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Financial Emphasis

The Causal Relationship Between Stock Market Trading Volume and GDP:
Evidence from Iceland

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This work has not previously been accepted in substance for any degree and is not being concurrently submitted in candidature of any degree. This thesis is the result of our own investigations, except where otherwise stated. Other sources are acknowledged by giving explicit references. A bibliography is appended.

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Abstract

The Icelandic economy and the Icelandic Stock Exchange have endured tremendous volatility in recent years. While the Icelandic economy has made a miraculous recovery from the financial crisis in 2008, the recovery of the Icelandic Stock Exchange has been less than ideal. These conditions have created an interesting situation for investigating the linkage between GDP and stock market development in Iceland. Previous investigations have in some instances, found evidence of a linkage between stock market development and economic growth. In spite of that, limited research has been conducted on this relationship in Iceland. This paper examines the causal relationship between Icelandic GDP and stock market trading volume in Iceland, in a sixteen-year period from 1999 to 2015. Using trading volume data from the Icelandic Stock Exchange and Icelandic GDP data, a Granger-causality test was performed in order to analyze the linkage, and the direction of causality between the variables. The findings of the statistical analysis fail to indicate the direction of the causality between changes in GDP and changes in trading volume.

Keywords: Trading Volume, Gross Domestic Product, Granger-causality, Icelandic Financial Market, Icelandic Stock Exchange.
Prefix

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1. Introduction

One of the main challenges in modern economics is to identify the driving forces behind sustainable economic growth. Economic growth is conventionally measured as an increase in the gross domestic product (GDP) of a country and is generally considered an important catalyst in raising the standard of living for its citizens. Economic growth theory, in simple terms, states that in order to sustain a positive long-run growth, there must be constant advances in technological knowledge in the form of new goods, markets, or processes (Solow, 1956). In the long run, sustainable economic growth can be achieved through increased accumulation and distribution of capital throughout the economy. Capital allocation within the economy drives investment and technological advances. Financial intermediaries have adopted the role of distributing capital from the areas in the economy that have a surplus of capital, to areas where there is a shortage of capital (Levine, Loayza, & Beck, 2000).

The existing literature on the role of financial sector in the economy, has in some instances found a linkage between economic growth and the financial sector. Previous findings have shown that the development of a strong and efficient financial industry will have positive effect on economic growth. For instance Garcia and Liu findings (1999) highlight three channels through which financial intermediaries stimulate economic growth. Firstly, financial intermediaries provide investors and the public with higher yield on their investment by applying their expertise in finding good ways of allocating capital raised from investors and savers. By providing a higher yield, financial intermediaries attract more capital and thus stimulate savings. Secondly, one of the main tasks of financial intermediaries is lowering transaction costs. This can be achieved by efficiently connecting lenders and borrowers or savers and investors. In doing so, the intermediary reduces time and labor needed to perform a transaction. Lastly, financial intermediaries can increase economic growth by promoting efficient allocation of investments. This can be achieved through a number of channels including fund pooling, risk diversification, liquidity management, screening, and monitoring (ibid). Despite these findings on the role of financial intermediaries concerning economic growth, the operations of the intermediaries have developed in a different direction. This is especially apparent for the banking industry. Not long ago, banks would compete among each other for peoples’ deposits, but today’s banking industry is much less dependent on deposits for their role in capital allocation (El-Erian, 2016).

One of the form in which financial intermediaries are able to provide efficient capital allocation be via stock markets. In its simplest form, the purpose of stock markets is to raise
capital for corporations by the issuing company shares, which is then bought by investors in the stock exchange. Through the stock market, corporations raise capital for their operations and investors gain ownership in the company and a share in future profits. The development of an efficient stock market can therefore improve allocation of capital and hence increase economic growth. In recent years, researchers have investigated the linkage between economic growth and stock market development, with various results. There are a number of variables, for example; market size, liquidity and volatility, that have been used as proxies to indicate stock market development (Garcia & Liu, 1999). When stock market indexes are used as proxies for stock market development, the result has shown that the relationship is a one-way causality leading from stock market development to economic growth (Abu, 2009; Mahdavi & Sohrabian, 1991; Olweny & Kimani, 2011). The same cannot be said about stock market capitalization, as the findings of Arestis, Demetriades, and Luintel (2001) suggest. Their findings indicate a weak relationship, leading from economic growth to market capitalization. The results from these investigations underline that stock market development is a multidimensional concept and the direction of the relationship depends largely on the proxy used to represent stock market development.

Before the establishment of the Icelandic Stock Exchange (ISE) in 1985, security trading had been conducted by Kauphöllin ehf. Bonds had been the dominant security instrument in Iceland and continued to be more popular than stocks after the establishment of the ISE. Before 1985, just a handful of companies issued shares and shares rarely changed hands after initial issue (Jónsson, 2003). In 1990, the first company was listed on the ISE and by 1999 the number of listings had reached 75 total (NASDAQ Iceland hf., n.d.-c). The development of the ISE was accelerated by joining NOREX, a collaboration of Nordic stock exchanges. Following the enrollment into the NOREX alliance, ISE introduced new regulation for its operations and adopted an electronic trading system, lowering transaction costs and increasing efficiency of trading (Einarsson, 2003). After the introduction of the electronic trading system, market capitalization and trading volume increased beyond what the Icelandic market had ever experienced. In 2007, market capitalization had grown to approximately 204% of GDP and the market turnover reached a record high of 529 billion ISK in July of that year (NASDAQ Iceland hf., n.d.-c; Pétursson, 2013).

Trading volume is a simple but convenient measure of counting trades in a market. As each trade has two sides, a seller and a buyer, trading volume is half of the transaction volume. Trading volume is used to measure the relative size of stock markets as a whole or individual stocks as, for instance, the share of a market. Trading volume is often used to estimate liquidity,
where higher volume indicates more liquidity and vice versa. Liquidity is also estimated by the size of the bid-ask spread. In some stock market regulations, trading volume is used as a benchmark to estimate damages in fraud and criminal cases (Anderson & Dyl, 2005), and has also been used to indicate how investors interpret new information (Lei, 2005). In this paper, trading volume will be used as proxy for stock market development, and is meant to reflect the liquidity of the stock market.

The objective of this empirical research is to test the causal relationship between changes in GDP and stock market development in Iceland. By using trading volume data from the Icelandic Stock Exchange from January 1999 to December 2015, and GDP for the same period, this paper will attempt to answer the following questions:

- Is there a connection between economic growth and stock market development (trading volume)?
- Do changes in GDP in Iceland cause changes in trading volume on the Icelandic Stock Exchange?
- Do changes in trading volume of the Icelandic Stock Exchange cause changes in Icelandic GDP?

These three questions thus aim to detect causality between changes in Icelandic GDP and changes in trading volume on the Icelandic Stock Exchange. This means that although growth in GDP and trading volume may increase or decrease during comparable periods, this research aims to detect whether either variable drives the other variable over a longer period.

The paper is divided into several sections. The first section is a literature review, describing the findings of previous research on the subject. The second part explains the formal concept of economic growth and describes the Icelandic economy. The third part discusses the history and development of the Icelandic Stock Exchange. The fourth part explains the formal concept of trading volume. Part five and six explain the analysis and present the research results. Finally, a discussion on the findings and compare them with previous literature.
2. Literature review

2.1 The effect of the financial industry on economic growth

Over the past few decades, extensive literature has documented the connection between financial markets and economic growth. The findings of Bencivenga and Smith (1991) suggest that the development of financial intermediation, such as banks and security markets, will increase real growth rates. Their research develops an endogenous growth model that supports the common beliefs about the role of financial intermediaries in the development of the economy. These common beliefs are that 1. financial intermediaries shift savings, or capital surplus, towards areas that have shortage of capital, 2. financial intermediaries generally reduce unnecessary capital liquidation. The model assumes that savings are a fixed number of peoples’ income and are deposited into banks. Economic growth is driven by capital allocation through financial intermediaries. King and Levine’s (1993) findings align with the results from Bencivenga and Smith, and suggest that financial services stimulate economic growth by increasing the rate of capital accumulation and providing efficient allocation of surplus capital in the economy. Since allocation of capital and rate of capital growth are among the main determinants of long-term economic growth, researchers have suggested that an efficient financial system is essential for the world’s economies (Garcia & Liu, 1999). Based on previous findings, Garcia and Liu (ibid) identified three main channels by which financial intermediaries affect economic growth. These channels are; 1. provide savers with higher yield by utilizing expertise and thereby stimulate savings, 2. reduce transaction costs, and 3. improve the allocation of resources.

Abu and Karim (2016) investigated the relationship between foreign and domestic investment on economic growth in 15 Sub-Saharan African countries from 1981 to 2011. By utilizing Granger-causality tests, they were able to demonstrate a one-way directional causality from foreign direct investment and economic growth, or in other words, that foreign direct investment Granger-causes economic growth. Furthermore, their results indicated a bidirectional causality between economic growth and domestic investment.

2.2 Stock market development and economic growth

Other theoretical work has directed its attention towards the linkages between stock market development and long-term economic growth. Levine’s (1991) findings on the connection between stock market development and economic growth suggest that stock market development accelerates growth by facilitating the ability to trade ownership of firms, without
disrupting the operations of the firm, and also by providing investors with ways to diversify their portfolios. Levine proposes an endogenous growth model to support his results. The model suggests that the emergence of stock markets diminish liquidity risk and explores how the stock market creates steady growth rates by alternating investment incentives.

Stock market development is a multi-dimensional concept which is usually measured in terms of stock market size, liquidity, volatility, concentration, integration with world capital markets, and regulation (Garcia & Liu, 1999). In 1998, Levine and Zervos investigated whether or not these factors were correlated with economic growth and attempted to provide evidence on the linkage between stock markets and long-run economic growth. In their research they sampled data from forty-seven countries in six continents. Their findings suggested that both banking development and stock market liquidity are good predictors of economic growth. However, they were not able to establish the direction of the causality between the financial sector and growth.

Today it is widely recognized that financial development is crucial for economic growth. In recent years’ multiple researchers have attempted to provide evidence on the direction of the causality between the stock market and economic growth, which seems to be somewhat of a hen and egg problem as research findings have yet to confirm whether it is economic growth that causes stock market development, or the other way around.

By utilizing the Granger causality test for quarterly US data between 1960 and 1989, Mahdavi and Sohrabian (1991) found an asymmetrical relationship between the rate of growth of stock prices and the growth rate of gross national product. The results showed that the rate of growth of stock price indexes, a proxy for stock market development, Granger-caused the rate of growth in gross national product. The findings did not detect a reverse causality when observing the linkage from growth rate to the stock price index. In light of these results, the researchers concluded that fluctuations in the stock market could be utilized to predict fluctuations in economic activity (ibid). This conclusion has merit in the real world as stock markets have been shown to be a good indicator of economic downturn. This is especially apparent for stock market indexes, which, almost without exemptions, start to decrease in value just months before a downturn in the economy (Mixa, 2008).

These findings are in line with research from three developing economies that on the link between stock market development and economic growth. Firstly, Abu (2009) used an error-correction method to examine the relationship between stock market development and economic growth in Nigeria from 1970 to 2007. Abu used market capitalization, market turnover and an all-share index as proxies to reflect the development of the stock market. His
results showed a positive relationship and that the stock market development contributed to economic growth in Nigeria. The results also demonstrated that the development of stock markets could increase investment growth in developing countries. Secondly, Dep and Mukherjee (2008) found similar results in the causal relationship between stock market development and economic growth in India over an eleven year period from 1996 to 2007. They used three proxies to reflect the stock market development in India, market capitalization, real value traded ratio, and volatility, and utilized a Granger non-causality test to explore the direction of the linkage with economic growth. They found bidirectional causality between real GDP growth and real market capitalization and unidirectional causality between both stock market activity and volatility towards economic growth. These results underline what is implied by the hen and egg problem, as from their results it is difficult to establish whether economic growth causes the increase in market capitalization or vice versa. Lastly, Olweny and Kimani (2011) investigated the relationship between stock market development and economic growth in Kenya from 2001 until 2010. In their research, they used a share index as a proxy for stock market development and found one-directional causality running from stock market development to economic growth. In the concluding remarks of the article, they recommend that further work may investigate whether other aspects of the stock market such as size, volatility or trading volume will exhibit different results.

Other literature has found a weak relationship between stock market development and economic growth. The findings of Arestis et al. (2001) indicate that the stock market contributes much less than the banking sector to economic growth. Utilizing a time-series method for five developed economies (Germany, Japan, United States, United Kingdom, and France), their results indicate that there is a weak linkage between the stock market and economic growth and that this linkage suggests that economic growth leads to the development of the financial sector and the stock market. In their research, they used data from 1968 to 1998.

In 2012, Ho and Odhiambo published a paper examining the relationship between stock market development and economic growth using time-series data from Hong Kong during a period ranging from 1980 to 2010. The study used four proxies of stock market development; market capitalization, market traded value, and stock market turnover. The results indicate that the direction of the causality depends on the proxy used to measure stock market development. Using stock market capitalization as a proxy for stock market development, the results indicated a one-directional causal flow from stock market development to economic growth, in both the short run and the long run. However, when stock market turnover was used, a causal flow from economic growth to stock market development was found in both the short and the
long run, but causal flow from stock market development to economic growth was only found in the short-run. Using traded value as a proxy for stock market development failed to yield any long-run causal effect in either direction. A short-run causality flow from economic growth to stock market traded value was detected (Ho & Odhiambo, 2012).
3. Economic growth

3.1 What is Economic growth

Economic growth is the increase in the goods and services produced by an economy or a nation, over a period. A nation’s economic growth is measured in terms of increase in gross domestic product (GDP) and means that there is an increase in national output and income. The growth in production can bring benefits in the form of higher standard of living (Parkin, 2016)

In the short run, economic growth is caused by two main factors, an increase in aggregate supply (AS) and an increase in aggregate demand (AD). If there is expected, future income, inflation or profit increase, the increase in aggregate demand (AD) will cause a higher level of real GDP (ibid).

In the long term, a number of different factors may cause economic growth. Firstly, an increase in capital in the economy may cause long-term growth. As capital increases, corporations and individuals have more money available for investing. Corporations could make large investments that increase their output and thereby increase economic growth. Secondly, the reason for economic growth may be because of an increase in the working population. More people can, with some limitations, increase long-term output, causing economic growth. Lastly, increased productivity due to technological advances or development of more efficient processes can increase the output and cause economic growth (ibid)

Economic growth is usually measured in terms of annual percentage change of GDP as shown in the following formula:

\[
\text{Economic growth} = \frac{GDP_2 - GDP_1}{GDP_1}
\]

The GDP formula has four parts of measurements, that when combined are a measure of the value of total production, usually in terms of years or quarters. The following formula shows how GDP is computed:

\[
Y = C + I + G + (X - M)
\]

Y= Gross domestic product
C = total consumption by consumers
I = total investment (spending on goods and services) by businesses
G = total spending by government (federal, state, and local)
(X - M) = net exports (exports - imports)
Gross domestic product can be measured in two ways. Firstly, by the total expenditure of goods and services, or by the total income earned producing goods and services. GDP equals aggregate expenditure and aggregate income (ibid)

Production or output in an economy can grow in value through two means: more units produced or increase in the prices of each unit. Measuring real GDP, as opposed to nominal GDP, shifts the focus from growth caused by inflation to growth through increase in production or output only (Parkin, 2016). Because real GDP removes the effect of price increases on growth in output, it is often referred to as, "constant price" or "inflation-corrected" GDP. Because nominal GDP includes inflation, it is generally higher than real GDP (Staff, 2004).

3.2. Theories, how is the economy measured, and how does it grow?

"Theory is something that is based on an assumption that is not quite true. To make a successful theory one has to make an unavoidably simple assumption so that the final results are not that sensitive. But it is still crucial that the assumptions are realistic."

Robert M. Solow, 1956

How does an economy or a nation keep increasing its GDP so that the economic growth trends upward? The three most prominent theories in the search for that answer are the classical -, the neoclassical -, and the modern day theory.

3.2.1 The Classical theory of economic growth

The classical theory of economic growth is a combination of work of Adam Smith, David Ricardo and Tomas Robert Malthus. They were the some of the leading economists of the eighteenth and nineteenth centuries. Adam Smith stated, the level of output per human or worker, as well as the growth of output, must be regulated by nations in two different circumstances. First by the skill, intelligence, and judgment, with which its labor is equipped. Secondly, by the proportion between the number of those who are employed in useful labor and of those who are not (Parkin, 2016)

According to Smith, there are three major sources of economic growth. First, economic growth is powered by growth in the labor force and accumulation of capital. Secondly, improved efficiency by which capital is allocated to labor through greater division of labor and technological progress. Lastly, growth can be achieved by increased foreign trade that expands the market and contributes to the other two sources of growth. Once the growth progress has begun, it becomes self-reinforcing in the progressive state. With capital accumulation, the
demand for labor rises and the growing labor force is absorbed into productive employment (ibid).

The division of labor is limited by the extent of the market. When the market for labor is very small, workers lack incentives to dedicate themselves to one corporation or employment entirely. With a larger labor force and lower demand for human capital, workers tend to dedicate themselves to employers. The specialization of labor increases wealth, which causes a widening of the market, empowering further division of labor. Smith further stated that growth could be encouraged through extension of the market institution and competition. This could be possible if capital accumulation, division of labor and foreign trade were sources of a nation’s economic growth (Meier & Rauch, 2000).

3.2.2 Solow neoclassical growth model
Solow neoclassical growth model is among the best-known model of economic growth worldwide. It is based on the Harrold-Domar growth model that uses national savings ratio and capital-output ratio to explain how investments leads to increased economic growth. The Solow model introduces two additional factors, labor and technology, to the economic growth equation (Todaro & Smith, 2003). The Solow model is built on two equations, a production function, and a capital accumulation function. The production function describes how inputs combines to produce output. According to the traditional neoclassical growth theory, output growth results from one or more of three factors: increase in labor quantity and quality (through population growth and education), increase in capital (through saving and investment), and technology advancements (Jones, 1998).

A closed economy, that has low levels of the previously mentioned factors, will experience slower economic growth than closed economies with high levels of output growth from these three factors. Open economies are also subject to these factors but experience income convergence at faster pace when capital flows from rich countries to poor countries, where capital-labor ratios are lower (ibid).

3.2.3. Modern day theory.
The modern day theory was developed by Paul Romer during the 1980’s and is based Joespeh Schumpeter’s ideas from the 1930’s and 1940’s. This theory is based on modern day growth questions, for example, "why is the world richer then it was a few centuries ago?" And "why do some nations grow more than others?" It states that real GDP per person grows because of
choices people make in the pursuit of profit and that growth will persist indefinitely (Todaro & Smith, 2003).

According to the growth theory, growth depends on how many people are working on or developing new technology and how effective their development is. The driving force behind technological development is profit. The forces of competition to diminish profits, in order to increase profits, companies constantly seek to either use lower-cost methods of production, or develop new and better products that people are willing to pay a higher price for. A key role in the new growth theory is that discoveries are a public capital good and that knowledge is a capital that is not subject to diminishing marginal returns (ibid).

3.3. The Icelandic economy
Iceland is the second largest island in Europe and the third largest in the Atlantic Ocean (The Central Bank of Iceland, 2016). As of January, 2016, the population of Iceland is approximately 332,000 (Statistics Iceland, 2016). The nation has one of the highest life expectancies in the world, where the average age is 84 years for women and 81 years for men. The country is a constitutional republic with a multiparty parliament system of government (The Central Bank of Iceland, 2016). Iceland’s economy is an open, developed economy that operates under the Nordic model, combining a free market economy with a welfare state. It guarantees its citizens access to health care, education and a relatively high standard of social security. The Icelandic economy is the smallest within the OECD with annual GDP of around 16,7 billion USD (calculated with ISK/USD 125,75 average for 2015) or 2,205 billion ISK in 2015. That is equal to 1/5000th of the global economy. The county is among the top ranked in GDP per capita comparison (Ólafsson et al., 2016).

In the first half of the 20th century, Iceland was one of the poorest countries in Western Europe. However, in the last few decades this has changed dramatically and Iceland now has one of the world’s highest standards of living. Iceland’s ranking slipped a few places after the financial crises in 2008, but has risen again since the year of 2013. In 2016 Iceland’s GDP per capita ranked 22nd globally. Small open economies like in Iceland are often more volatile than larger economies. Because of that, Iceland has experienced a lot more change in its economic growth than most other developed counties, in both historical and recent terms (ibid).
3.3.1 Economic growth in Iceland, historical overview

The Icelandic economy has gone through significant changes in the past two decades. Since 2000, the Icelandic population has seen the quality of living improve for the better but growth has been volatile and improvements have taken places through big sudden jumps rather than gradually. One can say that Icelandic economy has been through some kind of a roller-coaster ride since 2000, making the future movements in the Icelandic economy more difficult to predict (Greiningardeild Arion banka, 2017). Figure 1 shows the changes in GDP in Iceland between 1991 until 2015.

![Economic growth graph](image)

*Figure 1: Economic growth and subtraction in Iceland from 1991 – 2015 (Source: Hagstofa Íslands, nd.).*

In the last few years, Iceland has experienced a booming recovery in its economy, greater than its neighboring countries and high-income countries in general. Iceland owes this recovery mainly to very favorable external position, in particular through the tourism industry. (Ólafsson et al., 2016).

Since 1990, the quantity of fish exports, Iceland’s main export industry, have remained relatively stable. The success of the Icelandic fishing industry is often contributed to the quota system which was established in 1984 to insure the sustainability of the industry (OECD, 2015). Historically, the Icelandic economy has been relatively simple, relying mostly on fish and agriculture, with fish being the main export good. For example, in 1995, exports from fisheries amounted for approximately 50% of exports. However, in past two decades additional export sectors have been gaining momentum, i.e. tourism, and the aluminum and silicon sectors (Ólafsson et al., 2016). In 2015, consumption amounted for 50.1% of total gross domestic product, lowest portion of GDP since measuring started in 1945. While consumption decreased after the crisis, exports in Iceland have increased. In the period between 2011 and 2015 exports
portion of GDP has been over 50%, the highest ever measured. This is largely due to the increase of revenue from the service sector in relation to increased tourism, with approximately 32% of total exports (Hagstofa Íslands, 2016; Ólafsson et al., 2016).

When examining Icelandic economic performance, international trade plays an important role. Because of the small size of the economy, it cannot meet all the demands of its citizens and is thus heavily dependent on imports. Before the financial crisis occurred, Iceland had a large trade deficit, which was financed through external debt. Due to high interest rates, foreign investors found it quite attractive to lend money to the Icelandic economy (Ólafsson et al., 2016).

Unemployment in Iceland rose from 1% to 8% in the aftermath of the financial crises. Since 2009 the unemployment has been on the decline, but has yet to reach its pre-crisis levels. In 2016 the unemployment rate in Iceland went down to 2.3%, and is now close to Iceland’s natural unemployment rate (GAMMA, 2016). Iceland is starting to experience a shortage of human capital in some industries, e.g. construction where multiple tourism and real estate projects are taking place (Ólafsson et al., 2016).

3.3.2 Monetary policy
High inflation has long been a concern in Iceland, due to the volatility of the economy. The cross-selection relationship between inflation and growth is unclear. Although, it is clear that there is a correlation between high inflation and low growth, the end of high inflation crises is correlated with high growth (Bruno & Easterly, 1998). This trend can be seen in figure 2.

![Figure 2: The relationship between economic growth and inflation of the Icelandic economy in 1991-2015 (Source: Hagstofa Islands, n.d.).](image)
After applying various forms of exchange rate targeting monetary policies in 2001, the Icelandic Government decided to convert the monetary anchor to inflation and the Central Bank got tasked with the goal of keeping inflation at 2.5%, with certain bands of deviation permitted. However, since the adoption of the policy the inflation rate has usually surpassed the Central Bank's target with an average inflation of 4% since 2001. When the Icelandic krona falls in value, the imports of foreign goods rises in price causing inflation. In the year after the financial crisis in 2008, the krona fell by 50% with inflation reaching 18.6% at the peak of the recession. After the adoption of capital controls, the implementation of an inflation targeted monetary policy has been more successful with inflation remaining below 2% since 2014 (ibid).

3.3.3 Privatization, boom and burst

In 2003, the privatization of the state-run banks was completed. That marked the real beginning of the rapid growth the banks would experience in the following years. The economic growth in the following years was fueled by the increasing size of the Icelandic banks. The newly privatized banks took advantage of easing conditions in foreign capital markets, and favorable credit ratings that they acquired after privatization, to borrow abroad, funneling the funds into foreign loans to local homes and businesses. Icelandic borrowers were eager to take out loans in foreign currency to take advantage of lower interest rates. The easy access to capital drove the banks into aggressive lending (Sigurjonsson & Mixa, 2011). This lending spree was, among the factors, what drove economic growth in first decade of the twenty-first century or until the collapse of the financial system in 2008 (ibid).

In 2008, when the fragile conditions of foreign capital markets became more evident, trust was dwindling and appetite for risk with it, foreign investors wanted to pull back their investments from Iceland resulting in larger-than-normal flows of capital from the country. This again put strong downward pressure on the exchange rate of the Icelandic Krona (Ólafsson et al., 2016). After the crash in October 2008, the Icelandic economy suffered a currency and systematic crisis of extraordinary proportions. The capital controls were imposed November 28th, when an addition was made to the Foreign Exchange Act, allowing the Central bank of Iceland to set rules that would limit cross-border capital improvements. The main reason that the capital controls were established was to place a temporary restriction on specific types of cross-border capital movements and foreign exchange transactions. This was to prevent monetary and exchange rate volatility, while the Icelandic economy and financial system recovered after the crash. The capital controls played a crucial part in attaining and securing
the stabilization of the exchange rate. Furthermore, the capital controls ensured economic stability and restrictions in the financial sector (Central Bank of Iceland, 2016). Over the past few years the capital controls have had a large impact on the Icelandic economy, for example, the capital controls reduced the attractiveness of Iceland as an investment option for foreign parties and limited activity on the Icelandic Stock Exchange (Oddsson et al., 2011).

One of the biggest flaws of capital controls is that they are haltering for activity and economic growth. They can have restricting effect on the stock market and restrain foreign investment. There are many other factors besides the capital controls that have had an effect on investment in Iceland over the last few years, for example; financial reorganization, economic situation of households, the financial crisis, increased political risk, and unemployment (ibid).

In October 2009, the first step to dismantling the capital controls was taken. When the Central Bank of Iceland allowed for an inflow of foreign currency for new investments and outflow of currency that could originate from that investment. By that time offshore and onshore rate were almost equal, which indicated that boycotting the capital controls was possible. That led to the strengthening of the Icelandic krona, opposed to the former trend of a depreciating currency. New plan of abolishing the capital controls was presented in 2011 (ibid).

In 2015, the Icelandic government introduced a policy changes that were intended to dismantle the capital controls. The dismantling process consisted of two steps. The first step was initiated immediately following the policy changes. The second step of the process was initiated in 2017 and the capital controls were mostly dismantled in March 2017 (Fjármála-og efnahagsráðuneytið, 2017).

4.1 The establishment of a stock market

The Icelandic Central Bank in association with the Icelandic commercial banks and security houses established the Icelandic Stock Exchange (ISE) in 1985. The exchange was located on the Central Bank’s premises and the Central Bank handled operations and administrations. The establishment of the stock exchange in 1985 was an important step in security trading in Iceland. The newly established system enabled members of the Icelandic exchange to buy and sell securities without consulting the counterparty to the transaction, which previously had not been possible (Kristinsson, 2002).

Security trading in Iceland had previously been conducted by Kauphöllin hf., which had been established in 1934. The main financial instrument trading conducted by Kauphöllin hf. was bond trading (ibid). In the first years of operations, bonds were the dominant financial instrument being traded on the Icelandic Stock Exchange and it wasn’t until 1990 when the first listed equity stocks started trading on the exchange.

Securities exchanged on secondary markets in Iceland were next to nothing before 1990 (Einarsson, 2003). Individuals that held equity shares in Icelandic corporations had little hope of selling them, even stocks of well-known and established Icelandic companies (Jónsson, 2003). Many factors contributed to the illiquid and unappealing stock market for investors, one of which were tax regulations. The tax regulations before 1984 encouraged corporations to finance their operations with short-term loans. Banks offered low interest rates and corporations had no incentives to finance their operation with stock issuing (Magnússon, 2007). Other factors include shortage of domestic capital and various outdated traditions in the operational environment. Examples of some of those traditions include low dividend payments, substandard regulations on secondary markets, and low requirements for informational transparency (ibid). Inflation may also have contributed to the illiquid securities market between 1980 and 1990. The yearly average inflation was approximately 34% for the period. After 1990 the average yearly inflation declined to 3% and the lower inflation level may have contributed to the increasing interest in the security market (Einarsson, 2003).

During the 1980’s and 90’s, critical changes were made in order to create a better environment for investors and corporations. In 1984, the government changed the tax regulations. The new regulations allowed individual investors to deduct stock investment, up to a certain limit, from their income tax. The tax discount effect on the market was limited for the first few years or until 1989, when the number of individuals investing in stock increased
substantially. The tax discount was abolished in 2002 (Magnússon, 2007). Another large contributor to the development of the ISE was the privatization of corporations in various industries, including banking, telecommunication, and energy, that had previously been government owned (Guðjónsdóttir, 2000).

4.2. Icelandic Stock Exchange
In 1990, the first corporations were listed on ISE. Olís, the oldest oil company in Iceland, was the first publicly listed company on the ISE and public trading started the following year. Subsequently, the number of corporations listed on the ISE increased gradually (Magnússon, 2007). In 1995, just under 30 companies were listed on the exchange, most of which came from the transportation, oil and fishing industries (Guðjónsdóttir, 2000).

In 1994, Iceland became a member of the European Economic Area (EEA). The regulation surrounding the Icelandic financial sector today is largely based on the directives and regulations of the European Union, including regulations on financial markets, financial institutions and financial supervision. The main purpose of the EEA collaboration is to eliminate trade restrictions on services and capital allocation within EEA affiliated countries (Efnahags- og viðskiptaráðuneytið, 2012).

Trading volume on the ISE was relatively low between 1992 and 1998. During that period, the number of publicly traded companies increased from 11 to 67. According to Elín Guðjónsdóttir (2000), it is not uncommon for trading volume of a young market to increase due to the development of factors that affect market efficiency. Among the factors that were contributing to the low trading volume were high transaction costs, over-the-counter trading, little speculative trading, shortage of foreign investment and shortage of company privatization (ibid). In 1999 trading volume increased significantly and never before had more companies been listed on the ISE or a total of 75 companies (Einarsson, 2003; Guðjónsdóttir, 2000).

4.3. NOREX Alliance
The board of the Icelandic Stock Exchange realized that in order to further develop the Icelandic Stock Exchange, they would need to attract foreign investment. In the years leading up to 2000, the market had grown considerably with the introduction of newly listed companies and growing interest from individual investors. The ISE was also facing another problem in that Icelandic investors where increasingly moving capital away from ISE and into foreign investments. The board knew that in order to keep the market balanced it would have to
increase the amount of foreign investment by finding ways to make the Icelandic market competitive on a global scale. That would however only be possible if the infrastructure and regulations were consistent with international security exchanges (Guðjónsdóttir, 2000).

In 2000, the ISE became a part of NOREX, a collaboration of Nordic stock exchanges, which included the Danish and Swedish stock exchanges. NOREX was established with the objective of strengthening the Nordic security exchange markets in order to attract international investors and increase competitiveness (ibid). With the admission to NORDEX, the ISE gained access to foreign markets and was introduced to the NOREX trading system, SAXESS. The trading system made the Icelandic secondary market more efficient and more attractive to foreign investors (ibid).

The admittance into NOREX was a significant stepping-stone in the development of the Icelandic security market. With the involvement in the NOREX collaboration, the demands on listed Icelandic companies to disclose information increased along with other demands of standardization of processes. Regulations on information transparency were now comparable with the demands of other Nordic security exchanges that were members of NOREX. The newly established demands increased credibility in the Icelandic securities market and contributed to lower transaction costs (Einarsson, 2003).

The introduction of SAXNESS, NORDEX trading system, improved foreign access to information about listed Icelandic companies (ibid). The SAXNESS trading system was a powerful trading system that had the capabilities to process in the excess of 2,000 transactions per second (Kristinsson, 2002). The limited access to information had been a restrictive force in the development of the Icelandic Stock Exchange, but access to information is a key factor in the health and development of securities market (Einarsson, 2003).

Despite the improved market environment for both Icelandic and foreign investors, a few of the listed Icelandic companies were discontent with the increased demand of information disclosure. Their claim was that increased information on their operations would upset their competitiveness, because only a few companies in their sector were publicly listed. The unlisted companies would therefore have access to information that could strengthen their position. Also, some of the listed corporations where unhappy about the expenditure involved with being publicly listed (ibid).
4.4. Booming years

After the introduction of NOREX in 2000, the number of companies listed on the ISE stayed level to the previous year. The market capitalization did, however, continue to grow and reached approximately 400 billion ISK, with a market turnover of around 200 billion ISK (Jónsson & Gunnlaugsson, 2004). In the years that followed there were many company de-listings from the exchange and the number of companies reduced drastically. The most de-listings were in 2003 when a total of 18 companies de-listed their stock from the Icelandic Stock Exchange. The most common reason for these de-listings were mergers and acquisitions of listed corporations. Another possible reason for the de-listing of corporations was the increased information disclosure requirements that followed the introduction of the NOREX alliance. Listed companies were afraid that the disclosing of sensitive information could weaken their competitiveness against non-listed companies that were not required to disclose information publicly. In 2003 the number of listed corporations had dropped to 48 (NASDAQ Iceland hf., n.d.-b). Despite the decline in listed corporations the market capitalization continued to increase and by year end 2003, the market capitalization had reached 659 billion ISK and the market turnover was 554 billion ISK (Jónsson & Gunnlaugsson, 2004; NASDAQ Iceland hf., n.d.-b; Pétursson, 2013).

This trend of concertation and reduction of listed companies continued until 2007 when for the first time since 1999, there was an increase in listings. In 2006, 22 companies were listed on the Icelandic Stock Exchange. They then increased to 28 the following year. Since the start of the reduction of listings in 2000, the market capitalization increased from 397 billion ISK to 2,400 billion ISK, even reaching 3,700 billion in the first quarter of 2007 (Pétursson, 2013). During the same period the ISE experienced substantial fluctuations in market turnover, however there was an increase in the overall turnover. The market turnover peaked at 529 billion ISK in July 2007, which was close to the total stock market turnover in 2003. A substantial portion of the July 2007 turnover can be explained by the sale of Actavis group (Hreinsson, Benediktsdóttir, Gunnarsson, & Rannsóknarnefnd Alþingis, 2010).

By the end of 2007, the market capitalization had grown to approximately 204% of GDP. This was relatively large compared to the US (144% of GDP) and the UK (140% of GDP) (ibid). It is generally accepted that if the market capitalization to GDP ratio exceeds 100% the market is overvalued (Hreinsson et al., 2010; Investopedia, n.d.). This gives an indication of how overvalued the market had become. In 2016, this ratio was approximately 41% (NASDAQ Iceland hf., n.d.-a). According to an investigative report from the Icelandic parliament (Hreinsson et al., 2010), it is difficult to argue that foreign investment was
the reason behind the increase in market capitalization and evidence from this period suggest that the growth in stock prices was powered by increased leveraging of stock investors. This may also explain, to some degree, the increase in market turnover. The report further states that leveraging for stock investments was relatively uncommon before 2003 but increased substantially in the following years leading up to the financial crisis (ibid).

In 1993, Íslandsbanki, was listed on the ISE. For a few years, Íslandsbanki was the only major Icelandic bank listed on the stock exchange, but that changed when Landsbankinn and Búnaðarbankinn were listed in 1998 (NASDAQ Iceland hf., n.d.-b). In 2000, Íslandsbanki and FBA, an Icelandic investment bank, merged under the name Íslandsbanki-FBA. Both companies had been listed on the stock exchange before the merger and were re-listed under the Íslandsbanki-FBA name after the merger (Íslandsbanki, n.d.). The same year, Kaupþing Bank was listed on the ISE. Kaupþing Bank and Búnaðarbankinn merged in 2003 and listed under the same name after the merger. In 2006, the Íslandsbanki-FBA changed its name to Glitnir Bank. The same year, Kaupþing was listed, being the last of the three big banks to be listed on the ISE (NASDAQ Iceland hf., n.d.-b).

In 2006, the three banks (Landsbankinn, Kaupþing and Glitnir) accounted for under 15% of the entire trading volume on the ISE. In the following years, that portion increased significantly, and the banks became a substantially larger part of the total trading volume. At their peak in 2008, the banks accounted for just over 70% of total trading volume on the ISE (NASDAQ Iceland hf., n.d.-c). The increase in the combined trading volume of the three banks, as a portion of total trading volume, in the period between 2000 and 2008, can be seen in figure 3 (see Appendix A for further details).
Figure 3: The proportion of the three big banks, of total trading volume on the ISE between 2000 and 2008 (Source: NASDAQ Iceland, n.d.).

4.5. Fall of the Icelandic Stock Exchange

In October 2008, the Icelandic economy collapsed and the ISE took a severe blow as the currency depreciated and market capitalization tumbled. According to Páll Harðarsson (2014), the Icelandic market took the hardest hit of all stock markets worldwide in the financial crisis in 2008. The losses investors faced were unheard of as market capitalization took a dive from 2,570 billion ISK in 2007, to 207 billion ISK by end of year 2009 (NASDAQ Iceland hf., n.d.-a). The shareholders of Glitnir, Kaupþing and Landsbankinn lost around 13 billion USD or around 2/3 of Iceland’s GDP. However, losses for the creditors of the banks amounted to approximately 60 billion USD, or four-fold the GDP of Iceland (Harðarsson, 2014).

The effects of the financial crisis were international and although arguments can be made about the crisis being the result of a global credit crises, there are stronger arguments that the effect of the financial crisis in Iceland would have been smaller had there not been for the negligent behavior of the banks themselves (ibid).

The number of listed companies on the ISE dropped significantly following the crisis. At the end of year 2007, the number of listed companies was 30. By the end of year 2009, the number of companies that were left on the stock exchange was 13 in total (NASDAQ Iceland hf., n.d.-b). Before the crisis, trading volume and number of transactions had reached record numbers. After October 2008, trading volume and transactions disappeared almost entirely, this can be seen in figure 4. The 25th of July 2007 was excluded from the figure because of abnormally high trading volume caused by the acquisition of Actavis group.
In the years, leading up to the crash, the Icelandic public, government, and investors were in cloud nine. The Icelandic economy had become more open, foreign debt increased, and Icelandic banks promoted a higher standard of living through increased leveraging and quick cash boost from the stock market. At the start of 2008, banks where optimistic about the future prospects of the stock market, predicting a rise in the Icelandic stock index and issuing a buy recommendation on all listed financial firms (Mixa, 2009). This, as history has shown, turned out to be bad investment advice. The boom period of the Icelandic stock market ended with a sudden burst, and the stock market that had taken decades to build, was wiped out in just a few days.

4.6. Rebuilding the stock exchange
The collapse of the Icelandic financial system had substantial effects on the Icelandic community, most of them are beyond the scope of this paper. One of the most severe effects on the financial sector was total loss of trust from the Icelandic public, as trust is among the most important pillars of a well-functioning security market. The crises raised fundamental questions about the legal framework surrounding the financial sector. The Icelandic parliament revised several laws as a response to public demand for higher degree of governance and legislation for the financial industry. The crisis highlighted the importance of good corporate governance policies for corporations (Harðarsson, 2014).

Páll Harðarsson, the president of the Icelandic Stock Exchange, talked about how the financial crises had effected the Icelandic equity market and the steps to rebuild the stock market in his speech for the “Better Finance” conference in 2014. Harðarsson (2014) remarked that since the collapse of the stock exchange, NASDAQ OMX Iceland had actively promoted

Figure 4: Trading volume from January 2007 to December 2009 (excluding the Actavis sale in July 2007) (Source: NASDAQ Iceland, n.d.).
measures to create a best-in-class stock market framework in Iceland, in order to reclaim the previously lost goodwill. The ISE had increased its surveillance activities through active communication with issuers of stock and traders. ISE has received great benefits from the NASDAQ OMX Group affiliation, in regards to regulations and best practices (ibid).

Important steps were taken by the government in order to rebuild the financial market and to regain the trust that was lost because of reckless behavior from bankers prior to the crash. One of the more drastic steps that the government took was to re-establish capital controls that had been abolished in 1995, because of Iceland enrollment in the EEA. The capital controls had the effect of locking in foreign capital, in order to keep it from weakening the currency even further, when foreign investors removed money from the economy. The capital controls where intended as a short-term measure in order to prevent the complete crash of the Icelandic krona (Balduðsson & Portes, 2013). By locking in domestic capital, the Icelandic government increased the risk of an asset bubble, and foreign investment was harder to attract. The lack of foreign investment weakens the market and eliminates the possibility for corporations to raise domestic capital for expansion abroad (Harðarsson, 2014).

Although, the capital controls have been important for the survival of the Icelandic krona, it has had significant effects on the rebuilding of the stock market. Under the capital controls, the stock market has only been able to support corporations that rely entirely on the domestic market for its operations, with the notable exceptions of Marel, Óssur and Icelandair. Since the collapse, companies with operations outside Iceland have avoided listing on the stock exchange, as they could not use the raised capital for expansions abroad (ibid). Another direct result of the capital controls was the increased influence of pension funds on the ISE. The capital controls limited opportunities for pension funds to invest abroad and forced the funds to invest on the ISE. Collectively, the pension funds bought a significant portion of shares in most of the ISE listed companies, holding direct or indirect ownership in around 43% of listed shares in 2013. This has its advantages and disadvantages. One of the advantages is that the Icelandic public held an indirect ownership of a large portion of listed companies. On the other hand, market efficiency could have been effected by the size and influence of the pension funds. Despite these effects, it is clear that the recovery the ISE has made since the financial crisis is, in some part, contributed to the influence of the pension funds (Jónsson & Sigurgeirsson, 2014).

After the crash, the concept of the stock exchange as a platform to help small companies raise capital was lost and small Icelandic companies generally do not consider listing on the stock exchange a viable option. The first company listed after the crash came in December 2011, when Hagar, a leading Icelandic retailer, was listed (ibid). The number of listings
gradually increased and in the end of 2016, the number of companies listed was 21 (NASDAQ Iceland hf., n.d.-b). The Icelandic Stock Exchange is now well on its way to recovery, as market capitalization has gradually increased along with the trading volume that had been next to nothing since the crash. The development of the market capitalization and the increased trading volume in the post-crash era, from 2009 to 2016, can be seen in figure 5.

Figure 5: The end-of-year market capitalization and trading volume on the Icelandic Stock Exchange after the financial crisis (2009 to 2016) (Source: NASDAQ Iceland, n.d.).
5. Trading Volume

5.1 Defining trading volume
One way of defining trading volume is the number of shares transacted each day. For every bought share, there has to be a seller, therefore trading volume is one-half of the number of shares transacted. Stock markets report information about the trading volume at the end of each market day. The total volume in a given business day indicates the total number of shares transacted on that day, but trading volume can also be found for individual stocks. The reporting of trading volume suggests that information on volume data has some value for securities investors (Chan, 2000).

In an article by Anderson and Dyl (2005), the importance of measuring trading volume and in particular consistent measurements of trading volume are listed. Firstly, many inter-firm and inter-market comparisons involve the use of trading volume. Different securities can be evaluated in terms of its liquidity and trading volume can be used as a proxy for liquidity in these evaluations. Investment strategies can also involve trading volume data, for example, when an investment manager limits the position of the fund to a certain percentage of average trading volume. Secondly, Securities and Exchange Commission rules are couched in terms of trading volume, at least in the US. For example, SEC rules limit the sales of securities of insiders by either one percent of shares outstanding or the average weekly trading volume in the security in question. Thirdly, accurate trading volumes measures are a requirement for litigation in fraud lawsuits. Trading volume can be used to estimate economic damages in white-collar crimes involving listed corporations. Lastly, trading volume is frequently used in financial and economic research.

Previous literature points out two probable theories for what trading volume indicates to the investor. On one hand, trading volume is one of the most widely used proxy for measuring liquidity, and on the other hand, trading volume may reflect investors sentiment, or how investors interpret new information (Lei, 2005). The following chapters will explain the difference between these theories regarding the information contained in trading volume.

5.2 Investor Heterogeneity
A famous saying among investors is that trading volume is heavy during bullish markets, or in other words, when investors are optimistic about the future prospects of the stock market. On the contrary, volume is expected to be low during periods of little optimism amongst investors, or bearish markets (Karpoff, 1987). Individual investors may have different interpretations of
new information and therefore investors can be either bullish or bearish about their expectations of market or stock prospects (Atiase, Ajinkya, Dontoh, & Gift, 2011). Bullish investors want to raise their positions in the market, or the stock, that they are optimistic about, thus increasing trading volume. In a bearish market, investors do not want to get into the market or make investments and this will result in low trading volume (ibid).

Trading volume is said to reflect the changes in the expectations of individual investors (Beaver, 1968). If this assumption holds, it could hold great value for market participants. Beaver argues that although a piece of information regarding a particular stock may not affect the market price, it may affect expectations of individual market participants. Changed expectations of individuals would result in a shift in portfolio position and increased trading volume of security markets. Information about investor sentiment is therefore likely to be found in trading volume (Lei, 2005). If investors’ attitude towards a corporation is positive, or they are optimistic about the future prospects of the company, they are more likely to invest in those corporations. Irrational behavior of investors has been heavily researched and is generally accepted to have great influence on the stock market. This effect could result in abnormal trading volume in either direction, based on whether the opinion of the investor is positive or negative (ibid).

5.3 Liquidity
Another saying on Wall Street is that: “It takes volume to make prices move” (Karpoff, 1987). Numerous academic journals have documented the relationship between price and trading volume. Karpoff makes two assumptions regarding the relationship between prices and trading volume. These assumptions apply for markets where short positions are costlier than long positions. The assumptions are that there is correlation between trading volume and changes in stock prices, and that trading volume is higher when prices increase than when prices decrease.

The concept of liquidity can be easily recognized by investors, especially for investors that experience a lack of liquidity in stocks or illiquid markets. Broadly speaking, liquidity refers to the ability of market participants to trade quickly and easily at prices that are in accordance with supply and demand conditions. Furthermore, liquidity is often described by the depth, width, and resiliency of the market. Despite the importance of liquidity to financial markets, the concept is vague and not easily defined (Chan, 2000). Liquid markets increases the attractiveness of financial assets to investors. With liquid markets, investors can be relatively sure of not losing access to their capital, as they would when markets are illiquid.
Investors generally prefer to be able to convert their financial assets into cash quickly, easily and cheaply. Investors may even be willing to invest their capital for longer periods if they are confident that they will be able to convert their assets into cash at a future time. Liquid markets also provide corporations with a permanent access to capital through equity issuing (El Wassal, 2013).

Due to the vague concept of liquidity, researchers tend to disagree on the appropriate measurement of market liquidity. The two most commonly used proxies are the bid-ask spread and trading volume (Chan, 2000). Liquid markets have low transaction cost and the market impact of a transaction is small. Transaction costs are captured in the bid-ask spread between selling prices and buying prices of securities and explicit components such as brokerage commission. Market impact is the effect that a transaction has on the price of a security. A thin market is a market with low number of buyers and sellers, which results in few transactions, volatile prices, and large bid-ask spreads. In a thin market a single buy order will most likely drive the ask price up, even if the order is small. However, in a thick market with many sellers and buyers, a single order will usually not have a significant effect on the asset price (McLaren, 2003). An accurate measurement of market thickness is yet to be developed, but trading volume, if not abnormal, tends to give a reasonable measurement for market thickness and liquidity.

The primary purpose of a security market is to allocate capital from those who have a surplus of capital, to those who are in need of extra capital. In order to maximize its service for the economy, the development of the stock market is crucial. Stock market development is reflected in the quality of service it provides and the growth of the stock market. These factors complement each other and are important for establishing a well-developed market to serve the economy. For a stock market to grow, the size and liquidity of the market needs to increase. As the size of the market increases and more market participants get involved, the efficiency of capital allocation increases (El Wassal, 2013).

A number of proxies can measure the development of a stock market, including market capitalization, number of listings, services it provides, liquidity, and so forth. Liquidity refers to investors’ ability to convert securities into cash at a price that is similar to the price of the previous trade, assuming ceteris paribus or that no information has affected the price since the previous sale (Sharpe, Alexander, & Bailey, 1999). Liquidity plays an important role in asset pricing, market efficiency and corporate finance. Although previous research does not question the importance of liquidity in security markets, the appropriate proxy for measuring market liquidity is often disputed. A number of studies have suggested that transaction costs (bid-ask
spread), or measures derived from daily return and volume data, are appropriate proxies for measuring liquidity (Goyenko, Holden, & Trzcinka, 2009).

Liquidity has been used as a proxy for stock market development in multiple academic investigations on the linkage between stock market development and economic growth. In a research conducted by Ho and Odhiambo (2012), liquidity proxies such as traded value and market turnover were used to identify the causality between stock market development and economic growth in Hong Kong between 1980 and 2010. Using liquidity proxies, the results showed that there was a connection between stock market development and economic growth.

The following sections of the paper will explain and conduct a statistical analysis of the linkage between economic growth and the stock market, using trading volume as a proxy for stock market development.
6. Research method

This section examines the linkage between Icelandic gross domestic product (GDP) and the trading volume of stocks on the Icelandic Stock Exchange. A Granger-causality test was used to examine the direction of causality between the two factors. The method used was based on the methodology of Abu and Karim (2016), who explored the linkage between foreign direct investment, savings, investment and economic growth. In their study, they utilized the Augmented Dickey-Fuller test to check whether the variables were stationary or non-stationary. Furthermore, a VAR lag order selection was performed to estimate the optimum lag length. Lastly, their research used a Granger-causality test to find the direction of the cause between the variables.

6.1. Data

This study focuses on the Icelandic economy, spanning a period from January 4th 1999 to end of year 2015. This period was chosen as it marks the beginning of the alliance between the Icelandic Stock Exchange and NOREX collaboration, and the newest gross domestic production data available at the time of the research.

The daily trading volume data was retrieved from NASDAQ Iceland and Icelandic GDP data was retrieved from Statistics Iceland (í. Hagstofa Íslands). The stock market trading volume data was the daily trading volume over the period but the data on GDP was only available on a quarterly basis. Furthermore, the data on GDP was retrieved in constant prices in order to measure the true growth of GDP. The dataset excludes weekdays and major Icelandic holidays where markets are closed. To avoid excluding any daily fluctuations in the trading volume, the GDP data was modified. This was achieved by assuming that GDP grows linearly during each quarter or by the same amount each day for the entire quarter. The quarterly GDP will therefore be divided by the number of trading days in each quarter, as can be seen in the following equation:

\[
\text{Linearly growing GDP} = \frac{\text{Quarterly GDP}}{\text{Number of trading days in the same quarter}}
\]

To perform the test the variables, GDP and trading volume, were used in log terms, as was done in the study of Abu and Karim (2016).
6.2. Unit root test

In order to be able perform the Granger causality test with acceptable certainty of the right outcome, a test of stationary must be performed. This is important for studies that use time-series data, since time-series data can cause exogenous variables to imply that they are more significant than they truly are, if they correlate with the endogenous variable. This statistical evidence can be misleading and is called a "Spurious Regression", a strong relationship between one or more variables that is not caused by a real underlying causal linkage (Studenmund, 2008). To ensure that the equations are not spurious, a unit root test is conducted. There are several ways to conduct the unit root test, among which are the Augmented Dickey-Fuller test, Fisher-Philip Perron (Fisher-PP), Pesaran and Shin, and Levin Lin and Chu (LLC) (Abu & Karim, 2016). For simplification, the study will utilize the Augmented Dickey-Fuller (ADF) unit root test. The Augmented Dickey-Fuller is described in the following model:

\[ \Delta y_t = \mu + \gamma^* y_{t-1} + \sum_{j=1}^{p-1} \phi_j \Delta y_{t-j} + \varepsilon_t \]

The unit root test is carried out by testing the null hypothesis. If there is a failure to reject, the unit root is taken as evidence that a unit root is present. If a unit root is present, then the model specializes to the AR(p-1) model in the first difference which is an ARIMA(p-1,1,0) model for \( y_t \) or model with a time trend (Greene, 2003). The ARIMA model is the following:

\[ \Delta y_t = \mu + \beta_t + \gamma^* y_{t-1} + \sum_{j=1}^{p-1} \phi_j \Delta y_{t-j} + \varepsilon_t \]

A critical part of the ADF test is to estimate the number of lagged variables to avoid bias or reduced quality of the test. The procedure for estimating the number of lags is conducted with the help of information criterion method called Schwarz information criterion (SIC), which is explained in the following section. The SIC will be used for both variables.

6.3. Estimating lags

The number of lags to be included can be chosen by using an information criterion. The procedure involves combining a measure of model fit, with one of the information criteria. For this paper, three information criterion methods were used to find the optimum number of lags. The methods used are Akaike information criterion (AIK), Schwarz information criterion (SIC), also known as Bayesian information criterion (BIC), and the Hannan-Quinn information
criterion (HQC). The lag that receives the lowest value from these methods will be used in the Granger-causality test. The specification of the lag length is an important practical issue. If the lag length is too small the remaining serial correlation in the errors will bias the test and if the lag length is too large then the power of the test will suffer.

In order to limit the number of lags being considered in the previously mentioned information criteria tests, Schwert’s (2002) estimating procedure for large number of simulations will be utilized. The Schwert’s estimation of the largest lag length being considered model can be seen in the following formula:

$$Max\ lag = 12 \times \left( \frac{nr.\ of\ observations}{100} \right)^{0.25}$$

6.4. Granger-causality

Granger-causality is the circumstance in which one time-series variable consistently and predictably changes before another variable (Studenmund, 2011). Granger-causality was developed in the 1960s and has been widely used in economic research since its development. Granger-causality test can potentially identify the direction of the causation between two variables and is only applicable to time-series data. If Granger-cause is detected the past values of the former variable contain information that helps predict the latter. The formula for Granger-causality is based on linear regression modeling of stochastic processes (Seth, 2007). The test regresses variable Y by utilizing lagged values of Y and lagged values of variable X, as can be seen in the following formula:

$$Y_t = \beta_0 + \beta_1 Y_{t-1} + \cdots + \beta_{\rho} X_{t-\rho} + \alpha_1 X_{t-1} + \cdots + \alpha_{\rho} Y_{t-\rho} + \epsilon_t$$

If Granger-causality test indicates that if $X_{t-j}$ is statistically significant, there is evidence that it has an effect on $Y_t$ which cannot be explained by the change in $Y_{t-j}$—that is that the effect in $Y$ is caused by an event in $X$ that occurs at time $t-j$. If this is the case, then $X$ granger-causes $Y$. The test is performed for both $Y$ and $X$ to check whether the causality is bidirectional or unidirectional. The second test regresses the variable X by using lagged values of X and lagged values of variable Y, as can be seen in the following formula:

$$X_t = \beta_0 + \beta_1 X_{t-1} + \cdots + \beta_{\rho} X_{t-\rho} + \alpha_1 Y_{t-1} + \cdots + \alpha_{\rho} Y_{t-\rho} + \epsilon_t$$

If $Y_{t-j}$ is statistically significant, it explains a change in $X_t$ that cannot be explained by $X_{t-1}$. If this is the case, one can say that Y “Granger-causes” X. When interpreting the results from the Granger-causality test it is important to note that the test only provides inside on the direction of the causality. It does not indicate whether the causality has positive or negative effect or explain how long the impact requires to take place in the system (Abu & Karim, 2016).
7. Results

This section will discuss the results from the statistical models described in the previous chapter or the Augmented Dickey-Fuller test, the lag estimation tests and the Granger-causality test. GDP was defined as the endogenous variable and trading volume as the exogenous variable, due to the results from previous research.

The descriptive statistics for the variables used in the study can be seen in table 1. Both the trading volume data and the GDP data is represented in log terms.

Table 1

Descriptive Statistics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Log_GDP</th>
<th>Log_Trading_volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>9.700</td>
<td>8.840</td>
</tr>
<tr>
<td>Maximum</td>
<td>9.986</td>
<td>11.480</td>
</tr>
<tr>
<td>Minimum</td>
<td>9.392</td>
<td>4.920</td>
</tr>
<tr>
<td>Std. Dev.</td>
<td>0.169</td>
<td>0.792</td>
</tr>
<tr>
<td>Observations</td>
<td>4226</td>
<td>4226</td>
</tr>
</tbody>
</table>

7.1 Unit root test

In order to test whether or not the data was stationary an Augmented Dickey-Fuller (ADF) test was performed for both variables. The Schwarz information criteria test was performed to estimate the optimum lag length for each variable. The optimum lag length for trading volume and GDP was 10 and 0, respectively. The results from the Augmented Dickey-Fuller test can be seen in table 2.

Table 2

Results of the Augmented Dickey-Fuller unit root test.

<table>
<thead>
<tr>
<th>Variable</th>
<th>ADF t-statistic</th>
<th>Test critical value (5%)</th>
<th>Test for unit root in</th>
</tr>
</thead>
<tbody>
<tr>
<td>Log_Trading_volume</td>
<td>-4.232*</td>
<td>-2.8620</td>
<td>Level</td>
</tr>
<tr>
<td>Log_GDP</td>
<td>-1.149</td>
<td>-2.8620</td>
<td>Level</td>
</tr>
<tr>
<td>Δ Log_GDP</td>
<td>-65.039*</td>
<td>-2.8620</td>
<td>First difference</td>
</tr>
</tbody>
</table>

* indicates that the null hypothesis can be rejected at 5% significance level

The initial results from the ADF unit root test suggested that the data for trading volume was stationary at level, as can be seen in table 2. For the trading volume, the null hypothesis
can be rejected ($p < .05$) and the alternative can be accepted. The null hypothesis for non-stationary of the GDP data cannot be rejected. This indicates a non-stationary trend in the GDP data. In order to correct this non-stationary trend, the GDP data was tested at first difference. At first difference, the GDP data was stationary ($p < .05$). The results from the ADF unit root test of GDP data at first difference can also be seen in table 2.

7.2 Optimum lag length
A VAR lag order selection criteria test was performed to find the optimum lag length to be included for the Granger-causality test. Before performing the information criteria test, the Schwert (2002) largest lag test was performed and the results indicated that the largest lag length considered should not exceed 31 lags. The VAR lag order performed three information criterion test and the results are in table 3. The information criterion used in the test were: Akaike information criterion (AIC), Schwarz information criteria (SIC), and the Hannan-Quinn information criteria (HQC).
Table 3

*Results of the VAR lag order selection criteria test.*

<table>
<thead>
<tr>
<th>Lags</th>
<th>AIC</th>
<th>BIC</th>
<th>HQC</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.412642</td>
<td>1.418689</td>
<td>1.414780</td>
</tr>
<tr>
<td>2</td>
<td>1.240032</td>
<td>1.247590</td>
<td>1.242705</td>
</tr>
<tr>
<td>3</td>
<td>1.179650</td>
<td>1.188720</td>
<td>1.182857</td>
</tr>
<tr>
<td>4</td>
<td>1.135592</td>
<td>1.146174</td>
<td>1.139334</td>
</tr>
<tr>
<td>5</td>
<td>1.109050</td>
<td>1.121144</td>
<td>1.113327</td>
</tr>
<tr>
<td>6</td>
<td>1.095907</td>
<td>1.109512</td>
<td>1.100718</td>
</tr>
<tr>
<td>7</td>
<td>1.086356</td>
<td>1.101473</td>
<td>1.091701</td>
</tr>
<tr>
<td>8</td>
<td>1.080377</td>
<td>1.097006</td>
<td>1.086257</td>
</tr>
<tr>
<td>9</td>
<td>1.077443</td>
<td>1.095583</td>
<td>1.083858</td>
</tr>
<tr>
<td>10</td>
<td>1.070387</td>
<td>1.090040</td>
<td>1.077337</td>
</tr>
<tr>
<td>11</td>
<td>0.068157</td>
<td>1.089321*</td>
<td>1.07641</td>
</tr>
<tr>
<td>12</td>
<td>1.068006</td>
<td>1.090682</td>
<td>1.076025</td>
</tr>
<tr>
<td>13</td>
<td>1.067181</td>
<td>1.091368</td>
<td>1.075734</td>
</tr>
<tr>
<td>14</td>
<td>1.064093</td>
<td>1.089792</td>
<td>1.073180</td>
</tr>
<tr>
<td>15</td>
<td>1.062510</td>
<td>1.089721</td>
<td>1.072132</td>
</tr>
<tr>
<td>16</td>
<td>1.060863</td>
<td>1.089586</td>
<td>1.071020</td>
</tr>
<tr>
<td>17</td>
<td>1.059488</td>
<td>1.089722</td>
<td>1.070179</td>
</tr>
<tr>
<td>18</td>
<td>1.058201</td>
<td>1.089947</td>
<td>1.069427</td>
</tr>
<tr>
<td>19</td>
<td>1.057961</td>
<td>1.091218</td>
<td>1.069721</td>
</tr>
<tr>
<td>20</td>
<td>1.057120</td>
<td>1.091889</td>
<td>1.069415</td>
</tr>
<tr>
<td>21</td>
<td>1.057488</td>
<td>1.093769</td>
<td>1.070318</td>
</tr>
<tr>
<td>22</td>
<td>1.056951</td>
<td>1.094743</td>
<td>1.070315</td>
</tr>
<tr>
<td>23</td>
<td>1.055838</td>
<td>1.095142</td>
<td>1.069736</td>
</tr>
<tr>
<td>24</td>
<td>1.054607*</td>
<td>1.095423</td>
<td>1.069040*</td>
</tr>
<tr>
<td>25</td>
<td>1.054841</td>
<td>1.097169</td>
<td>1.069809</td>
</tr>
<tr>
<td>26</td>
<td>1.054914</td>
<td>1.098754</td>
<td>1.070416</td>
</tr>
<tr>
<td>27</td>
<td>1.055064</td>
<td>1.100416</td>
<td>1.071101</td>
</tr>
<tr>
<td>28</td>
<td>1.055466</td>
<td>1.102329</td>
<td>1.072038</td>
</tr>
<tr>
<td>29</td>
<td>1.055930</td>
<td>1.104304</td>
<td>1.073036</td>
</tr>
<tr>
<td>30</td>
<td>1.054949</td>
<td>1.104835</td>
<td>1.072590</td>
</tr>
<tr>
<td>31</td>
<td>1.054918</td>
<td>1.106317</td>
<td>1.073094</td>
</tr>
</tbody>
</table>

*: indicates the lowest value of the respective information criteria

The results from AIC and HQC indicated that the optimum lag length was 24, for the given dataset. The SIC indicated that the optimum lag length was 11. Because of the difference in results; two Granger-causality test were performed using both lag lengths.

7.3 Granger-causality

A Granger-causality test analyses the direction of the linkage between the variables. In order to avoid biases and errors the variables must be stationary. The results of the ADF test verified
that the variables were stationary. Table 4 shows the results from the first Granger-causality test with a lag length of 24.

Table 4

*The results from the Granger-causality test, with a lag length of 24.*

<table>
<thead>
<tr>
<th>Dependent Variables</th>
<th>Explanatory Variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Log_Trading_volume</td>
<td>∆Log_GDP</td>
</tr>
<tr>
<td>Log_Trading_volume</td>
<td>0.8378</td>
</tr>
<tr>
<td>∆Log_GDP</td>
<td>0.7804</td>
</tr>
</tbody>
</table>

*, **, and *** indicates statistical significance at 10%, 5% and 1%, respectively.

The results from the Granger-causality test fails to provide results of Granger-causality leading from trading volume to GDP at 5% significance level, $F(1, 4201) = 0.8378$, $p = 0.6904$. Furthermore, the results from the data do not provide evidence of causality leading from GDP to trading volume, $F(1, 4201) = 0.0224$, $p = 0.881$. In other words, the evidence from the dataset does not indicate that either variable Granger-causes the other. The result from the second Granger-causality test, using a lag length of 11, can be seen in table 5.

Table 5

*The results from the Granger-causality test, with a lag length of 11.*

<table>
<thead>
<tr>
<th>Dependent Variables</th>
<th>Explanatory Variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Log_Trading_volume</td>
<td>∆Log_GDP</td>
</tr>
<tr>
<td>Log_Trading_volume</td>
<td>0.9927</td>
</tr>
<tr>
<td>∆Log_GDP</td>
<td>0.9273</td>
</tr>
</tbody>
</table>

*, **, and *** indicates statistical significance at 10%, 5% and 1%, respectively.

As can be seen in table 5, when using Granger-causality test with a lag length of 11, no evidence indicates a Granger-causal between the variables. Trading volume does not Granger-cause GDP, with the given dataset, $F(1, 4214) = 0.9927$, $p = 0.4502$. Furthermore, GDP does not Granger-cause trading volume, with the given dataset, $F(1, 4214) = 0.9273$, $p = 0.5126$. Granger-causality cannot be detected, with the given dataset.
8. Discussion

This paper examined the causal relationship between economic growth and stock market development in Iceland using trading volume as a proxy for development of the stock market. The data utilized in the paper was trading volume data from the NASDAQ Iceland stock market and data on Iceland’s GDP, in a period ranging from January 1999 to December 2015. A unit-root test was performed for both variables and the results showed that the trading volume data was stationary at level but the GDP data was non-stationary at level. However, the GDP data was stationary at first difference. The lag estimation test indicated that the optimum number of lags for the data set were 11 and 24, respectively. A Granger-causality test was performed for both lags, in order to find indications of the direction of the causality between economic growth and trading volume.

The Granger-causality test fails to find evidence of the direction of causality between trading volume and economic growth. The same result were found for both lag lengths. These results indicate that changes in GDP do not Granger-cause changes in trading volume, with the given dataset. Furthermore, the results also indicate that changes in trading volume do not Granger-cause changes in GDP, with the given data. To summarize; with the given dataset, the Granger-causality test fails to detect the direction of the causality between GDP and trading volume.

8.1. The hen and egg dilemma.

Previous findings have suggested that efficient capital allocation drives economic growth (King & Levine, 1993), and that stock market development accelerates growth by providing an efficient way of allocating capital (Levine, 1991). Based on their findings, there is a connection between economic growth and stock markets. This linkage indicates that a developed stock market can be a driving force of economic growth, although others have found that the causality flows in the other direction (Arestis et al., 2001). According to Garcia and Liu (1999), stock market development is a multi-dimensional concept that can be measured by a number of different factors. Multiple investigations have investigated the direction of causality between these factors and their findings depend largely on the proxy used to reflect stock market development.

The results from this investigation supports the findings of Levine and Zervos (1998). Their findings suggest that stock market liquidity is a good predictor of economic growth, but they failed to find the direction of the causality. In this paper, trading volume, a measure of
liquidity, is used as a proxy for stock market development. The investigation fails to detect the direction of the causality, the same findings as in Levine’s and Zevos’s paper. Previous results have shown that stock market development, including trading volume, is linked with growth in the economy but researchers are yet to find the direction of the causality between the two variables. The hen and egg dilemma is that findings are inconclusive about whether stock market development drives economic growth or vice versa.

A number of factors could explain the failure to detect the direction between stock market and economic growth using trading volume. One of which is the use of trading volume as a proxy for stock market activity. As mentioned, previous empirical research has found different directions of causality, depending on the proxy utilized to reflect stock market development or activity. One of the proxies most often used to reflect stock market development is a stock market index. The result from using stock market indexes as a proxy has indicated a one-directional causality leading from stock market development to economic growth (Abu, 2009; Mahdavi & Sohrabian, 1991; Olweny & Kimani, 2011). Other proxies such as market capitalization, market turnover, traded value and volatility, have been utilized in previous research with various results (Deb & Mukherjee, 2008; Ho & Odhiambo, 2012).

8.2. Volatile economy during sample period

The period in which the sample data is derived from may also have affected the results. During the first half of the sample period, the Icelandic economy experienced unprecedented growth. A large portion of this growth can be contributed to the three major Icelandic banks and favorable international conditions for imports (Sigurjonsson & Mixa, 2011). There was high optimism among Icelandic citizens and investors as foreign credit flooded the Icelandic economy. This resulted in increased household borrowing, public consumption, and investment. The overflow of capital also meant that the banks were willing to take on higher risk in their investments. Leveraging became a common theme among investors on the ISE and the public view of the stock market was that it was a tool for getting rich quickly. Market capitalization and trading volume increased tremendously because of leveraging and increased number of market participants during the early years of the sample period.

The financial crisis in 2008 also had a significant effect on the economic environment and the ISE. The economy contracted and the stock market activity tumbled, affecting the latter half of the sample period. The number of corporations listed on the market fell down to 13 and market capitalization tumbled. The bankruptcy of the Icelandic banks had a significant impact
on the decrease of market capitalization and trading volume on the ISE. Before the crash the stocks of the banks had collectively, represented over 50% of the total trading volume in 2007 and over 70% of the trading volume in 2008 (see Appendix A for further details).

In late 2008, the capital controls were imposed on the Icelandic economy, in order to limit the outflow of currency and stabilize the Icelandic krona. The capital controls reduced the attractiveness of the ISE for foreign investors, preventing companies with operations abroad from raising capital on the ISE, and restricted foreign investments for the Icelandic pension funds. As a result, the capital controls limited activity on the ISE in the post crisis era, aside from the pension funds that were forced to invest almost exclusively in companies listed on the ISE. The pension funds could also hold a limited amount of shares in unlisted Icelandic companies (Jónsson & Sigurgeirsson, 2014). Since the financial crisis, the number of listed companies has increased by 13 or to 21 in total, as of May 2017. The newly listed companies all have their main operations in Iceland. The capital controls were, according to Páll Harðarsson (2014), one of the largest obstacle preventing the recovery of the ISE. Páll Harðarsson further stated that people had lost trust in the financial sector following the crash, and the recovery of that trust would be a vital part in rebuilding the stock market.

The absence of the Icelandic banks on the ISE after the financial crisis may have also effected the development of the ISE in the post crisis era. As previously mentioned, the banks significantly contributed to the large amount of trading volume in the years leading up to the financial crash. According to Lilja Björk Einarsdóttir, the CEO of Landsbankinn, it is necessary to re-list the Icelandic banks in order for the ISE to recover to its former statue (Ígisson, 2017).

The previously mentioned factors may all have contributed to the low levels of trading volume on the stock market following the crisis. In contrary to low levels of trading volume, the Icelandic economy made a remarkable recovery from the crisis. After two years of decline in GDP, the economy grew by 2% in 2011 and continued its growth during the remainder of the sample period. After the financial crisis, the driver of economic growth in Iceland has mainly been exports of goods and services, opposed to consumption and investments before the crash. The economic recovery can, in some part, be traced to the tourism sector that has grown immensely after the financial crisis (Hagstofa Íslands, 2016). Although the tourism sector has had a positive effect on the Icelandic economy, the growth of the sector has little impact on the Icelandic stock market. Apart from Icelandair Group hf., there are no companies in the tourism sector listed on the ISE. The growth of the tourism industry may therefore skew the results of the analysis; the economy has grown while the recovery of the ISE has been insubstantial. This effect can be seen in figure 6.
Another possible reason that the Granger-causality test fails to detect the direction of the linkage is the method used to convert the quarterly data into daily changes in GDP. The data on Icelandic GDP was only available in terms of quarters or years. In order not to lose daily fluctuations in trading volume, the GDP data had to be converted into daily data. To achieve this, the quarterly data was divided by the number of trading days in each individual quarter. This meant that the data on GDP did not change for around 60 days, depending on the number of trading days in each quarter, while there were daily changes in trading volume. This may skew the results, because GDP data stayed constant even though there were large fluctuations in trading volume.

8.3 Final words and further research.

Evidence from research articles previously mentioned in this paper have shown linkages between stock market development and economic growth. The direction of the causality is still uncertain, whether economic growth causes stock market development or vice versa. The results indicate that it is inconclusive whether increased trading volume of the ISE influences the Icelandic economy or vice versa. The recent economic growth in Iceland is therefore an insufficient indicator of the future development of the ISE.

Further research on this subject could investigate the relationship between the Icelandic stock market and the Icelandic economy using different proxies, for example, market capitalization, the OMIX8 index, or bid-ask spreads. In addition, due to the popularity of bonds in the Icelandic security market, further research could investigate the linkage between the
Icelandic bond market and economic growth. Lastly, due to the possible error in deriving daily economic growth, additional analysis could change the trading volume data into quarterly or monthly periods and see if the findings are in line with the findings of this paper.
References


Appendix A

The three Icelandic banks represented a larger portion of the trading volume on the Icelandic Stock Exchange before the financial crisis in 2008. Table A shows the portion of each bank of yearly trading volume and the combined portion of yearly trading volume.

*Table A:* The proportion of the three big banks, of total trading volume on the ISE between 2000 and 2008 (Source: Nasdaq Iceland, n.d.)

<table>
<thead>
<tr>
<th></th>
<th>Glitnir Bank</th>
<th>Kaupthing</th>
<th>Landsbankinn</th>
<th>% of total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>5,50%</td>
<td>3,26%</td>
<td>6,23%</td>
<td>14,99%</td>
</tr>
<tr>
<td>2001</td>
<td>17,38%</td>
<td>9,70%</td>
<td>3,15%</td>
<td>30,23%</td>
</tr>
<tr>
<td>2002</td>
<td>10,50%</td>
<td>8,47%</td>
<td>4,85%</td>
<td>23,82%</td>
</tr>
<tr>
<td>2003</td>
<td>13,67%</td>
<td>10,72%</td>
<td>7,12%</td>
<td>31,51%</td>
</tr>
<tr>
<td>2004</td>
<td>19,50%</td>
<td>16,95%</td>
<td>8,45%</td>
<td>44,91%</td>
</tr>
<tr>
<td>2005</td>
<td>16,81%</td>
<td>20,62%</td>
<td>10,70%</td>
<td>48,13%</td>
</tr>
<tr>
<td>2006</td>
<td>20,94%</td>
<td>18,71%</td>
<td>14,51%</td>
<td>54,17%</td>
</tr>
<tr>
<td>2007</td>
<td>21,61%</td>
<td>20,26%</td>
<td>11,69%</td>
<td>53,55%</td>
</tr>
<tr>
<td>2008</td>
<td>21,96%</td>
<td>31,48%</td>
<td>18,00%</td>
<td>71,44%</td>
</tr>
</tbody>
</table>