The Good Life does not come easily in Lithuania
A system dynamics analysis of emigration

by

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FOREWORD

This thesis was the final part of a master program in system dynamics at the University of Bergen. I would like to thank my professor, David Wheat, for agreeing to supervise this work. His feedback and guidance has been most appreciated and I am so thankful to have had the opportunity to learn from him. I would also like to extend my gratitude to my fellow students which have offered noting but support and encouragement. Not only have I gained a new set of skills through my studies, but I have also gained friends from all over the world that I hope to visit one day. The biggest gratitude of all goes out to my wonderful fiancé. Without his support, this would not have been possible.

ABSTRACT

The population of Lithuania has been declining for the last 25 years. This has mainly been caused by high emigration out of the country. In particular, of young adults seeking job opportunities abroad. This has made the demographic composition of the country unfavourable for sustaining a strong social system due to the increased ratio of pensioners. The goal of this thesis was to analyse the migration trend of labour emigration in the context of the theoretical literature and try to replicate it using a system dynamics model based on the migration theories of neo-classical economics and network theory. The model managed to replicate the population development in Lithuania but failed to fully explain the peaks and valleys in the emigration flow, indicating that the model could benefit from drawing from additional migration theory literature. Moreover, since there is no unified statistical method for documentation of migration, data challenges cause an additional level of uncertainty in the reference data. The government of Lithuania has been aware of the emigration issue and approved policy guidelines in order to alleviate the problem. The policies have however been no more than wishful thinking, rather than actual actions, since funding has not been allocated accordingly. Policy measures that could be taken in order to relieve the problem are discussed in this thesis as well as implementation challenges that could act as a barrier for the process. One thing is for sure, if the trend continues, it will have a negative effect on the social system as well as the economy.

Keywords: System dynamics, neo-classical economics theory, network theory, labour emigration, public policy.

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1. INTRODUCTION

1.1   Background

Population in Lithuania has been declining since the early 1990s. Negative natural change is a big part of that development caused by low fertility and relatively high mortality compared to other EU countries. However, the biggest contributor to the development is the negative net migration rate. Emigration out of Lithuania has far exceeded the immigration into the country for the last 25 years. Lithuania will be one of the countries experiencing the highest rate of population decrease by 2050 according to United Nations projection if the trend continues (Stankūnienė, Jasilionis, & Hendrixson, 2009). In 1990 the population of Lithuania was just below 4 million and today the population has dropped below 3 million, as can be seen in the graph in Figure 1. Eurostat expects the population to fall below 2 million by 2040 (European Commission, 2015a). The government of Lithuania has therefore significant interest in finding a solution to the problem of declining population as it will have enormous consequences for the country's economy and public welfare if the projections become reality.
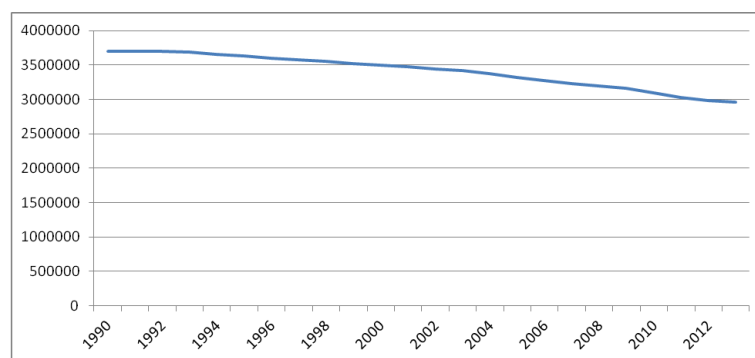
Figure 1 - Total annual average population in Lithuania over time. Data from the Demographic Yearbook 2013 published by Statistics Lithuania.

The historical aspect of the migration process in Lithuania has to be seen in the context of world history as it is a state that was formerly a part of the Soviet Union. The development of migration in the country in the last 25 years is relatively similar to the development in other former Soviet countries in Central and Eastern Europe.

After the fall of the Berlin wall, which led to the breakup of USSR, there were multiple factors that contributed to emigration from Central Europe. After 1991, new migration patterns emerged where there was constant negative net migration and increase in labour emigration. Even though formerly exiled Lithuanians have been returning to the country since it restored its independence in 1990, the net migration flow has still been negative (Brake, 2007). Some of the emigration can be explained by ethnic minorities that were placed in Lithuania as a part of forced labour relocation coming from Moscow. People from other parts of the Soviet Union, especially Russia, Ukraine and Belarus, were placed in Lithuania to increase the industrial workforce, tie the country closer to the union and deter any revolution. In 1989 approximately 10% of the Lithuanian population was foreign born and after the breakup of USSR many of those foreign born nationals decided to move back to their origin country. The outflow of this group of people peaked in 1993 and 1994. After the fall of communism, it was widely expected that there would be mass migration from the east to the west. Even though migration from the east to the west was significant, the forecasts were wrong in the sense that even though emigration turned out to be massive, most of it was actually within the central and eastern European region itself (Massey & Taylor, 2004).

It has been hypothesized that the mass emigration could be a result of a backlog of people that desired to move away from the countries but were unable to due to the restriction of population movement out of the Soviet Union. The push factors in post-Soviet Central Europe seem to have had a major effect on the emigration from the region, high unemployment being one of them. Under the rule of communism, all people were ensured jobs even though there was no real need for as many workers as were employed in certain areas of industries, resulting in over-employment. In addition to that, the level of technological advancement was low so sectors such as agriculture and heavy industry required more workers than was normal in the western part of Europe. When the former Soviet countries transitioned from communism into a market economy, these sectors were restructured resulting in high unemployment. At the same time, there was a demand for low-skilled workers in construction and agriculture in the western part of Europe that encouraged many to migrate to the west. After transitioning to a market economy the post-Soviet countries normally experienced low wages relative to the west, high unemployment and relative poverty, while the west offered better job opportunities with higher earnings (Kupiszewski, 2013). The high unemployment rate

coupled with little social protection made some groups more vulnerable than others, which then became more likely to emigrate to the west. The groups consist mainly of the young, the unskilled and those who recently finished education.

Lithuania became a part of the European Union in 2004 which meant that it became easier for people to migrate since accession to the union meant free movement of people. The number of Lithuanians working or studying abroad increased further after the EU accession. There are indications that the reasons behind emigration are mainly economical (Brake, 2007). In 2002, Lithuania was for example above the EU average when it came to unemployment while the country was below EU average in GDP per capita (The World Bank, 2014).

Since this thesis is focusing on migration issues in Lithuania, it is necessary to look at the historical emigration flow. Figure 2 shows the estimated emigration by Statistics Lithuania (*lt. Lietuvos Statistikos Departmentas*).
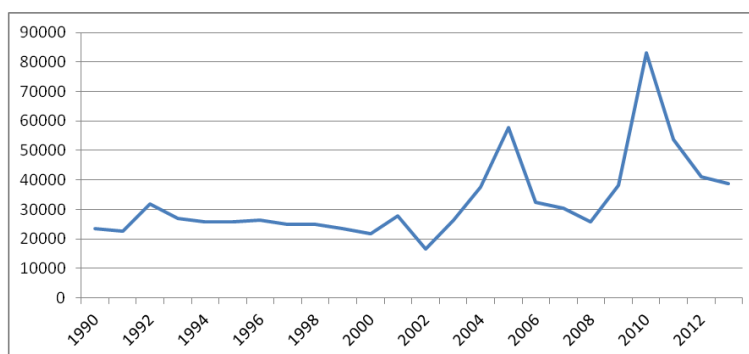
Figure 2 – The estimated emigration flow out of Lithuania from 1990-2013 by Statistics Lithuania.

The first wave of emigration in Lithuania took place in the beginning of the 1990s and it was mainly for ethnic reasons. The second and third wave of migration can be linked to Lithuania's accession to the EU in 2004 and the global economic crisis in 2008. The model will be focusing on labour migration and social networking, so ethnic migration will be treated as an exogenous factor in the model. The time horizon that is chosen for this work is therefore between 2001 and 2013.

The reason why the labour migration flow is much lower in the 1990s than it is in the 2000s, could be due to the fact that even though it had been financially beneficial to emigrate, it came with great psychological costs. Potential destination countries were also not really open to legal migration of Lithuanians before 2004, and even then not all EU countries opened up their borders for migrants from Lithuania until recently. Since labour migration was mainly illegal all processes such as finding a job, seeking housing

and possibly also working conditions could have taken a greater toll on the migrants. The level of technology we enjoy today was also less advanced in the 1990s. Computers were not necessarily a household item at that time and technology that makes communication between people, such as Skype and mobile phones, were less developed or did not yet exist. Therefore one might conclude that access to communication methods to stay in contact with family and friends back home has also had its effect on the psychological cost of emigrating. That coupled with the fact that destination countries were not open to Lithuanians could explain why labour emigration out of Lithuania was not greater than what we can observe on the graph in the 1990s.

If the emigration trend continues it will result in major problems for the government of Lithuania, as mostly people at a working age are emigrating, leaving the elderly behind. Coupled with low fertility, the sustainability of the demographic composition of the country could be compromised. The problem raises issues of many aspects, one being national security. If the trend continues on the similar path as it is now, the old age dependency ratio in the country could rise to an unsustainable level for the social welfare system. Declining labour force in the country due to emigration of people at a working age can also jeopardize economic growth, especially if extensive brain drain of highly skilled workforce takes place. It is important for the government to recognize and understand the dynamics behind the trend and include ways to alleviate the problem in their policy making. Sociologist Vladas Gaidys says in an interview with Vox Europ that if there will be nothing done to tackle the reasons behind emigration, it will only continue to grow. He concludes that "the good life does not come easily in Lithuania" (Bolzané, 2012).

1.2   Research objectives

The aim of this thesis is to contribute to and extend the research literature on migration and hopefully guide readers through the underlying structures of the system in which the problem originated. It is challenging to find a successful solution to any problem unless policy makers have a deep and clear understanding of the dynamics behind it. That applies not only to problems in the private sector, but also, and no less importantly to the public sector. As we all know, the public sector is full of complex issues that

decision makers attempt to solve. They design policies in order to diminish the effect of public problems to the lives of the people that live within the country. In this case we are dealing with emigration issues in Lithuania and problems that follow which have major consequences within the society. Decision makers, in this case politicians and policy advisors, need to understand both the behaviour of the system as well as its underlying structure. Only then is it possible to gain insights into the problem at hand and find realistic solutions to it.

2. METHODOLOGY

In order to achieve the research objectives relevant literature is presented to give insights into the context in which the problem takes place. The system dynamics approach will be used to build a computer model of the system in order to understand the reasons for the trend in the data. The model's behaviour will be analyzed in order to gain insights into the major feedback loops that will prove to have the biggest effect. After analyzing the model there will be discussions on possible policies that could contribute to solving the problem of declining population. They will include discussions on feasibility, implementation challenges, costs and benefits of those policies as well as the political environment that the solution has to be implemented in. Recommendations for further research in this area will also be suggested.

2.1   The system dynamics approach

Using the system dynamics method when analyzing an issue we start by defining the problem and discuss why it is important, who is affected and why we need to alleviate it. Then we develop a hypothesis for what is going on and build a computer simulation model that represents the hypothesis. After that we analyze the model by looking at the behaviour that it is producing and the structure of the system that lies behind it. The last two steps involve testing policy options for alleviating the problem and discussing possible implementation challenges that the suggested policy might face.

The computer model is built around the idea of a stock and flow system. Its purpose is to keep track of accumulations in the system where the stocks are influenced by the flows.
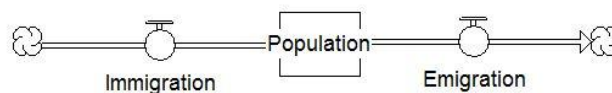
Figure 3 – A stock and flow diagram of migration

The flows are either in- or outflows from the stock and in the case of migration, as we see in Figure 3, immigration is the inflow and emigration is the outflow. If the outflow

is bigger than the inflow, the population stock depletes and that is the situation in Lithuania.
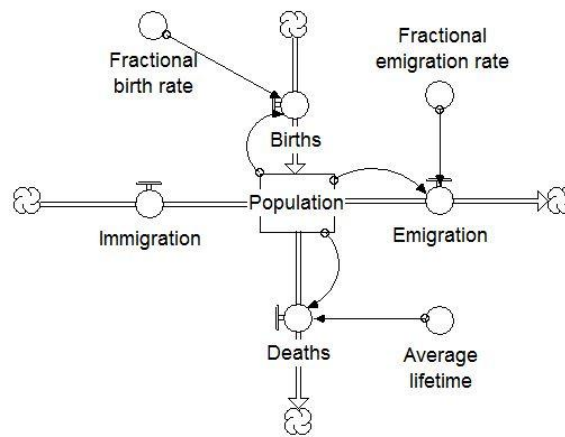
Figure 4 – A stock and flow diagram showing population development

A population stock is also affected by the inflow of births and the outflow of deaths as can be seen in Figure 4. The outflow of deaths is dependent on the average lifetime of the population and the inflow of births if dependent on the fractional birth rate. If the death rate is larger than the birth rate it is called natural decrease of a population.
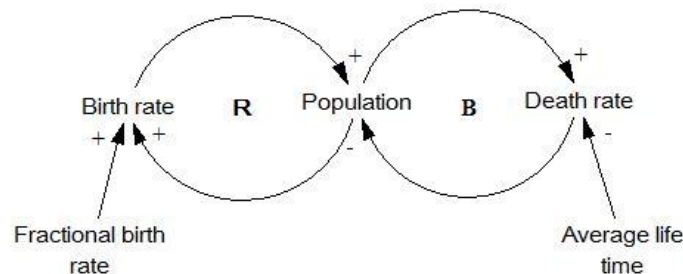
Figure 5 – A causal loop diagram of how births, deaths and population size influence each other. Source: Sterman, 2000.

A causal loop diagram (CLD) gives insights into the feedback of the system. A variable never stands alone and is always influenced by something else in the system. For example, the left loop in Figure 5 shows the relationship between birth rate and population. When birth rate increases, so does the population. When the population grows, the birth rate goes up. There are plus signs assigned to the arrows in the loop and therefore we say that the feedback in this case is a reinforcing one. On the right side of Figure 5, we have the loop representing the relationship between death rate and population. When we have an increase in the population, the death rate increases as

well. The higher death rate we have, the less people. Since we have an arrow here showing a negative relationship in the loop, we identify it as a balancing loop. If the loop holds an odd number of negative relationships, it is considered a balancing loop. (Sterman, 2004).

2.2   Limitations / Boundaries

As with every problem that is analyzed using any modelling method, there will always be ways to improve upon since it is far from perfect. Complex processes linked with socio-economic issues such as migration will never be captured fully by computer models. A model is not able to capture every individual decision making process. There is always a need for assumptions and generalizations. The system dynamics method enables one to look at issues from another perspective and has been proven to be a valuable tool in analyzing problems and adding to their understanding. The model in this case and the analysis of the issue will only be within the boundaries of Lithuania. Economic situations in destination countries will be exogenous and a number of feedback loops will be left out of the model in order to simplify it.

One of the biggest challenges in this thesis is the fact that data on emigration in Lithuania is far from perfect. In fact, due to high numbers of undeclared emigration, Statistics Lithuania has had to rely on estimations.
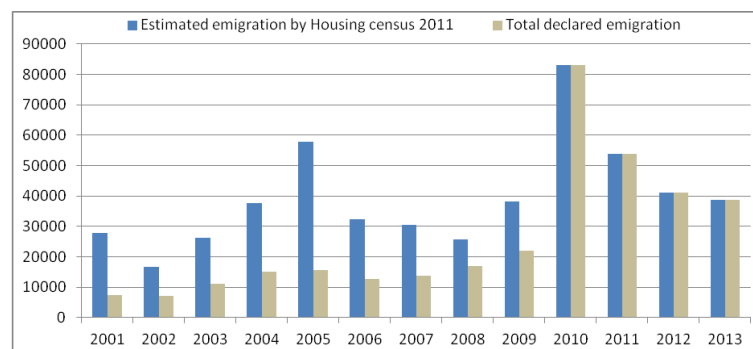
Figure 6 - The discrepancy between declared migration and estimated emigration by the 2011 Housing census. Data from Statistics Lithuania and the Lithuanian housing census 2011

The discrepancy between estimations of total emigration out of Lithuania and declared emigration can be seen in Figure 6. The reason that the columns match perfectly with each other from 2010 is because Statistics Lithuania assumes that after that time, all emigration is declared. Changes were made to the law on health insurance in Lithuania

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in 2010, obliging all registered permanent residents of Lithuania to pay health insurance contributions. After 2010 emigrants are therefore considered to have an incentive to declare their departure to avoid unnecessary payments, making the statistics on emigration more reliable (United Nations Economic and Social Council, 2014). The discrepancy between various columns in Figure 6 emphasizes the shortcomings of the data prior to 2010. Declared emigration appears to be far from the real emigration rate out of the country. It is highly plausible that the declared emigration in 2010 and 2011 is over-exaggerated since people who had previously emigrated without declaring it now had the incentive to return and declare that they had moved.

A large portion of emigration is undeclared, which means that the official data provided by Statistics Lithuania does not represent reality even though it provides a clear indication of the general trend. For example, the age structure of emigrants is somewhat unknown, as well as marital status and gender (Stankuniene and Jasilionis 2009). Therefore, it is a challenge to come up with a reference mode for the total emigration flow out of Lithuania that best represents detailed reality. However, we can make the assumption from available official statistical data that the largest group leaving the country is young people, mainly in the age group 15 to 29 years old (Ranceva & Rakauskienė, 2012).

Lithuania defines an emigrant as someone leaving Lithuania who has the intention to take up a permanent residence in another country for more than six months (Statistics Lithuania, 2006). At one time, Statistics Lithuania used data from the Population Register to create data on migration, but that did not reflect the real situation. As a result it was decided that other measures were needed to complement the statistics on declared migration. The 2001 Housing and Population Census was the first attempt to enumerate all permanent residents in Lithuania and the census work was carried out in cooperation and with recommendations from institutions such as Eurostat and the United Nations Economic Commission for Europe (hereafter UNECE). The census work was deemed successful as it fully complied with European standards and the results were comparable with those of other countries. The 2001 census created estimates for undeclared emigration from the year 1990 to 2000 based on the exhaustive demographical information that was gathered (Official Statistics Portal, 2001).

Since the census is only conducted once every decade, Statistics Lithuania experimented with ways to enhance the quality of their population statistics. After

comparing data from various administrative bodies within the government, it was deemed too inaccurate. Definitions that were used were not compatible and the level of uncertainty was too high. Following that process, Statistics Lithuania carried out an annual survey from 2006 to 2009 where undeclared emigration was assessed. The survey was based on the annual Labour force survey and it was designed to give information on undeclared emigration from 2001 to 2005 as well (Lapeniene, 2009). The results allowed for estimations on the main demographic and socio-economic characteristics of the emigrants and they indicated that only two thirds of residents of Lithuania declared their departure when emigrating out of the country (United Nations Economic and Social Council, 2014). The estimations were statistically satisfactory, but not without some uncertainty (Statistics Lithuania, 2010). The biggest challenge that Statistics Lithuania faced was to figure out the best possible way to integrate the estimates on undeclared migration from these surveys with the data on declared migration. The Population and Housing census was repeated in 2011 where the total population of Lithuania was enumerated again (Statistics Lithuania, 2013). The census is unique among surveys since it covers the entire population, and is therefore seen as one of the most reliable ways to measure migration stocks. The fact that the census is only carried out once every decade makes it harder to estimate annual migration flows. However, the data that was collected in the housing census survey was useful in further enhancing the estimations of undeclared emigration. The UNECE mentioned Lithuania in a practical guide for countries of Eastern Europe on statistics on international migration, where it was stated that the country had successfully been able to estimate undeclared migration using household surveys (Chudinovskikh, 2011).

One of the ways to measure the validity of the estimated emigration out of Lithuania is using a method called "mirror statistics", where data from the country of origin is compared to the data collected in the country of destination. Immigration flows are considered to be measured more accurately than emigration flows since data on foreigners is often more accurate and complete than data on nationals. That kind of a comparison might shed light on contradiction in the data and motivate discussions between the reporting countries regarding definitions and methodology (Chudinovskikh, 2011).

With Norway being one of the main destinations of emigrating Lithuanians in recent years it was interesting to compare the statistics of the emigration flow reported

and estimated by the two countries. Statistics Norway (*no. Statistisk Sentralbyrå, SSB*) defines an immigrant as a person that is born abroad or in Norway, to two parents and four grandparents that all hold a foreign citizenship. Persons who come to Norway and stay for less than six months are not considered as immigrated, and people who leave Norway within six months are not considered as emigrated (Statistics Norway, 2015). The statistics are not able to capture the persons that stay in Norway under six months without working, those who cross the borders on a regular basis or those who reside in the country illegally. As stated by most recent statistics by Statistics Norway, 35.000 Lithuanians are registered in Norway as long term migrants staying for more than 6 months as well as 8.000 short term migrants. The boxed line on the graph in Figure 7 represents the official number of Lithuanians that have been registered in Norway every year from 2002 to 2013.
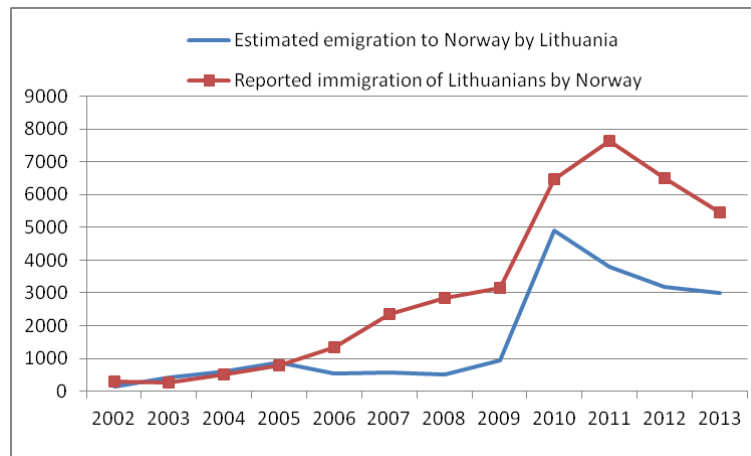
Figure 7 - Estimated emigration of Lithuanians to Norway over time compared to the total registered Lithuanian immigrants in Norway. Data from Statistics Norway and the Lithuanian housing census 2011.

The number far exceeds the total estimated emigration from Lithuania to Norway by the 2011 census showed on the same graph. The discrepancy in the data recorded by the two countries between 2006 and 2009 supports the belief that the emigration peak estimated by Statistics Lithuania in 2010 includes many previous emigrants and that using a reference mode that takes that into account can be justified. Both countries work from similar definitions of migrants with the same time frame of 6 months, so it would be interesting to find out where the difference in the numbers is coming from. One possible explanation is that the numbers given from Lithuania represent people moving to Norway, regardless of citizenship. The numbers from Norway are however immigrants that have Lithuanian citizenship, regardless of where they are coming from.

There has been evidence of a growing trend in recent years that emigrants from Lithuania do not necessarily move back to their origin country if they choose to move away from their destination country. In fact, they could be tempted to move to the third country, which would explain some of the difference between the numbers.
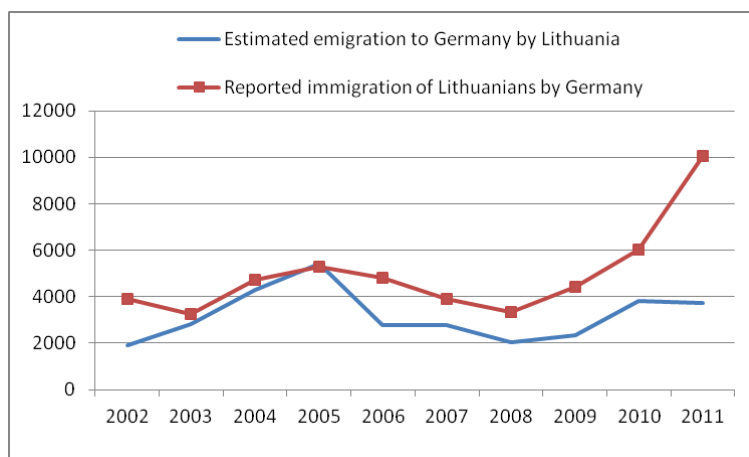
Figure 8 - Estimated emigration of Lithuanians to Germany over time compared to the total registered Lithuanian immigrants in Germany. Data from destatis.de and the Lithuanian housing census 2011.

If we use the same method of mirror statistics and apply it to the major destination country of Germany we see a similar pattern. People that migrate to Germany with the intention to stay for more than two months are obligated to register into the country (Saxon State Chancellery, 2015). Since they use a different definition for a migrant than Lithuania, it could explain some of the discrepancy in the data in Figure 8. However, both data on Lithuanian immigrants in Norway and Germany are showing a similar trend. The emigration into these countries that is estimated by Statistics Lithuania corresponds quite well to the reported immigration of Lithuanians up until 2005. After that there is a clear discrepancy which reaches a peak at 2011. This supports the belief that the peak in the estimated emigration data from Statistics Lithuania in 2010 needs to be adjusted.

The United Kingdom is the main destination for emigrating Lithuanians. In an article that was published in the Guardian in January 2013 it was mentioned that a recent population census in the United Kingdom had registered 100.000 Lithuanians in the country. Before the census came out, the Lithuanian embassy had told reporters that they believed that as many as 200.000 Lithuanians were living in the UK (Pidd, 2013). It would also be interesting to compare the estimated and reported flows of people between Lithuania and the UK to do a comparison since it has been the main country of

destination since Lithuania joined the EU. However, the UK only has data accessible online that categorizes Lithuania in a group with other central European countries. Lithuania as well as other European countries could benefit greatly from making detailed data on migration flows reported in their countries available to each other in able to do a comparison and improve on and discuss methods (Lapeniene, 2009).

Figure 9 – The reference mode of the model is the emigration flow out of Lithuania. The solid line is the estimation from Statistics Lithuania and the dashed line is a suggestion for a more likely scenario.

The reference mode that has been chosen is the dashed line in Figure 9 as it is considered to be a scenario that resembles reality in a more convincing fashion. The peak in 2010 is treated as an accumulated number for undeclared emigration in the previous years. The emigration flow in 2010 is estimated to be only slightly higher than the one measured in 2011, and the discrepancy is divided by 4 and added on to the values for years 2006 to 2009. This way was chosen in order to be as little intrusive on the existing data, however it is possible that the curve should be higher before 2010 and lower in 2011, but there is no way of knowing with an absolute certainty.

3. MIGRATION THEORY

There are many disciplines that study the phenomenon of migration. To this day, no discipline has been able to form a universal theory that manages to explain all aspects of migration. That is not to say that there is a shortage of theories on the subject. On the contrary, different disciplines such as economics, demography, political science, law, anthropology, history and other social sciences all strive to come up with a theory that is best suited for explaining migration. Each discipline explains migration from its own point of view which has led to a large diversity of migration theories. All the theories strive to answer the questions of who moves, when they move, why some people move while others choose to stay and why migration is sustained over time.

Anthropology looks at migration and how it develops in small groups through social networks. Sociology looks at migration as a process with many different outcomes that depend on labour markets, social capital and institutional structures. Sociology also researches how people incorporate the experiences that they have as migrants (Brettell & Hollifield, 2013). History examines migration in small groups or even from the view of the individual and the discipline looks at experiences of those groups or individuals (Brettell & Hollifield, 2013). Political science is more focused on the role of the state, national security, foreign policy, concepts like citizenship, how the government is involved in the migration process and why it has a difficulty controlling the situation (Brettell & Hollifield, 2013). The law discipline looks at legislation and how it discourages or enables migration as well as how the legal system copes with the process (Brettell & Hollifield, 2013). Economics explains migration by assuming that human beings are rational creatures that seek to maximize their utility. Also, the concept of human capital is crucial in economic theories of migration (Brettell & Hollifield, 2013). Economists highlight push and pull factors, propensity to migrate related to supply and demand as well as the effects that the phenomenon has on the economic side of the society, both in the sending and the receiving country. Demography deals with migration as well, as it is an important bi-flow of people and the discipline's main research focus is the population itself and how it develops (Brettell & Hollifield, 2013). When scanning through the many theories on migration and standpoints of these disciplines, one finds a valid point of view in each of them. They

all contribute to explaining migration from their perspective even though none of them is able to fully explain every case of emerging or established migration patterns.

Migration theories can also be divided into the categories of the micro, meso and macro approach in addition to dividing them by disciplines. The micro level looks at migration from the individual decision making process. It looks at the person's values, desires and what they expect as an outcome. The individual is believed to migrate to improve or secure his survival, to enhance wealth or comfort, to maintain a status or receive stimulation. The resources that the individual is able to use in the migration process are his money, information and connections to others. The macro level looks at the migration process from a broader structural level where economics, politics, demography and culture are looked at in relation to each other and how they work together. Income and unemployment are important in the economical perspective and how the political environment is in regards to regulations and cooperation with other nation states influences those factors. The culture in a given country generates certain norms that are easier for certain groups to relate to which then effects migration patterns. Population growth, the level of technology and availability of land and natural resources also pay a role in creating a certain environment, either encouraging or discouraging migration. The macro level looks at the balance and the structure between the political, economic and cultural spheres and how the role and actions of the government can influence the patterns of migration. Both of the levels of analysis mentioned above disregard the role and the nature of the migration decision making and the dynamics behind it. The meso level is the vaguest level of analysis as it looks at how people and their ties form a web of connections, either defined as strong or weak. The ties between people can be social or symbolic and they can be through families and households or even through kin, ethnicity, religion, nationality or political beliefs. Why people form those ties can be due to obligation, solidarity, information, control or access to resources of others. The fact is that a large portion of research on international migration has dealt with questions related to why people choose to migrate while the dynamics of migration have been researched to a lesser degree (Faist, 2000).

How the discipline of demography strives to explain the phenomenon is helpful in this case. Demography uses statistics, data and models to look at and determine population development. The discipline uses models in order to create forecasts on the development, which is useful to a number of other fields of disciplines since population

growth and decline and its effect is relevant in most research. In order to build the most accurate forecasting models, demography seeks out explanatory theories from a range of disciplines, making it a certain bridge between the literatures on the subject of migration. Demographic analysis can be separated into two categories, social and formal demography. The latter is more theoretical which entails the use of simplified assumptions. As a result, formal demography is less helpful when it comes to analyzing populations where migration is an important flow to and from the population stock. Migration is not a simple phenomenon so all attempts to over-simplify it can cause errors in any population forecasting models. On the other hand, social demography looks at how social, economic and political forces influence and shape the migration flows since researchers using the approach recognize the fact that it cannot be explained by one single discipline since there are many factors involved. This approach seeks to improve the understanding of the factors that influence all major changes in population development, including migration. From that research they estimate which groups of people are more likely to migrate than others as well as probability of events (Brettell & Hollifield, 2013).

Economics, as well as demography, uses models in order to help researchers to predict scenarios and outcomes and demography has often turned to economic theories to explain migration patterns. The economic discipline explains migration with the language that they are used to, using terms as demand and supply. The supply side represents the people that are ready to migrate and the skills and resources that they possess while the demand side is controlled by those institutions that allow for entrance and enforce the immigration regulation in a given country.

Economists assert that migrants choose to move from one place to the other mainly because of economic opportunities. These opportunities are measured by relative wage differentials, human capital ability differences and the costs of the migration process itself. These factors should influence whether people have the incentive to move or not, according to economics (Brettell & Hollifield, 2013). However, if wage differentials were sufficient to explain the phenomenon of migration, the most logical thing would be that the poorest people would have the strongest incentive to move. On the contrary, research has shown that that does not represent reality (Faist, 2000).

3.1   Neo-classical economics theory

The theory assumes that human beings make migration decisions based on their expectations of the relative gain. For example, if relative wage gain, or other expected benefits exceed the costs of moving to that country, then an individual would be inclined to move there. The theory makes the assumption that people have perfect information about wage levels and the employment opportunities in the destination country and that the migration decision is taken because of economic factors (Castles & Miller, 2009).

Neo-classical economic theory can be divided into two categories, micro and macro. The macro approach states that labour moves between two geographically distinct markets given that wage differences are seen as beneficial. If there is excess of labour supply in one destination, coupled with lower wages, labour will have an incentive to move to the destination that lacks labour force and offers higher wages. Eventually, the development of increased labour supply in the higher wage destination will cause wages to decrease. This process then has the opposite effect in the origin destination, as labour force supply decreases due to emigration, wages will increase. This development will then continue until emigration costs become equal to the benefits of emigrating (Massey et al., 1993). The micro approach allows for the individual assessment of the costs and benefits associated with migration. Migration is seen as an investment as it ensures higher wages than in the origin destination. Migrants are viewed as rational human beings that have the desire to maximize their potentials. Job opportunities, the cost of emigrating and other costs associated with migration has to be taken into the equation when making a decision (Kupiszewski, 2013). The theory also states that migration flows are simply an aggregated sum of individuals that move after doing the calculations of the expected benefits of migrating on an individual level. The sizes of the migration flow correspond to the relative differences in expected wages and migration is said not to occur in the absence of such economic differences (Massey et al., 1993).

As seen in the causal loop diagram in Figure 10, the higher relative expected employment opportunities a migrant can expect and the higher relative expected income, the more overall expected benefits are associated with migration. The cost of emigrating then has the opposite effect, as the higher the cost, the less benefits of

emigrating. When the expected benefits of migration rise, there should also be a rise in the number of people emigrating. However, when emigration increases up to a certain level, especially in a country with high unemployment and low wages, two loops are introduced.
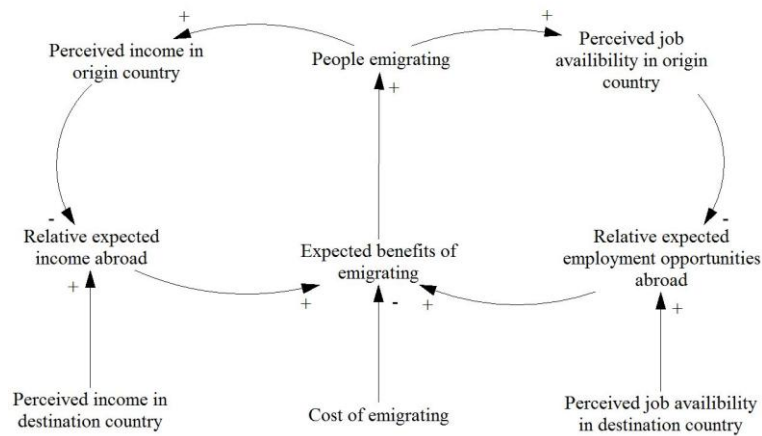
Figure 10 – A causal loop diagram showing the neo-classical economic theory of migration

The balancing loop on the left side of Figure 10 states that the more people emigrate, the higher the perceived income in the origin country. This happens due to the fact that emigration of working age population can cause shortages of labour, resulting in higher wages. The relative expected income then decreases as the perceived income in origin country increases and the less relative expected income, the less expected benefits of migrating and the less people eventually emigrate. However, even though increased income in origin country will decrease the relative conditions, the balancing loop can be very weak if the perceived income in the destination country continues to grow more rapidly than income in the origin country. The loop on the right side has the same characteristics but in this case the increased emigration leads to less pressure on the labour market, decreasing unemployment and therefore increasing job availability in the origin country.

This theory, as any other, does not come without shortcomings. It fails to explain return migration and researchers like Stark (2003), have been able to demonstrate that migration is possible even when wage differentials are not present. This theory also excludes the effects of any administrative, political or social conditions that might influence the decision making process. Despite its shortcomings, this theory has remained one of the most influential theories on migration research (Kupiszewski, 2013).

3.2 Network theory

Even though migration can be initiated due to a variety of reasons, network theory helps to explain why the process is sustained over time. Although wage differentials, relative employment opportunities or even political dissatisfaction cause people to move, the development of the migration process can lead to new causes of migration altogether, for example due to spreading of networks. Network theory states that the social links we have with others act as an additional pull factor when it comes to migration. Social networks connect people together through friendship, family or shared origin community (Massey et al., 1993). The social bonds connect people in both origin and destination countries as potential migrants connect with former migrants, established migrants and so on, all acting as further enhancements of the migration process. People use their connections and networks to gain access to employment abroad. When the migration network reaches a certain threshold, both the costs and the risks involved in migration decrease and as a result, the net expected benefits of migration increase (Massey et al., 1993). Therefore, even though initial migration can have taken place due to other factors, such as economic situation, migration can be sustained over time because the social network will have created a social process in itself that encourages migration. The reduced risks and declining costs associated with the growing network of migrants abroad encourages migration further (Massey et al., 1993).
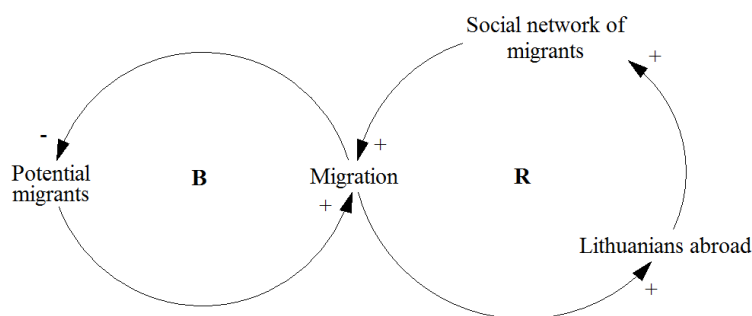
Figure 11 – A causal loop diagram of social network theory

Figure 11 shows a causal loop diagram of network theory and how it can be applied to the case of Lithuania. The more Lithuanian migrants abroad, the bigger the social network becomes, which then again leads to an increase in migration. The loop is reinforcing since all the connections are positive. The other loop is balancing since it

has a negative relationship which represents the depleting stock of Lithuanians. The more migration occurs, the less potential migrants will be left in the stock.

The neoclassical theory has proven to be helpful when trying to explain the migration phenomenon, but since it fails to take into consideration any political, social and administrative effects, it needs to be coupled with another theory when it comes to building a model on emigration. In this case, the social network theory proved to be well suited as an additional factor since it accounts for some of the other more personal aspects in the decision making process. Even though differences in for example wages can encourage migration, links or networks are needed to persuade people to take the decision to move (Thaut, 2009).

3.3   Systems approach to migration

In his publication on migration systems, Oliver Bakewell summarizes the main theories that have been established and divides them into categories. The embedded functionalist theory states that migration is a process that adjusts itself without outside interference, controls or regulation. In other words, that it functions automatically and organizes society within a wider social system even though it is sometimes imposed by external forces such as regulations. Those who adhere to the theory look at how patterns in various migration flows respond to changes in factors such as labour demand, culture and the economic conditions in both origin and receiving countries. This is consistent with the causal loop diagrams shown above, as they represent self-adjusting feedback loops. There are various shortcomings to this approach, as is common with theories within social sciences in general, as it does not draw from empirical data to support its claims as well as it does not touch on the subject of distinguishing the groups of people that migrate.

Zlotnik is one of the researchers who has been involved in the debate on migration systems and he has written on the skeletal approach, which focuses on the challenges that result from attempts to recognize the boundaries of migration systems. The approach aims at identifying migration flows between two countries by the political and economic relations and of the nation states as well as the strength and duration of the observed flows. This approach however offers limited explanations of why the

flows exist as it is only concerned with the question whether they do exist. As a result the approach is able to identify a series of flows and yet ignores influences of feedback as well as the human agency involved in the process (Bakewell, 2013).

Scholars such as Massey and Faist have contributed to the approach of the feedback form of migration systems. As the name implies, the feedbacks that take place within the system are examined in detail. Massey uses the concept of cumulative causation where the feedback mechanisms of choice are the primary drivers. In fact, all these theories are based on some sort of feedback mechanisms.

When modelling migration flows it is impossible to take into account all the different factors that come into play and motivate people to migrate. Historically, we could argue that the human being has moved from one place to the next to enhance its material well-being or standard of living. When it comes to modelling international migration in today's world, we can speculate whether economic factors in a given country present a necessary condition for voluntary mass migration. We can also analyze how the political factors influence the shape and size of the migration flows, as well as the direction it goes into. It is unlikely that modellers that deal with the phenomenon of migration will be able to come up with one general migration model that is applicable in any given migration scenario in the world and is able to explain immigration, return migration, immobilization and emigration, all in the same model. However, it is important for modellers to look at migration in the context of the environment it takes place in. Vital factors in that sense are the political liberty enjoyed by the population, the scope of social security, wage levels, the degree of political corruption perceived by the public, the level of economic performance and the size of the shadow economy (Massey & Taylor, 2004).

Overall, research related to migration has been more focused on immigration, and how it affects the receiving countries, rather than emigration and the conditions in the origin countries. Research has also leaned more towards studying the causes and impacts of migration separately instead of together. Hein de Haas (2010) emphasizes the need to research and analyze migration in a broad context with the economic and social development that takes place in both the origin and the receiving countries. The challenge is to recognize the boundaries of the effects that migration has on societal development and in return, how that overall development affects the dynamics of migration (de Haas, 2010).

The computer model used in this thesis is built around two migration theories in particular, the social-network theory and the neo-classical economics theory. It uses an input from the embedded functionalist theory in the sense that it is self-adjusting and functions automatically but external forces can influence the system.

4. DATA ANALYSIS

There is reason to believe that different mechanics are at work at different points in time that control the migration patterns in Lithuania. Major external events that influenced migration flows to and from the country were the regaining of independence in 1990, the accession to the EU in 2004, implementation of the Schengen agreement in 2007, and there is reason to believe that the flows were affected by the global economic crisis that hit in 2008 (Gropas & Triandafyllidou, 2014).

The period of labour migration starts from the mid-1990s but the flows were mainly illegal from the perspective of destination countries, since they did not allow free inflow of people from Lithuania until the country joined the EU. Lithuanians had waited for their freedom from the Soviet Union for a long time and when it finally came people had formed certain expectations about how things would be from then on. The anticipated economic wealth and success did not happen at once and the country experienced high unemployment in the 1990s. There had been over-employment in the labour market as the country was under the rule of communism. Transitioning into a market economy meant that industries and other sectors such as agriculture were being modernised, resulting in less need for labour. This hit the country hard economically and there was great uncertainty about what the future would bring. Lithuanians probably saw migration as their way of reducing financial risks for their families under the transition (Thaut, 2009).
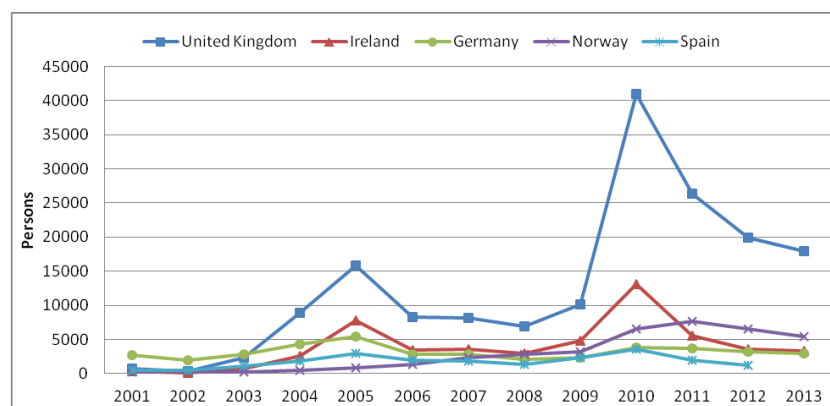
Figure 12 – Peaks of emigration clear around EU accession and global economic crisis. Comparison of emigration flows from Lithuania over time to major destination countries. Source: Statistics Lithuania and SSB.

When we look at the graph in Figure 12 we see two distinct peaks of emigration into the major destination countries. The first one after Lithuania joined the EU in 2004 and the second one following the global economic crisis in 2008. Unemployment rate in Lithuania peaked at 17.3% in 2001 and still the emigration flow out of the country does not show a big increase that year. After the EU accession in 2004, the only countries that did not opt for transition restriction on labour migrants were the United Kingdom, Ireland and Sweden but Sweden is not considered further in this analysis since it has not been one of the major destination countries. Given the restrictions from other EU countries and the good economic conditions of United Kingdom and Ireland it came as no surprise that those countries became the major destinations for emigrants from Lithuania (Elsner, 2012). The fact that English is the native language in Ireland and the United Kingdom has also made them attractive destinations for educated people, since English has become such a widespread language. This however is not included as a driving factor in the model even though in reality, language is likely to have an effect on people's preferences when it comes to choosing a destination.

The graph shown here above shows that the emigration flows go from being mainly directed to Germany in the beginning of the decade to being directed to the European countries that opened up their boarders to Lithuanian emigrants after the country's accession to the EU. The emigration flows are also increasing overall in the last few years, indicating that there are greater mobility opportunities for Lithuanians within the EU now than before (Thaut, 2009).

But what is interesting about the change in the flows is whether we are able to detect some common denominator in the major destination countries that can explain the shift in the flow and also its increasing magnitude. In her analysis on Lithuanian migration, Thaut (2009) stated that the primary determinants of emigration out of Lithuania were a combination of the demand and supply side factors that we know from neo-classical migration theory. On the demand side we have the labour shortages, decline in working age population and desire for cheap labour in Western European countries that then attracts Lithuanian labour migrants. At the same time, higher unemployment level, lower wages and the less developed economic conditions in Lithuania act as a push factor. The expanding network that links migrants with potential migrants then acts as a further enhancement of that development.

The different levels of unemployment between Lithuania and other European countries can work as an incentive to emigrate. When surplus of labour and high unemployment in the sending country is coupled with labour shortages and low unemployment in the receiving country, there is a clear indication that this has a major effect on people's decision to migrate. In fact, a survey conducted by RAIT in 2005, a Lithuanian market research and analysis company, the respondents indicated that unemployment in Lithuania was an important factor in their decisions to migrate to another country.
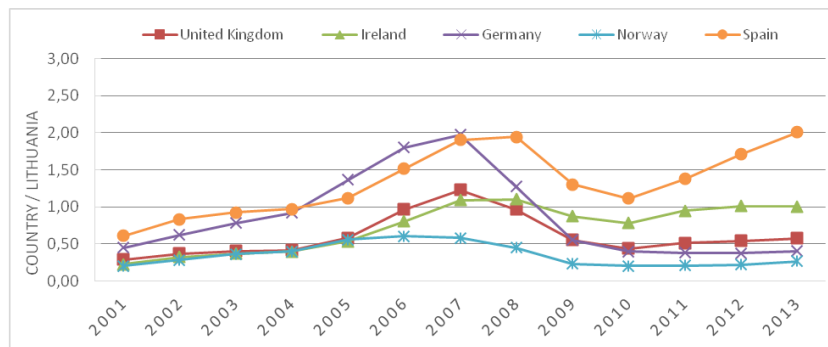
Figure 13 – Unemployment rate in the major destination countries relative to Lithuania. Source: Eurostat

Figure 13 shows how unemployment rate has developed from 2001-2013 in Lithuania relative to the major destination countries. If the country has relative unemployment rate lower than 1, the unemployment rate is lower than in Lithuania and vice versa. If we compare the graph with the one we have in Figure 12 we see that the emigration peaks in 2005 and 2010 align with valleys in relative unemployment, especially for the United Kingdom and Ireland. Between 2005 and 2008 when the relative unemployment rate increases in all destination countries except for Norway, the emigration flows to those countries decline. Norway has the best relative unemployment rate out of all the countries from 2006 onwards and at that time, emigration to Norway starts to slowly increase. Norway is considered to have been less effected by the global economic crisis in 2008 than other European countries and after 2011, the emigration flow to Norway is the second highest one from Lithuania, with only the flow into the United Kingdom succeeding it.

Figure 14 - Emigration flow out of Lithuania as a function of unemployment rate for 2004-2013. Correlation factor 0.673. Source: Statistics Lithuania.

The scatter graphs in Figure 14 show the emigration flow out of Lithuania as a function of the unemployment rate in the country after the EU accession in 2004. A trend line has been added in the graph for further visualization. The correlation factor in the graph is 0.673 which is still not high enough to completely explain the emigration pattern.

When we look closer at the demographic group that comprises the majority of the emigration flow out of Lithuania, which is the youngest working age population between the ages 15 to 24, we see that the average unemployment rate is actually double the national average (Thaut, 2009). This age group is considered the most mobile one so it does not come as a surprise that the data indicates that growing unemployment in the group coincides with growing emigration flows.

Figure 15 shows little or no correlation between unemployment rate in the destination countries, relative to Lithuania, and the emigration flows to said countries.

Figure 15 - Emigration flows to the major destination countries as a function of relative unemployment rate in those countries for 2001-2013 showing little or no correlation between the two. Data: Eurostat and Statistics Lithuania

That could mean, that even though the emigration flow out of Lithuania seems to be sensitive to the unemployment rate in the country, the destination country may not be

chosen from that criteria. It also indicates that the strength of the relative unemployment rate does not necessarily drive which destination is chosen, as long as unemployment is lower than in Lithuania, as seen by the fact that the majority of the emigration flows are higher when relative unemployment rate is lower than 1. So to fully explain the choice of a destination country, we need to factor in other criteria such as relative employment opportunities.

The relative income differentials between Lithuania and other EU countries could also be playing an essential part in encouraging Lithuanian labour emigration. In the formerly mentioned 2005 RAIT survey, the respondents identified low income as the biggest incentive for migration from Lithuania, but around 90% of them mentioned that income was the most important consideration for them when it came to making the decision to migrate (Thaut, 2009).

Table 1 – Difference in monthly average income and minimum income in EU countries in 2004 in Litas. Average income relative to Lithuania. Source: Thaut, 2009.

Country	Minimum income	Average income	Average income relative to Lithuania
United Kingdom	4233.1	11860.4	9.0
Ireland	4188.2	8314.3	6.3
Spain	1771.3	4492.1	3.4
Lithuania	500.0	1310.1	1.0

As you can see in Table 1, both the minimum income and the average income that a person can earn per month in Lithuania in 2004 is much lower than in some of the major destination countries. This comparison shows that relative income comparison can act as a major push factor for people considering migration as the financial benefits could be immense.
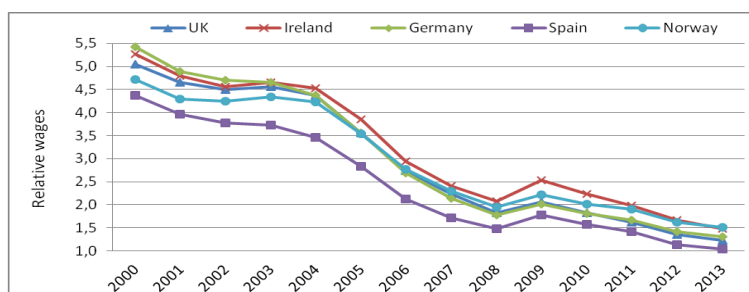
Figure 16 – Relative annual income development over time. Annual average income adjusted for PPP in US dollars in Lithuania from 2000-2013 relative to the major destination countries. Source: Statistics Lithuania and OECD.

When looking at the annual average income in Lithuania adjusted for purchasing power relative to the major destination countries in Figure 16 we see that the overall development is that the difference in income is getting smaller. Lithuania is catching up with the major destination countries especially following the EU accession, with the development taking a small setback after the global economic crisis. If the relative income was the only contributor to emigration from Lithuania the emigration flows should be declining. Since that is not the case it indicates that relative income alone is not sufficient in explaining migration flows and other factors need to be considered as well, such as the unemployment rate or social networks.

When we look at some economic indicators we can gain insights into how Lithuania compares to other countries when it comes to general economic development of the country. Comparing the annual social expenditures of the countries gives us an idea of the level of social welfare that the citizens enjoy in their country. In the graphs in Figure 17 and 18 we see how relative annual social expenditure per capita and relative GDP per capita have been developing since 2001. Lithuania is consistently below the other countries in both aspects.
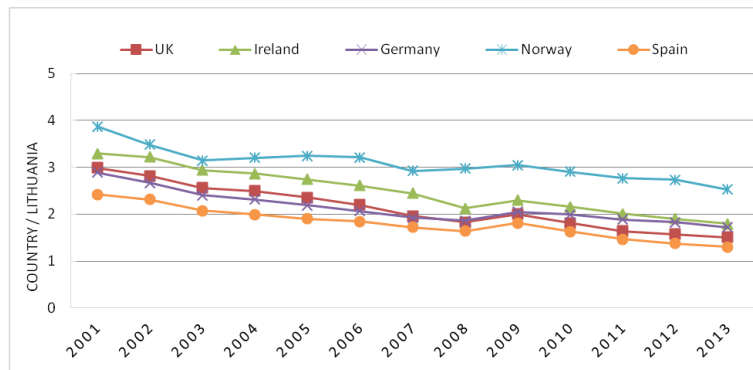
Figure 17 –Relative GDP per capita over time. Comparison of GDP per capita measured in US dollars. Source: The World Bank
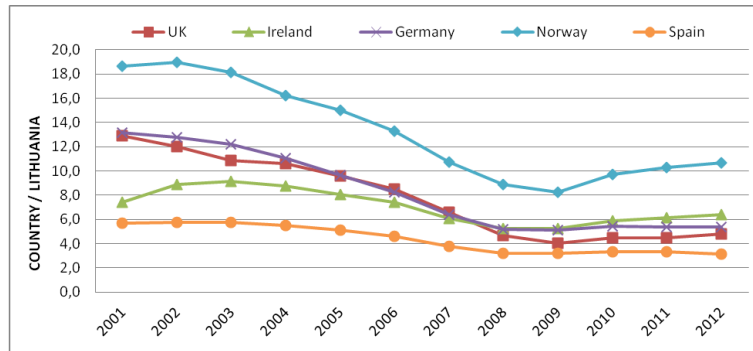
Figure 18 – Relative social expenditure over time. Comparison of annual social expenditure per person in Euros in major destination countries relative to Lithuania. Source: Eurostat

As mentioned earlier, Thaut (2009) says that the development in the migration trend due to supply-demand and push and pull factors can be further enhanced by social networking. In order to see if any evidence can be found in the data that could reinforce that theory, the variables of the stocks of Lithuanians in a given country and the flows into that country were set up in a scatter graph to give visual results. The graphs in Figure 19 and 20 show the correlation between the stock of Lithuanians and the inflows of them into Norway and the United Kingdom, lagging by one year.
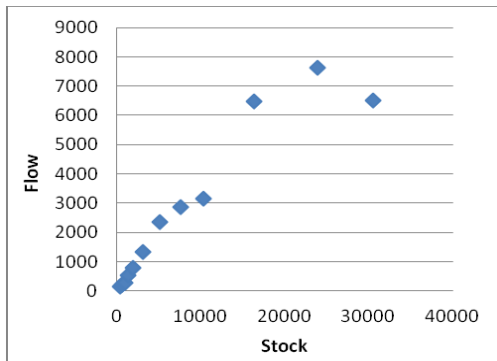
Figure 19 - Correlation between the flow of and the stock of Lithuanians in Norway. Source: SSB.
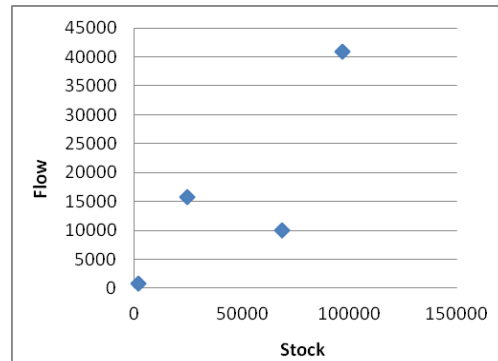
Figure 20 - Correlation between the flow of and the stock of Lithuanians in the UK. Source: Statistics Lithuania.

For Norway we have data from 2001 to 2013 for both the inflow and the stock and for the United Kingdom we only have data where we are able to compare the stock to the flow in 2002, 2006, 2010 and 2011. In both cases we see some evidence of correlation between the size of the stock and the magnitude of the flows. However, there is not enough data to conclude a correlation with statistical significance.

After having looked at relative unemployment rates, relative income and the size of the Lithuanian population abroad we are not able to say that any of those factors could by themselves explain migration but they all seem to have an effect.

5. THE MIGRATION MODEL

In this chapter the simulation models´ structure will be shown and explained how the different theories applied are used in the model. The three different sectors of the model will be explained in detail and the interactions between them. These sectors are the population-, economic- and social network sectors. Further documentation from the model can be found in Appendix A.

5.1   The model structure

The neo-classical economic theory tells us that migrants look at the differences in income and job opportunities between two countries so it focuses on the economic aspect of the decision making. Social network theory adds on to that theory by saying that even though migration processes can be initiated by those factors, social networks further enhance the process and sustain it over time.
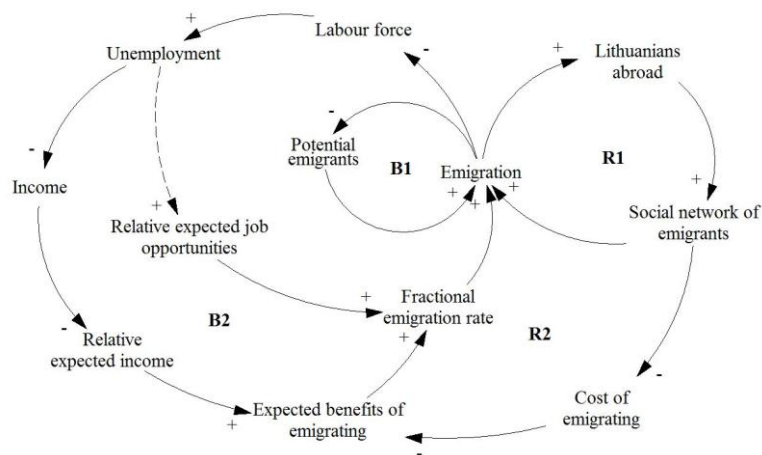
Figure 21 – A causal loop diagram of the theory behind the model

The model is built around that approach and in Figure 21 a causal loop diagram shows the two theories combined. In addition to the previously introduced loops in the social network chapter (see Figure 11, chapter 3.2), a new reinforcing loop, called R2, is introduced. The growing stock of Lithuanians abroad increases the social network which then decreases the costs of emigration and therefore the expected benefits of emigration increase. On the economic side of the model there is one balancing loop, B2. Increased emigration leads to less labour force in Lithuania which then again reduces

unemployment. Decreased unemployment can cause income to rise, which leads to a decrease in the relative expected income and increases the expected benefits of emigration. In theory, reduced unemployment in Lithuania reduces the relative expected job opportunities which then decreases the expected benefits of emigration. The link between unemployment and relative expected job opportunities is dashed since it is exogenous in the model. Therefore, we do not assign the loop a name.

The dynamics of the model are therefore highly dependent on the balance between these loops. The social network sector enticing effect on emigration and the balancing dynamics of the economic sector. The balancing loop of the economic sector is highly dependent on the relative situation in Lithuania compared to other countries and is therefore weak when other countries are doing better than Lithuania.

5.1.1 Population sector

Since the purpose of the model is to capture the dynamics behind emigration we need to incorporate a population sector with an aging chain and migration flows. There are three major stocks in the model that keep track of the people involved in the migration process. That is the stock of *Adults not interested in migrating*, *Adults interested in migrating* and the stock of *Lithuanian migrants* abroad. Since the children are not involved in the decision making process of migrating, they are not included in these stocks. However, due to the importance of the stock of children on overall population development, we include a structure for children as a side calculation in the model, seen on the right side on Figure 22.

The stock of *children* is increased by *births* and immigration and decreased by deaths, emigration and maturation. *Births* are dependent on the fertility rate, driven by data and the fertile population. We use the stocks of *Adults interested* and *Adults not interested in migration* to derive the fertile population. *Children deaths*, immigration and emigration is driven by fractional rates that are taken from data. The maturation flow of children becoming adults is affected by the *time to become an adult*, which is 15 years. That flow is then introduced as a ghost into the migration population sector on the left side of Figure 22. Note that the children structure is not divided into groups by gender.

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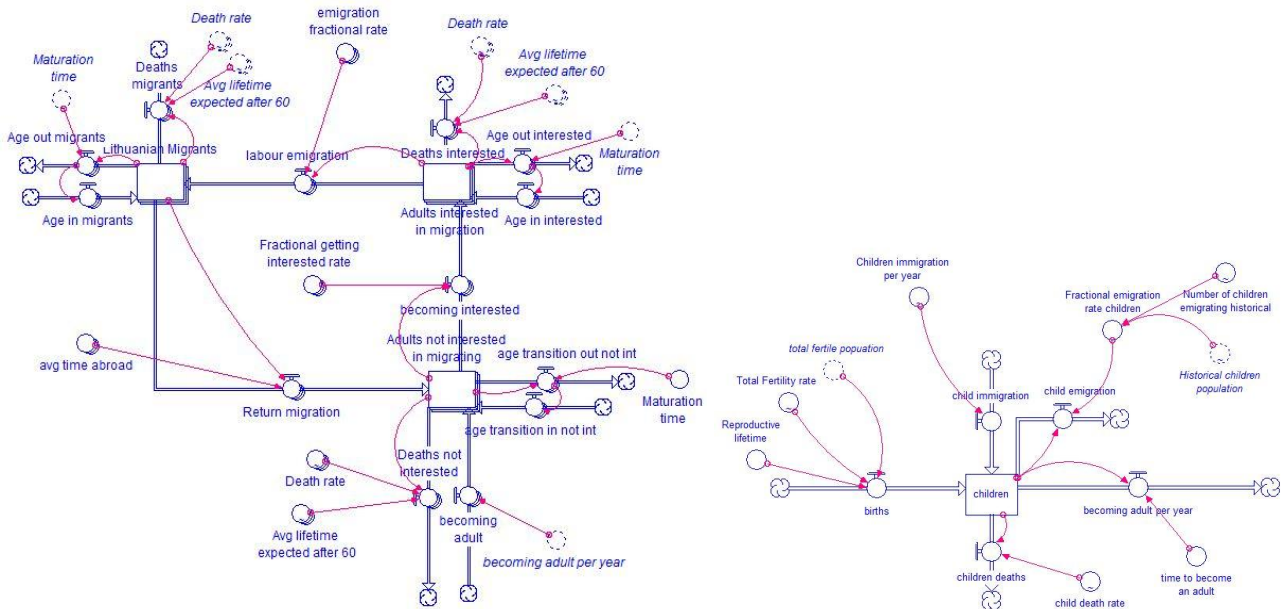
Figure 22 – The population sector of the model. To the left the aging chain and migration flows and to the right the children structure.

The stock of *Adults not interested in migration* is divided into groups by gender and age. The age groups are 15 to 29 year olds, 30 to 44 year olds, 45 to 59 year olds and those that are aged 60 and above. These age groups were chosen since emigration rates decline as people grow older and the dynamics of emigration would therefore be approached in a more realistic way. The age group of 15 to 29 year olds has the inflow of children becoming adult where 50% of them are male and 50% female. Maturation between the age groups in the stock happen through the age transition flows. When people from the age group of 15 to 29 maturate into the next age group above after a maturation time, they then flow into that age group and so on. The age group of 60 and above does not have any maturation outflow since that is the oldest age group. The inflow of people into that age group is the outflow of the age group of 45 to 59 year olds. Deaths are controlled by the fractional death rate for each age group, but the deaths for the age group of 60 and above are controlled by the *average lifetime expectancy after the age of 60*, depending on gender.

The stock of *Adults interested in migration* is also divided by gender and age groups. Deaths and maturation between age groups are calculated in the same way as in the stock of *Adults not interested in migration*. People move from the stock of *Adults not interested in migration* into the stock of *Adults interested in migration* by the flow *Becoming interested*. That flow is controlled by the *Fractional getting interested rate*,

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which is an estimate of the ratio of people considering to emigrate. The outflow from the stock of *Adults interested in migration* is the *labour emigration* flow. The flow is controlled by both the social network and the relative economic situation in Lithuania compared to the major destination countries.

People move into the stock of Lithuanians abroad by the *labour emigration* flow, which is divided into the major destination countries, age groups and gender. Deaths and age maturation between age groups are calculated in the same way as in the other two stocks. The *return migration* flow brings people from the stock of Lithuanians abroad and back into the stock of *Adults not interested in migration*. The *return migration* flow is controlled by the *average time abroad*, which is affected by the economic situation in each country. The better the situation, the more likely it is that people stay longer in that given country. Data in this sector is retrieved mainly from demographic yearbooks published by Statistics Lithuania.

5.1.2 Economic sector

As previously explained, the economic sector of the model is based on the neo-classical economic theory. Here the relative wages and the relative employment opportunities are the two factors driving emigration. The *relative economic situation due to income* is the net expected annual income in the major destination countries divided by the *expected annual income in Lithuania*, with an emphasis on the word "expected". The unemployment rates in Lithuania and the destination countries act as a factor that reduces the probability of getting the total expected annual income. The *net annual expected income in other countries* is the expected income minus the expected costs of emigrating. The *average annual income in Lithuania* and in the other countries are all exogenous drivers in the model, as well as unemployment levels abroad. The e*mployment* variable represents the number of people having a job in Lithuania and the *labour force participation rate* represents the percentage of people at a working age that are active in the labour market, but both of these variables are exogenous. The dynamics behind either the economic development abroad or in Lithuania are outside the scope of the model. The economic sector can be seen in Figure 23.
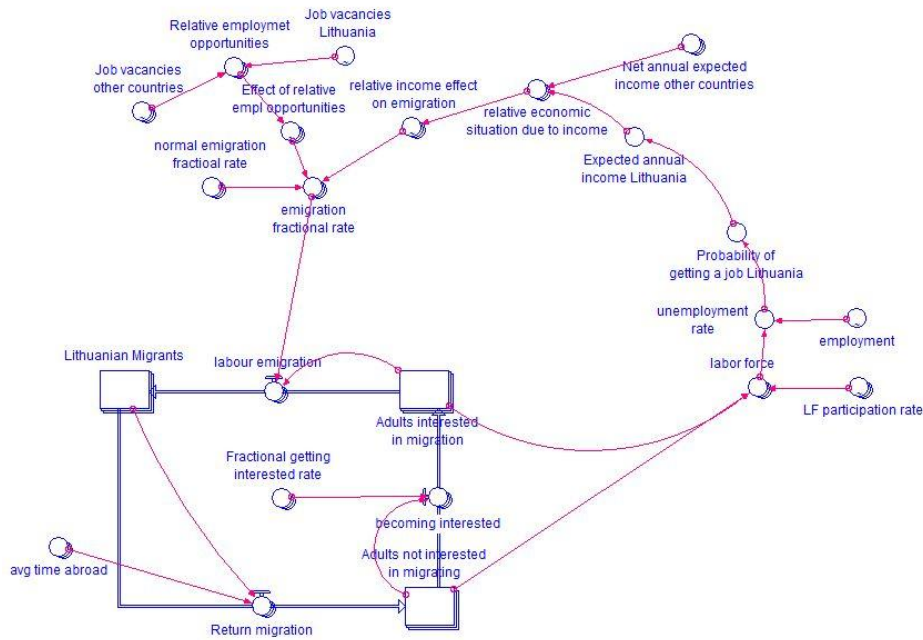
Figure 23 – The economic sector of the model

Job vacancies in both Lithuania and the other countries in question are exogenous to the model and combine to create *relative employment opportunities* in the destination countries versus Lithuania. Even though unemployment rates in Lithuania and the UK for example would be rather similar, it does not mean that employment opportunities in the countries are the same. Lithuania has only around 3 million residents while the UK has around 63 million residents. The number of job vacancies in the UK are therefore much higher than in Lithuania and that needs to be taken into account in the model. As shown in the causal loop diagram in Figure 21, the relative employment opportunities do not affect the expected benefits of migrating, rather it acts as a multiplication factor for the *emigration fractional rate*. The *effect of relative employment opportunities* is introduced to compensate for the difference in the sizes of the countries involved. In order to combine the two factors, the relative job opportunities and the relative annual income, they are tuned on a curve and multiplied to give either an amplification or dampening effect on the normal emigration rate. This gives the fractional rate of people emigrating due to economic effects, *emigration fractional rate*. The net expected annual income abroad is reduced by the cost of emigrating, which is represented by the *emigration cost index* seen in Figure 24. In a recent study by Dmytro Vikhrov (2013) financed by the European Union, migration costs are analysed in relation to migration flows.
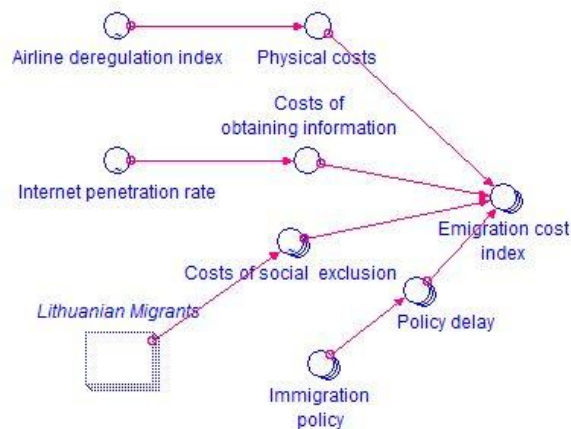
Figure 24 – The emigration cost index

The study says that emigration costs can be divided into *physical costs*, the *costs of obtaining information*, the *costs of social exclusion* and costs associated with overcoming barriers due to immigration policies. The *physical costs* include costs such as transportation and visa fees. The study chose the *airline deregulation index* to represent the reduced costs associated with physical costs since transportation has become cheaper over the years due to increased market competition. The *costs of obtaining information* is reduced by the *internet penetration rate* since technology has made it easier for potential migrants to familiarize themselves with conditions in a destination country. The *costs of social exclusion* are reduced by the extent of the social network of migrants in the country since connections to other people that share the same language and national identity in a destination country reduces the risk of social isolation. The stock of *Lithuanian migrants* abroad therefore affects the costs of social exclusion (Vikhrov, 2013). *Immigration policies* have acted as a barrier for migration of Lithuanians into the major destination countries, making it mostly illegal in nature before the country joined the EU. Norway and Germany allowed free movement of Lithuanian migrants in 2007, Spain in 2006 and the UK and Ireland in 2004. The psychological costs of immigrating into those countries therefore goes down significantly after that time since migration becomes legal. Since it is too vague to put a monetary value on all those factors, the emigration costs become an index between 0 and 1. The expected annual income abroad is then multiplied by the index to account for the reduction of the net benefits.

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5.1.3 Social network sector

The social network sector of the model is based on the network theory, which states that the larger a network becomes, the incentive for people to migrate becomes greater. The social network sector of the model can be seen in Figure 25.
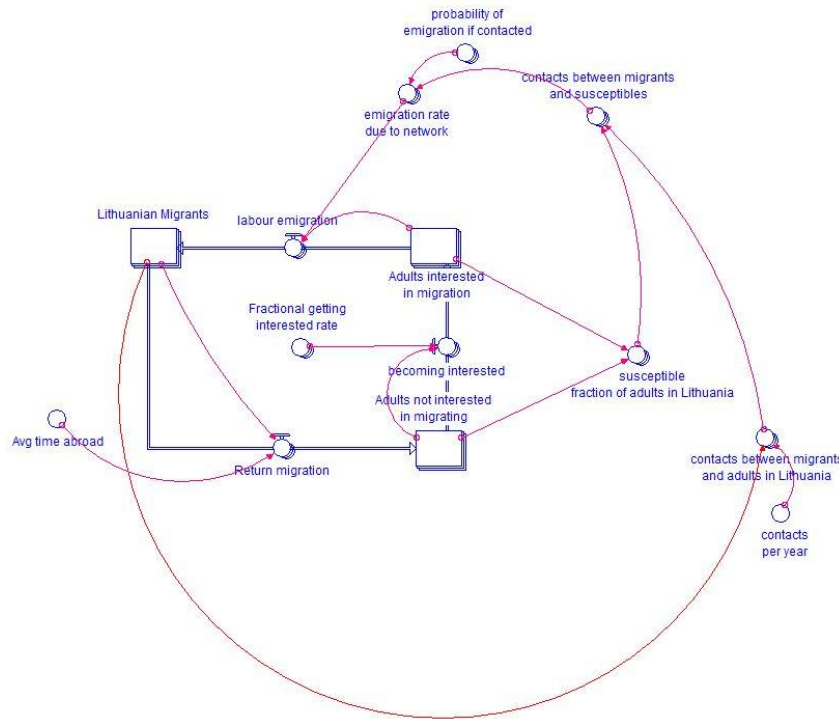
Figure 25 – The social network sector of the model

The extent of the network of *Lithuanian migrants* in a destination country has an effect on integration and psychological costs, meaning that the bigger the network, the less risk of social exclusion there is. The network of Lithuanians abroad is used as a connection to employment opportunities abroad, making emigration less risky at the same time. The model structure in the social network sector is drawn from the epidemic system dynamics model (Glass-Husain, 1991).

Lithuanian migrants abroad have a certain amount of contacts with people in Lithuania per year. Those who are considered "susceptible" for migration are those who are interested in migration. Contacts with susceptible people translates into an *emigration rate due to network* which influences the *labour emigration* flow. The major reinforcing loop in the sector can be seen in the structure in Figure 25. The larger the stock of *Lithuanian migrants*, the more contacts with susceptible people will take place, meaning that the emigration rate due to network will increase. The labour emigration

rate will therefore increase as well and eventually the stock of Lithuanians abroad will grow larger. The getting interested rate is also important in this loop since the more people that are susceptible, the more emigration will take place. The *fractional getting interested rate* is estimated for each for age but ideally, non-interested people could become interested in migration through a contact with a Lithuanian migrant, but this is not included in the model.

The overall structure of the model can be seen in Figure 26 where all those sectors are combined. The economic sector combined with the social network sector draws from components in the model to generate the Labour emigration flow. Data within the model is taken from Statistics Lithuania, statistics agencies in the destination countries, OECD, Eurostat and the World Bank.

Figure 26 – The complete emigration model of Lithuania

5.2   Behaviour of the model

In Figures 27-30, the total population and the emigration flow are compared with historical data. That is done in order to validate that the structure of the model is representative of the problem at hand. In Figure 27 the population developments between 2001 and 2013 are shown and the model proves to be representative in the sense that it manages to follow the trend of the data.
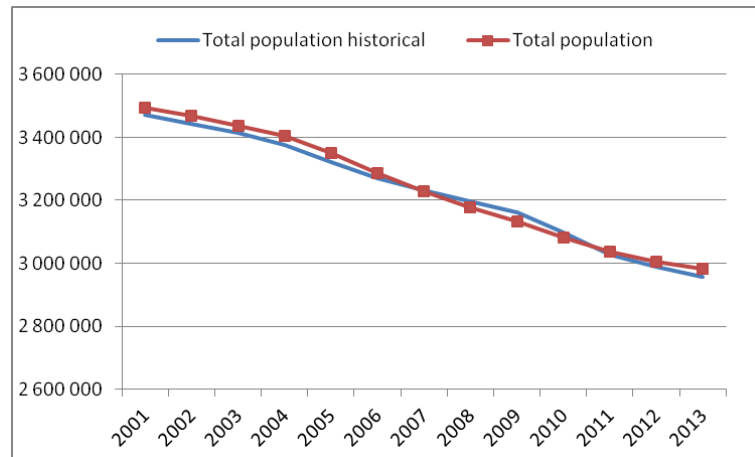
Figure 27- Simulated population development compared to historical data.

The reference mode used in this case is the total emigration flow out of Lithuania. The thesis is focused on explaining the dynamics behind labour emigration. In the total emigration flow the historical migration to Russia is included as an exogenous input since it is most likely of other nature than labour emigration. This input is minimal compared with labour emigration. Emigration to countries other than the major destination countries and Russia are omitted.
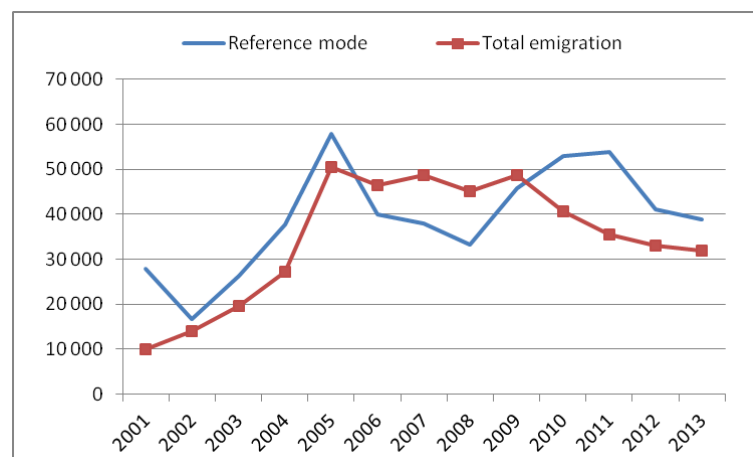
Figure 28 - Simulated total emigration over time compared to the reference mode.

Figure 28 shows the simulated total emigration between 2001 and 2013 compared with the reference mode of the total emigration flow. As we can see, the model does not replicate the reference mode perfectly. The model succeeds at generating a step in emigration after 2004 sustaining the emigration between 2005 and 2009 and then a drop in emigration occurs. This drop in emigration after 2009 in the model can be traced back to an increase in wages in Lithuania, rising unemployment rates in the destination countries and a decline in annual income in some of the destination countries.

In order to have a better understanding of the dynamics in the model we look at the behaviour of important loops individually. In Figure 29 the social network loop of the model has been disabled so the total emigration that we see consists only of dynamics from the economic sector. We see peaks in 2005 and 2009. When the effect of employment opportunities is disabled as well, we see that the relative income is the main contributor to the peaks in the behaviour of the economic sector.
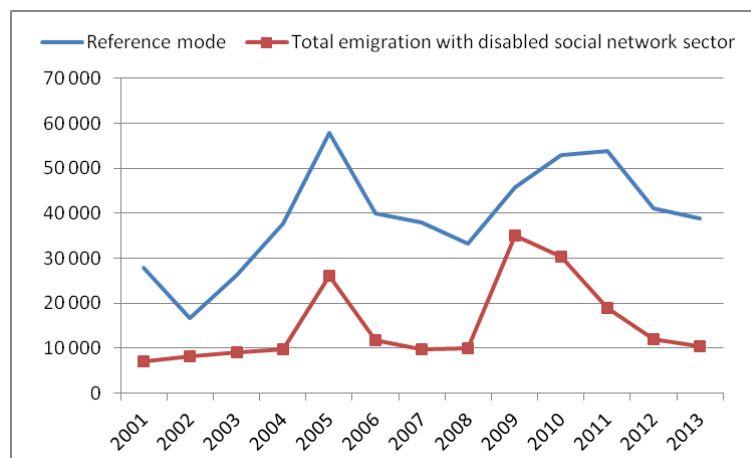
Figure 29 - Simulated total emigration without the network loop compared to the reference mode

When the economic loop of the model is disabled, it only generates emigration due to social networking. As Lithuanians abroad increase, following the peak in 2005, the migration due to social networking increases and peaks approximately 3 years later as seen in Figure 30. As expected, migration due to social networking works as an amplifier on the migration due to economic situation. The drop in the curve can be traced back to the effect of the balancing loop B1 in Figure 21 where the increased emigration drains the pool of potential emigrants.
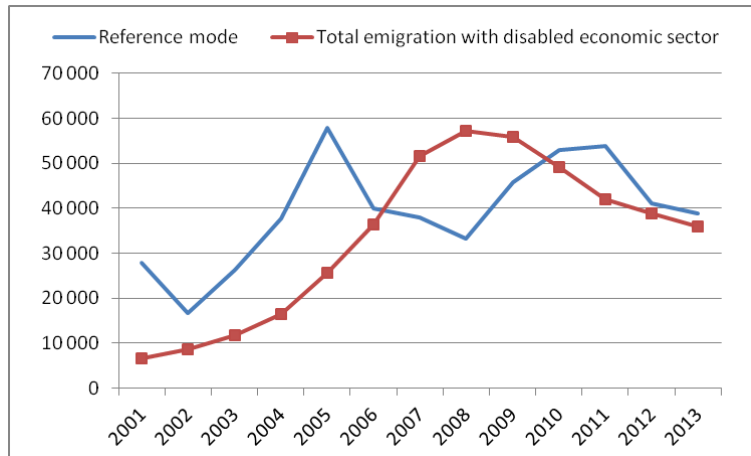
Figure 30 - Simulated total emigration without the economic loop compared to the reference mode

Running the model until 2050 reveals that the Lithuanian population continues to decrease as well as the labour force. Labour force emigration is going to be declining, but still remains high. The ratio of the people over 60 versus the adult population continues to grow. When we include simulations of forecasts for future fertility rates, we see that it has an effect on the development of the total labour force in Lithuania, seen in Figure 31.
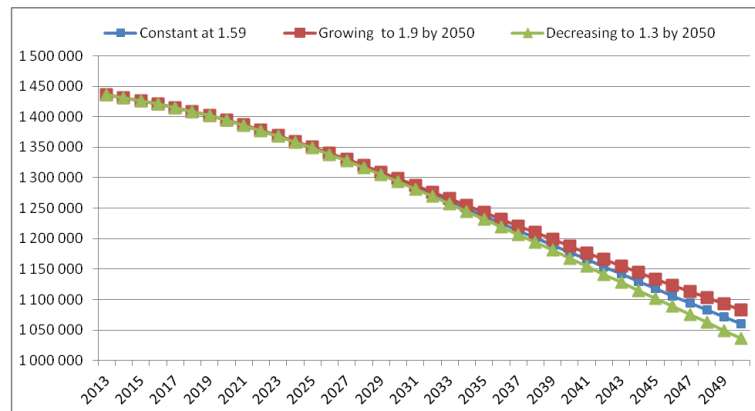
Figure 31 - Forecasts for the development of the total labour force under different fertility forecasts from 2013 to 2050.

If fertility rates stay at same level as 2013, at 1.59, we could expect a decrease in the labour force to around 1.05 million people by 2050. If the fertility rates increase from 2015 up to 1.9 in 2050 the labour force still drops to a number around 1.1 million. When fertility rates decrease gradually to 1.3 by 2050 the most drastic decline of the labour force occurs, making it slightly above 1.0 million. If we look at Jorgen Randers forecast on global development over the next forty years, we see that he estimates that the trend of declining fertility rates will continue (Randers, 2012). That means that the

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most drastic decline in the labour force seen on the graph could be the most likely scenario.

5.3   Limitations of the model

There are difficulties involved when modelling a phenomenon as complicated as migration. Simplifications and generalizations are needed in order to create a computer model but at the same time limit the ability of the model to replicate reality since human decision making is complex. The goal was however not to form any complete model explaining migration, but to use it to better understand the dynamics of labour force emigration in Lithuania. The model boundaries are limited to labour emigration out of Lithuania where economic conditions in the destination countries are exogenous. Economic factors in Lithuania, such as job vacancies and average annual income, are also exogenous as the model does not explain how they are determined over time. Demographic determinants, such as death rates and fertility rates are also exogenous since the model is only meant to replicate mechanisms that influence labour emigration. A clear limitation to the model is that it does not replicate the reference mode perfectly, which is the emigration flow out of Lithuania.

The parameters that the model is sensitive to include the probability of emigration if contacted, the fraction of adults becoming interested in migration, the normal average time spent abroad and contacts per year. It is a clear weakness of the model that these parameters are highly uncertain. The Emigration cost index includes the psychological costs associated with emigration as well as the immigration policy barriers but they are difficult to include in the model and need further research.

Using annual average income and unemployment rates for the probability of an expected income could give a false image of the reality since the probability for unemployed people to get work is less than for a person chosen at random from the labour force. The same is true when comparing the expected income in various countries since unemployed people are likely to earn less than the average. However, since the same is probably true for both destination countries and the origin country we use this approach as an approximation of the reality. As long as the error is the same in both origin and destination country the relative comparison is considered valid.

6.   POLICY ANALYSIS

6.1   Background information

As mentioned before, migration research has primarily evolved around immigration rather than emigration and the effects on the destination country rather than the origin country. This also applies when it comes to policy research on migration (Kupiszewski, 2013). Management of migration flows has become an issue that is high on the political agenda in most developed countries. The projections of aging populations in the OECD countries coupled with anticipated labour shortages will most likely drive international migration flows from developing countries into the developed ones. The gap in income and standard-of-living between developed countries and those that are considered developing, will keep on ensuring that there is an incentive within the system to migrate. Migration is considered to be a positive phenomenon both for sending and receiving countries if it can be managed properly. For sending countries, migration can entail economic growth, investment opportunities, growth of human capital and a decrease in poverty, but only if the country is able to restructure the economy in accordance with emigration and ensure a distribution of the benefits that come with it. Migration is a complex issue and policy makers need to be well aware of the linkages it has into the economic and social spheres in the countries involved (Katseli, Lucas, & Xenogiani, 2006).

When it comes to immigration flows, politicians often are put in an awkward position. The labour market might benefit greatly from increased immigration while the public discourse is against it. European welfare states see immigration both as a solution and a challenge. The demographic pressures on the welfare system caused by aging population can be largely alleviated by increased immigration while that same immigration is often blamed for the economic difficulties that governments are facing when keeping up a generous welfare state. There is always a certain level of frustration when the goals of a policy and its outcome do not match. Migration policies can influence migration flows greatly, both the demographic composition of the flow as well as its magnitude. There are contradictions between the reality in developed

countries and the immigration policies practiced there. The goals are seldom reached and often the total opposite of what was intended turns out to be the outcome. In general, the migration policy that is practiced in Europe is mainly catered to efforts to get the "right people" in, instead of minimizing immigration. The policy is often aimed at being responsive to the needs of the labour market, weather it is getting high skilled workers or low skilled seasonal workers into the country. Other common components of the European migration policy are to combat illegal migration, limiting abuse to the asylum system and offer integration measures (Massey & Taylor, 2004).

6.2   Current and former migration policies in Lithuania

Lithuania had a restrictive migration policy while the country was under the rule of the Soviet Union. Both immigration and emigration were illegal at the time and controlled by the USSR, which changed after the fall of communism. When the country joined the EU it in fact had a big impact on the migration policy in Lithuania. Free movement of people within the EU applied for Lithuanians which lifted all previous restrictions of migration (Kupiszewski, 2013).

The Lithuanian government has taken some measures to combat the growing demographic pressures in the country due to the high emigration flows. In 2006 the country started to experience labour shortages and in the next year, the government approved the Economic Migration Regulation Strategy. It was focused on mitigating the negative effects of emigration in the country and to provide incentives for Lithuanians residing abroad to return (European Migration Network, 2013b). In 2008, the government adopted the Immigration Policy Guidelines which was meant to further support the Economic Migration Regulatory Strategy. It specifically covers issues such as economic immigration, illegal migration and integration. The main objectives of the policy were to ensure that Lithuania managed to minimize labour shortages, avoid the negative effects of emigration and an aging population on social development and public finances, effectively manage migration flows to and from the country and participate actively in the EU's immigration policy-making process. In order to achieve those goals, the strategy included principles that should be followed. They include for example measures to only employ third country nationals if labour force from Lithuania

or other EU countries are unavailable. In addition to that, immigration should be based on selectivity and flexibility to ensure a match between labour demand and migrant flows. The policy recommended looking to countries that have strong ties with Lithuania, such as Belarus, Ukraine, Moldova and countries from the Southern Caucasus region. Integration efforts should be enhanced, such as Lithuanian language courses. However, increasing immigration should be secondary and efforts to encourage return migration should be continued. Agencies within the public sphere that deal with these issues also needed to cooperate more to enhance the effectiveness of the policy. There was no monitoring system included in the document which allowed for evaluation of the progress of the strategy. Another measure to tackle migration issues was a strategy, approved in 2011, called Global Lithuania Strategy, where further emphasis was put on encouraging return migration. This strategy included concrete evaluation criteria and a re-evaluation is scheduled to take place in 2019 (European Migration Network, 2013a).

Although the Immigration Policy Guidelines were approved in 2008, an additional resolution was made in 2014, on approval of the Lithuanian Migration policy guidelines. The document was intended to "establish the objectives, principles and direction of Lithuanian migration policy and to ensure proper control of migration processes". In order to do that the Government of Lithuania would approve the Lithuanian Migration Policy Guidelines and to establish that the provisions of the previously mentioned Immigration Policy Guidelines would be complied with by ministries and institutions. It should also be recommended to all municipalities to align their actions in pursuance of those guidelines. The document does not specify how this will be done. The main objectives of the migration policy were to gradually reduce mass emigration and to increase circular migration, ensure that the policy for attracting labour force met the demands of the labour market, combat illegal migration and create and develop an integration system for foreigners. The policy document specifies that immigration of third country nationals should not stimulate Lithuanians to migrate to other countries. It would also be necessary to address the growing negative attitude towards immigrants in the public discourse and reduce prevalence of xenophobia and discrimination within the society. In order to increase the attractiveness of Lithuania as a destination country, measures should be taken to improve procedures regarding for example residence and work permits. The policy guidelines, different from the ones

approved in 2008, included evaluation criteria and which agencies are responsible for providing information on the criteria. Information of how the objectives will be accomplished is however very vaguely mentioned as well as what actions the government plans to take. For example, the issue of reducing youth unemployment, and how it needs attention, is brought up, without mentioning what measures will be taken in order to accomplish that (Government of the Republic of Lithuania, 2014).

Dr. Karolis Žibas, junior research fellow at the Ethnic Research Institute, criticized Lithuania's migration policy in 2013 and stated in an interview that: "In fact, Lithuania does not have a long-term immigration strategy, there's only an administrative apparatus issuing work and residency permits" (Digryté, 2013). The new Migration Policy Guidelines were approved in 2014 so even though it offers some signs of a move in the right direction of the government of Lithuania, it still has to come to light weather the measures will bring about positive outcomes. It seems as if the migration issue, that appeared high on the political agenda in the years before the economic crisis in 2008, lost funding and resources in the following recession years. The policy guidelines from 2014 indicate that the government is ready to put further efforts into analyzing and tackling the issue of mass emigration. Former policy measures directed at the issue might have had some effects on the trend, but it does not change the fact that there are no indicators that the emigration trend is halting, making the former policies sound more like policy wishes than actual actions.

6.3   Policy options

Richard Elmore (1979) distinguishes between two approaches to policy making, which he calls forward and backward mapping. He defines forward mapping as a policy process that is initiated by a political statement by a government that an action will be taken on a certain issue. Detailed steps of implementation are then outlined and in the end, the intended outcome is defined as well as how its success should be measured. This approach assumes that positive results can be achieved through control and authority. It relies on the organizational structures within the administrative bodies, regulations, funding and authoritative relationships within the public sector in order to implement the policy and see it succeed.

When it comes to backward mapping, it is essential that the problematic behaviour that needs to change is clearly specified. We go all the way down the line to the actor itself and what behaviour it is that is proving to be so problematic that a policy needs to be designed to alleviate it. Only when the problematic behaviour is clear can we start to think of a course of action. Next, we need to recognize the organization that is most likely to have the best chance of successfully implementing the policy and which effects it will have. The administrative unit chosen for the job will then be analyzed with regards to which extent it is capable of changing the problematic behaviour. Resources needed for the unit to do the job are then outlined (Elmore, 1979).

In the case of Lithuania, there can be many aspects of the emigration problem so policy makers need to be clear on their intent. What is the main problematic behaviour at hand? Is it that people are leaving the country? Is it that people are leaving and not coming back? Is it that working age population is declining in the country? Is it that labour force participation is too low to provide enough workforce for the economy? The solution should be tailored to what is defined as the problematic behaviour. If the problem is simply that the country needs more people at a working age that can be solved simply with increased immigration of foreigners. If the problem is that people are simply leaving the country, the government can focus on policy measures aimed at getting people to stay in the country. If however, the problem is that emigrants are not returning from abroad, that is an issue that needs another solution. In this case, it seems that most policy measures taken by the government are focused above all on the low return migration rate. Emigration in itself is not seen as a negative thing, but something that could actually benefit Lithuanian society, if properly managed. The shortage of workforce is seen as a side effect of the low return rate and immigration is mainly seen as a short-term measure.

In the Lithuanian Migration Policy Guidelines, approved in 2014, the government mentions a few objectives in order to alleviate the problem of mass emigration in Lithuania. The three major flows of migration in and out of the country are mentioned, emigration, immigration and return migration. The migration policy has the objectives to decrease emigration, encourage return migration and to increase immigration if the labour market needs workforce. In order to decrease emigration, measures need to be taken towards eliminating negative social and economic factors that encourage migration and youth unemployment is an important part of that. In regards to return

migration, measures are needed to enhance cooperation with the destination countries, mobilize Lithuanians abroad to keep their ties with their homeland, provide consultation and support to those who return or contemplate returning as well as offer measures to integrate them into the labour market (Government of the Republic of Lithuania, 2014).

6.3.1 Return migration

When a country that has received large inflows of migrants experiences an economic downturn, it can lead to a process where the migrants move back to their origin country. No country has been totally successful in economically and socially integrating those who return. In order to accomplish that, it has to be done with holistic policies that are aimed at the population in general, that offer benefits to return migrants as a side effect. Policies that are especially aimed at return migrants could possibly bring about some resentment within the public and cause others to see return migrants as a group that is getting a special treatment by the government (Massey & Taylor, 2004).

One of the possible policy measures the government of Lithuania can take in order to combat the issue of emigration, is to encourage return migration. The government seems to be well aware of that approach since most of the approved policy guidelines evolve around return migration and as a primary approach, with immigration as a secondary approach. It is essential for the country that the likelihood of return migration should be increased, but studies show that the odds of return diminish considerably when people stay abroad for 3 years or longer (Thaut, 2009). According to Thaut, attempts should not be made to control the on-going migration trend by the origin country through restrictive policies. The migration flows are driven by structural forces and micro level processes. Emigration in itself should not be seen as a negative thing; it can in fact increase the expected return on education investments in case of short term migration and result in a brain gain for the origin country. Return migrants will raise the human capital of a country, given that they are able to make use of their newly required skills, knowledge and income, which could in general have a positive effect of a country's socio-economic development. The optimal way for societies to gain from migration and reduce the emigration push effect is to develop targeted policy measures, including making return migration more attractive (Thaut, 2009).

The government of Lithuania has however not been able to create the right environment for return migrants to make use of their newly acquired skills. It has been estimated that in recent years, around 40% of all return migrants have been economically inactive after returning to Lithuania (Hazans & Philips, 2011). It seems therefore that the government has not been successful up to this point to create an environment to harness the skills of these individuals and re-integrate them into the labour market. The government mentions that migrants usually get jobs that are below their qualifications possible as reason for this development. When educational levels of a migrant do not correspond to his work experience abroad it could be that an employer does not see the value in employing them. A failure to re-integrate return migrants into the labour market will entail the danger of re-emigration, which is exactly something that the government is interested in changing.

A policy aimed at increasing incentives for return migration could be increasing job opportunities for educated people. The fact that many of those emigrating are young, educated people who have been unemployed prior to departure suggests that the job opportunities for the group is lacking. When we look at investments in the private sector in Lithuania, we see that it is low, especially when it comes to innovation and research. This could have a negative effect of the growth of the economy in the long run (European Commission, 2015a). The EU 2020 targets set forward by the European Union include increasing investment in research and development to 3% of GDP. Lithuania currently spends 0.95% of its GDP towards the category but aims to increase it to 1.9% (European Commission, 2015b). Investment in innovation and research can have positive effects on competitiveness and growth of an economy, as Finland managed to prove, but they did just that following their economic crisis during the first half of the 1990s (OECD, 2009).

Implementing a policy evolving around investing in start-up companies could help the country achieve its goal. There already seem to be start-up platforms offered in Lithuania, for example Startup Lithuania and Startup Highway, but the country's research and innovation system is still not adequately developed according to the EU. The system fails to provide sufficient incentives for business research development as well as cooperation between the public and private sectors. The impact of policies already in place, to enhance cooperation between science and business, are well below the EU average and Lithuania seems to be using EU funding to replace rather than

compliment national funding towards research and development. Despite a number of strategy documents aimed at the subject as well as different measures and public programmes, there is overall lack of coherency which minimizes success. The country needs to simplify bureaucratic obstacles that make it difficult for university teams to participate in private industry projects and focus more on funding long-lasting programmes (European Commission, 2015a). A policy on return migration is not included in the model structure.

6.3.2 Immigration as a solution

Even though emigration can relieve pressures on the economy by reducing unemployment rate that can also cause labour shortages in certain sectors and at the same time hinder economic growth (Thaut, 2009). One of the ways to ensure sufficient labour availability in the country is to increase immigration of foreigners. Governments have to be aware of both long term and short term migration trends when designing a policy and in the future, Europe in general will lack sufficient labour force. Immigration policies that are restrictive might therefore not be the best solution in the long run (Koehler, Laczko, Aghazarm, & Schad, 2010). Demographic challenges that Europe faces can only be faced if immigration is included as one of the solutions. Many EU countries have however failed to create an attractive environment for foreign workers as laws are restrictive in terms of long-term residency. Work and education opportunities for family members are limited as well as language support and overall attitude towards immigrants in the countries often lacks tolerance (Platonova & Urso, 2012a).

Lithuania specifically has been experiencing long term labour force shortages within certain sectors, which became increasingly evident in and after 2007. Meanwhile, immigration of foreign workers remains low and has even been decreasing after the economy crisis in 2008. For example, residence permits for work purposes decreased from 4.498 in 2008 to 1.393 in 2010. The policy guidelines approved in 2008, aimed among other things to increase immigration, do not harmonize with that fact, further underlining the wishful nature of the guidelines. At the same time, emigration flows after the crisis have been increasing. The number of foreigners in Lithuania has been relatively stable over the years counting around 1% of the population. Most of the foreigners are citizens of Russia or Belarus that had residence

in Lithuania before 1990 and remained there after the fall of the Soviet Union without filing for Lithuanian citizenship but have a permanent residence permit. Foreign workers that have temporary residence permits in Lithuania originate mainly in neighbouring countries such as Russia, Belarus and Ukraine (Platonova & Urso, 2012b). Reluctance to increase labour immigration into Lithuania could also be related to national security issues evolving around large numbers of Russians working in the country.

The Migration Policy Guidelines from 2014 mentions that immigration is not high in the country compared to the needs of the labour market and that foreign workers are mainly concentrated in the service and industry sectors. The guidelines recognize inflexible and time consuming procedures to issue work and residence permits as one of the key causes for low immigration. No attempts have been made to attract specifically foreign workers into sectors that are suffering labour shortages and make procedures less difficult to go through. Moreover, foreigners that have studied in Lithuania are usually obliged to leave the country after they have obtained their degree. The country is therefore not considered to be doing so well when it comes to the selective immigration policy of "getting the right people in". In addition to slow administrative processes and restrictive legal framework, the country is also competing with other EU countries in regards to salaries; a factor that is hard for Lithuania to come up on top in.

Integration policies aimed at foreigners are also lacking in Lithuania, but there is no central agency or institution that is responsible for the issue. It is divided among many ministries and there is no document or regulation in place that supplies guidelines for how the integration policy should be managed and NGO's have ultimately provided the main infrastructure for integrating foreigners into Lithuanian society. Moreover, in comparison to other EU countries, Lithuania ranks at the low end on the Migrant Integration Policy Index, which considers access to nationality of migrants, labour market mobility, education, family reunification, political participation, long-term residence and anti-discriminatory policy. The effectiveness of Lithuania's integration measures is therefore considered low in comparison to other EU countries, making other countries possibly more attractive for foreigners. Lithuanians are also more likely than not to have a negative attitude towards immigrants which is definitely a barrier when it comes to integration of foreigners (Government of the Republic of Lithuania, 2014).

Many studies have been made that suggest that migration benefits countries in the long run and that immigration of foreigners does not have a substantial negative effect of either employment levels or wages. The immigrants contribute to the demand of goods and services which then further enhances labour demand. Hiring foreign workers can also have a decreasing effect on cost of production which instead decreases the cost of goods and services. The effect of immigration can therefore be higher on real income than on wages alone. The long term and short term effects depend however greatly on the flexibility and efficiency of the labour market and mobility of native workers so results could vary in terms of skill level, location and sector. Countries such as the UK, Spain and Norway are all considered to have benefitted greatly economically due to migration of foreign workers into the countries. The countries usually report that native workers and foreign ones are complementary in the workforce since the foreign workers usually fill positions that native workers either do not want or are not qualified for, depending on where labour shortages appear in the labour market. Direct competition for jobs between native and foreign workers is therefore often minimal.

The Lithuanian government needs to be aware of any trends that indicate skill and educational system mismatch within labour demand and act accordingly. In the long run, getting immigrants to fill the vacant positions within a sector might not be the best solution given that there is high unemployment rate in the country. The education system then needs to be better tailored to the needs of the market (Platonova & Urso, 2010). Policies on immigration of foreign workers are not included in the model since it is beyond the boundaries of the model.

6.3.3 Economic growth policy

The government acknowledges that the policy intended to encourage return migration has not been as successful as hoped in the 2014 Migration Policy Guidelines. Admission of foreign immigrants is mainly seen as a part of a wider policy mix intended to address the issue of labour shortages in the country. But the government recognizes that the relative economic wellbeing in Lithuania compared to the destination countries as the main cause of the overall migration problem that the country is facing. Easy and overall access of the population to amenities and markets

coupled with actions aimed at restoring trust in the government are crucial when it comes to battling migration (de Haas, 2010).

The EU mentions in a report on labour shortages that countries that find themselves in that situation can turn to many economic interventions to alleviate the problem, other than immigration of foreign workers. Those actions could include increasing wages, improve the condition of workers, increase labour force participation among demographic groups that are likely to be inactive such as women and current residents with a foreign background and investing in education (Platonova & Urso, 2012a). It is stated in the Migration Policy Guidelines of Lithuania, approved in 2014, that the negative effects of emigration can not only be eliminated through legal or administrative regulation, but rather through economic measures. Those could include reducing unemployment, job creation, employment stimulation, improvements within the health care sector and of people's living conditions as well as create an environment fostering wider employment opportunities. If these economic measures would be achieved it would weaken the economic and social factors, such as wage differentials and level of economic development, that act as push factors in emigration. The policy to increase funding in research and development to create an incentive for return migration harmonize with the Migration Policy Guidelines to create an environment for more job opportunities.

In order to deal with the problem that is a side effect of emigration, namely the shortage of labour force in Lithuania, a policy on increased labour force participation has been included in the model. The policy aims to gradually increase the retirement age up to 67 years by 2030 and by that time have 50% of the people at the age between 60 and 67 active in the labour force. The Lithuanian government already approved legislation in 2011 on increasing retirement age gradually up to 65 years in 2026, but today women qualify for retirement at the age of 60 and men at the age of 62.5 (Seputyte, 2011). The goal of the policy was mainly aimed at reducing the government's expenses related to the pension system, but also to encourage employment of elderly persons (Bitinas, 2011). In a report done by the European Commission where the country profile of Lithuania is analysed for 2015, it is stated that sustainability or the pension system could be at risk due to the ageing population. What is also mentioned is that the working age population is shrinking rapidly which could possibly slow down potential economic growth. Lithuania also has one of the fastest aging population and

the old-age dependency ratio is expected to double by 2040. (European Commission, 2015a). Overall increase of labour force participation in Lithuania is needed, but in this case we focus on the oldest age group by simulating the effects of the policy.
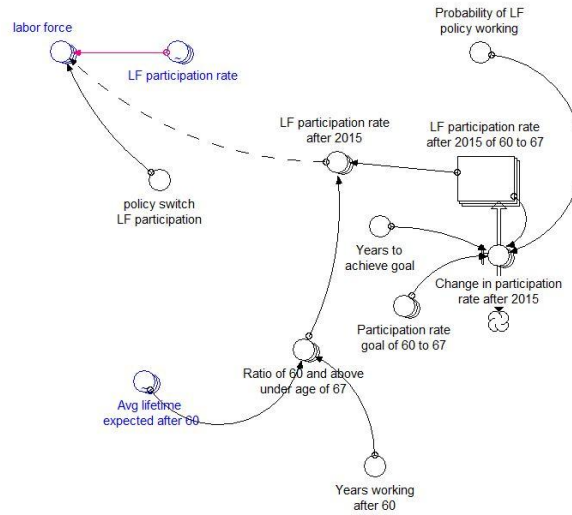
Figure 32 - The structure of the labour force participation policy in the model.

The structure of the policy can be seen in Figure 32. It is based around a gradual increase in the labour force participation rate after 2015 for people aged 60 to 67 using a stock and flow. To find the initial labour force participation rate (LFPR) for this age group we find the ratio of people aged 60 to 67 years old in the group that is 60 and above. That is done by dividing 7 years by the average lifetime after 60 at 2013, which is 7/16.87=41.5% for men and 7/22.97=30.5% for women. The participation rate for 60 and above in 2013 was 9.7% for men and 6.4% for women. That gives us the participation rate for the age group 60 to 67 which is 23.4% for men and 21% for women if it is assumed that there is no labour participation for people aged 67 and above. The change in participation rate after 2015 is the difference between the initial LFPR and the goal divided by the years to achieve the goal. The new LFPR for people between 60 and 67 is then changed to participation rate for the population over 60 years by multiplying it with the ratio of 60 to 67 in the 60 and above group. The policy switch is used to activate the policy after 2015 using the new labour force participation rate instead of the old one. There is a wishful thinking link between the new participation rate after 2015 and the labour force since the structure does not include what is needed for the policy to be implemented.
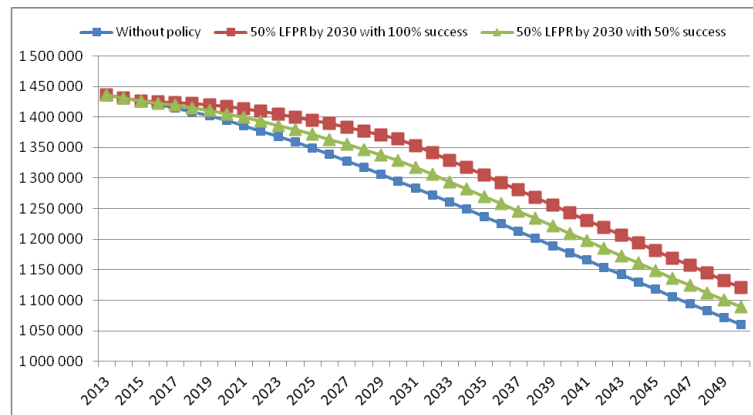
Figure 33 - Different developments of the labour force of Lithuania over time, depending on the policy and its success.

Without any policy action, the labour force will continue to decline and reach about 1.05 million in 2050, as can be seen in the graph in Figure 33. If the success of the policy is only 50%, the labour force will decline, but not as much as without any action. If the policy is implemented with 100% success rate the labour force will decline to around 1.12 million. In all these scenarios, the fertility rate is kept stable at 1.59, which is the same level as it is in 2013. We use extrapolation for the average lifetime expected after 60 years of age to account for the likelihood of growing life expectancy, but Eurostat projections expect that life expectancy of men above 60 years will grow to 19 years and female to 22.6 years by 2050 (Jankauskiene & Medaiskis, 2012). The policy does not predict any increase in labour force participation rate for people younger than 60 and therefore the impact on the labour force development is not great but does manage to improve the situation.

6.4   Implementation and feasibility

After the economy crisis of 2008, the government of Lithuania, as so many other others, had to go through painful budget cuts. The public sector felt those actions throughout the system and national institutions and agencies that deal with issues related to migration were no exceptions. The budget cuts brought about structural changes and loss of human resources within agencies. Before the economy crisis, the Lithuanian government both issued policy guidelines and started the Global Lithuania project. Both those documents were evidence that the government was ready to tackle the emigration issue at hand, but given the financial force majeure that the crisis brought on, resources

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were not allocated to the policy area. Migration is an issue that affects many sectors within the public and the Migration Policy Guideline document that was approved in 2014 includes a section where it is mentioned that the financial crisis did halt financial resource allocation. Other implementation challenges that followed were that there was no central organization responsible for migration, but rather spread through many ministries and their agencies. As Table 2 shows, there are at least five ministries responsible for issues related to migration.

Table 2 – Governmental institutions involved in the migration policy area. Information taken from Resolution No 79 on Approval of the Lithuanian Migration Policy Guidelines.

	Responsible agency	Responsible for
Formation of migration policy	Ministry of Interior	Formation of issues regarding migration policy.
	Ministry of Social Security and Labour	Labour policy, social integration of foreigners and administration of EU funds towards integration. The Lithuanian labour exchange agency under the ministry issues work permits to foreigners.
	Ministry of Education and Science	Education of foreigners, coordination of studies and employment of foreign teachers.
	Ministry of Foreign Affairs	Visas and policy areas that strengthen the relationship of Lithuanians abroad with Lithuania.
	Ministry of Economy	Formation of economic policy, analysis of demand and supply of human resources in the labour market and acknowledgement of education obtained abroad.
Implementation of migration policy	The Migration Department	Implementation of visas and immigration, asylum and Lithuanian citizenship procedures, issuing residence permits and implementation of the principle of free movement of people.
	The Police Department	Controlling and coordinating the operations of migration subdivisions of territorial police institutions which implement migration policy established by laws.
	The State Border Guard Service	National control of migration processes throughout the territory of Lithuania.

Coordination between those institutional bodies involved in the policy area is lacking and opinions and positions of the institutions are often conflicting. The government has

not been able to recognize which institution has the competence to oversee and solve the issue of integration of foreigners and there is need for more human capital in the area, both in regards to staff-to-duties ratio as well as qualification of specialists. These things have made it essential for non-governmental organisations to step in and deal with issues arising in the policy area. These include the International Organization for Migration in Vilnius, the Red Cross and others.

Implementation challenges of the policies mentioned above are many since they require cooperation between different agencies and ministries and legislation needs to be changed by elected officials. Former implementation challenges were discussed in the Migration Policy Guidelines, approved in 2014, where lack of funds, resources, human capital and coordination between responsible agencies were taken as examples of things that were lacking.

In the case of the innovation policy aimed at encouraging return migration it is unlikely that the policy would be opposed by the public or any interest group since investing in research and development is generally seen as a positive thing. The program would however need attention from the ministries that are responsible for the implementation, namely the Ministry of Social Security and Labour and the Ministry of Economy, but there is a danger that other issues would have priority. The policy aimed at encouraging immigration of foreign workers to meet the needs of the labour market, would face more political opposition since attitudes towards foreigners in Lithuania is more likely to be negative. The Ministry of Economy would also need to communicate the labour market needs in a sufficient manner to the Migration Department, that issues work visas, creating a great deal of coordination as well as access to frequently updated statistics on the labour market. The policy on raising the retirement age to 67 to increase labour force participation rate would also meet opposition by the public, especially the older population. Proposing a policy of that sort can be challenging for elected officials since older people are more likely to show up on election day. That policy could also entail a cultural feasibility issue and meet opposition by organized interest groups with access to the media.

When it comes to any kind of policies, they are political in nature and the political parties that are involved in their creation have an ultimate motive; to be re-elected. The political structure in a country is highly relevant when it comes to the policy making process. Weather an issue gains enough momentum to open up the window of

opportunity for a policy to emerge is dependent on public discourse, media attention and where we are in the election term. The policy proposal can change form from the time of campaigning to the time the political party is in power, and then again if elections are drawing near (Zincone, Penninx, & Borkert, 2011). Policy options will be deemed on their political feasibility and how likely it is for a politician to be able to sell the idea to its voters. As can be seen in Table 3, the biggest feasibility challenges of the three policy options mentioned above are outlined as well as the costs and the benefits they entail.

Table 3 – Outline of policy options

	Immigration	Economic growth	Return migration
Policy proposal	Simplify work visa and residence permit processes in order to increase inflow of foreign labour to the sectors that need it.	Raising the retirement age to 67 years to increase labour force participation. Decrease youth unemployment.	Foster innovation with better framework for start-up companies. Increase funding and emphasis on research and development.
Responsibility for implementation	Ministry of Social Security and Labour in cooperation with the Migration Department.	Ministry of Social Security and Labour in cooperation with the Ministry of Economy.	Ministry of Education and Science in cooperation Ministry of Social Security and Labour
Cost/benefit	Overall economic gain for the country. Funds needed to the Migration Department.	Decreased budget deficit of pension system and increased labour force. Funds needed to change administrative processes.	Benefits more likely visible in long run. Will require high costs to fund the program.
Feasibility	Politically it will prove as a challenge since public opinion is likely to be negative towards immigrants.	Increase retirement age unpopular. Voters tend to be older so less political feasibility. Cultural feasibility could pose a challenge.	Positive for political feasibility since it has the potential to score with voters.

Overall, good quality statistics regarding migration are essential when dealing with the task of creating policy options. If accurate numbers on population stocks and flows are unavailable or insufficient in any way, it makes it that much harder for policy makers to know whether they can allocate enough resources towards a solution. Any evaluation of one policy option over the other becomes almost pointless if information about scale and composition of those who migrate is missing. In those cases, objectives and measurements for success become blurred and funds needed to reach any policy goals will most likely be underestimated. Migration policy that is not supported by good data

and statistics can therefore lead us on a path that wastes both time and money (Chudinovskikh, 2011).

7. CONCLUSION

The aim of this thesis was to contribute to and extend the research literature on migration and apply the system dynamics approach to explain parts of the phenomenon in Lithuania. The approach is well suited to tackle this sort of analysis as complex models can be built intuitively. The model built in this thesis is drawn from literature in neo-classical economic theory and network theory. Using the model it is possible to explain part of the emigration patterns that have been occurring in Lithuania in the 12 years between 2001 and 2013. The model however fails to capture the complete dynamics of the process.

Nevertheless, using the model to forecast future trends and scenarios revealed that with current rates of fertility, mortality and emigration, Lithuania's labour force will continue to drop by 2050. This trend is not sustainable for the country and measures need to be taken by the government. Actions to reverse the trend or at least minimize its effect on the labour force and economic growth could include policy measures aimed at investing in research and development, increasing labour force participation rates, increase return migration and increase immigration of foreign workforce. The feasibility of such policy options are dependent on better coordination and cooperation between governmental agencies responsible, allocation of funds and resources as well as political environment in the country.

This work is a first step in modelling the problem of emigration in Lithuania and it can be built upon. Drawing from further migration literature the model could be extended in order to better replicate the trend. Estimates of uncertain parameters need to be looked at in more depth, especially the high sensitivity parameters mentioned earlier and the emigration cost index. All this work and future research are dependent on good quality statistics that represents reality and Lithuania could benefit from comparing their data with the major destination countries, especially when it comes to emigration flows.

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APPENDIX A – MODEL DATA

Population statistics	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Data source
Total annual average population	3499500	3470800	3443000	3415200	3377000	3322500	3269900	3231300	3198200	3162900	3097300	3028100	2987800	2957700	Demographic Yearbooks Lithuania
Total adult population	2789500	2786000	2783400	2782200	2768200	2748879	2716996	2699113	2686730	2672147	2627263	2573682	2543739	2521124	Demographic Yearbooks Lithuania
Total labour force	1671500	1635800	1630300	1641900	1620600	1606800	1588300	1603100	1565600	1528100	1518100	1481600	1472500	1465200	Labour Market Yearbooks Lithuania
Total children population	710000	684800	659600	633000	608800	573621	552904	532187	511470	490753	470037	454418	444061	436576	Demographic Yearbooks Lithuania
Migration statistics															
Estimated emigration by Statistics Lithuania	21816	27841	16719	26283	37691	57885	32390	30383	25750	38300	83157	53863	41100	38818	Demographic Yearbooks Lithuania
Immigration	1510	4694	5110	4728	5553	6789	7745	8609	9297	6487	5213	15685	19843	22011	Demographic Yearbooks Lithuania
Net migration	-20306	-2559	-1976	-6304	-9612	-8782	-4857	-5244	-7718	-15483	-77944	-38178	-21257	-16807	Demographic Yearbooks Lithuania
Emigration to former USSR countries	1426	3648	3453	3370	3052	4141	2297	1990	1625	2007	1479	1100	932	1111	Demographic Yearbooks Lithuania
Reference mode adjusted emigration	21816	27841	16719	26283	37691	57886	39929	37922	33289	45839	53000	53863	41100	38818	
Children age 0 to 14 emigrating	2147	2950	2950	2300	3000	7937	4100	2800	2700	3000	8483	5651	5179	5060	Demographic Yearbooks Lithuania
Children age 0 to 14 immigrating	756	756	812	812	581	859	1059	1105	1163	954	630	1404	1968	2331	Demographic Yearbooks Lithuania
Death rates															
Age 0-14	0,0008	0,0007	0,0007	0,0006	0,0007	0,0007	0,0007	0,0006	0,0006	0,0006	0,0005	0,0005	0,0005	0,0005	Demographic Yearbooks Lithuania
Age 15-29	0,0014	0,0015	0,0014	0,0013	0,0013	0,0014	0,0014	0,0014	0,0012	0,0011	0,0009	0,0009	0,0009	0,0009	Demographic Yearbooks Lithuania
Age 30-44	0,0033	0,0036	0,0034	0,0035	0,0034	0,0037	0,00385	0,0041	0,0037	0,0035	0,003	0,0029	0,003	0,003	Demographic Yearbooks Lithuania
Age 45-59	0,0099	0,0105	0,01	0,0101	0,0105	0,0113	0,0117	0,012	0,0113	0,0095	0,0094	0,009	0,009	0,009	Demographic Yearbooks Lithuania
Average lifetime expectancy after age 60															
Males	16,99	16,13	16,11	16,17	16,21	15,65	15,55	15,4	15,98	16,04	16,4	16,6	16,75	16,87	Demographic Yearbooks Lithuania
Females	22,21	21,74	21,82	22,1	21,92	21,66	21,55	21,73	21,9	22,22	22,55	22,89	23,01	22,97	Demographic Yearbooks Lithuania
Annual average income adjusted for PPP in USD															
United Kingdom	38137	39715	40176	41254	41940	41729	42711	43634	43028	43037	42319	41494	41496	41192	OECD
Ireland	39845	40878	40810	41994	43402	45219	45863	47037	48915	52838	52108	50989	51218	49506	OECD
Norway	35665	36540	37935	39196	40516	41633	43230	45042	46013	46460	47024	48635	49663	50282	OECD
Spain	33100	33713	33792	33643	33194	33325	33216	33692	34965	37176	36512	36140	35033	34824	OECD
Germany	41000	41716	41994	41983	41909	41794	41888	41886	42133	42138	42184	42859	43361	43682	OECD
Unemployment rate in %															
Lithuania	16,5	17,3	13,8	12,4	11,3	8,2	5,6	4,3	5,8	13,7	17,8	15,5	14,5	13	osp.stat.gov.lt
United Kingdom	5,4	5	5,1	5	4,7	4,8	5,4	5,3	5,6	7,6	7,8	8	7,9	7,5	Eurostat
Ireland	4,2	3,9	4,5	4,6	4,5	4,4	4,5	4,7	6,4	12	13,9	14,7	14,7	13,1	Eurostat
Norway	3,4	3,5	3,9	4,5	4,5	4,6	3,4	2,5	2,6	3,2	3,6	3,3	3,2	3,5	Eurostat
Spain	11,9	10,6	11,5	11,5	11	9,2	8,5	8,2	11,3	17,9	19,9	21,4	24,8	26,1	Eurostat
Germany	7,9	7,8	8,6	9,7	10,4	11,2	10,1	8,5	7,4	7,6	7,1	5,9	5,5	5,3	Eurostat

Job vacancies	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Data source
Lithuania	5000	5580	6160	6740	7320	7900	19500	26700	13000	5800	6700	9800	10500	10700	Yearbooks of Labour Statistics Lithuania
United Kingdom	358266	563166	605333	587666	638583	621166	603000	659666	616750	443333	471500	467750	467750	467750	OECD
Ireland	48848	48848	48413	50643	62207	68112	74204	102789	73185	54835	49079	48658	58890	58890	www.delni.gov.uk and OECD
Norway	18424	15191	12225	11114	10707	13321	18894	24302	26571	23875	24323	26703	19646	17787	OECD
Spain	106791	116460	130919	149534	150802	150802	150802	150802	150802	150802	150802	150802	150802	150802	OECD
Germany	452102	430995	372452	266281	206031	255758	354287	423439	389047	300640	359348	466288	477527	456974	OECD
Labour force participation rate															
Age 15 to 29 male	0,5887	0,564	0,545	0,54	0,5157	0,5027	0,501	0,51	0,5193	0,5237	0,5047	0,5123	0,512	0,533	osp.stat.gov.lt
Age 15 to 29 female	0,597	0,584	0,579	0,58	0,569	0,563	0,553	0,555	0,558	0,565	0,568	0,574	0,577	0,58	osp.stat.gov.lt
Age 30 to 44 male	0,9137	0,9157	0,925	0,923	0,9233	0,92	0,8993	0,8893	0,8903	0,891	0,9073	0,9217	0,9217	0,924	osp.stat.gov.lt
Age 30 to 44 female	0,8873	0,8917	0,8827	0,8843	0,8823	0,879	0,8557	0,859	0,852	0,8693	0,89	0,905	0,9027	0,8983	osp.stat.gov.lt
Age 45 to 59 male	0,8227	0,824	0,8353	0,843	0,8337	0,821	0,8097	0,8167	0,814	0,8157	0,831	0,853	0,8497	0,851	osp.stat.gov.lt
Age 45 to 59 female	0,7593	0,7523	0,7613	0,798	0,8127	0,7883	0,778	0,7783	0,765	0,7933	0,8167	0,831	0,8353	0,8317	osp.stat.gov.lt
Age 60 and above male	0,091	0,085	0,083	0,092	0,095	0,099	0,088	0,101	0,102	0,095	0,089	0,093	0,097	0,097	osp.stat.gov.lt
Age 60 and above female	0,047	0,036	0,035	0,041	0,038	0,042	0,044	0,052	0,059	0,061	0,053	0,06	0,064	0,064	osp.stat.gov.lt
Emigration cost															
Airline deregulation index	0,572	0,567	0,562	0,557	0,539	0,521	0,503	0,4655	0,428	0,3905	0,353	0,353	0,353	0,353	OECD FDI Regulatory Restrictiveness Index
Internet penetration rate	0,0643	0,0718	0,1769	0,2591	0,3123	0,3622	0,439	0,499	0,5522	0,5976	0,6212	0,6505	0,68	0,685	www.migrationpolicycentre.eu
Other statistics															
Total Fertility rate	1,39	1,3	1,24	1,26	1,26	1,29	1,31	1,35	1,47	1,55	1,5	1,55	1,6	1,59	Demographic Yearbooks Lithuania
GDP Per Capita Lithuania PPP	8618,503	9588,201	10646,77	12187,47	13260,55	14658,68	16756,74	19078,67	20617,46	18093,44	19843,44	22322,04	23813,41	25453,54	The World Bank
Persons employed in Lithuania	1473815	1439858	1405900	1438000	1436300	1473900	1499000	1534200	1520000	1317400	1247700	1253600	1275700	1292800	Yearbooks of Labour Statistics Lithuania
Exchange rate USD in LTL	4	4	3,664	3,056	2,781	2,778	2,75	2,518	2,356	2,485	2,607	2,483	2,687	2,597	www.bundesbank.de
Average gross montly earnings LTL	970	982	1013	1072	1149	1276	1495	1802	2151	2056	1988	2045	2123	2231	Labour Market Yearbooks Lithuania

APPENDIX B - MODEL EQUATIONS

Below is the source code for the equations from the iThink model.

```
Adults_interested__in_migration[Age, Gender](t) =
Adults_interested__in_migration[Age, Gender](t - dt) +
(becoming_interested[Age, Gender] + Age_in_interested[Age,
Gender] - labour_emigration[Age, Gender, Country] -
labour_emigration[Age, Gender, Country] - labour_emigration[Age,
Gender, Country] - labour_emigration[Age, Gender, Country] -
labour_emigration[Age, Gender, Country] - Deaths_interested[Age,
Gender] - Age_out_interested[Age, Gender]) * dt

INIT Adults_interested__in_migration[Age_15_to_29, Male] = 7495
INIT Adults_interested__in_migration[Age_15_to_29, Female] =
7341
INIT Adults_interested__in_migration[Age_30_to_44, Male] = 7758
INIT Adults_interested__in_migration[Age_30_to_44, Female] =
8114
INIT Adults_interested__in_migration[Age_45_to_59, Male] = 5488
INIT Adults_interested__in_migration[Age_45_to_59, Female] =
6502
INIT Adults_interested__in_migration[Age_60_and_above, Male] =
4915
INIT Adults_interested__in_migration[Age_60_and_above, Female] =
8545

INFLOWS:

becoming_interested[Age, Gender] =
(Adults_not_interested_in_migrating[Age,
Gender]*Fractional_getting_interested_rate[Age])

Age_in_interested[Age_15_to_29, Gender] = 0
Age_in_interested[Age_30_to_44, Gender] =
Age_out_interested[Age_15_to_29, Gender]

Age_in_interested[Age_45_to_59, Gender] =
Age_out_interested[Age_30_to_44, Gender]

Age_in_interested[Age_60_and_above, Gender] =
Age_out_interested[Age_45_to_59, Gender]

OUTFLOWS:

labour_emigration[Age, Gender, Country] =
(Adults_interested__in_migration[Age,
Gender]*emigration__fractional_rate[Country]+emigration_rate_due
_to_network[Country])
```

Deaths_interested[Age_15_to_29, Gender] =
Adults_interested__in_migration[Age_15_to_29,
Gender]*Death_rate[Age_15_to_29]

Deaths_interested[Age_30_to_44, Gender] =
Adults_interested__in_migration[Age_30_to_44,
Gender]*Death_rate[Age_30_to_44]

Deaths_interested[Age_45_to_59, Gender] =
Adults_interested__in_migration[Age_45_to_59,
Gender]*Death_rate[Age_45_to_59]

Deaths_interested[Age_60_and_above, Gender] =
Adults_interested__in_migration[Age_60_and_above,
Gender]/Avg_lifetime__expected_after_60[Gender]

Age_out_interested[Age_15_to_29, Gender] =
Adults_interested__in_migration[Age_15_to_29,
Gender]/Maturation__time

Age_out_interested[Age_30_to_44, Gender] =
Adults_interested__in_migration[Age_30_to_44,
Gender]/Maturation__time

Age_out_interested[Age_45_to_59, Gender] =
Adults_interested__in_migration[Age_45_to_59,
Gender]/Maturation__time

Age_out_interested[Age_60_and_above, Gender] = 0

Adults_not_interested_in_migrating[Age, Gender](t) =
Adults_not_interested_in_migrating[Age, Gender](t - dt) +
(Return_migration[Age, Gender, Country] + Return_migration[Age,
Gender, Country] + Return_migration[Age, Gender, Country] +
Return_migration[Age, Gender, Country] + Return_migration[Age,
Gender, Country] + becoming_adult[Age, Gender] +
age_transition_in_not_int[Age, Gender] -
becoming_interested[Age, Gender] - Deaths_not_interested[Age,
Gender] - age_transition_out_not_int[Age, Gender]) * dt

INIT Adults_not_interested_in_migrating[Age_15_to_29, Male] =
367272
INIT Adults_not_interested_in_migrating[Age_15_to_29, Female] =
359704
INIT Adults_not_interested_in_migrating[Age_30_to_44, Male] =
380121
INIT Adults_not_interested_in_migrating[Age_30_to_44, Female] =
397588
INIT Adults_not_interested_in_migrating[Age_45_to_59, Male] =
268888
INIT Adults_not_interested_in_migrating[Age_45_to_59, Female] =
318616
INIT Adults_not_interested_in_migrating[Age_60_and_above, Male]
= 240815
INIT Adults_not_interested_in_migrating[Age_60_and_above,
Female] = 418719

```
INFLOWS:

Return_migration[Age, Gender Country] =
((Lithuanian_Migrants[Age, Gender
Country]/avg_time_abroad[Country])*Effect_of_avg_time_abroad_on_
probability_of_return[Country])

becoming_adult[Age_15_to_29, Gender] =
becoming_adult_per_year*1/2
becoming_adult[Age_30_to_44, Gender] = 0
becoming_adult[Age_45_to_59, Gender] = 0
becoming_adult[Age_60_and_above, Gender] = 0

age_transition_in_not_int[Age_15_to_29, Gender] = 0

age_transition_in_not_int[Age_30_to_44, Gender] =
(age_transition_out_not_int[Age_15_to_29, Gender])

age_transition_in_not_int[Age_45_to_59, Gender] =
(age_transition_out_not_int[Age_30_to_44, Gender])

age_transition_in_not_int[Age_60_and_above, Gender] =
(age_transition_out_not_int[Age_45_to_59, Gender])

OUTFLOWS:

becoming_interested[Age, Gender] =
(Adults_not_interested_in_migrating[Age,
Gender]*Fractional_getting_interested_rate[Age])

Deaths_not_interested[Age_15_to_29, Gender] =
(Adults_not_interested_in_migrating[Age_15_to_29,
Gender]*Death_rate[Age_15_to_29])

Deaths_not_interested[Age_30_to_44, Gender] =
(Adults_not_interested_in_migrating[Age_30_to_44,
Gender]*Death_rate[Age_30_to_44])

Deaths_not_interested[Age_45_to_59, Gender] =
(Adults_not_interested_in_migrating[Age_45_to_59,
Gender]*Death_rate[Age_45_to_59])

Deaths_not_interested[Age_60_and_above, Gender] =
(Adults_not_interested_in_migrating[Age_60_and_above,
Gender]/Avg_lifetime__expected_after_60[Gender])

age_transition_out_not_int[Age_15_to_29, Gender] =
(Adults_not_interested_in_migrating[Age_15_to_29,
Male]/Maturation__time)

age_transition_out_not_int[Age_30_to_44, Gender] =
(Adults_not_interested_in_migrating[Age_30_to_44,
Male]/Maturation__time)
```

```
age_transition_out_not_int[Age_45_to_59, Gender] =
(Adults_not_interested_in_migrating[Age_45_to_59,
Male]/Maturation__time)

age_transition_out_not_int[Age_60_and_above, Gender] = 0

children(t) = children(t - dt) + (births + child_immigration -
children_deaths - becoming_adult_per_year - child_emigration) *
dt

INIT children = 684800

INFLOWS:

births = if time > 2015 then
Policy_switch_fertility*((total_fertile_popuation/Reproductive__
lifetime)*Future_fertility__scenarios)+(1-
Policy_switch_fertility)*((total_fertile_popuation/Reproductive_
_lifetime)*Total_Fertility_rate)
 else
((total_fertile_popuation/Reproductive__lifetime)*Total_Fertilit
y_rate)
child_immigration = Children_immigration__per_year

OUTFLOWS:

children_deaths = (children*child_death_rate)

becoming_adult_per_year = (children/time_to_become_an_adult)

child_emigration =
(children*Fractional_emigration_rate_children)

LF_participation_rate__after_2015_of_60_to_67[Gender](t) =
LF_participation_rate__after_2015_of_60_to_67[Gender](t - dt) +
(Change_in_participation_rate_after_2015[Gender]) * dt

INIT LF_participation_rate__after_2015_of_60_to_67[Male] =
0.097*1/(6/16.87)
INIT LF_participation_rate__after_2015_of_60_to_67[Female] =
0.064*1/(6/22.97)

INFLOWS:

Change_in_participation_rate_after_2015[Gender] =
if time >2015 then
(Participation_rate_goal_of_60_to_67-
init(LF_participation_rate__after_2015_of_60_to_67))/Years_to_ac
hieve_goal*Probability_of_LF__policy_working
else 0

INIT Lithuanian_Migrants[Age, Gender, UK] = 235
INIT Lithuanian_Migrants[Age, Gender, Ireland] = 220
INIT Lithuanian_Migrants[Age, Gender, Norway] = 40
INIT Lithuanian_Migrants[Age, Gender, Spain] = 230
INIT Lithuanian_Migrants[Age, Gender, Germany] = 1180
```

```
INFLOWS:

labour_emigration[Age, Gender, Country] =
(Adults_interested__in_migration[Age,
Gender]*emigration__fractional_rate[Country]+emigration_rate_due
_to_network[Country])

Age_in_migrants[Age_15_to_29, Gender, Country] = 0

Age_in_migrants[Age_30_to_44, Gender, Country] =
Age_out_migrants[Age_15_to_29, Gender, Country]

Age_in_migrants[Age_45_to_59, Gender, Country] =
Age_out_migrants[Age_30_to_44, Gender, Country]

Age_in_migrants[Age_60_and_above, Gender, Country] =
Age_out_migrants[Age_45_to_59, Gender, Country]

OUTFLOWS:

Return_migration[Age , Gender, Country] =
((Lithuanian_Migrants[Age , Gender,
Country]/avg_time_abroad[Country])*Effect_of_avg_time_abroad_on_
probability_of_return[Country])

Deaths__migrants[Age_15_to_29, Gender, Country] =
Lithuanian_Migrants[Age_15_to_29, Gender,
Country]*Death_rate[Age_15_to_29]
Deaths__migrants[Age_30_to_44, Gender, Country] =
Lithuanian_Migrants[Age_30_to_44, Gender,
Country]*Death_rate[Age_30_to_44]
Deaths__migrants[Age_45_to_59, Gender, Country] =
Lithuanian_Migrants[Age_45_to_59, Gender,
Country]*Death_rate[Age_45_to_59]
Deaths__migrants[Age_60_and_above, Gender, Country] =
Lithuanian_Migrants[Age_60_and_above, Gender,
Country]/Avg_lifetime__expected_after_60[Gender]

Age_out_migrants[Age_15_to_29, Gender, Country] =
Lithuanian_Migrants[Age_15_to_29, Gender,
Country]/Maturation__time
Age_out_migrants[Age_30_to_44, Gender, Country] =
Lithuanian_Migrants[Age_30_to_44, Gender,
Country]/Maturation__time
Age_out_migrants[Age_45_to_59, Gender, Country] =
Lithuanian_Migrants[Age_45_to_59, Gender,
Country]/Maturation__time
Age_out_migrants[Age 60 and above, Gender, Country] = 0

Average_annual__income_Lithuania =
(((Average_gross_montly_earnings_LTL*Months_in_one_year)*Exchang
e_rate_USD_in_LTL)*Purchasing_power_parity_Lithuania)
```

```
avg_time_abroad[Country] =
normal_avg__time_abroad*relative_economic_effect_on_avg_time_abr
oad

contacts_between_migrants_and_adults_in_Lithuania[Country] =
sum(Lithuanian_Migrants[*, *, Country])*contacts__per_year

contacts_between_migrants_and_susceptibles[Country] =
contacts_between_migrants_and_adults_in_Lithuania*susceptible_fr
action_of_adults_in_Lithuania

contacts__per_year = 25

Costs_of_obtaining_information = 1-Internet_penetration_rate

Costs_of_social__exclusion[Country] =
GRAPH(sum(Lithuanian_Migrants[*, *, Country]))
(0.00, 0.99), (20000, 0.952), (40000, 0.797), (60000, 0.47),
(80000, 0.333), (100000, 0.238), (120000, 0.152), (140000,
0.0825), (160000, 0.0349), (180000, 0.0159), (200000, 0.00)

Effect_of_avg_time_abroad_on_probability_of_return[Country] =
GRAPH(avg_time_abroad)
(0.00, 1.00), (1.00, 1.00), (2.00, 0.95), (3.00, 0.902), (4.00,
0.771), (5.00, 0.613), (6.00, 0.492), (7.00, 0.384), (8.00,
0.283), (9.00, 0.162), (10.0, 0.108), (11.0, 0.0698), (12.0,
0.0508), (13.0, 0.0413), (14.0, 0.0349), (15.0, 0.02)

Effect_of_relative_empl_opportunities[Country] =
GRAPH(Relative_employmet_opportunities)
(0.00, 0.508), (4.76, 0.531), (9.52, 0.542), (14.3, 0.588),
(19.0, 0.612), (23.8, 0.646), (28.6, 0.669), (33.3, 0.738),
(38.1, 0.831), (42.9, 0.9), (47.6, 1.00), (52.4, 1.11), (57.1,
1.28), (61.9, 1.55), (66.7, 1.87), (71.4, 2.19), (76.2, 2.44),
(81.0, 2.63), (85.7, 2.73), (90.5, 2.81), (95.2, 2.88), (100,
2.95)

Emigration_cost_index[Country] =
((Physical_costs*0.2)+(Policy_delay*0.4)+(Costs_of_social__exclu
sion*0.2)+(Costs_of_obtaining_information*0.2))

emigration_rate_due_to_network[Country] =
(contacts_between_migrants_and_susceptibles*probability_of_emigr
ation_if_contacted)

emigration__fractional_rate[Country] =
(normal_emigration__fractioal_rate*relative_income_effect__on_em
igration*Effect_of_relative_empl_opportunities)

Expected_annual_income_Lithuania =
Average_annual__income_Lithuania*Probability_of_getting_a_job_Li
thuania

Expected_annual_income_other_countries[Country] =
Annual_average_income_adj_PPP_in_USD_other_countries*Probability
_of_getting_a_job_other_countries
```

```
Fractional_emigration_rate_children =
Number_of_children__emigrating_historical/Historical_children__p
opulation

Fractional_getting_interested_rate[Age_15_to_29] = 0.02
Fractional_getting_interested_rate[Age_30_to_44] = 0.015
Fractional_getting_interested_rate[Age_45_to_59] = 0.01
Fractional_getting_interested_rate[Age_60_and_above] = 0.005

Future_fertility__scenarios = GRAPH(TIME)
(2015, 1.61), (2015, 1.61), (2016, 1.62), (2016, 1.62), (2017,
1.63), (2017, 1.63), (2017, 1.64), (2018, 1.64), (2018, 1.65),
(2018, 1.65), (2019, 1.66), (2019, 1.66), (2020, 1.67), (2020,
1.68), (2020, 1.68), (2021, 1.68), (2021, 1.69), (2021, 1.70),
(2022, 1.70), (2022, 1.70), (2023, 1.71), (2023, 1.71), (2023,
1.72), (2024, 1.73), (2024, 1.73), (2024, 1.74), (2025, 1.75),
(2025, 1.76), (2026, 1.77), (2026, 1.78), (2026, 1.79), (2027,
1.80), (2027, 1.81), (2027, 1.82), (2028, 1.83), (2028, 1.84),
(2029, 1.85), (2029, 1.86), (2029, 1.87), (2030, 1.89), (2030,
1.90)

GDP_Per_Capita_USA_PPP_2013 = 53042

Immigration__policy[UK] = if time <2004 then 0.95 else 0.05
Immigration__policy[Ireland] = if time <2004 then 0.95 else 0.05
Immigration__policy[Norway] = if time <2007 then 0.95 else 0.05
Immigration__policy[Spain] = if time <2006 then 0.95 else 0.05
Immigration__policy[Germany] = if time <2007 then 0.95 else 0.05

labor_force[Age_15_to_29, Gender] =
(Adults_interested__in_migration[Age_15_to_29,
Gender]+Adults_not_interested_in_migrating[Age_15_to_29,
Gender])*LF_participation_rate[Age_15_to_29, Gender]

labor_force[Age_30_to_44, Gender] =
(Adults_interested__in_migration[Age_30_to_44,
Gender]+Adults_not_interested_in_migrating[Age_30_to_44,
Gender])*LF_participation_rate[Age_30_to_44, Gender]

labor_force[Age_45_to_59, Gender] =
(Adults_interested__in_migration[Age_45_to_59,
Gender]+Adults_not_interested_in_migrating[Age_45_to_59,
Gender])*LF_participation_rate[Age_45_to_59, Gender]

labor_force[Age_60_and_above, Gender] = If time > 2015 then
(policy_switch_LF_participation*(Adults_interested__in_migration
[Age_60_and_above,
Gender]+Adults_not_interested_in_migrating[Age_60_and_above,
Gender])*LF_participation_rate_after_2015[Age_60_and_above,
Gender])+((1-
policy_switch_LF_participation)*(Adults_interested__in_migration
[Age_60_and_above,
Gender]+Adults_not_interested_in_migrating[Age_60_and_above,
Gender])*LF_participation_rate[Age_60_and_above, Gender])
else
```

(Adults_interested__in_migration[Age_60_and_above,
Gender]+Adults_not_interested_in_migrating[Age_60_and_above,
Gender])*LF_participation_rate[Age_60_and_above, Gender]

LF_participation_rate_after_2015[Age_15_to_29, Gender] = 0
LF_participation_rate_after_2015[Age_30_to_44, Gender] = 0
LF_participation_rate_after_2015[Age_45_to_59, Gender] = 0

LF_participation_rate_after_2015[Age_60_and_above, Gender] =
Ratio_of_60_and_above_under_age_of_67[Gender]*LF_participation_r
ate__after_2015_of_60_to_67[Gender]

Maturation__time = 15

Months_in_one_year = 12

Net_annual_expected_income_other_countries[Country] =
Expected_annual_income_other_countries*(1-Emigration_cost_index)

normal_avg__time_abroad = 5

normal_emigration__fractioal_rate[Country] = 0.01

Participation_rate_goal_of_60_to_67[Male] = 0.5
Participation_rate_goal_of_60_to_67[Female] = 0.5

People_interested_ratio =
sum(Adults_interested__in_migration)/Total_adult_population_Lith
uania_endogenous

Physical_costs = Airline_deregulation_index

Policy_delay[Country] = DELAY1(Immigration__policy,1)

Policy_switch_fertility = 0
{Switch: 1 = ON, 0 = OFF}

policy_switch_LF_participation = 0

Pop_60_and_above =
Adults_interested__in_migration[Age_60_and_above,
Male]+Adults_interested__in_migration[Age_60_and_above,
Female]+Adults_not_interested_in_migrating[Age_60_and_above,
Male]+Adults_not_interested_in_migrating[Age_60_and_above,
Female]

probability_of_emigration_if_contacted[Country] = 0.05

Probability_of_getting_a_job_Lithuania = 1-unemployment__rate

Probability_of_getting_a_job_other_countries[Country] = (100-
other_countries__Unemployment_Rate)/100

Probability_of_LF__policy_working = 0.5

```
Purchasing_power_parity_Lithuania =
GDP_Per_Capita_Lithuania_PPP/GDP_Per_Capita_USA_PPP_2013

Ratio_of_60_and_above =
Pop_60_and_above/Total_adult_population_Lithuania_endogenous

Ratio_of_60_and_above_under_age_of_67[Gender] =
Years_working_after_60/Avg_lifetime__expected_after_60[Gender]

Reference_mode_total_emigration_more_likley_scenario =
GRAPH(time)
(2001, 27841), (2002, 16719), (2003, 26283), (2004, 37691),
(2005, 57886), (2006, 39929), (2007, 37922), (2008, 33289),
(2009, 45839), (2010, 53000), (2011, 53863), (2012, 41100),
(2013, 38818)

relative_economic_effect_on_avg_time_abroad[Country] =
GRAPH(relative_economic_situation_due_to_income)
(0.00, 1.00), (0.5, 1.00), (1.00, 1.00), (1.50, 1.38), (2.00,
1.56), (2.50, 1.70), (3.00, 1.81), (3.50, 1.89), (4.00, 1.95),
(4.50, 2.00), (5.00, 2.00)

relative_economic_situation_due_to_income[Country] =
Net_annual_expected_income_other_countries/Expected_annual_incom
e_Lithuania

Relative_employmet_opportunities[Country] =
Job_vacancies__other_countries/Job_vacancies_Lithuania

relative_income_effect__on_emigration[Country] =
GRAPH(relative_economic_situation_due_to_income)
(0.00, 0.657), (0.2, 0.683), (0.4, 0.743), (0.6, 0.829), (0.8,
0.929), (1.00, 1.00), (1.20, 1.73), (1.40, 2.73), (1.60, 3.80),
(1.80, 4.61), (2.00, 5.00)

Reproductive__lifetime = 35 {years}

susceptible_fraction_of_adults_in_Lithuania[Country] =
sum(Adults_interested__in_migration)/(sum(Adults_interested__in_
migration)+sum(Adults_not_interested_in_migrating))

time_to_become_an_adult = 15

Total_adult_population_Lithuania_endogenous =
sum(Adults_not_interested_in_migrating)+sum(Adults_interested__i
n_migration)

Total_emigration_flow =
Historical_emigration_to_former_USSR_countries+Total_labour_emig
ration
total_fertile_popuation =
Adults_not_interested_in_migrating[Age_15_to_29,
Female]+Adults_not_interested_in_migrating[Age_30_to_44,
Female]+Adults_interested__in_migration[Age_15_to_29,
Female]+Adults_interested__in_migration[Age_30_to_44, Female]
```

```
Total_historical_adult_population = Total_population_historical-
Historical_children__population

Total_labour_emigration = SUM(labour_emigration)

total_labour_force = sum(labor_force)

Total_Lithuanians__abroad = sum(Lithuanian_Migrants[*, *, *])

Total_population_Lithuania =
children+sum(Adults_interested__in_migration)+sum(Adults_not_int
erested_in_migrating)

Total_return_migration = sum(Return_migration[*, *, *])
unemployment__rate = (sum(labor_force)-
employment)/sum(labor_force)
Years_to_achieve_goal = 15
Years_working_after_60 = 6
```