The Role of Financial Innovation on Financial Development in the Case of Norway

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ABSTRACT

This thesis investigates the long-run equilibrium relationship and short-run relationship between gross domestic product, inflation, foreign direct investment, stock market traded, financial innovation, and financial development in the case of Norway between 1989 and 2018. In this thesis, the main aim is to find out the effect of financial innovation in the long-run and short-run on financial sector development. Level relationship between variables in this study confirmed by bounds test under the ARDL model mechanism. ECM under the ARDL approach used for the short-run and indicated that financial development converges to long-run equilibrium level by 48.61% speed of adjustment by the contribution of gross domestic product, inflation, foreign direct investment, stock market traded, and financial innovation every year.

Results of ARDL estimation indicated that financial innovation has an inelastic, positive, and significant effect on financial development in the long-run and has a significant and negative effect in the short-run. Furthermore, the gross domestic product has a positive effect, and inflation and stock traded value have a negative effect on the financial sector development in the long-run. The Toda-Yamamoto causality test results indicate that there is a bidirectional relationship between financial innovation and financial development.

Keywords: Financial Innovation, Financial Development, Toda-Yamamoto Causality Test, ARDL Approach, Norway.

ÖZ

Bu çalışma, 1989-2018 yılları arasında Norveç örneği ile gayri safi yurtiçi hasıla, enflasyon, doğrudan yabancı yatırım, hisse senedi piyasası, finansal yenilik ve finansal gelişme arasındaki uzun dönemli denge ilişkisini ve kısa dönemli ilişkiyi araştırmaktadır. Bu çalışmanın temel amacı, uzun dönemde ve kısa dönemde finansal yeniliğin finansal sektör gelişimi üzerindeki etkisini ortaya koymaktır. Bu çalışmada değişkenler arasındaki seviye ilişkisi, ARDL model (Gecikmesi Dağıtılmış Otoregresif Model) mekanizması altında sınır testi ile doğrulanmıştır. ARDL yaklaşımı altında kullanılan Hata düzeltme modeli (ECM) belirtilen finansal gelişmeyi; gayri safi yurtiçi hasıla, enflasyon, doğrudan yabancı yatırım, hisse senedi piyasası ve finansal yeniliğin katkısıyla uzun dönemli denge seviyesine % 48,61 oranında bir uyum hızına yaklaşmaktadır. (yıl).

ARDL tahmin sonuçları, finansal yeniliğin uzun dönemde finansal gelişme üzerinde esnek olmayan, pozitif ve anlamlı bir etkiye sahip olduğunu ve kısa dönemde finansal sektör gelişimi üzerinde anlamlı ve olumsuz bir etkiye sahip olduğunu göstermiştir. Ayrıca, uzun dönemli denge ilişkisinde gayri safi yurtiçi hasıla finansal sektör gelişimi üzerinde olumlu bir etkiye sahipken, enflasyon ve hisse senedi işlem değeri ise olumsuz bir etkiye sahiptir. Bu çalışmada doğrudan yabancı yatırımlar uzun dönemde anlamsız bir katsayıya sahiptir. Toda-Yamamoto nedensellik testi sonuçları, finansal yenilik ve finansal gelişme arasında çift yönlü bir ilişki olduğunu göstermektedir.

Anahtar Kelimeler: Finansal Yenilik, Finansal Gelişme, Toda-Yamamoto Nedensellik Testi, ARDL Yaklaşımı, Norveç.

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LIST OF ABBREVIATIONS

ADF	Augmented Dickey Fuller
ANBERD	Analytical Business Enterprise Research and Development Database
ARDL	Auto-Regressive Distributed Lag
CPI	Consumer Price Index
ECM	Error Correction Model
ECT	Error Correction Term
FD	Financial Development
FDI	Foreign Direct Investment
FI	Financial Innovation
GDP	Gross Domestic Product
PP	Phillips-Perron
R&D	Research and Development
STR	Stock Traded value

Chapter 1

INTRODUCTION

Achieving to develop the financial sector, is one of the most important economic goals in different countries. To reach this aim, understanding the factors that influence financial development is very important. One of the most important determinants is growth. Previous literature studies analyzed the relationship between financial development and growth. So far, this relationship has been explained by different hypothesizes.

However, the important effect of growth on finance is firstly supply-leading hypothesis. Financial development is an ascertain reason for growth. This hypothesis explains the one-way relationship from financial sector development to growth and efficient financial expansion is required for economic growth. Decreasing the transaction and monitoring expenses in a well-developed financial sector can improve financial intermediation (McKinnon, 1973).

In opposition to the supply-leading in the growth-led finance hypothesis, Robinson (1952) believes growth determines financial development. Financial services might be demanded more depending on economic growth. Simply it means the causality from economic growth to financial development (Calderón and Liu, 2002).

The stage of development is another hypothesis which explained the linkage of growth and financial development (Patrick, 1966). It postulates that financial development and growth can lead to one another.

The stage of development hypothesis includes the demand-following and supply-leading hypothesis and the linkage of the growth and financial sector development is change over time. Well developed financial sectors strongly correlated with economic growth and the future rate of growth efficiency upgrading (King and Levine, 1993).

One of the principal key factors affecting financial development is inflation. Inflation means, increasing the average price of the goods and services when the purchasing power is falling (Sexton, 2015). The financial sector development is negatively influenced by inflation. Financial development and inflation have a considerable negative fundamental relationship that was examined my Boyd, Levine, and Smith (1996). Moreover, an increase in the inflation rate has contrary relations with financial development (Haslag and Koo, 1999). The financial system will be inefficient in distributing the resources with a high inflation rate because of uncertainly and abrasion in the financial market (Keho, 2009; Naceur and Ghazouani, 2004; Andres et al., 1999). Furthermore, A positive and significant link between financial crisis and inflation because of an inefficient market and financial market frictions were founded by Demirguc-Kunt and Maksimovic (1998).

The next important and critical factor for financial development is the effect of FDI. FDI is defined by the International Monetary Fund (1993) as a type of international investment of the business or direct investor to achieve a lasting interest in the direct investment enterprise. The lasting interest illustrates the long-run linkage between the

direct investor and direct investment enterprise and the remarkable management effect by the investor on the business. This relationship is settled when 10 percent or more of the voting power or ordinary share of the business is in the control of the direct investor.

A well-developed financial system absorbs FDI to grow in the economy of the host country. Intermediation finance institutions like financial markets, stock markets, and banks help to organize and mobilize the saving and investment and create new business, optimal distribution of capital to those projects have high returns, and so on. Simply it means that yields from foreign direct investment in the well developed financial system are acting as a catalyst and help to increase its inflow to the host economy. The financial sector of the country includes all banking sectors and all other financial institutions. The banking sector can provide direct foreign investment inflows in and improve the financial sector by speeding up and lowering the cost of transactions, more loan availabilities, and use the benefits of foreign exchange services. Also the relationship between the foreign investor and domestic will be better by the efficient financial market like the stock market (Kaur, Yadav, and Gautam, 2013). Moreover, growth in the stock market by the domestic investors or foreign investors can significantly help the financial sector developing.

The financial market specifically the stock market has a vital influence in financial development. The stock market as one of the most principal elements in the financial structure of each economy has always effected financial development. Some important studies have explained the role of stock markets between growth and financial development. Also, the influence of the stock market in the mature and economic growth affected differently from emerging capital markets.

The well-developed stock market has a good bank sector development in the country, and countries with incapable stock markets will have weak bank sector development (Demirgüç-Kunt, and Levine, 1996). Furthermore, the stock market has a major duty in economic development especially in lower-middle-income countries (Chen, and Komal, 2016). The stock market as intermediation between the investor and corporation tends to speed up the trading and leading the money to grow corporates. The stock traded in a market can be explained by the number of shares that are being traded in both foreign and domestic markets multiply by the price of the shares (World development indicators, 2019). So the total value of stock market trading may impact the economy both positively or negatively because trading shares in the market are not related to growth directly. After all, showing the volume of trading is one of the substantial factors in the financial structure for liberalization as part of the development. Moreover, in the market with creating new financial instruments, there are possibilities to increase and ease the market to guiding the money to make a balance in and controlling the liquidity in the whole market. So the last factor that is related to new financial instruments is financial innovation.

Mentioned previous studies disregard the influence of financial innovation on financial development. Financial innovation is defined as creating the financial instruments, markets, technologies, business, processes, and new usage of existing ideas in other markets and popularizing them (Tufano, 2003).

Before the financial global crisis of 2007, many studies explained the positive influence of financial innovation on diversifying of the banking service sector and improving and amending the quality of existence services (Berger, 2003; Merton, 1992), help sharing the risk (Allen and Gale, 1994), eventually, ameliorate allocative

efficiency (Houston et al. 2010; Ross, 1976). Financial innovation can help to increase the monitoring and controlling processes (Chortareas, Girardone, and Ventouri, 2012). Beck, Chen, Lin, and Song (2016) found that the important factor related to growth in the bank sector is financial innovation. After the financial crises in 2007, a lot of studies started to discuss the negative effect of financial innovation. Credit expansion helped to increase in boom and house prices increased subsequently and this is the principal reason for the recent global financial crisis (Brunnermeier, 2009).

Henderson et al. (2011) argue that financial innovation helps banks to develop structured instruments to utilize money from investors' when they are confused in financial markets. Financial innovation in industries and countries with better opportunities for growth or in other words in developing countries has higher growth and has a significant and substantial duty in the development of the financial sector (Beck, Chen, Lin, and Song, 2016). Furthermore, the bank sector shows better growth in profits, loans, and assets in areas where there is advanced financial innovation (Lee, Wang, and Ho (2020).

So far, the importance of economic growth, inflation, FDI, stock market, and financial innovation on financial development is explained. The role of financial innovation in financial development is investigating as the main goal of this thesis in the long and short-run relationship in Norway. Research and development in financial and insurance activities by industry in Norway from 18 million units (National currency - current prices) in 1987 increased to 1.37 billion in 2017. Norway has ranked in the top 10 countries for ease of doing business (The rankings are benchmarked to May 1, 2019, the source of this ranking is Doing Business Database). Furthermore, in the Global Innovation Index (2019) Norway is in the top 20 countries with high-income. Also,

the Global Innovation Index in 2019 published that Norway has the first place in the ranking for infrastructure compared to all other countries. Norway is ranked as the best (Number one) in digital infrastructure and the financial structure is safe, reliable, and cost-effective. Providing the retail payment cost ranked as the third most efficient in the world at 0.49% of GDP. In Norway, the financial sector has cooperated to innovate which has prepared the financial sector an expandable banking infrastructure.

The main gap in the literature that this thesis tries to fill in investigating the impact of financial innovation in financial development in the long-run and besides the short-run in Norway. Previous studies examined the impact of economic growth, inflation, FDI, stock market growth on financial development but none of them include financial innovation as a determinant of financial development. To the author's best information, this study contributes to investigate and illustrate the role and impact of financial innovation on financial development in Norway.

The rest of this thesis is organized as follows; firstly literature review of financial development and the importance of that with other macroeconomics variables explained in chapter 2 and then in chapter 3 introducing the methodology and data of this thesis. After all the empirical results in chapter 5 and concluding the finding of this thesis and policy suggestion in chapter 6 explained respectively.

Chapter 2

LITERATURE REVIEW

 The evolution of financial development has three different stages which are financial repression, financial development, and financialization (Barradas, 2015). each of them has a different impact on the financial sector in the society or on the real economy. The financial repression in most of the countries started with a lot of rules and limitations on the function of banking activities and financial markets. However, in the 1980s the second stage (financial development) was raised because of the strong liberalization in the financial sector. The financial system experienced huge growth concerning investments, saving, derivatives, securitization, and shadow banking system because of liberalization and change in the rules process. After that extreme financial deepening was appeared and because of this, the linkage of financial development and growth returned. According to the third stage (financialisation) of evolution that can be related to the negative influence of the huge development in the financial sector on the economy. Financial development as a second stage is not independent of the financialisation. It means financial development is the beginning of the process for the third stage or financialisation. Development in the financial sector has a notable role to reach the third stage (financialisation) and also has a direct effect on the economy and society. Recent studies also verify the previous studies result that explained above. In Nigeria between 1981 and 2000 credit to the private sector decreased and from 2001 to 2005 increased again. After that between 2006 and 2014 again increased and credit and broad money to private keep the same trend and

over these year evidence shows the increase in financial development. Improve in telecommunications and deregulation in this area helped and crate investment and financial opportunities in the country (Adeola and Evans, 2017). The persistence of the evolution of financial development manifested as the expansion of the scale of that (Sun, 2017).

In the literature, the number of researches that explain the linkage of financial development and growth is uncountable. In general, all the studies found financial development is so required for economic growth and growth has effecting financial development as well. In most cases, financial development and economic growth base on theoretic analysis are expected to have a positive correlation. However, there is some study like Robinon (1979) that believes financial sector development doesn't affect growth. Demetriades and Hussein (1996) found both growth and financial development are connected. However, Kemal et al (2007) by using the panel data for 19 developed countries found there is no causal link of growth and financial development. There are a lot of studies that explain the development of the financial sector inducing economic growth. Khan et al. (2005) found that there is a positive linkage between financial development and growth in the long term and also in the short term growth in the economy impressed by the change in share of investment. James (2008) suggests that in both quantitive and qualitative channels, growth is affected positively from financial sector development. Bojanic (2012) explained that there is a long-run equilibrium linkage among financial development and trade openness and economic growth. There is a one-way Granger causality running from financial development and trade openness to economic growth. In the other study, Calderón and Liu (2003) investigate the causality direction of growth and financial development. They found that in 109 countries financial development causes growth.

Furthermore, they found bidirectional causality when they make two samples for industrial countries and developing countries. Financial intermediaries have more effect on less developed countries and also it takes time to see the importance of financial deepening on the real sector. On the other side, a recent study in OECD countries highlighted a high level of financial development does not have a positive influence on the growth in the economy (Pagano and Pica, 2012) In the recent study for 193 countries, there is significant evidence that shows there is a bidirectional positive effect between growth in the economy and financial development (Khan, Peng, and Li, 2019). In more developed countries finance has a very significant and strong effect to compare with the development of emerging economies. The countries with lower trade openness face the weaker positive effect of finance because countries with more open economies have more access to financing from the external sources. (Botev, Égert, and Jawadi, 2019)

Another important determinant of financial development is inflation. Boyd, Levine, and Smith (2001) and Haslag and Koo (1999) illustrated the impact of inflation on financial sector performance and according to the evidence in their study, explained that this relationship is significantly negative and same as Kim, and Lin (2010), they believe a nonlinear link between inflation and financial sector performance. Kim and Lin (2010) with a panel for 87 countries between 1960 and 2005 found that in the long-run financial development has been affected negatively by inflation and in the short-run has a positive impact and inflation and finance link is nonlinear. Bittencourt, (2011) indicated the linkage between inflation and financial sector development in the case of Brazil as a developing country, and the found between 1985 and 2004 inflation reduce development in the financial part of the country. In another study in the case of Turkey, Ozturk and Karagoz (2012) concluded that growth in credit to the private

sector as a proxy for financial development depends on to decrease in the inflation rate of the country. The lower level of inflation is so important to facilitate financial system development. Al-Nasser and Jackson (2012) by the focus on the bank sector, explained there is a negative significant effect from inflation to banking sector development by controlling the other factors that may be related to financial development. Another study in Ghana explained that financial development has been positively affected by inflation in the short term, however, no significant relationship has been witnessed in the long term (Abbey, 2012). In another study, the same as most of the other studies examined that in Pakistan financial sector development has been negatively influenced by inflation (Khan, 2015). Sanusi, Meyer, and Ślusarczyk (2017) by using the ARDL model tested the dynamic causal link of inflation and financial sector development with monthly data in South Africa. In this study, they explained there is a long term linkage between inflation and financial development and also Granger causality from inflation to financial development. Furthermore, in this study opposite of widespread belief about financial development and inflation linkage, found that relation is positive from inflation to financial sector development. middle-income countries have a strong and positive influence on financial development however, this impact in the case of low-income countries is low. Moreover, inflation in medium and high inflation rate countries hurts financial development. The level of financial development can be improved by high gross domestic product and at the same time low inflation (Ehigiamusoe, Guptan, and Narayanan, 2019). In a very recent study, there is evidence by using the ARDL approach in and quarterly data between 2002 and 2007 that shows inflation affecting financial development positively in Nigeria this result supporting that inflation can lead to an increase in financial development (Afangideh, Garbobiya, Umar, and Usman, 2020).

Another important element that is affecting the stage of financial development of each country is foreign direct investment. FDI is working as an engine for economic growth not because just it's so helpful for capital financing because has other benefits like importing the knowledge to the host country. Here we summarized some studies in this area to check how the FDI is affecting the financial development and the importance of that for development and growth.

Ang, (2008) investigated the foreign direct investment determinant in Malasia between 1960 and 2005 and found that development in the financial base is linked and affiliated with foreign direct investment. More recent studies are shown the influence of FDI on economic growth positively depends on the development of the financial sector. Chee, and Nair (2010) used the panel data between 1996 and 2005 to investigate whether FDI and financial development have a separate or complementary effect on growth or not. The complementary growth impact is important in the countries that are not well developed and just as important for developed and developing economies. The FDI itself affects economic growth. In conclusion, the positive effect of foreign direct investment can achieve just if the developed countries or developing countries invest in financial development, education, and using the new technology. In the same way, Choong (2012), Sghaier and Abida (2013), Choong, Yusop, and Soo (2004), Choong and Lim (2009), Azman-Saini and Law, (2010), investigated the role of the financial development to absorbing and facilitating the positive effect of FDI on economic growth.

Another study in the case of Sri Lanka investigated the links among financial sector development, FDI, and growth. It this study when the dependent variable was financial development as a result explained by the study that FDI causes financial development

in 2 models out of 4 (Jahfer, and Inoue, 2014). Abidin et al (2015) indicated the linkage between economic growth, FDI, financial development, and international trade in ASEAN countries. In this study, they used the ARDL approach and they found and long term linkage of the variables that growth was the dependent and FDI and financial development and stock market were independent and all of them had a significant coefficient, and also they found unidirectional Granger causality from FDI to financial sector development. Salahuddin et al (2018) studied the impact of some variables including FDI and financial development on carbon dioxide and the same as Abidin et al (2015) in their result found that FDI granger causes financial sector development. Nor, Ripain and Ahmad (2015) explained that the degree of financial freedom is so important and concerning foreign direct investment and growth relationships. The financial freedom index is measuring the openness of the financial sector and as much as this index is higher is showing the higher financial sector development. They emphasized the influence of FDI related to the degree of freedom of the financial sector of the country.

In a very recent study in the case of Bahrain finding illustrates that there is a significant positive linkage of FDI and financial development between 1978 and 2015 (Alsmadi and Oudat, 2019). With data for 50 joining the Belt and Road Initiative countries the role of FDI investigated and the result indicated, there is a positive and significant correlation between foreign direct investment and financial development of the host country (Aibai, Huang, Luo, and Peng, 2019). The importance of the financial market especially the stock market in financial development as an important determinant is investigated in previous studies. The stock market is helping the companies to fundraise for their development and facilitating and guiding the money transferring from investors to the companies that they need funds. The stock market also can affect

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financial development, however, it is not certain whether financial development has been influenced positively by this money-raising or not. Volatility in the stock market can have an impact on the real economy negatively. Arestis, Demetriades, and Luintel (2001) explained the importance of volatility in the stock market. This study explained that volatility had a negative effect in Japan and France, and in the united kingdom hurts financial development as well. Aizenman and Marion (1996) also measure the volatility by using fiscal, monetary, and external and they found the same result and negative effect. Furthermore, the influence of the stock market is important in the linkage of financial development and growth. This is the other reason to check the importance of the market in this study. For instance, Garcia, and Liu (1999) illustrated the linkage of financial development and growth, and one of their findings was markets and financial intermediaries are complements instead of swap. As Saci, Giorgioni, and Holden (2009) explained there is a two common way of measuring the market size. First, the market turnover ratio that is also used by Beck and Levine (2002); Demirguc-Kunt and Levine (1996); Rousseau and Wachtel (2000). Second, the total stock market value traded was used by Levine and Zervos (1996); Rousseau and Wachtel (2000). According to the definition by the world bank, the total value traded is showing the value of the shares traded in total numbers of shares that traded. In this thesis, we used the stock market traded, and especially in the case of Norway in the 2007-2008 financial crises, we had a very high volume in the market. There is a study that indicated the linkage of financial development and growth with and without the influence of the stock market. Caporale, Howells, and Soliman, (2004) used the seven countries data by Toda and Yamamoto (1995) causal test to find the link of stock markets and economic growth. First, they investigated the bivariate context model for causality between domestic credit and prevalence of bank deposits as a proxy of

financial development and economic growth. In this model, they found a causal linkage between financial development and growth for three countries. However, since the result might be biased because of the lack of the important variable that is not in the model, they ran the trivariate context to create dynamic interaction of financial development, stock market development, and growth. This time results change substantially, causality has been founded between financial development and growth by five countries. The result is showing that the stock market is so important and is boosting economic development. In another study, Enisan and Olufisayo (2009) used the ARDL bounds test to examine the linkage of stock market development and growth in seven countries. Finally, they found the unidirectional from stock market development to economic growth as a result of the VECM framework and in the VAR framework demonstrates the short-run two-way causality between stock market development and growth. Prats and Sandoval (2016) explained that with the presence of banks, the stock market as a liquidity supply and information source is a fundamental element in the financial system.

Financial innovation is anything that can provide a better service or decrease the risk and a process of creating new financial services or instruments that can provide a better service or decrease the risk or facilitate the investing process or help the financial system to work better and easier. This process can also include the improvement in technology in the financial system, decreasing the risk of transferring money, mobile money banking. Some of the studies believe the financial innovation has a positive influence on the economy and financial system, banking services (Berger, 2003; Merton, 1992) and that's so important for the facilitation of money transfer and improving the allocative efficiency (Houston et al, 2010; Ross, 1976). On the other hand, some studies strongly believe that financial innovation was the main reason for

the recent financial crises by credit expansion, and that helped to increase house prices (Brunnermeier, 2009) and also by securities that were neglected the risks (Gennaioli et al, 2012). Beck et al (2016) completely investigated the dark sides and bright sides of the financial innovation 32 OECD countries. Mollaahmetoğlu and Akçalı (2019) by using the panel data for 15 countries between 2003 and 2016 found that financial innovation and financial development influence economic growth significantly. Establishing a more open financial system for innovation in developing countries is important for a sustainable economy. Financial innovation has a very important role in the 2007-2008 financial crises so from this point we can see that the studies in this area are dividing into two groups. In a very recent study, it is mentioned that financial innovation assists financial sector development, financial deepening, and growth (Gao, 2020). In this thesis, the influence of financial innovation in the financial development of Norway as a developed country investigated to check if financial innovation has a positive or negative effect on financial development. There is no evidence that they indicate the importance of financial innovation on financial sector development in Norway.

Chapter 3

DATA AND METHODOLOGY

3.1 Data and Study model

In this thesis, data are collected annually between 1989 and 2018 for Norway. In this thesis, Domestic credit provided by the financial sector (% of GDP) which includes all credit to different sectors on the base of the gross except for credit to the central government, as a proxy for financial development, Gross domestic product (constant 2010 US$) which means gross value added with all producers in the economy plus any product taxes and minus any subsidies, Consumer price index (2010 = 100) that explain the changes in the cost to an average of acquiring a package of goods and services as a proxy for inflation, Foreign direct investment net inflows (% of GDP) that show the net of the foreign investment in country and Stocks traded, total value (% of GDP) which shows the value of shares traded in domestic and foreign multiplied by matching prices, are taken from the World Bank Development indicators (2019). As a proxy for financial innovation, Research and development expenditures in the financial intermediation industry used in this thesis study and data collected from the Analytical Business Enterprise Research and Development database (ANBERD).

The relationship among GDP, CPI, FDI, the stock traded, financial innovation and financial development can be structured as:

$$\ln FD_t = \beta 1 \ln GDP_t + \beta 2 \ln CPI_t + \beta 3 \ln FDI_t + \beta 4 \ln STR_t + \beta 5 \ln FI_t + \epsilon_t \qquad (1)$$

Where Ln FD represents Financial development, Ln GDP indicates the Gross domestic product, Ln CPI shows Consumer price index, Ln FDI represents Foreign direct investment net inflows, Ln STR represents Stocks traded and Finally, Ln FI represents Financial innovation.

All of them are used in the model in logarithmic forms. β1, β2, β3, β4, and β5 respectively have represented the coefficients of the variables.

3.2 Unit root tests

Before start checking the empirical results to order integration of variables, we apply the Augmented Dickey-Fuller and Phillips-Perron unit root tests to find whether the series is stationary or non-stationary in the other words checking the cointegration possibility and the integration level of between variables (Dickey and Fuller, 1981; Phillips and Perron, 1988). The H0 for both tests is there is a unit root. The PP unit root tested to find the variance of the residual that indicates the auto-correlation (Katırcıoğlu, 2009). The model for the ADF test in the general model with the intercept and trend is :

$$\Delta Y_t = \alpha_0 + \alpha_2 t + \delta Y_{t-1} + \sum_{i=2}^{p} \beta_j \Delta Y_{t-i-1} + \epsilon_t \qquad (2)$$

Where y shows the variable; α is showing intercept; t is indicated trend; ϵ_t is the white noise; and p is showing the lag level. Akaike information Criteria or other criteria in order to find the optimum lag of p to make certain the error terms they are are not serially correlated (Katırcıoğlu et al, 2007). Both the ADF test and the PP test using the t-tests for δ.

Phillips and Perron is a bit different from the ADF test and is using the nonparametric methods to find the serial correlation in the errors unaccompanied by adding lag (Phillips and Perron, 1988). Newey-West is the popular method estimate as :

$$\omega^2 = \gamma_0 + 2\sum_{j=1}^{q}(1 - \frac{j}{\alpha+1})\gamma_j \qquad (3)$$

$$\gamma_j = \frac{1}{T}\sum_{t=j+1}^{T} \in_t \in_{t-j} \qquad (4)$$

Where q = the truncation lag, γ_j is showing the estimated residuals covariance j-lag apart and T in the model.

According to Zivot and Andrews (1992) unit root test as the third test in this study for checking the possibilities of structural breaks and stationary, Three different models on Zivot and Andrews are used in the model can be explained as follows. Model B shows a break in trend and drift and model T only in trend and finally model I only in the drift. All of these models shown as follows:

Model B: $\Delta Y_t = \beta_1 + \beta_2 t + \delta Y_{t-1} + \theta DU_t + \gamma DU_t + \sum_{i=1}^{m} \alpha i \, \Delta Y_{t-1} + \in_t$ (5)

Model T: $\Delta Y_t = \beta_1 + \beta_2 t + \delta Y_{t-1} + \gamma DU_t + \sum_{i=1}^{m} \alpha i \, \Delta Y_{t-1} + \in_t$ (6)

Model I: $\Delta Y_t = \beta_1 + \beta_2 t + \delta Y_{t-1} + \theta DU_t + \sum_{i=1}^{m} \alpha i \, \Delta Y_{t-1} + \in_t$ (7)

where DUt = 1 and DTt = t − Tb if t > Tb and 0 otherwise. Tb is an abbreviate used to show possible breakpoint

3.3 The bounds test analysis

The bounds test through the ARDL mechanism is for finding the long term level relationship among the variables. The ARDL model applied the first time by Pesaran, Shin, and Smith (2001) may be accepted no matter what of whether the explanatory variables are I(0), I(1), or mutually cointegrated in order. The ARDL approach has a great many advantages but the two important and principle ones are; firstly this approach avoids serial correlation and endogeneity problems that other methods of

cointegration have. Secondly, avoiding pretest of variables they are non-stationary and this is also a fundamental requirement with other methods (Narayan, 2004). The ARDL approach suggests following the error correction models;

$$\Delta \ln FD_t = \alpha_{0_Y}$$

$$+ \sum_{i=1}^{n} b_{i_Y} \Delta \ln FD_{t-i} + \sum_{i=0}^{n} c_{i_Y} \Delta \ln GDP_{t-i} + \sum_{i=0}^{n} c_{i_Y} \Delta \ln CPI_{t-i}$$

$$+ \sum_{i=0}^{n} c_{i_Y} \Delta \ln FDI_{t-i} + \sum_{i=0}^{n} c_{i_Y} \Delta \ln STR_{t-i} + \sum_{i=0}^{n} c_{i_Y} \Delta \ln FI_{t-i}$$

$$+ \lambda_{1_Y} \ln FD_{t-1} + \lambda_{2_Y} \ln GDP_{t-1} + \lambda_{3_Y} \ln CPI_{t-1} + \lambda_{4_Y} \ln FDI_{t-1}$$

$$+ \lambda_{5_Y} \ln STR_{t-1} + \lambda_{6_Y} \ln FI_{t-1} + \in_t$$

$$(8)$$

Where α_{0_Y} is the drift and $\in_t$ is the error. The beginning of the model indicates error correction dynamics and the next part indicates the long-run relationship. The null hypothesis for the bounds test is $\lambda_{1_Y} = \lambda_{2_Y} = \lambda_{3_Y} = \lambda_{4_Y} = \lambda_{5_Y} = 0$ and the alternative hypothesis is $\lambda_{1_Y} \neq \lambda_{2_Y} \neq \lambda_{3_Y} \neq \lambda_{4_Y} \neq \lambda_{5_Y} \neq 0$. The computed F-statistic is evaluated by the Narayan (2005) critical values.

After determining the long-run linkage, the error correction model is used to estimate the short-run relationship and error correction term. ECM explained as follows;

$$\Delta \ln FD_t = \alpha_{0_Y}$$

$$+ \sum_{i=1}^{n} b_{i_Y} \Delta \ln FD_{t-i} + \sum_{i=0}^{n} c_{i_Y} \Delta \ln GDP_{t-i} + \sum_{i=0}^{n} c_{i_Y} \Delta \ln CPI_{t-i}$$

$$+ \sum_{i=0}^{n} c_{i_Y} \Delta \ln FDI_{t-i} + \sum_{i=0}^{n} c_{i_Y} \Delta \ln STR_{t-i} + \sum_{i=0}^{n} c_{i_Y} \Delta \ln FI_{t-i}$$

$$+ \alpha ECT_{t-1} + \in_t \tag{9}$$

where ECT_{t-1} shows the error correction term that explains the speed of adjustment to the long-run equilibrium level.

3.4 Causality test

The Toda and Yamamoto (1995) test is utilized to illustrate casual linkage among variables. The most important advantage of this test is feasible despite the integration of the variables. Modified Wald statistic suggested by Toda and Yamamoto (1995) in order to find the causal relationships of variables. To find the optimal lag selection Hacker and Hatemi (2012) information criteria are used in this model. In this equation, k indicates the optimal VAR order and the d_{max} is the maximum integration order. VAR $(k+d_{max})$ estimated as follows:

$$\ln FD = \alpha_0 + \sum_{i=1}^{k} \alpha_{1i} \ln FD_{t-i} + \sum_{j=k+1}^{d_{max}} \alpha_{2j} \ln FD_{t-j} + \sum_{i=1}^{k} \beta_{1i} \ln GDP_{t-i}$$

$$+ \sum_{j=k+1}^{d_{max}} \beta_{2j} \ln GDP_{t-j} + \sum_{i=1}^{k} \gamma_{1i} \ln CPI_{t-i} + \sum_{j=k+1}^{d_{max}} \gamma_{2j} \ln CPI_{t-j}$$

$$+ \sum_{i=1}^{k} \delta_{1i} \ln FDI_{t-i} + \sum_{j=k+1}^{d_{max}} \delta_{2j} \ln FDI_{t-j} + \sum_{i=1}^{k} \theta_{1i} \ln STR_{t-i}$$

$$+ \sum_{j=k+1}^{d_{max}} \theta_{2j} \ln STR_{t-j} + \sum_{i=1}^{k} \rho_{1i} \ln FI_{t-i} + \sum_{j=k+1}^{d_{max}} \rho_{2j} \ln FI_{t-j} + \in_{1t}$$

$$\tag{10}$$

$$\ln GDP = \beta_0 + \sum_{i=1}^{k} \beta_{1i} \ln GDP_{t-i} + \sum_{j=k+1}^{d_{max}} \beta_{2j} \ln GDP_{t-j} + \sum_{i=1}^{k} \alpha_{1i} \ln FD_{t-i}$$

$$+ \sum_{j=k+1}^{d_{max}} \alpha_{2j} \ln FD_{t-j} + \sum_{i=1}^{k} \gamma_{1i} \ln CPI_{t-i} + \sum_{j=k+1}^{d_{max}} \gamma_{2j} \ln CPI_{t-j}$$

$$+ \sum_{i=1}^{k} \delta_{1i} \ln FDI_{t-i} + \sum_{j=k+1}^{d_{max}} \delta_{2j} \ln FDI_{t-j} + \sum_{i=1}^{k} \theta_{1i} \ln STR_{t-i}$$

$$+ \sum_{j=k+1}^{d_{max}} \theta_{2j} \ln STR_{t-j} + \sum_{i=1}^{k} \rho_{1i} \ln FI_{t-i} + \sum_{j=k+1}^{d_{max}} \rho_{2j} \ln FI_{t-j} + \in_{2t}$$

$$(11)$$

$$\ln CPI = \gamma_0 + \sum_{i=1}^{k} \gamma_{1i} \ln CPI_{t-i} + \sum_{j=k+1}^{d_{max}} \gamma_{2j} \ln CPI_{t-j} + \sum_{i=1}^{k} \beta_{1i} \ln GDP_{t-i}$$

$$+ \sum_{j=k+1}^{d_{max}} \beta_{2j} \ln GDP_{t-j} + \sum_{i=1}^{k} \alpha_{1i} \ln FD_{t-i} + \sum_{j=k+1}^{d_{max}} \alpha_{2j} \ln FD_{t-j}$$

$$+ \sum_{i=1}^{k} \delta_{1i} \ln FDI_{t-i} + \sum_{j=k+1}^{d_{max}} \delta_{2j} \ln FDI_{t-j} + \sum_{i=1}^{k} \theta_{1i} \ln STR_{t-i}$$

$$+ \sum_{j=k+1}^{d_{max}} \theta_{2j} \ln STR_{t-j} + \sum_{i=1}^{k} \rho_{1i} \ln FI_{t-i} + \sum_{j=k+1}^{d_{max}} \rho_{2j} \ln FI_{t-j} + \in_{3t}$$

$$(12)$$

$$\ln FDI = \delta_0 + \sum_{i=1}^{k} \delta_{1i} \ln FDI_{t-i} + \sum_{j=k+1}^{d_{max}} \delta_{2j} \ln FDI_{t-j} + \sum_{i=1}^{k} \beta_{1i} \ln GDP_{t-i}$$

$$+ \sum_{j=k+1}^{d_{max}} \beta_{2j} \ln GDP_{t-j} + \sum_{i=1}^{k} \gamma_{1i} \ln CPI_{t-i} + \sum_{j=k+1}^{d_{max}} \gamma_{2j} \ln CPI_{t-j}$$

$$+ \sum_{i=1}^{k} \alpha_{1i} \ln FD_{t-i} + \sum_{j=k+1}^{d_{max}} \alpha_{2j} \ln FD_{t-j} + \sum_{i=1}^{k} \theta_{1i} \ln STR_{t-i}$$

$$+ \sum_{j=k+1}^{d_{max}} \theta_{2j} \ln STR_{t-j} + \sum_{i=1}^{k} \rho_{1i} \ln FI_{t-i} + \sum_{j=k+1}^{d_{max}} \rho_{2j} \ln FI_{t-j} + \in_{4t}$$

$$(13)$$

$$\ln STR = \theta_0 + \sum_{i=1}^{k} \theta_{1i} \ln STR_{t-i} + \sum_{j=k+1}^{d_{max}} \theta_{2j} \ln STR_{t-j} + \sum_{i=1}^{k} \beta_{1i} \ln GDP_{t-i}$$

$$+ \sum_{j=k+1}^{d_{max}} \beta_{2j} \ln GDP_{t-j} + \sum_{i=1}^{k} \gamma_{1i} \ln CPI_{t-i} + \sum_{j=k+1}^{d_{max}} \gamma_{2j} \ln CPI_{t-j}$$

$$+ \sum_{i=1}^{k} \delta_{1i} \ln FDI_{t-i} + \sum_{j=k+1}^{d_{max}} \delta_{2j} \ln FDI_{t-j} + \sum_{i=1}^{k} \alpha_{1i} \ln FD_{t-i}$$

$$+ \sum_{j=k+1}^{d_{max}} \alpha_{2j} \ln FD_{t-j} + \sum_{i=1}^{k} \rho_{1i} \ln FI_{t-i} + \sum_{j=k+1}^{d_{max}} \rho_{2j} \ln FI_{t-j} + \in_{5t}$$

$$(14)$$

$$\ln FI = \alpha_0 + \sum_{i=1}^{k} \rho_{1i} \ln FI_{t-i} + \sum_{j=k+1}^{d_{max}} \rho_{2j} \ln FI_{t-j} + \sum_{i=1}^{k} \beta_{1i} \ln GDP_{t-i}$$

$$+ \sum_{j=k+1}^{d_{max}} \beta_{2j} \ln GDP_{t-j} + \sum_{i=1}^{k} \gamma_{1i} \ln CPI_{t-i} + \sum_{j=k+1}^{d_{max}} \gamma_{2j} \ln CPI_{t-j}$$

$$+ \sum_{i=1}^{k} \delta_{1i} \ln FDI_{t-i} + \sum_{j=k+1}^{d_{max}} \delta_{2j} \ln FDI_{t-j} + \sum_{i=1}^{k} \theta_{1i} \ln STR_{t-i}$$

$$+ \sum_{j=k+1}^{d_{max}} \theta_{2j} \ln STR_{t-j} + \sum_{i=1}^{k} \alpha_{1i} \ln FD_{t-i} + \sum_{j=k+1}^{d_{max}} \alpha_{2j} \ln FD_{t-j} + \in_{6t}$$

$$(15)$$

Chapter 4

EMPIRICAL RESULTS

The ADF and PP tests utilized for this thesis to illustrate the integration order of the variables. Table 1 indicates the findings of the ADF and the PP tests. As the results of the ADF test in all models with intercept and trend, with intercept, and without trend and intercept, tests indicate that LnFD, LnGDP, LnCPI, and LnSTR are integrated order of 1, I(1), and LnFI is integrated order of zero, I(0) and result for PP test just for LnFDI indicates that has not the unit root at the level and it is I(0) and all other variables have the order of integration 1, I(1). On the other hand, the ADF test indicated that LnFDI integrated of order zero, I(0). The finding of the PP test for LnFDI indicates that it is I(0) in all three models. After all, there is a mixed order of I(0) and I(1) integration orders of variables.

Table 1: The ADF and the PP Tests (Unit Root tests)

Statistics (Level)	Ln FD	lag	Ln GDP	lag	Ln CPI	lag	Ln FDI	lag	Ln STR	lag	Ln FI	Lag
τ_T (ADF)	-3.169	(0)	-0.979	(0)	-2.463	(4)	-0.315	(3)	-1.988	(1)	-4.060**	(0)
τ_μ (ADF)	-0.179	(0)	-3.662**	(0)	-1.091	(4)	-1.421	(3)	-2.063	(1)	-3.779*	(0)
τ (ADF)	1.764	(0)	2.180	(1)	12.909	(0)	-1.407	(3)	0.017	(1)	2.498	(0)
τ_T (PP)	-3.143	(4)	-1.042	(1)	-3.703**	(1)	-4.444*	(4)	-1.430	(0)	-4.104**	(8)
τ_μ (PP)	-0.096	(3)	-3.229**	(1)	-1.155	(1)	-4.307*	(4)	-1.628	(0)	-4.214*	(3)
τ (PP)	1.960	(4)	5.097	(4)	12.631	(1)	-4.281*	(4)	0.176	(0)	2.466	(3)

Statistics (First Difference)	Ln FD	lag	Ln GDP	lag	Ln CPI	lag	Ln FDI	lag	Ln STR	lag	Ln FI	Lag
τ_T (ADF)	-4.968*	(3)	-3.694**	(0)	-4.541*	(3)	-3.160	(1)	-4.004**	(0)	-4.597*	(2)
τ_μ (ADF)	-5.052*	(0)	-2.663***	(0)	-4.443*	(3)	-14.382*	(0)	-3.995*	(0)	-5.910*	(0)
τ (ADF)	-4.587*	(0)	-1.386	(0)	-1.230	(1)	-14.491*	(0)	-4.043*	(0)	-5.397*	(0)
τ_T (PP)	-4.984*	(6)	-3.703**	(1)	-5.327*	(1)	-14.028*	(7)	-3.926**	(3)	-6.979*	(3)
τ_μ (PP)	-5.109*	(6)	-2.631***	(2)	-5.472*	(0)	-14.302*	(3)	-4.014*	(1)	-6.343*	(3)
τ (PP)	-4.583*	(1)	-1.386	(0)	-1.526	(4)	-14.211*	(3)	-4.063*	(1)	-5.441*	(2)

Note:
FD represents financial development; GDP indicates gross domestic product; FDI shows foreign direct investment inflows; CPI is consumer price index; STR is stocks traded, and FI is financial innovation. All of the data in each series used in logarithmic forms. τT indicates the general model with trend and intercept; $\tau\mu$ is the model with intercept and without the trend; τ is the limited model without trend and intercept. Lag lengths were used to remove the effect of serial correlation and shown in the brackets. In the PP test, numbers in brackets indicate Newey-West Bandwith (as determined by Bartlett-Kernel). Both in ADF and PP tests, unit root tests were performed from the general to the least limited model by removing intercept and trend from the models. *, **, and *** respectively show rejection of the null hypothesis at the 1 percent, 5 percent, and 10 percent levels. Tests for unit roots have been carried out in E-VIEWS 10.5.

Moreover, in this thesis, Zivot and Andrews (1992) test applied for supporting the finding the integration order of variables under the structural break, and findings are summarized in Table 2. There is a unit root in LnFD, LnGDP, LnCPI, LnFDI, and LnSTR so they are I(1) and LnFI is I(0) and which means stationary in the level form under the existence of a structural break. Overall results finding recommend the mixed order integration for variables.

Table 2: Unit root test - Zivot and Andrews (1992)

	Statistics (level)			Statistics (1st D)			Conclusion
	ZA$_B$	ZA$_T$	ZA$_I$	ZA$_B$	ZA$_T$	ZA$_I$	
Ln FD	-4.169	-3.408	-4.342	-5.704*	-5.554*	-5.843*	
Break year	2001	2010	2013	1996	1999	1996	I(1)
Lag length	0	0	9	1	1	1	
Ln GDP	-3.344	-3.502	-3.319	-4.700	-4.180***	-4.292	
Break year	1996	1998	2008	2008	2010	2012	I(1)
Lag length	1	1	1	0	0	0	
Ln CPI	-3.762	-3.516	-3.595	-5.242**	-5.253*	-5.311**	
Break year	2001	2002	2011	2004	2012	2002	I(1)
Lag length	4	4	4	3	3	3	
Ln FDI	-2.825	-3.000	-0.196	-5.207**	-4.844*	-4.712***	
Break year	2012	2013	2014	2006	2012	2013	I(1)
Lag length	4	4	4	3	3	3	
Ln STR	-4.182	-3.958	-3.905	-5.025**	-4.034	-5.025***	
Break year	2006	2008	2011	2008	2008	2008	I(1)
Lag length	1	1	1	0	2	0	
Ln FI	-5.413**	-5.306*	-5.456*	-7.114*	-5.517*	-5.545*	
Break year	2005	2009	2005	2000	1999	1996	I(0)
Lag length	0	0	0	2	2	2	

Notes:
 FD is financial development; GDP is gross domestic product; FDI is foreign direct investment inflows; CPI is consumer price index; STR is stocks traded, and FI is financial innovation. All of the data in each series used in logarithmic forms. ZA$_B$ represents the model with a break in both the intercept and trend; ZA$_T$ is the model with a break in the trend; ZA$_I$ is the model with a break in the intercept. *, **, and *** respectively show the null hypothesis rejection at 1%, 5%, and 10% levels.

In this thesis bounds test is applied under the ARDL approach for estimation of the equilibrium level relationship between variables that have mixed orders of integration. The bounds test outcome in table 3, indicates that F-statistic is above the upper bound critical value at lag 3. Hence, the null hypothesis is rejected that means there is a long-

run equilibrium linkage among independent variables and the dependent variable which is financial development.

Table 3: Bounds test for the level relationship

Variables	FII	Level of significant	I(0)	I(1)	Conclusion
F LnFD (LnGDP, LnCPI, LnFDI, LnSTR,LnFI)	7.118	10%	2.08	3	H0 Rejected
		5%	2.39	3.38	H0 Rejected
		1%	3.06	4.15	H0 Rejected

Notes:
Akaike information criteria (AIC) are used to select the number of lags. FII indicates the F-statistic in the model with restricted intercept and no trend.
Asymptotic: n=1000.

Table 4 indicates the estimated long-run coefficients under the ARDL approach. All of the coefficients in the long-run have a significant probability at a 10% significant level except for LNFDI which is not significant statistically. The findings show that the GDP has a significant, elastic, and positive influence on financial development and this result is consistent by the findings of Ang James, (2008); Khan et al (2005). CPI in this study is a proxy for inflation that has an elastic and negative impact on financial development significantly this result is consistent with Bittencourt (2011); Kim and Lin (2010) studies. However, STR which represents the stock traded value has a negative inelastic influence on financial development in Norway and as stock traded value is showing the size of the traded shares and the volume of that in the stock market it can be expected to be negative and the higher stock traded value indicates higher activities in the stock market and investors prefer financing form stock market rather than domestic credits and as a result, higher stock market activity reduces the level of domestic credits., The FI that represents financial innovation has an inelastic positive influence on financial sector development. Financial innovation is providing and

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facilitating the financial process in the system. New instruments in the financial system facilitating and decrease the cost of money transferring and ease the financing for those they have limited access to financing from the private sector. So, in the long term, it can have a positive impact and in this thesis will discuss more details about this important finding.

Table 4: Level coefficients in the long-term model trough the ARDL model

| Dependent variable | Regressors | | | | | |
	LN GDP	LN CPI	LN FDI	LN STR	LN FI	Intercept
LN FD	7.699**	-11.611***	-0.088	-0.716**	0.713***	-159.546**
	(2.6523)	(-2.1202)	(-1.8468)	(-2.4390)	(2.0184)	(-2.7281)

Notes:
The numbers in parentheses are t-statistics for variables.
∗, ∗∗, and ∗∗∗ significance level at 1%, 5%, and10% levels, respectively.

After the estimation of coefficients for explanatory variables in the long and short term on the ARDL approach, that's necessary to check the stability of the model and applied diagnostic tests to approve model validity. The results of the diagnostic tests are reported in Table 5. Furthermore, figure 1 illustrates the findings of the CUSUM test, and figure 2 indicates the CUSUMSQ test findings in the model. In Figures 1 and 2, the two lines in up and down are the critical lines and the line in the middle is showing the statistic value in both figures for CUSUM and CUSUMSQ the statistic value is between the critical lines. They indicate the ARDL model in this study is stable in both the long and short term. Table 4 indicates the 4 different diagnostic tests and the findings of these tests approve the reliability and validity of the ARDL approach in this thesis.

Table 5: Diagnostic tests

Test statistics	F-Version	Prob
Serial correlation(LM Test)	2.7380	0.159
Functional form	0.8201	0.407
Heteroskedasticity (White Test)	0.9428	0.761
Normality	0.5729*	0.751

Notes :
* indicates LM-version.

The straight lines represent critical bounds at 5% significance level

Figure 1: CUSUM test results in the model

The straight lines represent critical bounds at 5% significance level
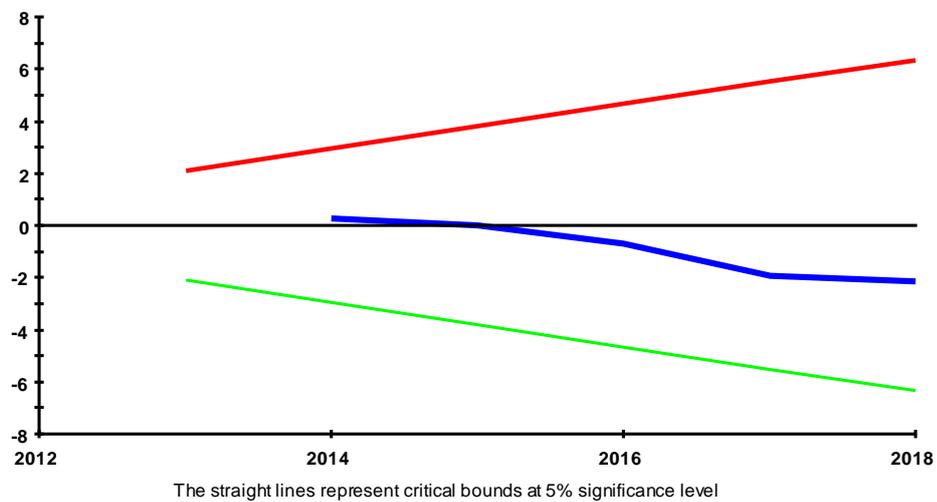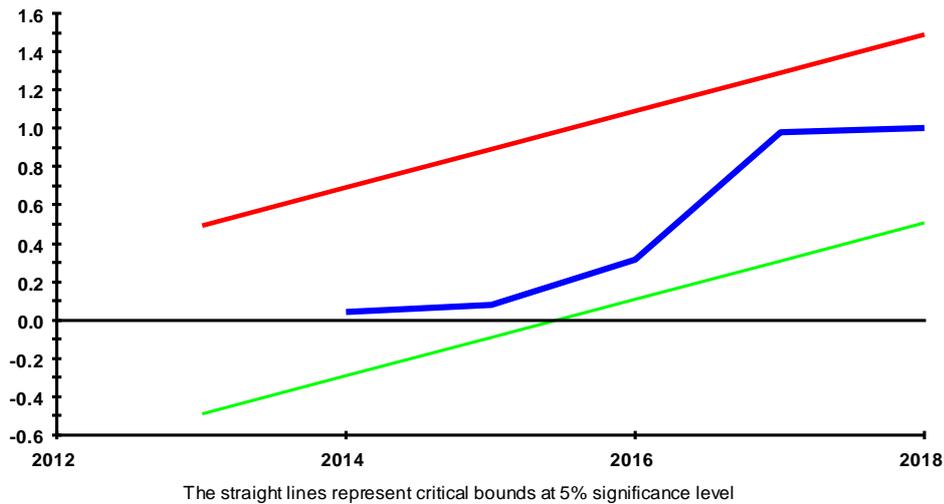
Figure 2: CUSUMSQ test results in the model

Table 6 presents the conditional error correction model results through the ARDL model. Results in this model indicate the error correction term (ECT) of the model equals -0.4861. ECT of the model suggested that financial development converges to the long-run equilibrium level in every year by 48.61% speed of adjustment with GDP, inflation, FDI, stock market traded value, and financial innovation contribution in Norway.

In short-run, GDP hurts domestic credit in different lags. FDI has just one significant coefficient in the short-run relationship with financial development and indicates that it has a negative impact on financial development in the short-run. Financial innovation has a negative coefficient (-0.162) in the short-run relationship with financial development and it is statistically significant. It means a 1% increase in financial innovation has a 0.162% negative impact on domestic credit as a proxy for financial development. The reason behind the estimated negative short-run coefficient of financial innovation is designing new financial instruments that need research and development and it is costly. Research and development cost increases the estimated

prices (shadow prices) of the new products in the short run. Therefore, investors do not prefer to adopt newly introduced financial instruments. Shadow prices need a longer time to be sustained. Sustained shadow prices stimulate the adoption of new financial instruments and contribute to financial development positively in the long run.

Table 6: Conditional error correction model trough the ARDL approach

Dependent variable: lnFD (3, 3, 0, 3, 3, 3)*			
Regressor	Coefficient	Standard error	p-value
$\hat{U}_{t-1}$	-0.4861	0.1640	0.014
$\Delta LNFD_{t-1}$	-1.3087	0.3018	0.001
$\Delta LNFD_{t-2}$	-0.7085	0.2582	0.021
$\Delta LNGDP$	-4.5654	0.9583	0.001
$\Delta LNGDP_{t-1}$	-6.9404	2.4258	0.017
$\Delta LNGDP_{t-2}$	-2.3684	0.7767	0.012
$\Delta LNCPI$	-5.6443	1.3856	0.002
$\Delta LNFDI$	-0.0382	1.3856	0.049
$\Delta LNFDI_{t-1}$	-0.0394	0.0329	0.258
$\Delta LNFDI_{t-2}$	-0.0540	0.0292	0.094
$\Delta LNSTR$	-0.1570	0.0377	0.002
$\Delta LNSTR_{t-1}$	0.2722	0.0508	0.000
$\Delta LNSTR_{t-2}$	0.2287	0.0910	0.031
$\Delta LNFI$	-0.1620	0.0493	0.008
$\Delta LNFI_{t-1}$	-0.3243	0.1162	0.019
$\Delta LNFI_{t-2}$	-0.0927	0.0514	0.101
R-Squared	0.9702	Adj. R2	0.8710
SE of Reg.	0.0249	Residual Sum of Sq	0.0037
AIC	60.7150	SBC	47.1087
F-stat.	12.2248	F-prob.	0.000

Notes:
* indicates p-lag structures in the model

After all, Toda Yamamoto (1995) test utilized to show the long term casual direction linkage of financial development and explanatory variables and vise versa. The result of these tests is summarized in Table 7. The results indicate a bidirectional causal linkage o economic growth and financial development. There is a unidirectional relationship from inflation to financial development however, there is no evidence for the causality relationship between FDI and financial development. Same as inflation, a unidirectional causal relationship of stock market traded value and domestic credit as a proxy for financial development exist. Ultimately, financial innovation and financial development have a bidirectional causal relationship and this is an important finding to answer the main question of this thesis. This finding is showing financial development is affecting by financial innovation and as a result financial innovation a fine as a substantial and serious element for financial sector development. If there is any change in financial innovation, financial development will change as well and financial innovation is driven by financial development and conversely.

Table 7: Toda Yamamoto (1995) Causality Test

Hypothesis	Chi-square P-value	Decision
lnFD does not cause lnGDP	0.015	Reject
lnGDP does not cause lnFD	0.014	Reject
lnFD does not cause lnCPI	0.383	Fail to Reject
lnCPI does not cause lnFD	0.003	Reject
lnFD does not cause lnFDI	0.521	Fail to Reject
lnFDI does not cause lnFD	0.262	Fail to Reject
lnFD does not cause lnSTR	0.593	Fail to Reject
lnSTR does not cause lnFD	0.053	Reject
lnFD does not cause lnFI	0.001	Reject
lnFI does not cause lnFD	0.000	Reject

Notes:
5000 simulations are used to compute bootstrapped critical values. HJC criteria are used for the optimum lag length selection.

Chapter 5

CONCLUSION

This thesis was initiated to illustrate the impact and role of financial innovation in the long-run and short-run on financial development between 1989 and 2018 in the case of Norway. As a result of unit root tests, the mixed order integration for variables was found. Under the ARDL approach, the long-run linkage of the variables was confirmed by the bounds test. The error correction of the model demonstrates that financial development short values by the speed of 48.61% adjustment converge to their long-run equilibrium level every year as a result of the other explanatory variables contribution. This outcome shows GDP, inflation, FDI, stock traded value, and financial innovation are essential factors for financial development in the long term in Norway.

Findings indicate in the long term there is a positive linkage between financial innovation and financial sector development and a 1% increase in financial innovation will increase the financial development level by 0.71%. However, in the short-run, it is vise versa and they have a negative significant relationship and a 1 percent increase in financial innovation will negatively affect the financial development by 0.162%. the results indicated that new activities or new instruments can hurt or help the financial system. To answer this question that is quite related to the main aim of this thesis, the new financial instruments need research and development before applying and using and this is costly and in the short-run can increase the estimated prices of the

instruments or new financial services. Moreover, investors don't accept the risk of new financial instruments. By the time shadow prices will be sustained and this stimulates the adoption of new financial services and instruments and positively contribute to financial development in the long-run. Nevertheless, by the time they will discover and evaluate the benefits of them and this evaluation needs time. That's why in the long term has a positive influence and in the short term negative. Furthermore, the finding indicates that in the long term economic growth has a positive elastic impact on financial sector development, and inflation on the contrary with growth has a negative elastic influence on financial development. However, FDI as an essential element for financial development in this model is not significant and this can be related to intense changes in FDI net inflows in Norway. Stock traded value has a negative inelastic influence on financial development. The stock traded value represents the activities in the stock market and when it increased it means investors prefer financing through the stock market rather than domestic credit.

The Toda–Yamamoto (1995) test indicates a bidirectional causal direction of financial innovation and financial development so the effect of financial innovation is necessary to check as an essential and vital determinant for financial sector development. Also, unidirectional relationship from inflation and the stock market traded value to financial development and bidirectional causal direction of growth and financial development found as side findings of this test.

According to the results, this study strongly recommended that financial policymakers should be aware and be conscious of the effect of new financial activities and new instruments in financial systems and they need to monitor the function of them in systems. Furthermore, this study recommended, it is better for the new financial

activities or new instruments in the financial system make a trial period in the short term in the specific market, for instance, the domestic capital market to can check the effect and monitoring the function of them better and if there are any problems they can control it or adjusting that before is hurts the others part of financial systems and decrease the cost of research and development for new instruments it can help to decrease the estimated prices of new instruments. At the same time keeping the inflation rate stable and controlling to continued sustainable and increase in the gross domestic product are two factors that help and leads the financial development especially in developed countries like Norway.

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APPENDICES

Appendix A: R&D in financial and insurance activities by industry

: Research and development in financial and insurance activities by industry
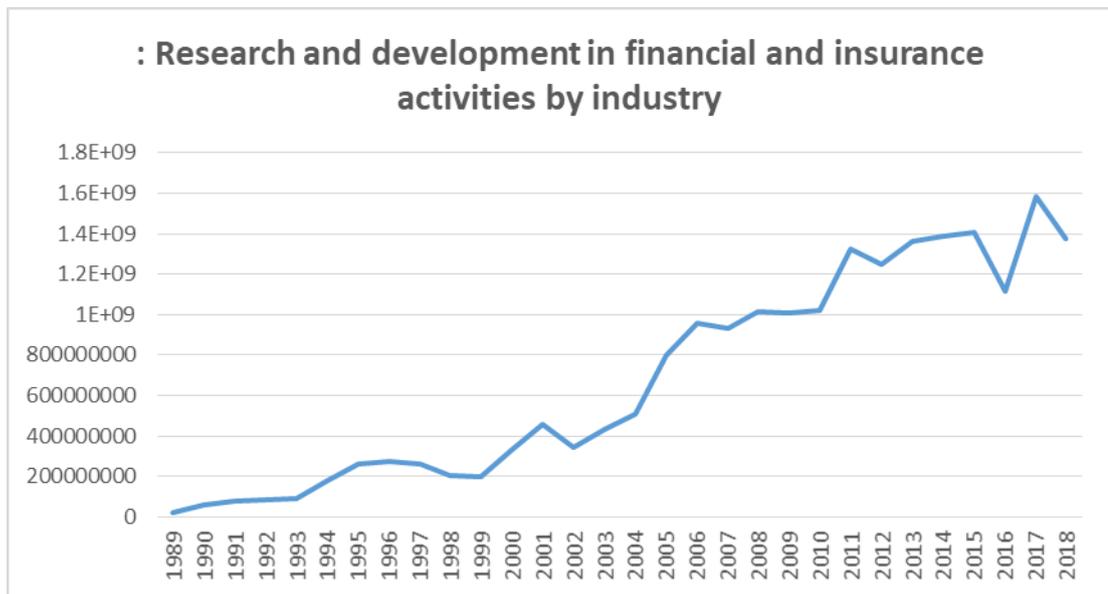
Appendix B: Domestic credit provided by the financial sector (% of GDP)

Domestic credit provided by the financial sector (% of GDP)