

## CHAPTER 4

### RESEARCH METHODOLOGY

#### 4.1 Introduction

This chapter intends to provide a summary of the theoretical framework that depicts the three objectives of this dissertation. This followed by the model specification, description of variables, source of data and other relevant points. Lastly, the evaluation of the times series is also included as a part of the designing the analysed economic model.

#### 4.2 Research Framework

Careful analyses of the examined variables would reveal enormous diversities in terms of the interrelationship between each other. This might correspond to bringing in additional insights into the proposed nexus by performing a thorough analysis. Our empirical analysis starts from the premise that the GDP growth rates, external debts, trade openness could function as potential drivers for FDI inflows in OE. In keeping with this assumption, this notion has been formulated into the first objective (RO1) that addresses the macroeconomic determinants for FDI inflows.

Historically, the expansion of the European trades and controls over external market in general and OE in particular led to an acute increase in the rate of FDI inflows. Although views are highly varied over the economic disorder of OE, historian economists tend to link such economic deterioration with the FDI inflows, which reached to its peak during the period 1888 and 1896 where £30 million was recorded.

Having said that, the first objective tests the effect of GDP growth rates (GDPR), government expenditure (GE), external debts (ED) labour force (LAB), consumer price index (CPI) as well as trade openness (TO) on FDI inflows (FDI). Given the availability of data, these variables have been selected to present a more synthetic analysis of the first objective and it helps to establish key factors that theoretically match with the prior studies.

As stated in the first chapter, the second objective (RO2) of this study is to examine the macroeconomic determinants of external debt. In doing so and based on the prior literatures, a number of explanatory variables have been designated to formulate the empirical model of this particular objective such as foreign direct investment (FDI), GDP per capita (GDP), external debt (ED), government expenditures (GE), trade openness (TO), interest service (IS).

The third objective (RO3) tests the impact of foreign direct investment (FDI), external debt (ED), government expenditures (GE), trade openness (TO), and consumer price index (CPI) on the economic growth. Employing the endogenous growth model, this study intends to expand the Cobb-Douglas production function to scrutinise the reliability of this model using historical data. Overall, the choice of selecting some variable over other reflects our concern that these determinants need more attention in the sense of visualising the outlook of OE economy.

### **4.3 Formulation of the Econometric Models**

#### **4.3.1 FDI Determinants Model**

A large number of studies imply various explanatory variables such as, economic growth rates, TO and ED. However, it is important to mention here that some of these variables are formally integrated in certain FDI theories, whereas others were included

due to its rational reasoning (UNCTAD, 2012). From this perspective, it seems relevant to combine between different types of variables and propose a unique cluster that would serve as platform to trace FDI inflows. Hence and for constructing an econometric model for the first objective, the macroeconomic determinants for FDI are formulated into the following regression equation:

$$FDI = f(GDPR, ED, GE, TO, LAB, CPI) \quad (4.1)$$

where *FDI* is the net inflow of FDI inflows, *GDPR* is the growth rate, *ED* is the external debts as % GDP, *GE* is the governmental expenditure as % GDP, *TO* is the trade openness measure by the sum of export and imports over GDP, *LAB* is the labor force and *CPI* is a proxy of inflation rate.

Having shown that, the variables are transformed into log form and the log-linear form that depicts Ln for the above equation is represented in the following FDI determinants model:

$$LNFDI_{it} = \alpha_0 + \beta_1 LNGDPR_{it} + \beta_2 LNED_{it} + \beta_3 LNGE_{it} + \beta_4 LNTO_{it} + \beta_5 LNLAB_{it} + \beta_6 LNCPI_{it} + \varepsilon_t \quad (4.2)$$

where  $\alpha_0$  is the intercept,  $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6$  are the coefficients to be estimated and  $\varepsilon_t$  is the error term.

#### 4.3.2 External Debt Determinants Model

For this particular model, the study implies the econometric models of two gap model (Chenery & Strout, 1966). This model postulates the notion that a gap can be identified between country's own provision of resources and its absorptive capacity. The

proponent of this model argues that developing countries might either face a shortage with their domestic savings as a way to boost for investment opportunities or they are facing serious challenges with foreign exchange constraints to finance the needed capital and intermediate goods. Hence, two possible sources of debt accumulation are identified by the gap models which are the saving gap, and foreign exchange gap. The starting point of these models begins with the macroeconomic assumption where aggregate output equals aggregate expenditure which is represented as follows:

$$(4.3) \quad Y = C + I + (X - M)$$

where  $Y$  is the GNP,  $C$  is consumption,  $I$  is investment (or domestic capital formation),  $X$  is exports and  $M$  is imports. The equation can also be written as:

$$(4.4) \quad Y + M = C + I + X$$

Subtracting  $C$  (consumption) from both sides we will get this new form of equation:

$$(4.5) \quad Y - C + M = I + X$$

Since  $Y - C = S$ , where:  $S$  = Savings (domestic).

$$(4.6) \quad S + M = I + X$$

This relationship can be restated using the following equation that explains the two gap models foreign exchange gap and saving gap:

$$M - X (\text{Foreign Exchange Gap}) = I - S (\text{Savings Gap}) \quad (4.7)$$

Thus, it is obvious that according to the equation (4.5) a number of factors that can be listed as government expenditure, government revenue, domestic investment, export of goods and services, imports of goods and service, international reserve. It is important to mention that the notion of two gaps is not consistent with neo-classical economic theory. This is because the neo-classical economics thoughts assumes that resources can be easily shifted between different employments.

The prior literatures also identified other possible determinants of external debt. For instance, the economic growth measured by GDP or GDP per capita (Hajivassiliou, 1987; Sezgin, 2004; Tiruneh, 2004) trade openness (Forsslund et al., 2011) government expenditure (Bader & Magableh, 2009; Awan et al., 2011) and Foreign direct investment (FDI) (Imimole et al., 2014). Thus, this study proposes this equation to examine the external debt determinants in the Ottoman Empire for 1881 to 1913.

Using this platform would allow us to propose the following production function:

$$ED = f(FDI, GDPR, TO, GE, IS) \quad (4.8)$$

And hence, the ED determinants model for RO2 is as follows:

$$LNED_{it} = \alpha_0 + \beta_1 LNGDPR_{it} + \beta_2 LNFDI_{it} + \beta_3 LNTO_{it} + \beta_4 LNGE_{it} + \beta_5 LNIS_{it} + \varepsilon t \quad (4.9)$$

where *GDPR* is the GDP growth rate, *FDI* is foreign direct investment, *TO* is the trade openness, *GE* is the government expenditure, *IS* is the interest service and  $\varepsilon t$  is Error term.

### 4.3.3 Economic Growth Model

The theoretical framework within which this study is carried out relies on the endogenous growth, whereby the rate of growth of a technological progress is the leading factor of long-term economic growth. Large body literatures have used this model in predicting short and long-term economic growth. Following the path of the prior studies, this study will employ the model of Cobb-Douglas which was adopted by numerous authors such as Grossman & Helpman (1991), Barro & Sala-I-Martin (1995), Bende-Nabende & Ford (1998), De Mello (1999), Bende- Nabende (2002), Bende-Nabende et al., (2003) & Li & Liu (2005). The Cobb-Douglas production function represents the relationship between two or more inputs - typically physical capital and labor - and the number of outputs that can be produced.

$$Y_t = f(K, L) \quad (4.10)$$

where  $Y_t$  is the real GDP per capita representing the output level;  $K$  denotes the amount of domestic investment measure by the total gold reserve proxied by domestic investment (DI) as % of GDP; and  $L$  represents the amount of labour that is measured via the labour force (LAB) of OE. As a matter of fact, the rise in the amount of capital or labour may probably boost the level of output in the economy. Besides that, the FDI is a chief catalyst in producing an economic growth in the host countries.

Ogutcu (2002) contends that FDI functions as an essential component in driving forward the economy in the developing countries. Practically, the direction of FDI inflows is at the infrastructure such as ports, utility companies and railroad. Within the OE context, the main economic sector that benefited from FDI was railways, especially in Anatolia and Syria. With the aim of exporting goods and service, the European

countries paid more attention to infrastructure such as ports, utility companies, insurance, and shipping. In contrast, the FDI in the industrial sector such as mining and manufacturing remained limited. Against this background, one important objective of this study is to examine the impact of FDI inflows on economic growth. Thus, extending the Cobb-Douglas production function framework with FDI becomes necessary to serve the main intention of this study and with that, the equation will be:

$$(4.11) \quad Y_t = f(K^*, L)$$

where  $K^*$  includes the domestic investment (DI) and FDI as % of GDP.

Some commentators, including economists have argued that the endogenous growth theories are built upon the notion that human capital (HC) is important factor in determining the sustainability of an economic growth. This is because the investment in providing a good education system will eventually produce a skilful nation that has the capability to innovate and produce technology. Using the endogenous growth models, many studies found a positive relationship between an educated population and economic growth (Barro 1991; Mankiw et al., 1992; Barro & Martin, 1995). Therefore, with the inclusion of HC, the above equation is viewed as follow:

$$(4.12) \quad GDP_t = \alpha_0 + \beta_1 LAB_t + \beta_2 DI_t + \beta_3 FDI_t + \beta_4 HC_t + \epsilon_t$$

where  $LAB$  is labor force,  $DI$  is domestic investment,  $FDI$  is foreign direct investment and  $HC$  is human capital.  $\epsilon_t$  is Error term.

The trade theories such as Heckscher-Ohlin theory argue that the international trade is responsible in enhancing the exchange of goods and service and thus help to meet the needs of people. The relationship between free trade and economic growth has

been discussed widely in the economic literatures focusing on both developed and developing countries. According to Debaere (2003) the Heckscher-Ohlin theory provides a solid platform and comparative advantages that can largely explain international trade. The key hypothesis of the theoretical framework of international trade theories is the fact that the free trade tend to stimulate competitive and dynamic economic atmosphere. Harrison (1996) argues that trade openness (TO) is positively affecting the economic growth. In a similar study, Chen (1992) has reported that TO due to government policies is an essential factor in fostering the economic growth. Hence, the equation is updated with the inclusion of TO as an explanatory variable based on the prior literature.

$$GDP_t = \alpha_0 + \beta_1 LAB_t + \beta_2 DI_t + \beta_3 FDI_t + \beta_4 HC_t + \beta_5 TO_t + \varepsilon_t \quad (4.13)$$

A similar relationship appears to hold for the external debts (ED) which demonstrate a vital indicator of an economic growth. Economists have argued that, countries with high debt to GDP ratio tend to be less effective in generating revenues due to the grip of debts. The ED – growth was empirically tested using different growth model. For instance, Iyoha (1999) analyse the impact of ED on economic growth in the region of Sub-Saharan African countries. The econometric model manifests the ED in a form of ratio (debt services to export) and the findings indicate a negative sign, which means that ED is curbing the economic growth. He concluded that countries with heavy debt burden have more difficulties to attract foreign investments. Nguyen et al., (2003) found ED has a deleterious impact on growth specifically after exceeding the threshold level. Theoretically, the Keynesian framework embraced the classical doctrine which prohibits the government to involve in any public debts simply because this will

ultimately lead to the reduction of total (public and private) savings, the increase of the interest rate, decrease of investments and the reduction of capital stock. With these developments in mind, the above growth equation is developed to include the ED as follow:

$$GDP_t = \alpha_0 + \beta_1 LAB_t + \beta_2 DI_t + \beta_3 FDI_t + \beta_4 HC_t + \beta_5 TO_t + \beta_6 ED_t + \varepsilon_t \quad (4.14)$$

The presence of  $\varepsilon$  is to ensure that the model would be able to capture the overlooked effects and it is assumed to be a white noise. To make the model more efficient and consistent with the first objective's equation, it is advised to use log-linear. According to Chang *et al.*, (2001) converting the model into natural logs would mitigate the stationary in the variance-covariance matrix. Therefore, the updated GDP model is presented as follow:

$$LNGDP_t = \alpha_0 + \beta_1 LNFDI_t + \beta_2 LNED_t + \beta_3 LNTO_t + \beta_4 LNGE_t + \beta_5 LNCPI_t + \varepsilon_t \quad (4.15)$$

where  $GDP$  is the GDP per capita,  $FDI$  is foreign direct investment,  $ED$  is the external debts as % GDP,  $TO$  is the trade openness,  $GE$  is the government expenditure and  $CPI$  is a proxy of inflation rate.  $\varepsilon_t$  is Error term.

It is important to mention here that the last equation (4.15) entails the third research objective of this study (RO3). In terms of the expectation of coefficient signs, it is predicted that  $\beta_1$  and  $\beta_5$  would have a negative and significant signs whereas the rest of coefficient  $\beta_2$ ,  $\beta_3$  and  $\beta_4$  are expected to have a positive sign.

#### **4.4 Definition and Measurement of Variables**

The selection of variables is deemed to pass through several filtrations such as theoretical propositions and evidence in the literature. This filtration is not guaranteed, as the subjectivity and criticism over the selected items are unavoidable. Having said that, this study observe a set of explanatory variables includes, Foreign Direct Investment (FDI), GDP growth rates (GDPR), Domestic Investment (DI), Trade Openness (TO), Government Expenditure (GE), External Debts (ED), Labour force (LAB), Real Gross Domestic Product (GDP) per capita and Human Capital (HC).

##### **4.4.1 Gross Domestic Product (GDP) Per Capita**

GDP per capita is a measurement of a country's economic output, which include all items and services produced by all the people and firms in a certain time and within a specific border. The formula to calculate it is by dividing the GDP/Population. There are two types of GDP per capita; real and nominal. While the first, the real GDP per capita is adjusted for inflation and deflation, the latter, which is nominal GDP per capita, does not have such feature. Due to the inflation influence, the nominal GDP is higher than real GDP. The Ottoman economy witnessed a few waves of inflation during 17<sup>th</sup> and 18<sup>th</sup> century resulted in the debasement of local currency. Yet, by the mid of 19<sup>th</sup> century the First World War, the overall price level was relatively stable (Berument & Gunay, 2007). Thus, this study employs nominal GDP to come up with the GDP per capita. The data of GDP is provided in a number of studies and projects such as Pamuk (2005), Tuncer (2011) and Mandision (2018) who presented the GDP estimations. Unlike many studies which use US dollar as a reference, this current study will use British Pound since it was the primary and dominant currency in the international transactions. The exchange rate was One British Pound = One Ottoman Lira.

#### 4.4.2 GDP Growth Rates (GDPR)

It is one of the main economic indicators that determine the performance of an economy. The inconsistency growth of GDP per capita within a country will more likely create undesirable outcomes to the economic sectors and eventually hinder the economic growth (Aziz & Azmi, 2017). The TurkStat with the assistance of many economists has estimated the GDP for the years before the WW1, utilizing fiscal data and a series of censuses on population, agriculture and industry as well as statistics on foreign trade (Pamuk et al., 1996). These estimates are relatively important to draw precise conclusions on the economic growth of OE and it allows the researcher to considerably extend and strengthen results presented in the prior studies. The below table (Table 4.1) shows a summary of three years of economic growth records of Eastern Mediterranean countries including the Ottoman Empire from 1820 to 1913 as published in the study conducted by Pamuk et al., (1996). It is obvious that there was a rise in the economic growth in most of the region which is relatively a good sign.

**Table 4.1:** Economic Growth of Ottoman Empire From 1820 to 1913

|                  | GDP per Capita (in 1990 PPP Dollars) |      |       | Annual Change in GDP per Capita (in %) |         |
|------------------|--------------------------------------|------|-------|--|---------|
|                  | 1820                                 | 1870 | 1913  | 1820-70                                | 1870-13 |
| <b>Istanbul</b>  | 680                                  | 880  | 1,200 | 0.5                                    | 0.7     |
| <b>Syria</b>     | 680                                  | 880  | 1,300 | 0.5                                    | 0.9     |
| <b>Jordan</b>    | 680                                  | 950  | 1,450 | 0.7                                    | 1.0     |
| <b>Lebanon</b>   | 550                                  | 700  | 1,000 | 0.5                                    | 0.8     |
| <b>Palestine</b> | 650                                  | 850  | 1,200 | 0.5                                    | 0.8     |
| <b>Egypt</b>     | 600                                  | 750  | 1,050 | 0.4                                    | 0.8     |

Source: Pamuk et al., (1996)

#### 4.4.3 Foreign Direct Investment (FDI)

The FDI inflows as a % of the GDP are used in the current study. Indeed, the FDI inflows offers a reliable source of data to view the accumulation of external capitals a host country could receive in a particular year (Bornschier et al., 1978; Alfaro et al.,

2004). Recently, the nexus between FDI inflows and economic growth is becoming an attractive topic and with the globalisation, these studies might have more impact on the economic policies.

#### **4.4.4 Trade Openness (TO)**

It is the level of free trade internationally and it is measured as a sum of total exports and imports of goods and services by GDP. A positive sign of TO indicate that TO is positively contributing to the economic growth. Additionally, higher degree of TO tends to enhance the economic climate by providing more possibilities to foreign investors to establish their business in more dynamic environment.

#### **4.4.5 External Debts (ED)**

Following the prior studies, the ratio of the external debt/GDP is seemed to be the appropriate measurement to test external borrowing since the indebted states can only service its foreign loans if the output of the economy is sustainable and economic growth is showing positive signs. Therefore, the current study will employ this rate to testify the external borrowing.

#### **4.4.6 Domestic Investment (DI)**

According to the prior literatures, the DI functions as a robust determinant of economic growth. DI includes a number of elements such as land renovations (fences, ditches, drains, and so on); plant, machinery, and equipment acquisitions; and the building of streets, railways, and the like, including schools, offices, hospitals, private residential dwellings, and commercial and industrial buildings. Yet, due to the nature of this study that deals with the historical data, the DI is proxied by total reserve in gold.

The decision to go ahead with this proxy is pertained to two main reasons: 1) the availability of the data and 2) the importance of reserve in engaging in public projects such as building of streets, railways and school ..etc. Thus, the total reserve functioned as a provision of capital for the future infrastructure plans.

#### **4.4.7 Interest Service (IS)**

The inclusion of IS in the economic model has numerous advantages. One of them is knowing the accumulated burden associated with the external loans. It is an important vehicle that allow banks and financial institution to generate earning though the mechanism of interest. In this model, IS is obtained from the archived economic data of OE and this was considerably significant to the Ottoman economy which was relying on the external source in financing its deficit budget. The documentations also show both the nominal and real value of the loan.

#### **4.4.8 Government Expenditure (GE)**

The level of expenditure is a necessary indicator for both internal and external investors as it presents the willingness in moving forward with economic growth. The GE is measured by the amounts the ratio of GE over GDP. The economic reforms undertaken by OE had a great impact on the level of governmental expenditure. Thus, a positive sign is predicted between GE and economic growth.

#### **4.4.9 Labour Force (LAB)**

This variable refers to the number of employees that are hired to perform a certain job. Empirically, a negative relationship is found between LAB and economic growth (Clark et al., 1999). The rational explanation resides on the fact that high population

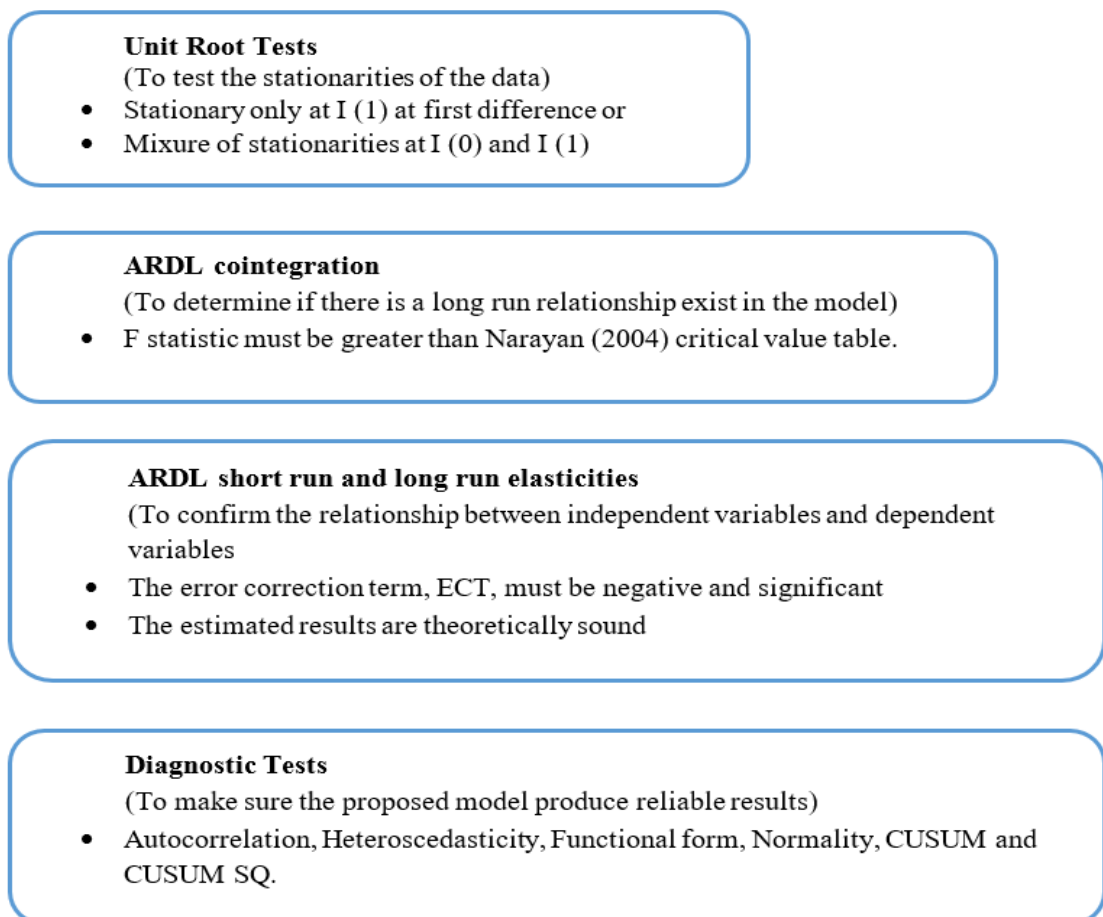
growth tend to lower total economic revenue of a state due to the relevant expenditures incurred by the government in meeting the increasing demands of people. The Ottoman population statistics were developed to satisfy pressing administrative and military needs. A permanent population register system (*Tahrir Books*) became vitally important for the government in the nineteenth century.

The recruitment of a modern army and its organization into active and reserve units required accurate information about the number and age of the male population. In the nineteenth century, the administrative division of the Ottoman state underwent several changes that tend to confuse one unfamiliar with the process. Moreover, between 1854 and 1908, the Ottoman state received approximately 5 million Muslim immigrants from Russia (Caucasus, Crimea, Kuban, and Central Asia) and the Balkans; at the same time some 500,000 to 800,000 Greeks, Armenians, and Arabs emigrated, chiefly to Russia and the Americas. For the Ottoman economy, with the beginnings of industrialisation in 1880, a huge transfer of labours form agricultural to the industrial sector was prevalent.

#### **4.5 Estimation Techniques**

The analysis commences with testing the stationarities of the data using well-known unit roots, which is the Augmented Dickey-Fuller (ADF). Besides that, the data will also be analysed via powerful unit root known as Kwiatkowski-Phillips-Schmidt-Shin (KPSS). More importantly, is the detection of stationarities of the time series data. This is because; it helps to better decide on the appropriate estimation that matches with the nature of the data in terms of the short run and the long run relationship between dependent variables and its independent variables. With that in mind, this thesis will employ Autoregressive Distributed Lag (ARDL) estimation techniques.

The primary motives behind the selection of ARDL as the adopted technique for this particular study are pertained to the four major aspects. First, it allows examining the short and long run between the dependent and explanatory variables within multivariate framework. Second, it is the preferable model to perform co-integration analysis in the case of limited sample. Third, ARDL can be used where a non-stationary or mixed stationary, level  $I(0)$  or  $I(1)$ , Finally, the usage of ARDL model enables a multiple estimation of a single equation. The below diagram 4.1 summarize the undertaken steps that have been utilized to analyse the data.



**Figure 4.1:** The Flowchart of The ARDL Analysis

#### 4.5.1 Unit Root Test

A time series data might suffer for the stationarity if there is a possible change in the shape of distribution that caused by a shift in the time. The purpose of this test is to determine the variable is stationary either at level, I(0) or at first difference, I(1). To examine the stationary properties Augmented Dickey Fuller (ADF) and Phillips-Perron (PP) will be used. The null hypothesis for this test assumes that the data is not stationary and there is a presence of unit root for the series.

##### 4.5.1.1 Augmented Dickey-Fuller (ADF)

The method is a modified version of the Dickey-Fuller (DF), which has been developed by Dickey & Fuller in 1979. This test is conducted through the application of ordinary least square (OLS) regression equation. The ADF test makes a parametric correction for higher-order correlation by assuming that they series follow an AR ( $\rho$ ) process and adjusting the test methodology where  $\rho$  is the number of lagged changes in  $Y_t$  necessary to make  $\mu_t$  serially uncorrelated. Two types of ADF regression covered linear and non-linear trend as it is shown in the below equation:

$$\Delta Y_t = B_0 + B_1 t + \alpha Y_{t-1} + \sum_{i=2}^k \gamma \Delta Y_{t-i} + \varepsilon_t \quad (4.16)$$

where:

$t$  = the time or trend variable

$\Delta$  = the first difference operator

$Y_t$  = the logarithm of the variable in period  $t$

$\Delta Y_t = Y_t - Y_{t-1}$ ,  $\alpha$  and  $\beta$  are the constant parameters

$\varepsilon_t$  = the disturbance term which was assumed to be white noise

$p$  = the number of the lagged terms.

The hypotheses under this test can be presented as below:

$H_0: \alpha = 0$  (non-stationary)

$H_0: \beta = 0$  (non-stationary)

$H_A: \alpha < 0$  (non-stationary)

$H_A: \beta < 0$  (non-stationary)

The computed absolute value of t-statistic exceeds the ADF critical  $t$  values then the above null hypotheses are subject to rejection whereby  $Y_t$  is stationary.

#### 4.5.1.2 Phillips-Perron (PP)

Recently, the PP becomes an important reliable tool for unit root tests. The researchers Phillips and Perron have introduced it in 1988 as a part of improving the nonparametric method of controlling time series. Similar to ADF, the PP implies the following regression.

$$\Delta Y_t = \alpha_0 + \alpha_1 t + \beta Y_{t-1} + \varepsilon_t \quad (4.17)$$

where  $\alpha_0$  is the intercept,  $\beta$  and  $\alpha_1$  are the estimators of the equilibrium parameters,  $t$  is the trend term, and  $\varepsilon_t$  is the error term.

It is obvious that the PP and ADF share the same equation except for PP where it assumes that the lag terms in the regression functions is equal to zero  $p = 0$ . In terms of the stationary, aspect, the PP applied the null and alternative hypothesis as follow:

$H_0: Y_t$  is non-stationary,  $Y_t$  does exhibit a unit root.

$H_1: Y_t$  is stationary,  $Y_t$  does not exhibit a unit root.

#### 4.5.1.3 Kwiatkowski-Phillips-Schmidt-Shin (KPSS)

The KPSS is deemed to act as a vital component of unit root series. Unlike previous mentioned tests, KPSS tend to provide a direct test of the null hypothesis against the alternative of unit root and in order to do so the test uses this regression:

$$Y_t = \beta_t + (r_t + \alpha) + \varepsilon_t \quad (4.18)$$

The KPSS test is breaks up a series into three parts: a deterministic trend ( $\beta_t$ ), a random walk ( $r_t$ ), and a stationary error ( $\varepsilon_t$ ). The null and the alternative hypotheses are formulated as follows:

H<sub>0</sub>: Y<sub>t</sub> is trend (or level), stationary.

H<sub>1</sub>: Y<sub>t</sub> is a unit root process.

#### 4.5.2 Autoregressive Distributed Lag (ARDL) And Cointegration

The analysis of cointegration is an essential part of an econometric research. Autoregressive Distributed Lag (ARDL) is designed to predict the actual value of dependent variable using a short and long run analysis, which is based on the lagged values of the independent variable. As stated above, ADRL function well for small data sample (Zhang & Yue, 2002). Thus, the ADRL requires a transformation of the models using Unrestricted Error Correction Model (UECM) to come up with a short and long run relationship analysis. The existing literatures assert that ARDL is also useful to interpret the dynamic relationship between economic variables (Dixit, 2014; Ravinthirakumaran, 2014; Jalil et al., 2010). Therefore, this study uses ARDL to estimate the extent of casualty relationship between FDI and economic growth.

### **4.5.3 Diagnostic Tests**

They are a set of tests that involve in checking the adequacy and closeness of fit of the empirical model to the data. Autocorrelation, heteroscedasticity, and normality are among the statistical analyses that can be used for this purpose.

#### **4.5.3.1 Autocorrelation Test**

Although there are many tests to examine the autocorrelation, the Breusch-Godfrey test is one of the most common tests used by the economic researchers compared with other test such as Durbin Watson test. The null hypothesis predicts that there is no serial correlation. If p-value is smaller than the significance level, the null hypothesis will be rejected.

#### **4.5.3.2 Normality Test**

Normality will be tested using Shapiro –Wilk test since it has been found to be the most powerful test in most situations. The null hypothesis for this test assumes that the data are normally distributed. If p-value is smaller than significance level, the null hypothesis will be rejected.

#### **4.5.3.3 Heteroscedasticity Test**

This test is based on detecting the squared fitted values in the regression of squared residuals. The test puts as assumption that the ordinary regression model have the same variance throughout the entire sample. The existence of heteroscedasticity tends to make the regression model inefficient (the variance of the error term is non-constant). The null hypothesis assumes that there is homoscedasticity in the model. If p-value is smaller than significance level, the null hypothesis will be rejected.

#### 4.6 Sources of Data

While many European countries started to have an accounting system in the mid of eighteenth century, the OE was lagging behind and only in 1880 the Ministry of Finance produced the first governmental financial report which contained the budget expenditure and revenues of the state. The Turkish Statistical Institute (TurkStat) has recently published this economic data with the assistance of economic historians who translated the figures into English. Thus, in examining the suggested paradigm, the researcher has chosen to restrict the scope of this study to a period of 33 years from 1881 to 1913.

All the data refer to the area within 1913 border: Northern Greece, Anatolia, Syria and Iraq. The statistical yearbook issued by Ottoman administration in 1879 is a significant piece of work that covered several subjects such as education, population, health, transportation, justice, finance, agriculture, industry, mining, forestry, land and foreign trade. The historical data of Turkstat relies heavily on this yearbook to produce the Ottoman statistical data.

Due to the limitation of the provided data in Turkstat, this study relies on other sources namely, Maddison Project Database (MPD) (2018), Tuncer & Pamuk (2014), Tuncer (2011), Guran (2003), and Eldem (1999) and Pamuk (1987). For instance, the import and exports figures were obtained from Tuncer & Pamuk (2014) who gathered the annual foreign trade statistics of OE with these countries: United Kingdom, France, Germany, Austria, Russia and United States. Additionally, the GDP figures represent a challenging part as the historical data of Maddison project has shown some serious problems pertained to OE economic statistic.

To overcome this shortcoming, Pamuk (2005) has estimated the GDP growth rate for benchmark years. This GDP data was reconfirmed by the work of Vedat Eldem who

constructed GDP per capita using utilizing fiscal data and a series of censuses on population, agriculture and industry as well as statistics on foreign trade. The rest of variables, Turkstat supplies the desirable data. Thus, the sources of each variable are presented in the following table 4.2. More importantly, to preserve the reliability of the data, the researcher has conducted a meeting with the ambassador of Turkey in Malaysia who offered their valuable support to the research by providing access to the database of the historical data. Here, I shall highlight the fact that the Turkish government is engaging a long term project to revive the economic historical archive of Ottoman through providing the documentations accessible to all the researchers in both languages English and Turkish.

**Table 4.2: Sources of Data**

| Variable              | Terms   | Description   | Sources                            |
|-----------------------|---|---|------------------------------------|
| <b>FDI</b>            | Natural logarithm real Foreign Direct Investment Inflow | Foreign direct investment % of the GDP                        | Pamuk, (1987); Geyikdağı, (2011)   |
| <b>GDPR</b>           | Natural logarithm of Economic Growth Rate               | GDP Growth rates %  | Maddison, (2018) ; Pamuk, (2006)   |
| <b>DI</b>             | Natural logarithm of Total reserves                     | Total reserve in gold as % of GDP                             | Turkstat                           |
| <b>TO</b>             | Natural logarithm of Trade Openness                     | sum of total exports and imports of goods and services by GDP | TurkStat                           |
| <b>GE</b>             | Natural logarithm of Government Expenditure             | Government Expenditure as % of GDP                            | TurkStat                           |
| <b>ED</b>             | Natural logarithm of External Debts                     | ED as % of GDP  | TurkStat ; Tuncer, & Pamuk, (2014) |
| <b>LAB</b>            | Natural Logarithm Total Labour Force                    | Total labour force  | TurkStat                           |
| <b>GDP per capita</b> | Natural Logarithm Economic Growth                       | GDP per capita  | Pamuk, (2006)                      |
| <b>CPI</b>            | Natural logarithm of Inflation                          | Inflation rate  | TurkStat ; Tuncer, & Pamuk, (2014) |
| <b>IS</b>             | Natural logarithm of Interest Service                   | Interest Service  | TurkStat ; Tuncer, & Pamuk, (2014) |

#### 4.7 Summary

This section offered discussion about the sampling procedure and data sources; method of data analysis, economic models and variables measurements. In addition to that, ARDL models will be developed according to this study's objective. The aim of this chapter is to provide a visibility on the econometric models and all the relevant concepts. It also intends to present the fragmentation of the data and its resources so with that this study can be achieve its objectives successfully. The next chapter discusses the results and its analysis.

