E-Estonia: Assessment of a Digital Reform

By

Gergő BATIZ

Submitted to
Central European University
Department of Economics

In partial fulfillment of the requirements for the degree of
Master of Economic Policy in Global Markets

Supervisor: Professor Lajos BOKROS

Budapest, Hungary

2016

EXECUTIVE SUMMARY

This thesis studies the association between the usage intensity of digital services and 1) citizens' attitudes, 2) competitiveness and productivity, and 3) openness in the case of Estonia.

Citizens' attitudes are measured through their trust in different institutions, through perceived levels of corruption, and through election turnouts. The limited data available fails to confirm any association between usage and trust levels, and between usage and corruption perception, but identifies a higher election turnout rate when the e-voting service is available.

Competitiveness and productivity is measured using the two most popular rankings from World Bank and World Economic Forum, and labor and total factor productivity data. No association shows up related to productivity data, but a higher increase in usage levels are associated by a less deteriorating score of regulatory burden, confirming a favorable connection between service usage and business environment.

Openness is measured by FDI and business demographics. The analysis uncovers a positive relationship between usage intensity and FDI stocks but no visible change in company ownership patterns.

Based on the results, further research is recommended to the scientific community, and the continuation and extension of reforms to Estonian policymakers.

i

TABLE OF CONTENTS

CONTENTS

INTRODUCTION

Importance of the Topic and Aim of Research

We are living in an age of where everyone and everything are connected. Yet in all too many countries we do official business as if we were still living in the 20th or 19th century: endless paperwork, spending long hours waiting in government offices, going back and forth between administrators.

E-government is one of the buzzwords when it comes to public administration today. Indeed, properly implementing electronic services can result in enormous cost savings for the state, the private sector and ordinary citizens alike, while a lean administrative environment can also increase the competitiveness and attractiveness of a country.

Estonia is currently the go-to country when it comes to the best e-government implementation, at least according to popular media, and implementing the Estonian model in another country seems to promise the same benefits.

But is the system really so great? There is little scientific work regarding macro-level changes in association with e-government service usage in Estonia.

Therefore, the aim of this graduation thesis is to study the association between the usage of e-government services in Estonia and changes in three main areas: Attitudes towards the state, competitiveness and productivity, and openness of the economy.

E-Government Services in Estonia

What is E-Government?

Van Dijk (2012) defines electronic government (e-government) as follows: "all data, communication and transaction processing activities related to governmental tasks and responsibilities in which ICT is being used". This is no doubt a loose definition as according to it, any involvement of IT already makes for having e-government in a country. However, it is obvious that it is wrong to equate a system where electronic tax filing takes two hours and it is one of a dozen services available online, with an other system where tax filing takes 5 minutes and hundreds of services are available. Therefore, when a government claims that it has implemented e-government, this practically doesn't mean anything until one looks more deeply into the scope of services available and the quality of their implementation.

The reason why the Estonian e-government system is the topic of this paper is that it offers services in unparalleled number and quality, and it have effectively transformed the way how citizens interact with government, and how people transact and get things done in general. As an example: Automated tax-declarations, no need for driver's license and registration documents while driving, electronic voting even on national elections, or a digital signature that is today preferred to manual signatures, just to name a very few from the many hundreds of municipal and state services Estonians can use today. (eesti.ee 2016)
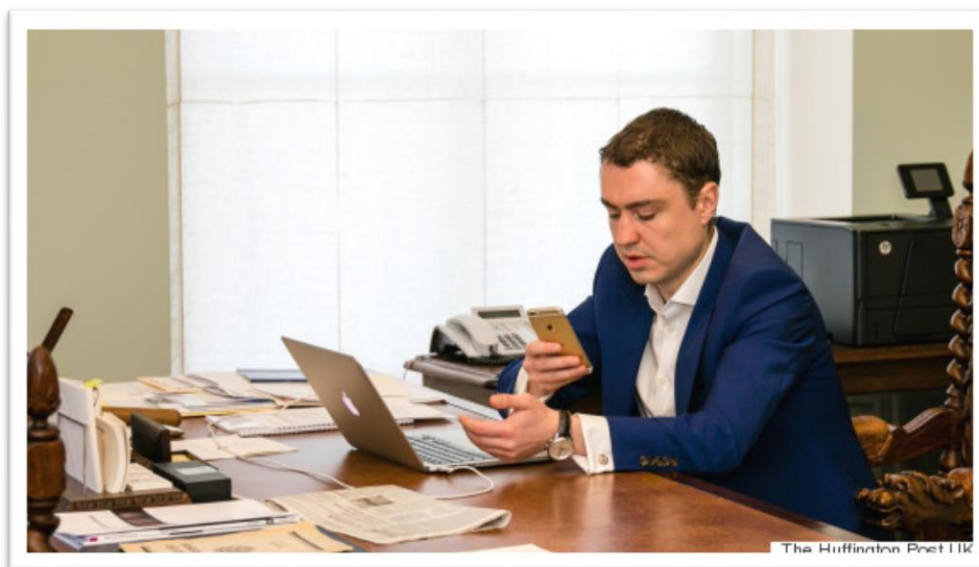
Figure 1 – Prime Minister Taavi Roivas authenticating via his smartphone before

approving three bills from Parliament (Source: The Huffington Post online)

Infrastructure

The Estonian system is built on three core elements: the ID-cards, the National Register, and the so-called X-Road network.

The ID-card is compulsory to all Estonian citizens. It is both a traditional ID with a biometric data chip, but also a key to all digital activities: It contains a cryptographic key-pair that is used to identify a citizen and to encrypt communications between the user's computer and the servers of the system. Public-key cryptography is also used to generate the time-stamped digital signatures on any document or transaction. The ID-cards have a SIM-card extension as well, so users don't need to use a USB card reader anymore but they can do all authentication via their cellphones if they prefer (European Commission 2016).

3

The National Register is the database containing the basic information of all citizens: ID-number, name, birth, gender, address history, legal status / citizenship, and legal relationships. In all other databases, only the IDs are used, so this is the database that is needed to observe real the identity of citizens, other databases by themselves are anonymous.
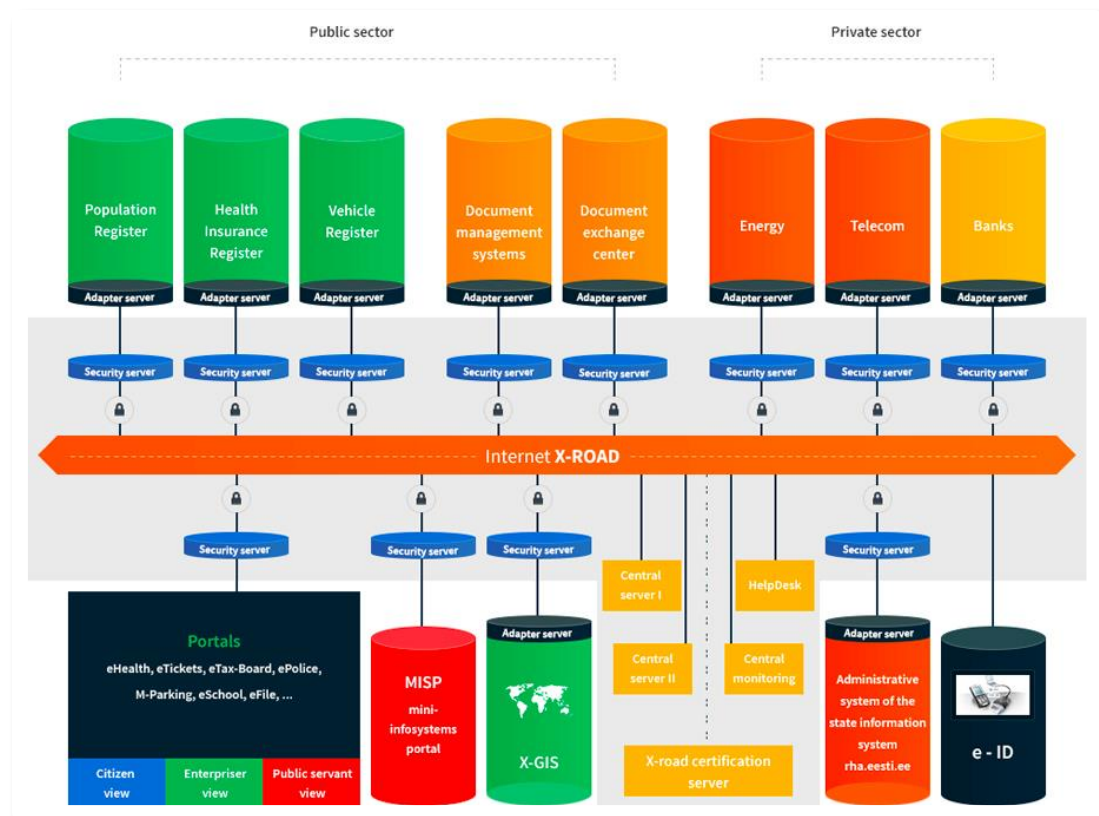

Figure 2 - The X-Road infrastructure connecting all elements of the system.

(Source: Republic of Estonia Information System Authority (RIA) 2016)

X-Road is a secure data-sharing network connecting all users and servers of the e-government system using standard data formats.

Principles

The general organizing principle is that no data should be stored in more than one place. Different national databases (healthcare, education, criminal records, etc.) exist separately and only IDs of citizens are stored, but not their identity (which must be queried from the National Register based on ID in case it is needed). This way data on people is always stored separately and anonymously and can only be connected with the authorization of the data owner (the citizen) or in well-defined cases, resulting in fair privacy. Furthermore, all citizens and entities can access all the data stored on them and also view a full log of who requested data on them (e.g.: doctors and pharmacists query medical information, police query criminal record and driver's license in case of a routine roadside check, educational institutions query data when processing applications, etc.). Unauthorized query is a criminal offense punishable even with imprisonment. Since it is in the mutual interest of all parties to maintain trust in the system, regulations are strictly enforced and independent security audits are frequently taking place (Herlihy 2013).

Some entities are also linked together. This way board members and employees are linked to companies so they can securely transact in the name of their companies as well. Property is also linked to entities, this way owners of land and real estate can be seen when browsing the land registry, just like the wealth and business stakes of public officials. This radically improves transparency (Herlihy 2013).

Some third parties can also connect to these databases. All banks, utility and telecommunications companies are connected to the system, so banks can autonomously perform credit assessment, telecommunication companies can check regular income before contracting for a subscription, etc., provided that the client

granted access to his / her data to them. The system makes anonymized data available by offering API-s and providing built in visualization tools via the main website, enabling researchers and statisticians to work more efficiently (Herlihy 2013).

Legal framework, Establishment of System, Keys to Success

There is no one comprehensive legislation governing e-government services. Instead, numerous laws regulate different aspects of the service, such as the data protection act, signatures act, consumer protection act, archives act, public information act, and so on. The system itself was established in a gradual way, overarching different governments (Herlihy 2013; Vassil 2015).

Period	Item
1998 - 2003	• Principles of the Estonian Information Policy I • Principles of the Estonian Information Policy II
2004-2006	• Estonian Information society
2007-2013	• Programme for Increasing Awareness of the Information Society
2008-2011	• Information Society Strategy for Local Governments
2009-2011	• Information Security Policy • Implementation Plan
2011	• Estonian Broadband Strategy
2012	• Estonian Cyber Security Strategy
2013	• Estonian Information Society Startegy
2014-2017	• Cyber Security Strategy
2014-2020	• Estonian Information Society Strategy

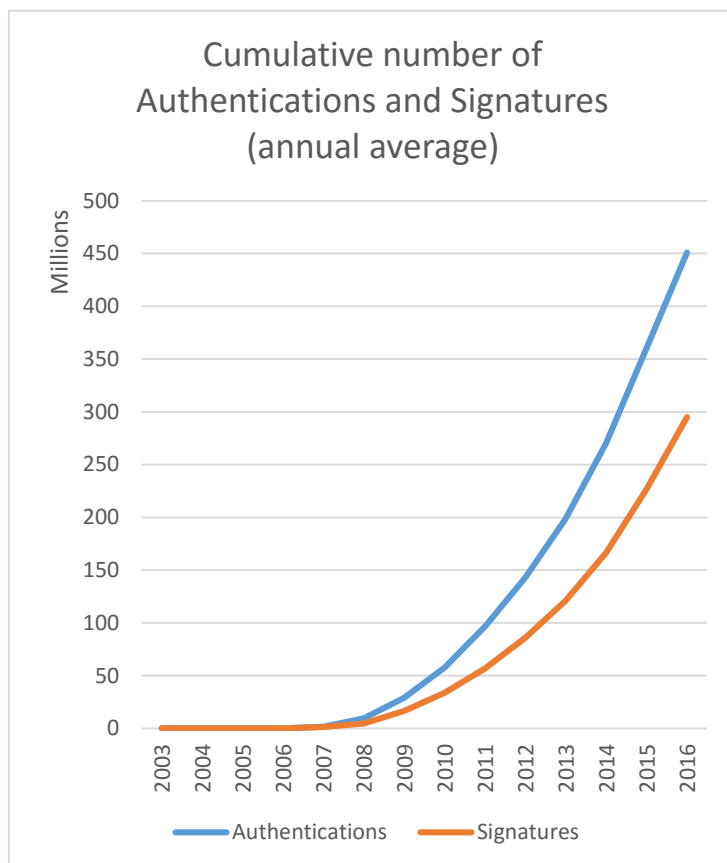*Figure 3 – Legislative Timeline Leading up to the Current System*

6

Figure 4 – Cumulative Number of Authentications and Signatures

New ID-cards were introduced in 2002, but as it can be seen from the chart, usage growth wasn't significant until around 2006. The main reason for this was a digital divide in society, and that many households did not realize the benefits of having an internet subscription and therefore using the services provided by the system. The solution for this fundamental obstacle came primarily from the private sector: Banks, utilities and telecommunications companies wanted to go as digital as possible for cost-efficiency reasons, and with the backing of the government, there was a joint effort launched ('Tiger Leap Project') aimed at educating the population on ICT and introducing digital solutions in public schools. Since companies actively pushed for using the new-generation ID-cards, people were getting them anyway and they stared to realize the benefits. This is when service usage growth picked up enormous momentum and made today's digital society in Estonia a reality (Vassil 2015).

All-in-all, the most important enablers of realizing this system were probably the strong cooperation between the government and the private sector in transforming the way Estonians transact; and a political consensus overarching all governments that

the country should specialize on ICT after the change of systems, and probably also some sort cultural setup that enabled citizens embrace this new way of doing things.

For the rest of this thesis, the term 'digital services' will be used to refer to services that can be used via the e-government system.

E-Government and Citizens' Trust in the State

What is Trust?

Literature primarily on trust itself goes back to the second half of the 20st century. Arrow (1974) describes trust as a lubricant to economic exchange and an efficient mechanic governing transactions. He thinks of trust as a form of 'implicit contracting' where parties agree not to unfairly exploit the other and suggests that trust is a unique intangible commodity. Such view of trust as an asset gets carried forward by other scholars later: Coleman (1990), Putnam, Leonardi, and Nanetti (1993) and Fukuyama (1995) all include trust as a component to 'social capital', together with norms and networks. Putnam also argues that such social capital enhances a society's ability to facilitate coordinated action, that is, to organize. Levi (1996) extends the concept with a risk factor: She describes trust as a set of socio-psychological phenomena that enable individuals to take risk when engaging with others, solve problems of collective action, and mutually act against their narrow short-term self-interests, in order to reap benefits from cooperation. Levi further suggests that trust is formed by a rational (although possibly subconscious) decision.

Partly due to its intangible nature, the concept of trust is not straightforward to grasp. It can be concluded however, that it is an intangible social asset, it influences interactions among individuals and how they organize as a group, and it serves as one end of an implicit agreement to put aside selfish short-run self-interest for longer-term cooperation and mutual benefit.

Why is Trust Important?

As the previous paragraph already suggests, trust has far reaching implications for society. Leibenstein (1987) have studied trust as an economic input from a game theory perspective, and concluded that it served as a coordinating mechanism enabling players to play out games to the highest individual and social benefit. Continuing Leibenstein's line of thought, we can think of (economic) life as an infinitely repeated prisoner's dilemma, where players who trust each other can play out the socially optimal outcome. Using this example, it can be argued that trust on a social level is no else than people playing nice with others in anticipation of being reciprocated. This implicit agreement makes production and exchange possible (Misztal 1996). Therefore, societies with higher levels of trust and social capital in general are more likely to produce the set of institutions necessary for economic growth, than societies with less of it (Levi 1996). As Levi (1996) continues to elaborate, trust has serious consequences to government as well: Trust affects citizens' tolerance level of the regime and their compliance with the its laws.

Putnam, Leonardi, and Nanetti (1993) had compared Northwestern and Southern Italian societies and they had concluded that the better performance of institutions in the North was attributed to higher levels of trust in that society, as the dominant interpersonal relation was generalized towards the government and the individual too. Based on their findings, they establish that a high level of trust is essential to well-functioning institutions. Guiso, Sapienza, and Zingales (2000) had further investigated the issue, but focusing on the financial profile of households. They have found that in areas with high levels of social trust, households are less risk-averse: they invest a larger portion of their savings into stocks, they tend to use more of formal arrangements for getting credit and less informal lending. Perhaps not surprisingly, firms in these

areas had easier access to credit and more shareholders on average, overall leading to a more financially sound economy. Continuing on the fiscal line of argument, it is important to point out the work of Randlane (2012) on tax compliance in Estonia: He confirmed the seemingly trivial claim that general attitudes towards the state affect compliance with the obligation to pay taxes, as the more people trust the state, the less tax they avoid. Lühiste (2006) also point out how higher levels of social trust are leading to more equal societies through solidarity.

This section about the importance of trust is probably summarized the best by Bjornskov and Meon (2013), who conducted a sophisticated inquiry into the casual mechanism from trust to economic growth. They have uncovered a robust chain of causality: Higher levels of trust lead to better education, legal and bureaucratic institutions, and these ensure a significantly higher per capita growth of income. In their analysis, the quality of political institutions doesn't play a significant role in this chain, only economic-judicial institutions.

What Drives Trust?

As Mishler and Rose (1998) summarize, there are two main approaches when it comes to what influences trust in institutions:

Cultural theorists claim that trust in institutions is politically exogenous and national political trust is directly proportional to the prevailing national interpersonal trust. Many of the already showcased ideas fall into this category, such as Fukuyama's (1995) claim that more trusting individuals are more likely to organize, or Putnam, Leonardi, and Nanetti (1993) and Helliwell and Putnam (1996), claiming that institutional trust is a bottom-up construct stemming from the personal interactions between people.

11

Institutional theorists, on the other hand, assert that trust in institutions is politically endogenous and is a function of the perceived policy performance and ability of the government to deliver economic prosperity (Przeworski et al. 1996).

As it is generally the case, the true nature of trust is likely to be correctly described by both of these approaches. Culture should definitely have a strong effect or an initial calibration on an individual's trust in institutions, but a rational individual is also rightfully expected to reevaluate his trust in institutions based on their performance. Lühiste (2006) have examined exactly these relationships in the Baltic states and have confirmed both mechanics with real data:

The cultural explanation was confirmed by the study, as variation in interpersonal trust explains 11% of the variation in trust towards government among different nations. This weak but robust finding is in line with the results of Mishler and Rose (2001) who also concluded that institutional explanations of trust are stronger that cultural ones.

Institutional theories were also confirmed (R^2 = 15%): Governmental and economic performance of the government (*outcomes*) influences trust, and the less corrupt a government is perceived by its citizens, the more trusting they are. Also it is worth pointing out here that Estonia is the least corrupt country in the CEE-region according to Transparency International's Corruption Perception Index. Political performance (*how* government works) also significantly influences public trust in institutions. '[…] transparent and efficient administration' is recognized as a driver of this performance, therefore a well-functioning e-government system can in theory strengthen trust in the state.

The study had some more general findings as well. In general, Baltic people distrust their parliaments and parties more (57% of population don't trust) than other

CEE countries (51%) while having roughly the same level of interpersonal trust in the society. It is also worth pointing out that the most trusted institution also happens to be the least democratic one: the military. The author explains the situation by history, and by the fact that the older population tends to be more suspicious towards government and the younger ones are expected to bring about change in trust, but the results show only a weak negative correlation between age and level of trust.

Lühiste (2006) have examined the drivers of trust in a comprehensive framework, but there are other scholars pointing out some more concrete relationships: Lipsky (2010) emphasizes how important the role of government's agents is: Citizens tend to project their experience with street-level bureaucrats on the state in general. Levi (1996) further underlines the importance of using high standards in the recruitment of government and administration employees exactly for this reason. Most importantly for the present study, Im et al. (2014) have analyzed the relationship between trust in the government and internet and e-government usage: They have concluded that in general, internet usage is negatively correlated with trust in government (most probably because it leads to better-informed citizens), but internet usage combined with e-government usage doesn't exhibit the same relationship. Based on this, it can be inferred that e-government usage boosts trust in the state, especially in the case of Estonia, where broadband Internet usage is extremely widespread already (European Commission 2016), so the trust effects of internet usage are already in the baseline.

E-Government, Competitiveness and Productivity

Competitiveness and Administrative Burden

As Bjornskov and Meon (2013) proved, trust leads to higher overall productivity levels and therefore higher growth. Naturally, the level of growth is influenced by many other factors besides trust. The growth of an economy is the increase of its level of output. Output is the result of combining input factors using a certain technology. In case of a country, we can think about technology in the most general sense, also including everything about how people do business, interact, and live their lives in general. From a business point of view, this set of cultural factors form an important determinant of the business environment alongside the regulatory setting, the quality of institutions, endowments of production factors and capital, and human resources.

Competitiveness is essentially the state of the business environment of an economy relative to others. Increasing competitiveness is or should be a core objective of any sane economic policy, as it enables the economy to produce more output using the same amount of resources, or if the country also competes for investment in an open setting, it can attract additional inputs to production (FDI, talent etc.) on top of efficiency gains. Therefore, improving aspects of the business environment is key. A well-functioning e-government system is favorable in this regard, as by increasing trust, it creates a culture that is more conductive to cooperation and organization, it increases the quality of institutions, and it decreases corruption. These are merely indirect effects through trust, but having a well-functioning e-government system in place also directly affects the business environment and competitiveness by reducing administrative burden.

14

Figure 5 - The 12 Pillars of Competitiveness of the

World Economic Forum's Global Competitiveness Report

(Source: World Economic Forum 2016b)

Allers (1994) defines administrative burden as the cost businesses incur in complying with data provision and reporting regulations. A. F. M. Nijsen (2003) and Ntaliani, Costopoulou, and Sideridis (2012) further add that such compliance ties down considerable resources which is especially burdensome for small and medium sized enterprises. The importance of reducing this burden is widely recognized by governments, and countless policies are set up to this end (European Commission 2007; UK Cabinet Office 2006).

What Government can do about it?

As Wegrich (2009) describes, the Standard Cost Model called Mistral is currently the standard to use by the European Union and the OECD for quantifying administrative burden. A. F. Nijsen, Vellinga, and others (2001) explain that 3 main factors influence this hindrance: 1) The amount of regulation and rules to comply with, 2) How control and checks of compliance are implemented, and 3) How the administrative infrastructure used for information transfer is designed. E-government affects the business environment directly through this third channel, by simplifying and automating the administrative infrastructure. As Zuurmond and Robben (2009) specify, the most important source of administrative burden is paper-based bureaucracy. Indeed, as it was already recognized by the end of the 80s, computerization lowers communications time and costs (Hammer and Mangurian 1987; Malone, Yates, and Benjamin 1987).

Allers (1994) looks at government in this system as a provider of services that cost money to implement and offer, but create cost savings for businesses. This essentially means that there is a transfer of costs from business to the state and if we believe that the market is better at allocating additional resources, such pure cost-transfer mechanisms already generate efficiency gains. But automating processes and making them paperless not only transfers costs from private to public sector, but also reduces costs. Time spent on getting things done, the costs of paper handling, the time needed to fill out forms, the time of message transportation, and the time needed for processing incoming data, just to name a few, are either eliminated or drastically reduced. Unseen it may be, but standardizing reporting enables the creation of standardized and consolidated databases, that can make administrative processes even more streamlined in the medium to long run (Bergeron and Raymond 1997;

Boonstra and de Vries 2005; Elgarah et al. 2005; Henriksen 2002; Mäkipää 2006; Young, Carr, and Rainer 2000). Furthermore, empirical evidence confirms that the use of e-government helps founders to establish companies faster and more cheaply, and boosts company productivity in general (Badri and Alshare 2008). All this shows well that government has in its discretion a powerful set of tools to unencumber business and boost growth in the form of electronic service delivery and administration.

E-Government and the Openness of the Country

Why is Openness Important?

The basic economic paradigm of trade is the exploitation of comparative advantages for the mutual benefit of trading partners by specializing in producing the good or service with the least opportunity cost, and then trading these. As Krugman (1979, 1980) explains, gains arise from more variety to consumers and higher quality, and lower equilibrium prices as firms reap cost-efficiency from economies of scale. As Andersen and Babula (2008) reports in their review of papers on the subject, the size and the distribution of welfare gains are disputed by scholars, but not their existence as such.

The relation of trade and growth is better understood (Andersen and Babula 2008): Trade affects productivity mainly through two channels: The first is that openness enables quicker capital accumulation leading to higher growth levels. This was found not to be the strongest channel (Klenow and Rodriguez-Clare 1997; Hall and Jones 1999). The channel empirically confirmed to be more relevant is a second one, productivity growth (Frankel and Romer 1999): Exposure to competition by trade incentivizes firms to be more efficient and wet out inefficient firms, leading to an average higher productivity; it gives access to foreign intermediary inputs and

technology; it expands market size enabling economies of scale; and it fosters international knowledge diffusion. It is empirically measured by Coe and Helpman (1995) that foreign R&D enhances domestic productivity and further confirmed by others (Keller 1998; Lumenga-Neso, Olarreaga, and Schiff 2005; Coe, Helpman, and Hoffmaister 1997). It should also be pointed out that trade can lead to the opposite effect if a country happens to be specialized on a knowledge-unintensive industry, or there is a lack of complementary inputs needed for the production of relatively technologically advanced goods (Basu and Weil 1996; Acemoglu and Zilibotti 2001).

A number of empirical studies have proved these theories: Hakura and Choudhri (2000) confirmed that openness increases productivity growth, especially through import competition and especially in mid-growth sectors. They have also found a weak positive effect through the export expansion channel in the case of high-productivity sectors. No effect was confirmed for low productivity sectors, as they are probably engaged in niche-markets or went bankrupt from foreign competition. Paolo Figini and Enrico Santarelli (2006) and Gozgor (2014) examined the effect trade has on unemployment in the G7 countries and have found that all trade openness measures are inversely correlated with unemployment. The study of Ramona and Ioana (2014) suggest that the flow of FDI, an important component of international flows, is a good predictor of changes in long-run economic growth (positive relationship). Gokcekus, Muchova, and Brincikova (2015) discovered that not only technology and knowledge spills over form more advanced trading partners, but business culture as well: They have found that openness to a less corrupt trading partner reduces corruption levels of a country.

How can E-Government Influence Openness?

As the empirical studies also point out, FDI is a vital aspect of international flows. A number of factors closely related to competitiveness influence a country's attractiveness to foreign capital. Schuller (2008) studied the level of globalization and openness in the Baltic states since the change of systems and he points out that the Baltic states had increasing levels of openness and competitiveness since the fall of the Soviet Union, and they maintain these high levels ever since. The capability to attract FDI is very much linked to competitiveness and as it is discussed in the previous chapter the e-government is one of the tools that can raise that.

Besides the basic gravity-theory mandating that FDI flows depend on economy sizes, there are a number of other factors influencing the decision to move capital to a country. Tintin (2013) investigated the institutional determinants of FDI in post-socialist economies by including four composite institutional variables alongside traditional macroeconomic ones: economic freedoms, state fragility, political rights, and civil liberties, along with GDP and openness measures. The analysis finds all factors significant and robust in explaining FDI-growth. In connection to e-government, the variable of interest is economic freedoms, which is a composite index of 10 measures revolving around rule of law, government size, regulatory efficiency and market openness. Measures about regulatory efficiency are particularly influenced by e-government as those are focused on regulatory and administrative burden, transparency, and the ease of setting up new ventures. Since the study have found these variables to be robust in explaining changes in FDI, it is plausible that a well-implemented e-government system can indeed increase the openness of the country.

ANALYSIS

Usage Data

For the purposes of this study the number of authentications and the number of signatures is used to measure the usage of digital services.

Authentications happen every time a user logs in to a service, making this an excellent measure, as it not only shows the number of people using these services, but also embodies usage frequency, this way being a measure of usage intensity.
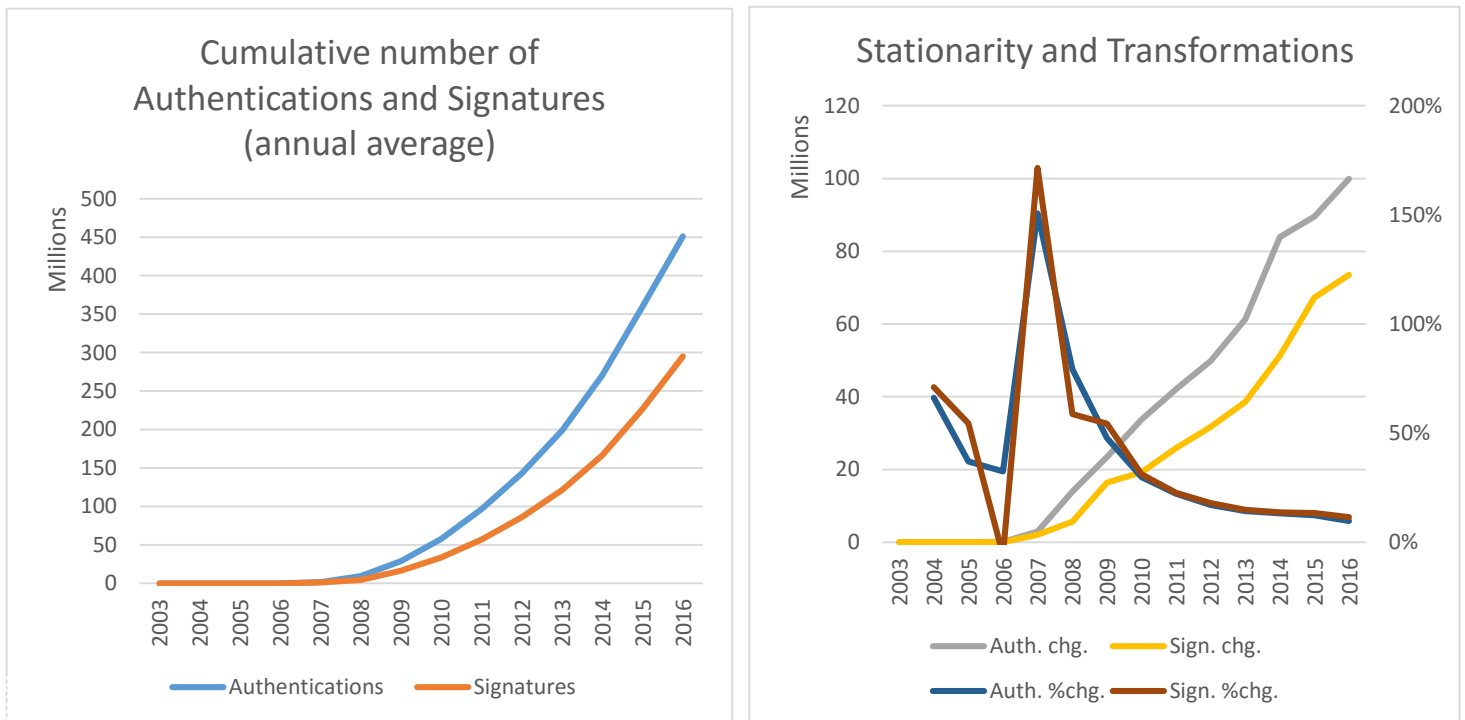

Figure 6 – Usage Data of Digital Services

(Source: Certification Authority)

The digital signature is a cornerstone to the e-government system, as a digital signature is needed whenever a paper-based signature would be required if administration was done on paper. This way it basically shows the number of transactions, contracts and settled errands via the system.

Data was sourced from the Certification Authority of the system, handling all authentications and signatures for all services.[1]

The provided dataset contains the growth in the number of authentications and signatures per month from January 2007 to March 2016. This data was transformed to monthly levels, which in turn was used to create the time series of annual changes and annual averages as the overwhelming majority of the dependent variables in this research are only available in the form of annual data.

The Vassil (2015) paper contained annual changes for years 2003-2006, so these were added to the dataset's annual figures resulting in having annual data 2003-2016 and monthly data 2007/01 - 2016/04.

Citizens' Attitudes

Hypotheses

Based on the literature review, the experience of using digital services can strengthen people's trust in the state in a multitude of ways:

- Increased perceived performance of government service delivery (Przeworski et al. 1996)

- Increased perception of a transparent and efficient administration (Mishler and Rose 2001)

- Being a more pleasant and convenient interaction with government (Lipsky 2010; Levi 1996)

- Usage of e-government itself is found to balance out the decrease of trust from using the Internet, therefore it must influence trust in state positively (Im et al. 2014)

Based on these theories they hypotheses to investigate are the following:

H 1.1   Trust towards institutions: The usage intensity of digital services is positively correlated with the general prevailing trust in the state.

In order to test this hypothesis, I examine the levels of trust in the Estonian society using data from the European Social Survey. Furthermore, as it was discussed in the literature review, perceived level of corruption is also related to level of trust, so I also examine correlation between usage of digital services and perceived levels of corruption using the Corruption Perceptions Index of Transparency International. Since the portfolio of digital services also include the possibility to vote online on elections and trust in the state is expected to influence turnout on votes, I examine election turnouts as well:

H 1.2   Corruption perception: The usage intensity of digital services is negatively correlated with the general perception of corruption of the country.

H 1.3   Election turnouts: The possibility of electronic voting increases election turnout.

Data Sources and Description

Trust data is acquired form the European Social Survey. It is a survey administered every two years in all EU Member States. The aim is to gauge the attitudes of society towards social, political and moral issues. There are 7 variables relating to trust under the political indicators section of the survey:

22

1. Trust in the national parliament
2. Trust in the legal system
3. Trust in the police
4. Trust in politicians
5. Trust in political parties
6. Trust in the European Parliament
7. Trust in the United Nations

All these variables are measured on a 0-10 ordinal scale where 0 means the respondent doesn't trust the institution at all and 10 means the opposite. Data is available 2002-2012 for every two years for all countries, resulting in 5 data points. Results of the 7th round are published continuously, and the Estonian data is already public, but not of all countries. Due to the small number of data points, only descriptive analysis is performed.

Corruption data is sourced from Transparency International. The Corruption Perceptions Index (CPI) is a composite index aggregating the assessment of 12 institutions and 13 surveys mainly based on the assessment of analysts and business people. The survey assigns a score to each country on a scale of $0 - 100$ since 2012 ($0 - 10$ before), where 0 is the most corrupt and 100 is the least corrupt. Countries are also ranked. Since TI doesn't provide access to a consolidated database, the aggregation of survey rounds prepared by the Center for Economic Studies (CES) is used.

For the purposes of this analysis, recent scores of 0-100 are converted back to the previously used 0-10 scale dividing by 10. Data is available $1998 - 2015$ on an annual basis.

23

Election turnout data is acquired from the International Institute for Democracy and Electoral Assistance (IDEA). The data contains all local, national and European Parliament elections since the country's re-independence, the first being the national election of 1992. The following variables are available:

- Whether or not digital voting was allowed (Yes / No)
- Type of election (National / Local / European)
- Date of election
- Size of electorate (number of eligible persons)
- Turnout (number of votes as a percentage of eligible voters)
- Number of votes
- Number of digital votes
- (Generated) Number of paper votes (All – digital)
- (Generated) Share of paper votes (% of all)
- (Generated) Share of e-votes (% of all)

Although only 17 data points (8 for e-voting) in total are available, in addition to descriptive analysis, a regression of turnout on usage data is also performed to allow for patterns to emerge if any.
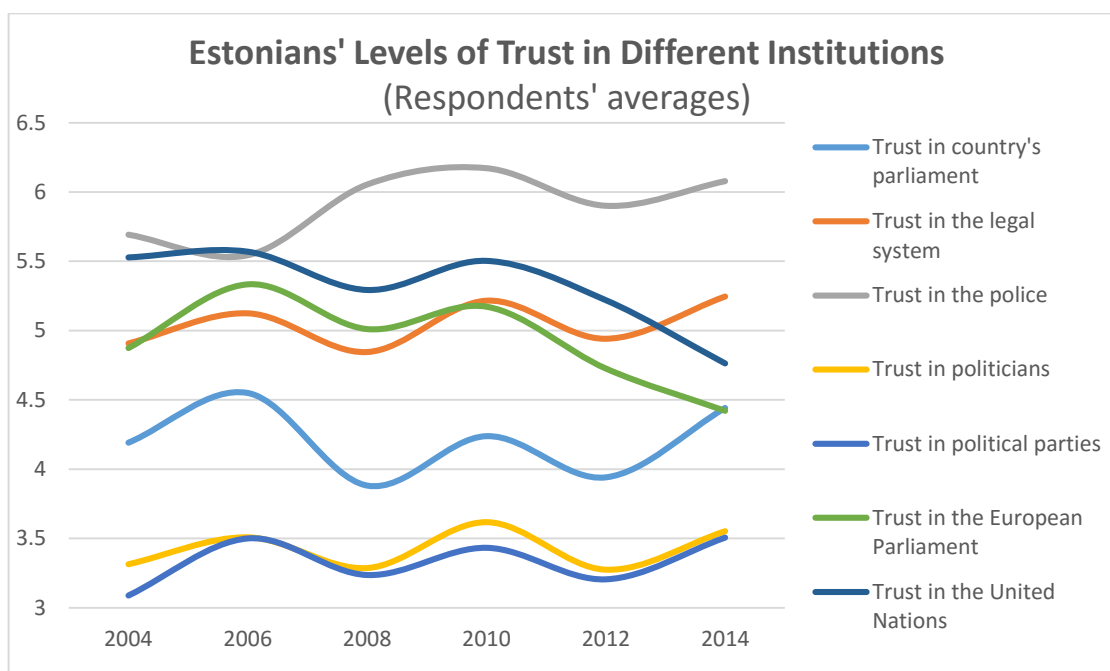
Trust in Institutions

Figure 7 – Estonians' Levels of Trust in Different Institutions (Scores)

Looking at the ESS results for trust, it is not really possible to conclude anything regarding the effect of digital service usage, as data resolution is too low and trust is likely influenced by a vast number of factors through a multitude of channels. What is clear from the time series is that most trust variables fluctuate around a mean, except for trust in foreign institutions (EP and UN) which declined by 2014 relative to other trust variables, as it can be seen how they leave the seasonal pattern. The cyclical pattern might be due to elections as well: all local maxima are before national elections and minima are after (national election years were 2003, 2007, 2011, and 2015).

Looking at the changes of Estonians' trust over time is more informative if compared to other countries. Also, global influences, such as the financial crisis of 2008 can be accounted for this way. Unfortunately, such ranking can only be done until 2012 at the moment, as 2014 figures are not available for all countries yet:
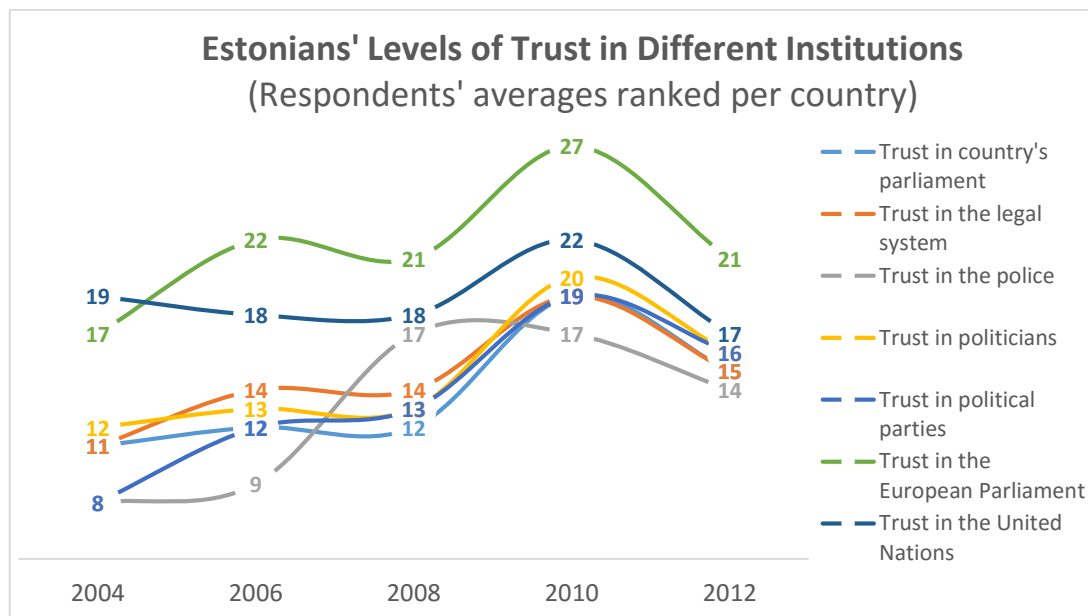
Figure 8 - Estonians' Levels of Trust in Different Institutions (Ranking)

Looking at rankings, it can be concluded that there seems to be a decline in trust compared to other countries, but since the timeframe is short, ranking might also exhibit cyclicality in the medium-to-long run.

H 1.1 **All in all, based on the data available, it is not possible to reject the null hypotheses, and it cannot be said that the usage of digital services is accompanied by any increase in trust levels.**

However, I believe that the failure to find evidence is merely a result of a lack of adequate data on the issue. As it was mentioned in the literature review, more scholars have confirmed the positive relationship in other cases, and I see no reason to believe that psychological mechanisms of trust are different for Estonians. Further study of the issue is advised as more data becomes available and / or an in-depth primary research is feasible.

Corruption
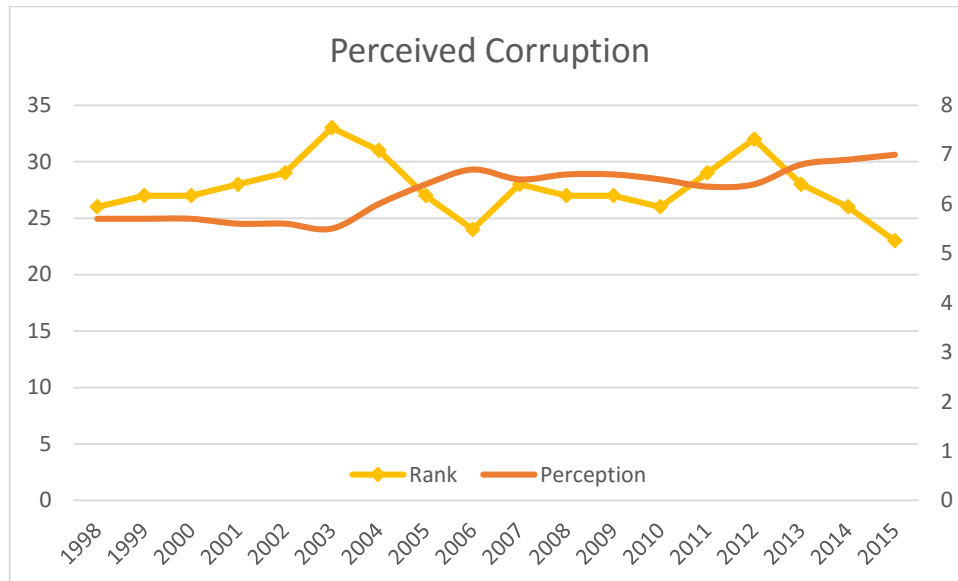
Figure 9 – Corruption Perception Score and Rank of Estonia

Examining the score and rank of the country over time, we can see a slow but steady improvement. Trying to back this up with more exact results, the regressions yield no significant numbers.

H 1.2 Using the available data, the null hypothesis cannot be rejected, and no relationship can be concluded between using digital services and the perceived corruption levels in the country. Further study is advised as data becomes more abundant.

Election Turnout
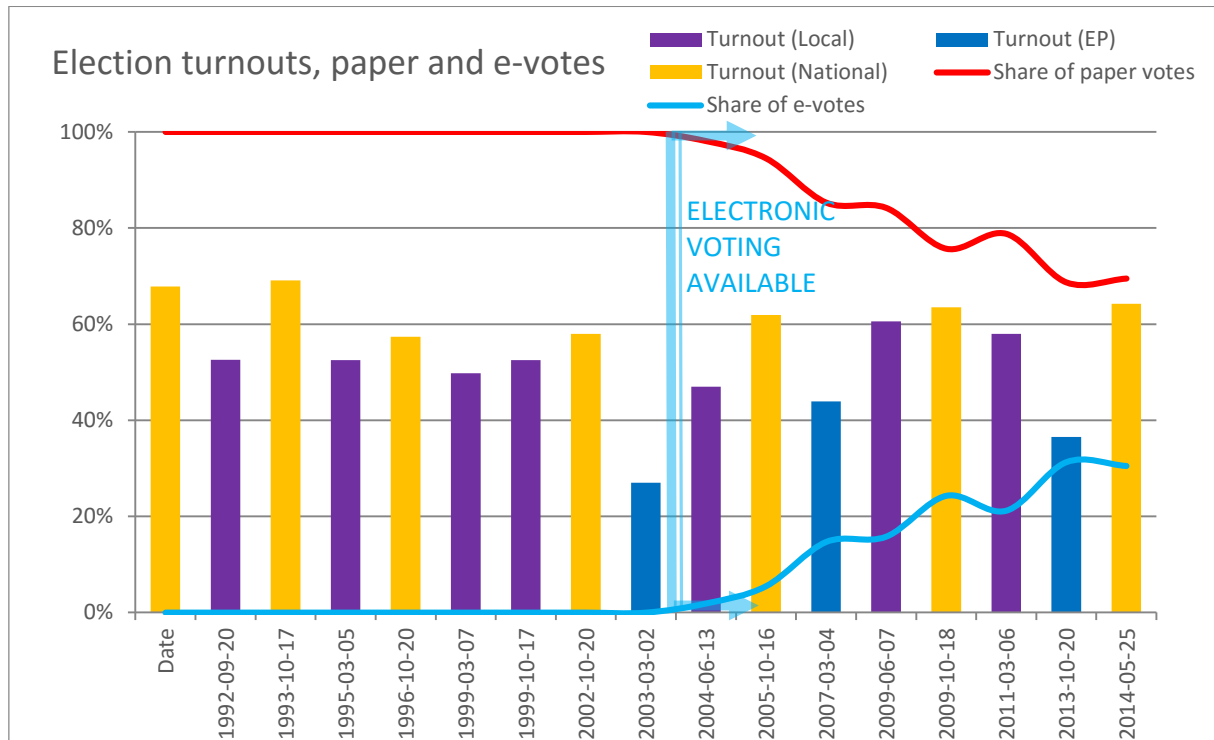
Figure 10 – Election Turnouts

Looking at the descriptive graph of election statistics over time, three things can already be seen:

- Electronic votes are replacing ordinary votes at a steady rate.
- National elections have the highest turnout rates, followed by local and European ones.
- Since the advent of electronic voting, turnout is on an increasing trend in all elections types.

In order to back up the visual impressions with something more solid, a regression was run to see how turnouts are related to the type of election, the availability of e-votes and the usage intensity of digital services:

28

	Turnout	Turnout
% Change Number of Authentications	-0.000105	
	(0.0105)	
% Change Number of Signatures		-0.00396
		(0.0134)
Election is Local	0.150	0.147
	(0.0663)	(0.0688)
Election is National	**0.230****	**0.231****
	(0.0403)	(0.0444)
E-vote available	**0.132***	**0.131***
	(0.0394)	(0.0441)
Constant	0.270***	0.276***
	(0.0160)	(0.0219)
N	9	9
R-sq	0.907	0.908
Standard errors in parentheses	* $p<0.05$ ** $p<0.01$ *** $p<0.001$	

Table 1 – Regression Results of Election Turnouts and Service Usage

Although having 9 observations is far from solid evidence, the regression backs up the visual intuition of the descriptive graph: According to the data, overall on average, the **availability of electronic voting is associated with a 9 ~ 17 percentage points higher turnout** at an election, controlling for election type.

The regression also shows that election type is a significant to turnout: Local and European Parliament elections are both exhibiting lower turnout rates, while overall on average according to the data, a **national election is expected have a 19 ~ 27 percentage points higher turnout then municipal or European ones**, controlling for electronic voting availability.

H 1.3 Data seems to confirm the hypothesis that the availability of e-voting increases election turnouts, however the low number of years available to study and the lack of an instrumental variable or a control group means that the results must be taken with a grain of salt, and although causality is intuitively plausible, formally is not proven by this regression.

29

Further validation of the results is advised as more data becomes available over time.

Competitiveness and Productivity

Hypotheses

As Allers (1994), A. F. M. Nijsen (2003), and Ntaliani, Costopoulou, and Sideridis (2012) all point out, coping with administrative burden ties down a considerable amount of company resources. The amount of administrative burden is an integral factor to the competitiveness of an economy. The advent of the Estonian e-government services lowers exactly this burden, therefore

H 2.1   It is expected that usage of digital services is correlated with the improvement of the competitiveness of the economy through reduced regulatory burden.

In order to test this, I examine scores and ranks of the different aspects of the Estonian business environment over time, and study the change in different measures of productivity.

H 2.2   Increased usage intensity of digital services is accompanied by an increase in productivity.

Data Sources and Description

Two datasets are used to study the changes of the business environment over time: The dataset of the Global Competitiveness Report of the World Economic Forum (WEF GCR) and the Doing Business Report of the World Bank (WB DB).

WEF Global Competitiveness Report. WEF "defines competitiveness as the set of institutions, policies and factors that determine the level of productivity of an economy, which in turn sets the level of prosperity that the country can achieve" (World Economic Forum 2016a). The GCR is published by the WEF every year, and each country is assessed on the above through a large number of variables having a score and a country rank for each. Data is available on an annual basis from 2007 to 2016 for the majority of variables. Only variables that have a significant relationship with service usage are presented in the next section.

WB Doing Business. The WB also prepares a similar report each year, but with a much narrower focus. While the GCR measures things such as the quality of the education system, public health or broadband internet availability, the DB report focuses purely on business related issues, such as time and number of filled out forms needed to register a business, quality of dispute settlement or protection of minority investors. Countries are assessed by scores and ranks, but WB also includes a handy distance to frontier (DTF) metric that takes the best performing country's score as 100% and expresses other countries score as a percentage of that. DTF values are available 2004 – 2016 or 2006 – 2016 on an annual basis.

For testing hypothesis 2.1, select business environment variables from the GCR and DTF values from the DB are regressed on usage data.

Productivity data is sourced from the latest Penn World Table (PWT) and The Conference Board Total Economy Database (TED). The following variables are selected from these databases:

- Total Factor Productivity Level
  (Current PPPs, USA=1, from PWT, available annually 1990-2011)

- Total Factor Productivity Growth
  (Tornqvist Index, from PWT, available annually 1993-2014)

- Labor Productivity per Hour Worked
  (in 2014 USD converted to 2014 price level with updated 2011 PPPs, from TED, available annually 1990-2015)

- Labor Productivity per Hour Worked Growth
  (percent change from previous year, from TED, available annually 1990-2015)

Competitiveness

In order to uncover relationships between changes in business environment scores, an initial subset of 61 variables were selected based on the likelihood of a relationship suggested by the literature. After the first differenced and log-differenced transformations of these variables were generated, those level and first-differenced variables that were non-stationary according to a Philips-Perron and Augmented Dickey-Fuller tests were dropped in order to minimize the chance of detecting spurious correlations. The remaining variables were regressed on usage intensity, and after dropping borderline significant cases, only the variables of regulatory burden and the aggregate GCI-value remained as significant.

Dependent Variables		Explanatory Variables				Reg. Sats	
Name	Type, *improve* *worsen*	ß of Number of Sign. Δ%	ß of Number of Auth. Δ%	Std. Err. Of N. Sign Δ%	Std. Err. Of N. Auth Δ%	N	R^2
Burden of government regulation, 1-7 (best)	Score Δ	0.175*		(0.0575)		9	0.513
	Score Δ		0.235**		(0.0601)	9	0.585
	Score Δ%	0.0411*		(0.0135)		9	0.511
	Score Δ%		0.0550**		(0.0143)	9	0.577
GCI Aggregate	Score	0.0521**		(0.0112)		10	0.469
	Score		0.0462***		(0.00874)	10	0.445
	Rank	-2.051**		(0.439)		10	0.492
	Rank		-1.719***		(0.325)	10	0.417
	Score Δ%	-0.0178**		(0.00472)		9	0.492
	Score Δ%		-0.0244***		(0.00381)	9	0.588
	Score Δ	-0.0841**		(0.0218)		9	0.505
	Score Δ		-0.115***		(0.0175)	9	0.600

Table 2 – Regression Results of Business Environment Variables and Service Usage

Regulatory burden. Although the score of regulatory burden were decreasing and the corresponding rank worsening since 2010, the regression results suggest that the decline would have been even worse without digital services, as there is a significant positive correlation between the change in service usage and change in score.

Aggregate GCI Score. The aggregate GCI score is the weighted score resulting from aggregate scores of subcategories of variables, therefore all GCI variables influence this figure. The GCI scores of Estonia are improving, just like its ranking. According to the regression, both the scores and ranks are improving with service usage, but results also show that the higher the increase in service usage, the lower the improvement in GCI score. This has probably to do with changes in other variables making up this aggregate index and the small number of observations.

H 2.1 Based on the results the hypothesis can be confirmed. Usage of digital services indeed seem to be associated with improvement in the change of regulatory burden scores, but the scores merely decrease less instead of increasing, suggesting that some other factors are offsetting a positive effect of

digital services, if any. Competitiveness scores are recovering since 2010, but in order to establish causality, a more in-depth analysis needs to be conducted.

Productivity

The regression results on productivity show no connection between usage and productivity variables whatsoever.

H 2.2 There is not enough evidence to reject the null hypothesis, and it cannot be concluded that an increase in the usage of digital services is associated with any change in productivity levels.

Openness

Hypotheses

As (Schuller 2008) pointed out in his study, the Baltic states had increasing levels of openness and competitiveness since the change of systems, and as Tintin (2013) states, regulatory efficiency is an important determinant of the competiveness and therefore attractiveness of a country. In this section, I examine if there is a relationship between the usage intensity of digital services and foreign direct investment inflows to the country.

H 3.1   An increase in the usage intensity of digital services is associated with an increase of FDI-inflows into the country.

If the country indeed becomes a more attractive investment destination, that should also show up in business demographics data. Therefore, the second hypothesis for this chapter is:

34

H 3.2   An increase in the usage intensity of digital services is associated with an increase of foreign business ownership in the country.

Data Sources and Description

Foreign Direct Investment was the sole data in this paper that is available in a higher resolution than annual. Quarterly data was acquired from the Federal Reserve Bank of St. Louis and Eurostat:

- FDI stocks
  (National currency, available 1992Q2 – 2013Q4 quarterly, FED)

- FDI flows
  (Percentage change quarter-on-quarter, available 1992Q3 – 2013Q4 quarterly, FED)

- FDI Stocks
  (mEUR, 1997-2012, annual, Eurostat)

Business demography data was sourced from the Estonian Statistical Office and Eurostat.

- Number of enterprises by ownership
  (count, available 2000-2015 annually, Statistics Estonia)

- Number of enterprise groups by country of owner
  (count, available 2004-2015, Statistics Estonia)

- Enterprise birth rates
  (New companies / All, %, 2004-2013, Statistics Estonia)

- Market integration
  *(Average values of inward and outward FDI / GDP * 1000, 1997-2012, Eurostat)*

35

FDI

After transforming monthly usage data to quarterly and regressing FDI growth, regressions were performed using various lag structures. Probably due to the still small number of observations, some lag specifications showed borderline significant coefficients, but those were not robust. Therefore, the most conservative result is reported here, which is:

	FDI (Kroon)	Change in FDI (mEUR)
% Chg. In Number of Signatures	**135,777,930.0**** *(36,166,744.7)*	**312.9*** *(112.5)*
Constant	*238,040,173.4**** *(39,991,818.3)*	*637.5 (329.2)*
N	*24*	*9*
R-sq	*0.085*	*0.190*

Table 3 – Regression Results of FDI Stocks and Service Usage

A quarter with 10 percentage points higher increase in the usage intensity shown by the number of signatures is associated by a 13 million kroons (~ 870 thousand €) higher FDI stock in the country, overall on average, according to the limited data available.

H 3.1 Based on the limited data available the hypothesis can be confirmed, although a more in-depth study should be undertaken to establish the existence and dynamics of causality between the usage of digital services and FDI-levels.

Business Demography

Examining changes in business demography in association with changes in the usage intensity of digital services yields no significant results.

H 3.2 **Using available data, it is not possible to reject the null hypothesis, and I cannot conclude that there is any association between digital service usage intensity and changes in business demography in terms of foreign ownership.**

CONCLUSIONS

The goal of this thesis was to establish if there is a positive association between the usage of e-government services and citizen's attitudes, competitiveness and productivity, and openness of the economy in the case of Estonia.

In the area of citizens' attitudes, although literature suggests, nor changes in trust levels, nor changes in the perception of corruption could be verified to have a relationship with the changes in usage intensity. However, it seems that the availability of electronic voting is associated with increased election turnouts.

In terms of competitiveness and productivity, changes in productivity could not be confirmed to have any relationship with changes in service usage, but in terms of the business environment, higher usage is associated with a lower deterioration of the administrative burden scores of the country.

When it comes to the openness of the country, it cannot be concluded that foreign ownership is changing significantly in terms of the usage of digital services, but there seems to be a positive relationship with the stock of FDI.

Based on these findings, it can be concluded that the availability and the usage intensity of digital services is associated with favorable tendencies in the economy, but those favorable changes are in some cases also being offset by negative ones (e.g. regulatory burden), or diminish on a macro level (e.g. productivity).

Overall, the goal of the thesis to measure changes in such complex and rather qualitative phenomena as trust, or such aggregate macro-level measures as productivity was probably too ambitious for the timeframe examined, as all variables involved in this analysis except for FDI were available only on an annual basis resulting

38

in a major bottleneck for this project. Despite this shortage of data, some findings are still visible, but in order to establish the existence and dynamics of causal relationships, conducting further, more in-depth research is advised.

POLICY RECOMMENDATIONS

Based on the conclusions of this research, it seems evident that the digital services offered in Estonia are associated with favorable tendencies in election turnouts, regulatory burden and FDI-levels, therefore these should be continued and it is recommended to further extend the scope of these services.

However, it is suspected that the favorable effects of the availability and spread of digital service usage cannot fully manifest at this moment, as regulatory burden scores are still worsening for some reason, and productivity is below optimal levels.

Unfortunately, the score of regulatory burden in the Global Competitiveness Report is based on an expert survey that is publicly unavailable, so the exact cause of the worsening scores are not known. Nevertheless, competitiveness and productivity can be improved by tackling some other areas of the economy. As the overall assessment of Estonian competitiveness was out of the scope of this paper, the following recommendations are partly based on the assessment of international organizations:

- According to the WB DB Report, Estonia has worsening rankings in the areas of Getting Credit, Enforcing Contracts and Resolving Insolvency (World Bank 2016). Therefore, it is recommended to improve regulation in these areas by developing reforms based on consultation with businesses and considering the adoption of best practices from other countries.

- Based on the most recent country report of the European Commission, it is further recommended to close the gender gap in educational participation, and combat early school leaving. The country is currently facing skill shortages in

developing technology-intensive high value-added sectors, and this should be mitigated through investing in education (European Commission 2016).

- Energy efficiency is still lower than in other EU countries, therefore investments should be made into refurbishing public buildings and a scheme should be set up to support the energy efficiency upgrades of residential buildings (European Commission 2016).

All-in-all, things in the country look good: The aggregate score for the business environment is improving in both benchmarks, the country's finances are in exceptionally good shape, and employment is at record levels (European Commission 2016). **This way, the most important recommendation is to keep up the current progress, carry on with ongoing reforms while maintaining their political support in the population, by ensuring that benefits reach all parts of society and are well communicated.**

REFERENCES

Acemoglu, Daron, and Fabrizio Zilibotti. 2001. "Productivity Differences." *The Quarterly Journal of Economics* 116 (2): 563–606. doi:10.1162/00335530151144104.

Allers, M. A. 1994. *Administrative and Compliance Costs of Taxatation and Public Transfers in the Netherlands.* Groningen: Wolters-Noordhoff. http://library.wur.nl/WebQuery/clc/926097.

Andersen, Lill, and Ronald Babula. 2008. "The Link Between Openness and Long-Run Economic Growth." https://www.usitc.gov/publications/332/journals/openness_growth_link.pdf.

Arrow, Kenneth Joseph. 1974. *The Limits of Organization.* The Fels Lectures on Public Policy Analysis. New York : Norton, [1974].

Badri, Masood Abdulla, and Khaled Alshare. 2008. "A Path Analytic Model and Measurement of the Business Value of E-Government: An International Perspective." *International Journal of Information Management* 28 (6): 524–35. doi:10.1016/j.ijinfomgt.2006.10.004.

Basu, Susanto, and David N. Weil. 1996. "Appropriate Technology and Growth." National Bureau of Economic Research. http://www.nber.org/papers/w5865.

Bergeron, F., and L. Raymond. 1997. "Managing EDI for Corporate Advantage: A Longitudinal Study." *Information & Management* 31 (6): 319–33. doi:10.1016/S0378-7206(97)00007-4.

Bjornskov, Christian, and Pierre-Guillaume Meon. 2013. "Is Trust the Missing Root of Institutions, Education, and Development?" *Public Choice* 157 (3-4): 641–69. doi:http://link.springer.com/journal/volumesAndIssues/11127.

Boonstra, Albert, and Jan de Vries. 2005. "Analyzing Inter-Organizational Systems from a Power and Interest Perspective." *International Journal of Information Management* 25 (6): 485–501. doi:10.1016/j.ijinfomgt.2005.08.006.

Coe, David T., and Elhanan Helpman. 1995. "International R&d Spillovers." *European Economic Review* 39 (5): 859–87.

Coleman, James S. 1990. *Foundations of Social Theory.* Cambridge, Mass. and London:

eesti.ee. 2016. "Services A-Z - Eesti.ee." *Services A-Z.* Accessed June 5. https://www.eesti.ee/portaal/!portaal.teenused_a_y?nk=t.

Elgarah, Wafa, Natalia Falaleeva, Carol C. Saunders, Virginia Ilie, J. T. Shim, and James. F. Courtney. 2005. "Data Exchange in Interorganizational Relationships:

Review Through Multiple Conceptual Lenses." *SIGMIS Database* 36 (1): 8–29. doi:10.1145/1047070.1047073.

European Commission. 2007. "Action Programme for Reducing Administrative Burdens in the EU – Smart Regulation – European Commission - European Commission." http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2007:0023:FIN:en:PDF.

———. 2016. "eGovernment in Estonia." February. https://joinup.ec.europa.eu/sites/default/files/ckeditor_files/files/eGovernment%20in%20Estonia%20-%20February%202016%20-%2018_00_v4_00.pdf.

———. 2016. "Country Report Estonia 2016." Accessed June 5. http://ec.europa.eu/europe2020/pdf/csr2016/cr2016_estonia_en.pdf.

Frankel, Jeffrey A., and David Romer. 1999. "Does Trade Cause Growth?" *American Economic Review*, 379–99.

Fukuyama, Francis. 1995. *Trust : The Social Virtues and the Creation of Prosperity*. London : Hamish Hamilton, 1995.

Gokcekus, Omer, Eva Muchova, and Zuzana Brincikova. 2015. "Level and Quality of Openness and Corruption in the ECA Countries." *Applied Economics Letters* 22 (16): 1340–44. doi:10.1080/13504851.2015.1031863.

Gozgor, Giray. 2014. "The Impact of Trade Openness on the Unemployment Rate in G7 Countries." *Journal of International Trade & Economic Development* 23 (7): 1018–37. doi:10.1080/09638199.2013.827233.

Guiso, Luigi, Paola Sapienza, and Luigi Zingales. 2000. "The Role Of Social Capital In Financial Development." *SSRN Electronic Journal*. doi:10.2139/ssrn.209610.

Hakura, Dalia S., and Ehsan U. Choudhri. 2000. "International Trade and Productivity Growth: Exploring the Sectoral Effects for Developing Countries - WP/00/17 - wp0017.pdf." https://www.imf.org/external/pubs/ft/wp/2000/wp0017.pdf.

Hall, Robert E., and Charles I. Jones. 1999. "Why Do Some Countries Produce so Much More Output per Worker than Others?" National bureau of economic research. http://www.nber.org/papers/w6564.

Hammer, Michael, and Glenn E. Mangurian. 1987. "SMR FORUM The Changing Value of Communications Technology." *Sloan Management Review (1986-1998)* 28 (2): 65.

Helliwell, Jf, and Rd Putnam. 1996. "Tuning in Tuning Out. The Strange Disappearance of Social Capital in America (vol 28, Pg 1, 1995)." *PS-POLITICAL SCIENCE & POLITICS* 29 (2): 138–138.

Henriksen, Helle Zinner. 2002. "Performance, Pressures, and Politics: Motivators for Adoption of Interorganizational Information Systems." Handelshøjskolen i København, Ph. D School of Informatics. http://www.hellezinnerhenriksen.info/data/hzh_phd.pdf.

Herlihy, Peter. 2013. "'Government as a Data Model' : What I Learned in Estonia | Government Digital Service." October 31. https://gds.blog.gov.uk/2013/10/31/government-as-a-data-model-what-i-learned-in-estonia/.

Im, Tobin, Wonhyuk Cho, Greg Porumbescu, and Jungho Park. 2014. "Internet, Trust in Government, and Citizen Compliance." *Journal of Public Administration Research & Theory* 24 (3): 741–63. doi:10.1093 /jopart/mus037.

Keller, Wolfgang. 1998. "Are International R&D Spillovers Trade-Related?: Analyzing Spillovers among Randomly Matched Trade Partners." *European Economic Review* 42 (8): 1469–81.

Klenow, Peter, and Andres Rodriguez-Clare. 1997. "The Neoclassical Revival in Growth Economics: Has It Gone Too Far?" In *NBER Macroeconomics Annual 1997, Volume 12*, 73–114. MIT Press. http://www.nber.org/chapters/c11037.pdf.

Krugman, Paul. 1980. "Scale Economies, Product Differentiation, and the Pattern of Trade." *The American Economic Review* 70 (5): 950–59.

Krugman, Paul R. 1979. "Increasing Returns, Monopolistic Competition, and International Trade." *Journal of International Economics* 9 (4): 469–79.

Leibenstein, Harvey. 1987. "On Some Economic Aspects of a Fragile Input: Trust." In *Arrow and the Foundations of the Theory of Economic Policy*, edited by George R. Feiwel, 600–612. New York:

Levi, Margaret. 1996. *A State of Trust*. EUI Working Papers of Robert Schuman Centre: 96/23. Badia Fiesolana, San Domenico (FI) : European University Institute, 1996.

Lipsky, Michael. 2010. *Street-Level Bureaucracy, 30th Ann. Ed.: Dilemmas of the Individual in Public Service*. Russell Sage Foundation.

Lühiste, Kadri. 2006. "Explaining Trust in Political Institutions: Some Illustrations from the Baltic States." *Communist and Post-Communist Studies* 39 (4): 475–96. doi:10.1016/j.postcomstud.2006.09.001.

Lumenga-Neso, Olivier, Marcelo Olarreaga, and Maurice Schiff. 2005. "Onindirect'trade-Related R&D Spillovers." *European Economic Review* 49 (7): 1785–98.

Mäkipää, Marko. 2006. "Inter-Organizational Information Systems in Cooperative Inter-Organizational Relationships: Study of the Factors Influencing to Success." In *Project E-Society: Building Bricks*, edited by Reima Suomi, Regis Cabral, J. Felix

Hampe, Arto Heikkilä, Jonna Järveläinen, and Eija Koskivaara, 68–81. IFIP International Federation for Information Processing 226. Springer US. http://link.springer.com/chapter/10.1007/978-0-387-39229-5_7.

Malone, Thomas W., Joanne Yates, and Robert I. Benjamin. 1987. "Electronic Markets and Electronic Hierarchies." *Commun. ACM* 30 (6): 484–97. doi:10.1145/214762.214766.

Mishler, William, and Richard Rose. 1998. *Trust in Untrustworthy Institutions : Culture and Institutional Performance in Post-Communist Societies*. Studies in Public Policy: 310. Glasgow : Centre for the Study of Public Policy (University of Strathclyde), 1998.

———. 2001. "What Are the Origins of Political Trust? Testing Institutional and Cultural Theories in Post-Communist Societies." *Comparative Political Studies* 34 (1): 30–62. doi:10.1177/0010414001034001002.

Misztal, Barbara A. 1996. *Trust in Modern Societies : The Search for the Bases of Social Order*. Cambridge : Polity Press, 1996.

Nijsen, Andreas Franciscus Maria. 2003. *Dansen Met de Octopus: Een Bestuurskundige Visie Op Informatieverplichtingen van Het Bedrijfsleven in de Sociale Rechtsstaat*. Eburon.

Nijsen, André FM, Nico Vellinga, and others. 2001. *Mistral*. EIM. http://www.ondernemerschap.nl/pdf-ez/H200110.pdf.

Ntaliani, Maria, Constantina Costopoulou, and Alexander B. Sideridis. 2012. "Alleviating SMEs' Administrative Burdens: The Rural Inclusion Initiative." In *Global Security, Safety and Sustainability & E-Democracy*, edited by Christos K. Georgiadis, Hamid Jahankhani, Elias Pimenidis, Rabih Bashroush, and Ameer Al-Nemrat, 237–44. Lecture Notes of the Institute for Computer Sciences, Social Informatics and Telecommunications Engineering 99. Springer Berlin Heidelberg. http://link.springer.com/chapter/10.1007/978-3-642-33448-1_32.

Paolo Figini, and Enrico Santarelli. 2006. "Openness, Economic Reforms, and Poverty: Globalization in Developing Countries." *The Journal of Developing Areas*.

Pritchett, Lant. 1996. "Measuring Outward Orientation in LDCs: Can It Be Done?" *Journal of Development Economics* 49 (2): 307–35.

Przeworski, Adam, Jose Antonio Cheibub, Fernando Papaterra Limongi Neto, and Michael M. Alvarez. 1996. "What Makes Democracies Endure?" *Journal of Democracy*, no. 1: 39.

Putnam, Robert D., Robert Leonardi, and Raffaella Nanetti. 1993. *Making Democracy Work : Civic Traditions in Modern Italy*. Princeton, N.J. : Princeton University Press, c1993.

Ramona, Simuţ, and Meşter Ioana. 2014. "An Investigation of Cointegration and Causality Between Investments, Exports, Openness, Industrial Production and

Economic Growth: A Comparative Study for the East European Countries." *Annals of the University of Oradea, Economic Science Series* 23 (1): 369–78.

Randlane, Kerly. 2012. "Tax Compliance and Tax Attitudes: The Case of Estonia." *Journal of Management & Change* 29 (1): 89–103.

Republic of Estonia Information System Authority (RIA). 2016. "X-Road Factsheet." *X-Road Factsheet*. Accessed June 5. https://www.ria.ee/public/x_tee/X-road-factsheet-2014.pdf.

Schuller, Bernd-Joachim. 2008. "Globalization and Competitiveness of Nations - the Baltic States." *Economics & Management*, August, 673–78.

Tintin, Cem. 2013. "The Determinants of Foreign Direct Investment Inflows in the Central and Eastern European Countries: The Importance of Institutions." *Communist and Post-Communist Studies* 46 (2): 287–98. doi:10.1016/j.postcomstud.2013.03.006.

UK Cabinet Office. 2006. "Administrative Burdens-Routes to Reduction." *United Kingdom*.

Van Dijk, Jan. 2012. *The Network Society*. Sage Publications.

Vassil, Kristjan. 2015. "Estonian eGovernment Ecosystem." June. http://pubdocs.worldbank.org/pubdocs/publicdoc/2016/3/165711456838073531/WDR16-BP-Estonian-eGov-ecosystem-Vassil.pdf.

Wegrich, Kai. 2009. *The Administrative Burden Reduction Policy Boom in Europe: Comparing Mechanisms of Policy Diffusion*. Centre for Analysis of Risk and Regulation, London School of Economics and Political Science. http://eprints.lse.ac.uk/36536/.

World Bank. 2016. "Doing Business in Estonia - World Bank Group." Accessed June 5. http://www.doingbusiness.org/data/exploreeconomies/estonia.

World Economic Forum. 2016a. "FAQs." *Global Competitiveness Report 2015-2016*. Accessed May 31. http://wef.ch/1KCKxJZ.

———. 2016b. "Methodology." *Global Competitiveness Report 2014-2015*. Accessed May 24. http://wef.ch/1pkBto1.

Young, Dale, Houston H. Carr, and Jr R. Kelly Rainer. 2000. "Strategic Benefits from a Mature Innovation." *American Journal of Business* 15 (2): 43–52. doi:10.1108/19355181200000010.

Yu, Shu, Jakob de Haan, and Sjoerd Beugelsdijk. 2011. *Trade, Trust and Institutions*. CESIFO Working Papers - Trade Policy: 3571. Munich : Ludwig-Maximilian University, 2011.

Zuurmond, Arre, and Frank Robben. 2009. "We Need to Dig a New Suez Canal: How Can ICT Help Changing Compliance Costs in the Next 20 Years?" In *Business Regulation and Public Policy*, 1–19. Springer. http://link.springer.com/chapter/10.1007/978-0-387-77678-1_16.

Coe, David T., Elhanan Helpman, and Alexander W. Hoffmaister. 1997. "North-South R&D Spillovers." *Economic Journal* 107 (440): 134–49.

107 (440): 134–49.