In the Model 2.A (robustness model for Model 2), it is found that there is a statistically significant (negative) relationship running from Disorder of Polity Quality to food utilization in terms of both the percentage of People Using at Least Basic Water and the Percentage of People Using at Least Basic Sanitation services. Recall that Disorder of Polity Quality includes religious-ethnic tensions, external conflict, bureaucratic quality and law and order. Hence, an increase in Disorder of Polity

Quality due to the rise in any of these variables threatens the food utilization pillar of food security.

In the equation for Gini Index, it is estimated that food utilization does not statistically affect the growth rates of Gini Index for both Model 1.A and Model 2.A in the robustness test. In addition, the findings of democracy, which is assumed as the exogenous variable, are different in the robustness test compared to the main analysis. While an increase in Democracy leads to a decrease (-0.013) Gini growth rate for both models in the main analysis, there is no statistically significant relationship between them in the robustness test.

Recall that the growth rate of Food Supply and Food Import is considered as the proxy of food availability. In both models, the results show that there is no statistically significant relationship running from food utilization to food availability in the robustness test. Note that, the growth rates of Gross Domestic Product per capita (in purchasing power equivalent) is employed as the proxy for food accessibility. The estimated panel VARs by adding the food utilization find that an increase in food utilization (in both percentage of people using at least basic sanitation services and water) positively impacts food accessibility. Moreover, the Urbanization negatively affects the ratio of People Using at Least Basic Water and Sanitation services. In contrast, an increase in Trade Openness, which is the proxy for globalization, positively affects the percentage of People Using at Least Basic Water.

3.7.Conclusion

What are the dynamics among political instability, food security and income inequality? This chapter provides new cross-country evidence on the relationship between these rising global risks. Unlike the majority of the existing literature, this study shows how these three issues interact simultaneously and separately. For this purpose, this study performs Panel Vector Autotregressive model (Panel VAR) with a large panel dataset for 2008-2017. The main

analysis of this thesis also goes beyond and it measures (IRFs) and Forecast Error Decompositions (FEVDs). Although these are not the first aims of this chapter, it is important to show for deeper understanding of interactions.

As performed in the previous chapter of this thesis, this chapter performs Panel Vector Autoregressive Analysis in two models separated based on two different political instability concepts composed in the first chapter of the thesis. Model 1 uses the first aspect of political instability called the Structural Defect, while Model 2 is analyzed by employing Disorder of Polity Quality. Moreover, the main analysis of this chapter adopts the first two pillars of food security, while the robustness test checks the analysis by supplementing the third pillar of food security.

First, in both models, food accessibility dimension of food security stands out in terms of its relationship with other indicators. Gross Domestic Product per capita (in purchasing power equivalent), assumed as the proxy of food accessibility interacts with almost all the variables except for Gini Index, representing income inequality. However, it is frequently impacted by other indicators. These findings are also provided by the robustness test, which is performed by including the third pillar of food security, which is food utilization. These results mean food accessibility is very sensitive. More clearly, it can be concentrated on increasing food availability and utilization to improve food accessibility.

Second, another point highlighted according to results is that political instability(both Structural Defect and Disorder of Polity Quality) has a significant (negative) impact on food accessibility That is to say that a politically stable environment paves the way for increasing food accessibility. Nevertheless, Structural Defect growth rate has a stronger impact (-0.11) on food accesibility growth rate than Disorder of Polity Quality growth rate impact's on food accessibility (-0.00). Recall that Structural Defect, which is generated with PCA in Chapter I, includes the following variables: socio-economic conditions (S_EC), investment profile

(IP),military in politics (M_P), corruption (COR),bureaucratic quality (BQ),internal conflict (IC). Disorder of Polity Quality involves: external conflict (EC), religious tension(RT), ethnic tension(ET), law and order (LO),bureaucratic quality(BQ). In this context, structural problems leading to political instability threaten food affordable by undermining purchasing power.

In addition, these two different aspects of political instability differ in terms of the variables on which political instability impacts and the variables by which political instability is affected. In this context, considering food security pillars, Structural Defect growth is affected by food availability (in terms of Food Import) and it impacts food accessibility. However, an increase in Disorder of Polity Quality leads to a decrease in food accessibility, food availability (in terms of Food Supply). In addition, Disorder of Polity Quality has a relationship (positive) with income inequality. The robustness test, which is performed by supplementing the effects of food utilization, supports these results. It also shows that the escalation of Disorder of Polity Quality impacts food utilization. In this context, the second dimension of political instability has much more interaction with the other variables than the first dimension.

Third, it is noteworthy that although this study expects income inequality is a much more "influencing" variable, it is mostly the "influenced" variable. Both in the main analysis and robustness test, Gini is impacted by both food availability indicators and Disorder of Polity Quality. According to the literature review, it is thought that the nexus from Disorder of Polity Quality to income inequality makes considerable sense. However, the analysis results displaying the direction from food availability to income inequality has been expecting a different direction. This result can stem from two reasons. First, the analysis is performed with the variables published annually, instead of using a 3-years average. Hence, this research is conducted by the most general indicators evaluated within the food availability pillar of food security. The results may change when the analysis is performed by using the variables published in 3-year average indicators of food availability. The second reason, findings can be

reasonable in food security and income inequality studies concentrating on regional dynamics. In addition, income inequality is negatively impacted by globalization, represented by Trade Openness and Urbanization, which stands for urban population, and these results are considerably reasonable.

Fourth, with respect to exogenous variables, Urbanization somewhat stands out and it impacts on almost all the variables both in the main analysis and in the robustness test. The affect of Democracy differs in different political instability dimensions. Although an increase in the growth rate of Democracy leads to a decrease in Structural Defect, there is no significant relationship with Disorder of Polity Quality. In the main analysis for both models, democratization leads to a decrease in income inequality, it is not significant in the robustness test, performing the analysis by adding the food utilization.

Finally, the third pillar of food security, namely food utilization, interacts with only the food accessibility pillar among the other pillars of food security. In addition, food utilization is statistically significantly impacted by only Disorder of Polity Quality aspect of political instability. Another point to be noted is that in the robustness test, we analyze by adding the third pillar in addition to the first two pillars of food security, where food accessibility is still the most interacting variable of this analysis.

In addition to all, thsi study performs the Impulse Response Functions (IRFs), which investigate the responses of a dependent variable to other variable shocks and the Forecast Error Variance Decomposition (FEVDs), which depicts the contribution of each endogenous variables shock to the determination of the other variables' forecast error variance. In a nutshell, all variables are explained mainly with their own shocks and changes within themselves for 4 years forecast horizon.

Using panel VARs, this study presents the first study in the literature, which empirically observes the interconnections between political instability, food security, and income inequality

using different indicators. However, of course, there are some limitations to our study, most notably the limited number of annually published food security data. Nevertheless, it is hoped that this study will shed light on future studies aiming to investigate the dynamics among political instability, food security and income inequality.

NOTES

[i] see details : https://classroom.synonym.com/about-food-shortages-in-the-french-revolution-12078373.html

[ii] see details https://www.oxfordreference.com

[iii] It should be noted that our analysis analyzes aggregated effects of variables included by Structural Defect and Disorder of Polity Quality.

[iv] see details: https://myweb.uiowa.edu/fsolt/papers/Solt2014.pdf.

[v] see details: https://www.who.int/foodsafety/areas_work/nutrition/en/

[vi]see details: https://www.usaid.gov/who-we-are/agency-policy

[vii] Kuznets(1955) focuses on the changes in urban inequality rather than the narrowing intersectoral income gap. In this context, he uses the long term effects of urbanization for making his study and identifies urbanization as a process that is expected to reduce inequality in the long term.

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3.8.Appendix

Appendix A.

Robustness Panel VAR Test Results

MODEL1.A

Variables	Gini	Food Import	Food Supply	GDP (PP)	Sanitation	Water	Structural Defect
Gini (t-1)	0.314 (0.032)	0.115 (0.459)	-0.002 (0.019)	-0.034 (0.050)	-0.003 (0.003)	-0.002 (0.002)	-0.074 (0.048)
Food Import (t-1)	-0.001*** (0.0002)	-0.065 (0.049)	-0.000 (0.000)	0.0001*** (0.000)	-8.31e (0.0001)	-0.001 (0.042)	-0.0001*** (0.0006)
Food Supply (t-1)	-0.019 (0.001)*	5.908 (6.581)	-0.040 (0.053)	0.004* (0.001)	0.0006 (0.008)	-0.003 (0.004)	-0.057 (0.101)
GDP (PP) (t-1)	-0.061 (0.042)	-2.654 (1.784)	0.040* (0.031)	0.203*** (0.061)	0.001 (0.004)	0.002 (0.001)	-0.076 (0.056)
Sanitation	0.376 (0.538)	-0.368 (31.117)	0.328 (0.460)	1.136*** (0.539)	0.899*** (0.118)	-0.001 (0.042	-0.525 (1.405)
Water	-1.536 (0.565)	-2.179 (85.529)	0.833 (0.703)	1.883** (0.765)	-0.172 (0.187)	1.053 (0.106)	-2.634 (1.788)
Structural Defect (t-1)	0.002 (0.017)	2.739 (2.060)	-0.001 (0.022)	0.132*** (0.039)	-0.004 (0.003)	-0.003 (0.002)	0.377*** (0.050)
Democracy (t-1)	0.0278 (0.142)	-0.199 (1.200)	0.006 (0.021)	-0.0006 (0.024)	0.004 (0.002)	0.001 (0.003)	-0.190*** (0.064)
Population (t-1)	-0.016 (0.030)	0.400 (1.629)	0.026 (0.100)	-0.244** (0.121)	0.002 (0.009)	-0.001 (0.005)	-0.093 (0.153)
Trade Openness (t-1)	-0.0001 (0.00006)**	-0.0001 (0.003)	-0.000 (0.0001)	0.0002 (0.000)	2.84e-06 (0.0001)	0.0002** (0.0001)	-0.0003 (0.0002)
Urbanization (t-1)	-0.0001*** (4.31e-06)	0.010*** (0.000)	5.54e-06* (3.24))	0.0002*** (7.90e-06)	-2.71e-06*** (6.06e-07)	7.57e-06*** (4.07e-07)	-0.0002 (7.27e-06)***

Number of Observations	669
Number of Countries	117
GMM Criterion Q(b)	1.79e-30
Hansen test p-value	0.006
CD	0.999

MODEL 2.A

Variables	Gini	Food Import	Food Supply	GDP (PP)	Sanitation	Water	Disorder of Polity Quality
Gini (t-1)	0.031 (0.032)	0.361 (0.444)	-0.003 (0.019)	-0.021 (0.051)	-0.003 (0.003)	-0.002 (0.002)	-17.040 (25.7062)
Food Import (t-1)	-0.0001*** (0.0000)	-0.066 (0.050)	-0.000 (0.000)	0.0001 (0.000)***	-8.17e-06 (0.00001)	-0.001 (0.042)	-0.034 (0.042)
Food Supply (t-1)	-0.019* (0.001)	5.857 (6.392)	-0.040 (0.053)	0.004 (0.001)*	0.0005 (0.008)	-0.003 (0.004)	44.320 (41.132)
GDP (PP) (t-1)	-0.061 (0.042)	-2.095 (1.451)	0.042 (0.298)	0.203 (0.062)***	0.001 (0.003)	0.002 (0.101)	1.461 (2.867)
Sanitation	0.372 (0.538)	-6.195 (28.224)	0.348 (0.452)	0.842* (0.534)	0.900 (0.117)***	0.0001 (0.042	25.576 (30.202)
Water	-1.536 (1.635)	-2.345 (85.559)	0.838 (0.703)	1.871** (0.758)	-0.172 (0.187)	1.053 (0.106)***	11.190 (16.337)
Disorder of Polity Quality (t-1)	0.000** (5.02e-06)	0.000 (0.000)	-0.0008*** (6.94e-06)	-0.0005*** (8.23e-06)	-1.58e-06*** (5.29e-07)	-1.68e-06*** (3.22e-07)	-0.002*** (0.0006)
Democracy (t-1)	-0.027 (0.018)	-0.414 (0.745)	0.006 (0.021)	-0.027 (0.024)	0.004 (0.005)	0.001 (0.003	--2.000 (5.347)
Population (t-1)	-0.016 (0.030)	-0.167 (1.238)	0.030 (0.101)	-0.215 (0.114)*	0.002 (0.009)	-0.001 (0.005)	6.696 (10.184)
Trade Openness (t-1)	-0.0001 (0.0006)**	-0.0003 (0.004)	-0.000 (0.000)	0.0002 (0.0004)	2.88e-06 (0.0000)	0.0002 (0.000)**	0.006 (0.010)
Urbanization (t-1)	-0.00001*** (4.12e-06)	0.010*** (0.000)	5.50e-06* (3.18e-06)	-0.0001** (7.80e-06)	-2.72e-06*** (5.97e-07)	7.57e-06*** (3.99e-07)	-0.000 (0.0008)
Number of Observations	669						
Number of Countries	117						
GMM Criterion Q(b)	1.79e--30						

Hansen test p-value	0.006
CD	0.999

Note: Number of observations between 2008-2017. Robust standart errors are in parantheses. All the panel satisfy stability condition(all the eigenvalues lie inside the unit circle). Panel-specific fixed effects removed using forward ortogonal deviation or Helmert tranformation. The optimal lag selection is at one and decided through Overall Coefficient of Determination (pvarsoc in Stata). *, **, and *** denote statistical significance at 10 %, 5 %, and 1 % levels, respectively.

Appendix B.

Robustness Granger Test Results (with three pillars of food security)

MODEL 1.A

Variables	Null Hypothesis	Chi^2	P value
Gini Index	• Food Import (excluded) does not granger cause Gini Index.	30.004***	0.0000
	• Food Supply (excluded) does not granger cause Gini Index.	1.613*	0.0000
	• GDP(pp) (excluded) does not granger cause Gini Index.	2.412	0.120
	• Structural Defect (excluded) does not granger cause Gini Index.	0.030	0.863
	• Percentage of people using at least basic sanitation services (excluded) does not granger cause Gini Index.	0.442	0.506
	• Percentage of people using at least basic drinking water (excluded) does not granger cause Gini Index.	0.885	0.347
Food Import	• Gini Index (excluded) does not granger cause Food Import	0.064	0.801
	• Food Supply (excluded) does not granger cause Food Import	0.809	0.368
	• GDP(pp) (excluded) does not granger cause Food Import	2.213	0.137
	• Structural Defect (excluded) does not granger cause Food Import	1.768	0.184
		0.000	0.991

	• Percentage of people using at least basic sanitation services (excluded) does not granger cause Food Import. • Percentage of people using at least basic drinking water (excluded) does not granger cause Food Import.	0.001	0.980
Food Supply	• Gini Index (excluded) does not granger cause Food Supply • Food Import (excluded) does not granger cause Food Supply • GDP(pp) (excluded) does not granger cause Food Supply • Structural Defect (excluded) does not granger cause Food Supply • Percentage of people using at least basic sanitation services (excluded) does not granger cause Food Supply. • Percentage of people using at least basic drinking water (excluded) does not granger cause Food Supply.	0.016 1.283 1.671 0.005 0.507 1.404	0.901 0.257 0.093* 0.945 0.476 0.236
GDP per capita(PP)	• Gini Index (excluded) does not granger cause GDP(pp) • Food Import (excluded) does not granger cause GDP(pp) • Food Supply (excluded) does not granger cause GDP(pp) • Structural Defect (excluded) does not granger cause GDP(pp) • Percentage of people using at least basic sanitation services (excluded) does not granger cause GDP(pp) • Percentage of people using at least basic drinking water (excluded) does not granger cause GDP(pp)	0.465 7.681 1.927 11.132 4.440 6.050	0.495 0.006*** 0.065* 0.001*** 0.035** 0.014**
People using at least basic sanitation services	• Gini Index (excluded) does not granger cause Percentage of people using at least basic sanitation services • Food Import (excluded) does not granger cause Percentage of people using at least basic sanitation services • Food Supply (excluded) does not granger cause Percentage of people using at least basic sanitation services • Structural Defect (excluded) does not granger cause Percentage of people using at least basic sanitation services	1.273 0.652 0.005 0.026	0.259 0.419 0.945 0.873

	• GDP(pp)(excluded) does not granger cause Percentage of people using at least basic sanitation services	0.176	0.674
	• Percentage of people using at least basic drinking water (excluded) does not granger cause Percentage of people using at least basic sanitation services	0.840	0.359
People using at least basic drinking water	• Gini Index (excluded) does not granger cause Percentage of people using at least basic drinking water	1.277	0.258
	•		
	• Food Import (excluded) does not granger cause Percentage of people using at least basic drinking water	474.674	0.119
	• Food Supply (excluded) does not granger cause Percentage of people using at least basic drinking water	0.744	0.388
	• Structural Defect (excluded) does not granger cause Percentage of people using at least basic drinking water	0.020	0.889
	• GDP(pp)(excluded) does not granger cause Percentage of people using at least basic drinking water	2.632	0.105
	• Percentage of people using at least basic sanitation services (excluded) does not granger cause Percentage of people using at least basic drinking water	0.0000	0.996
Structural Defect	• Gini Index (excluded) does not granger cause Structural Defect	2.337	0.126
	• Food Import (excluded) does not granger cause Structural Defect	7.496	0.000***
	• Food Supply (excluded) does not granger cause Structural Defect	0.061	0.804
	• GDP(pp) (excluded) does not granger cause Structural Defect	0.227	0.599
	• Percentage of people using at least basic sanitation services (excluded) does not granger cause structural Defect.	0.141	0.708
	• Percentage of people using at least basic drinking water (excluded) does not granger cause Structural Defect.	2.171	0.141

MODEL 2.A

Gini Index	• Food Import (excluded) does not granger cause Gini Index.	32.882	0.0000***
	• Food Supply (excluded) does not granger cause Gini Index.	1.610	0.092*
	• GDP(pp) (excluded) does not granger cause Gini Index.	2.698	0.100
	• Disorder of Polity Quality (excluded) does not granger cause Gini Index.	9.514	0.002***
	• Percentage of people using at least basic sanitation services (excluded) does not granger cause Gini Index.	0.479	0.489
	• Percentage of people using at least basic drinking water (excluded) does not granger cause Gini Index.	0.882	0.348
Food Import	• Gini Index (excluded) does not granger cause Food Import	0.660	0.417
	• Food Supply (excluded) does not granger cause Food Import	0.820	0.365
	• GDP(pp) (excluded) does not granger cause Food Import	2.083	0.149
	• Disorder of Polity Quality (excluded) does not granger cause Food Import	1.768	0.184
	• Percentage of people using at least basic sanitation services (excluded) does not granger cause Food Import.	0.000	0.991
	• Percentage of people using at least basic drinking water (excluded) does not granger cause Food Import.	0.001	0.978
Food Supply	• Gini Index (excluded) does not granger cause Food Supply	0.033	0.857
	• Food Import (excluded) does not granger cause Food Supply	1.178	0.278
	• GDP(pp) (excluded) does not granger cause Food Supply	2.083	0.094*
	• Disorder of Polity Quality (excluded) does not granger cause Food Supply	15.740	0.000***
	• Percentage of people using at least basic sanitation services (excluded) does not granger cause Food Supply.	0.593	0.441
	• Percentage of people using at least basic drinking water (excluded) does not granger cause Food Supply.	1.421	0.233
	• Gini Index (excluded) does not granger cause GDP(pp)	0.176	0.675
	• Food Import (excluded) does not granger cause GDP(pp)	3.687	0.055*

GDP(pp)	• Food Supply (excluded) does not granger cause GDP(pp)	2.064	0.094*
	• Disorder of Polity Quality (excluded) does not granger cause GDP(pp)	4.991	0.000***
	• Percentage of people using at least basic sanitation services (excluded) does not granger cause GDP(pp)	2.485	0.015**
	• Percentage of people using at least basic drinking water (excluded) does not granger cause GDP(pp)	6.088	0.014**
Percentage of people using at least basic sanitation services	• Gini Index (excluded) does not granger cause Percentage of people using at least basic sanitation services	1.305	0.253
	• Food Import (excluded) does not granger cause Percentage of people using at least basic sanitation services	0.654	0.419
	• Food Supply (excluded) does not granger cause Percentage of people using at least basic sanitation services	0.004	0.947
	• Disorder of Polity Quality (excluded) does not granger cause Percentage of people using at least basic sanitation services	8.874	0.003***
	• GDP(pp)(excluded) does not granger cause Percentage of people using at least basic sanitation services	0.155	0.694
	• Percentage of people using at least basic drinking water (excluded) does not granger cause Percentage of people using at least basic sanitation services	0.840	0.359
Percentage of people using at least basic drinking water	• Gini Index (excluded) does not granger cause Percentage of people using at least basic drinking water.	1.276	0.259
	•		
	• Food Import (excluded) does not granger cause Percentage of people using at least basic drinking water	474.674	0.119
	• Food Supply (excluded) does not granger cause Percentage of people using at least basic drinking water	0.749	0.387
	• Disorder of Polity Quality (excluded) does not granger cause Percentage of people using at least basic drinking water	7.227	0.000***
		2.697	0.101

	• GDP(pp)(excluded) does not granger cause Percentage of people using at least basic drinking water • Percentage of people using at least basic sanitation services (excluded) does not granger cause Percentage of people using at least basic drinking water	0.0000	0.997
Disorder of Polity Quality	• Gini Index (excluded) does not granger cause Disorder of Polity Quality	0.479	0.489
	• Food Import (excluded) does not granger cause Disorder of Polity Quality	0.675	0.411
	• Food Supply (excluded) does not granger cause Disorder of Polity Quality	1.061	0.281
	• GDP(pp) (excluded) does not granger cause Disorder of Polity Quality	0.260	0.610
	• Percentage of people using at least basic sanitation services (excluded) does not granger cause Disorder of Polity Quality	0.712	0.399
	• Percentage of people using at least basic drinking water (excluded) does not granger cause disorder of Polity Quality	0.469	0.493

Appendix C.

Top 10 Countries By Lowest/Highest Political Instability

	POLITICAL INSTABILITY			
Rank	**Top 10 Countries By Lowest Structural Defect**	**Top 10 Countries By Highest Structural Defect**	**Top 10 Countries By Lowest Disorder of Polity Quality**	**Top 10 Countries By Highest Disorder of Polity Quality**
1	New_Zealand	Zimbabwe	Finland	Guinea
2	Norway	Nigeria	Sweden	Indonesia
3	Luxembourg	Guinea	Ireland	Iran
4	Finland	Ethiopia	Luxembourg	Bangladesh
5	Sweden	Myanmar	Iceland	Uganda

6	Canada	Congo Republic	Norway	Turkey
7	Germany	Egypt	Austria	Thailand
8	Australia	Bangladesh	Netherlands	Senegal
9	Singapore	Uganda	Australia	Sri Lanka
10	Netherlands	Pakistan	Malta	Kenya

Appendix D.

Top 10 Countries By Lowes/Highest Food Availibility

FOOD AVAILABILITY				
Rank	**Top20 Countries By Highest Food Import(% merchandise Import)**	**Top 20 Countries By Lowest Food Import(% merchandise Import)**	**Top 20 Countries By Highest Food Supply (%merchandise Import)**	**Top 20 Countries By Lowest Food Supply (%merchandise Import)**
1	Argentina	Belgium	Belgium	Zambia
2	Turkey	Gambia	Austria	Madagascar
3	India	Cameroon	United States	Kenya
4	Hungary	Egypt	Ireland	Ethiopia
5	South Korea	Algeria	Turkey	Zimbabwe
6	Brazil	Iran	Italy	Uganda
7	United States	Jordan	Germany	Congo Rep.
8	Zambia	Honduras	Israel	Namibia
9	China	Gabon	France	Bolivia
10	Panama	Bangladesh	Portugal	Mozambique

Appendix E.

Top 10 Countries By Lowes/Highest Food Accessibility

FOOD ACCESSIBILITY		
Rank	**Top 10 Countries By Highest Gross Domestic Product per capita (in purchasing power equivalent)**	**Top 10 Countries By Lowest Gross Domestic Product per capita (in purchasing power equivalent)**
1	Luxembourg	Malawi
2	Singapore	Mozambique
3	United Arap Emirates	Ethiopia
4	Norway	Madagascar
5	Ireland	Burkino_Faso
6	United States	Uganda
7	Austria	Guinea
8	Netherlands	Gambia
9	Denmark	Zimbabwe
10	Iceland	Senegal

Appendix F

Top 10 Countries By Lowes/Highest Food Utilization

FOOD UTILIZATION				
Rank	**Top 10 Countries By Highest Percentage of People using at least basic sanitation services**	**Top 10 Countries By Lowest Percentage of People using at least basic sanitation services**	**Top 10 Countries By Highest Percentage of People using at least basic drinking water services**	**Top 10 Countries By Lowest Percentage of People using at least basic drinking water services**
1	Australia, Austria, Israel, Malta, New Zealand, Singapore, South Korea, United States	Ethiopia	Austria,Belgium Denmark,Finland, France,Germany, Hungary,Iceland, Israel,Malta, Netherlands,New Zealand,Norway, Romania,Singapore,Sweden, United Kingdom	Ethiopia
2	Japan	Madagascar	Greece	Uganda
3	Spain	Ghana	Luxembourg	Mozambique
4	Denmark	Congo Rep	Spain	Madagascar
5	Belgium	Burkino_Faso	Australia	Burkino_Faso

6	Canada	Uganda	Czech Republic	Angola
7	Cyprus	Guinea	Portugal	Kenya
8	Finland	Mozambique	Cyprus	Zambia
9	Sweden	Malawi	Estonia	Cameroon
10	Estonia	Zambia	Slovenia	Guinea

Appendix G

Top 10 Countries By Lowes/Highest Gini Index

INCOME INEQUALITY		
Rank	**Top 10 Countries By Lowest Gini Index (Highest Income Equality)**	**Top 10 Countries By Lowest Gini Index (Highest Income Equality)**
1	Belarus	Namibia
2	Slovenia	South Africa
3	Slovakia	Zambia
4	Czech Republic	United Arab Emirates
5	Denmark	Angola
6	Finland	Honduras
7	Iceland	Colombia
8	Sweden	Sri Lanka
9	Belgium	India
10	Netherlands	Suriname