Does investment and deregulation of the ICT sector lead to growth?

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Abstract

The aim of this thesis is to investigate whether investment in information and communication technology (ICT) and the level of deregulation of these markets do have a positive impact on economic growth. Furthermore, the purpose is to analyse whether the lower economic performance in southern Europe may possibly be explained by lower levels of investment in ICT and slower deregulation of the ICT markets.

Several different dynamic panel data estimations on 11 EU countries were performed. The main conclusion from the estimations is that the variable *Telecom* which measures the level of deregulation in the telecom market, was shown to have a significant negative effect on the dependent variable economic growth. This is in accordance with theory since an increase in the regulations of the telecom markets is expected to have a negative impact on growth. However, the hypothesis that investments in ICT and early deregulation of ICT markets should promote economic growth could not entirely be supported in this analysis. Several different models with different lags, first differences etc. were estimated, but the regression results were not improved. Therefore, the same conclusion remained and the hypothesis could thus still not entirely be supported in this specific analysis.

Keywords: economic growth, ICT, deregulation, dynamic panel data, southern Europe

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Tables and figures

1. Introduction

The IT revolution has dramatically changed the economic system since the 1990s, making it more efficient, productive and has facilitated transactions, both within and across countries. Undoubtedly, the information and communication technology (ICT) did account for a large contribution to economic growth during the second half of the 1990s[1]. In order to take advantage of the economic benefits of ICT, countries have adjusted their economies in terms of political transitions and reforms, increasing investments in ICT and deregulation of ICT markets. Countries such as the US and the Nordic countries have invested relatively more than others in ICT[2] and successfully reformed and adjusted their economies towards the era of ICT which have affected their economic growth positively. During the past decades, the countries in southern Europe (e.g. Greece, Italy, and Spain) have experienced lower economic growth than other parts of Europe, possibly because these countries did not manage to take advantage of and adjust their economies to the development of ICT. It is possible that these countries did not fully succeed in performing the necessary political transitions and long run reforms needed to adjust to the new economic system. Therefore, this analysis is of highest importance, since it aims at investigating how the level of investment in ICT and deregulation of ICT markets affect economic growth.

The deregulation of ICT markets is an important factor in this context, because for example, earlier deregulation of these markets has been linked to higher growth in ICT[3]. Sweden, Finland, the US and the UK were among the first in the world to deregulate their telecom and ICT markets and have thus benefited economically from the rapid development of ICT. Countries in the southern parts of Europe, such as for example Italy, with more regulated ICT markets were not able to fully take advantage of the ICT revolution (Andersson, 2015, p. 6). Furthermore, Conway and Nicoletti (OECD, 2003) highlight the fact that the timing of the reforms to deregulate markets is rather important in this context. During the 1990s when the ICT revolution took place, the product market reforms in southern Europe were of a slower and more cautious nature. These factors could possibly contribute to the explanation to why these

[1] See e.g. Oliner and Sichel, (2000)

[2] See Appendix A2 *Figure 1*.

[3] See e.g. OECD (2003).

countries have experienced lower economic growth during the past decades than other parts of Europe.

Furthermore, the current economic system is possibly in the middle of another transition towards an even more digitalized system with the expansion of artificial intelligence (AI) and other advanced technological innovations (Andersson, Nilsson, 2016, p. 217). For the southern European countries, this third economic revolution may be even more difficult to follow and adjust their economies and societies to, since they are already lacking behind in the current economic system.

The hypothesis of this study is that investment in and the deregulation of ICT markets do have a positive impact on economic growth and furthermore, that during the past decades the countries in southern Europe (e.g. Greece, Italy and Spain) have experienced lower economic growth than other parts of Europe, possibly because these countries did not manage to take advantage of and adjust their economies to the development of ICT. These countries did not manage to perform the necessary political transitions and long run reforms needed to adjust to the new economic system.

By looking at the level of investment in ICT and the deregulation of the ICT markets since the mid 1990s in several European countries, the aim of this thesis is to investigate how the level of investment in ICT and the deregulation of ICT markets affect growth and whether the relatively lower economic growth in the southern European countries can be explained by the lack of investment in ICT and a slower deregulation of these markets.

The relationship between investment in ICT and economic growth is a rather unexplored area within economic research – investment in ICT is widely *assumed* to contribute to economic growth. The OECD showed in 2003 that investment in ICT accounted for 0.3-0.8 percentage points of growth in GDP per capita during the years 1995-2001 for the countries where data was available (OECD, 2003, p. 36), but the research on this specific topic is on the other hand limited. Therefore, this study is unique in the sense that it analyses a large dataset covering the recent years and explores the impact of investment in ICT as well as the deregulation of these markets on economic growth in the longer term.

2. Theory

Economic growth has been proved to be determined by factors such as technological development, investments, the productivity in the economy and the overall level of and investment in human capital. Institutions constitute an important role behind all these factors since they shape and form the rules in the economy. Countries with reliable institutions and the above-mentioned factors tend to be richer than other countries (Jones, Vollrath, 2013, p. 257). Even though there has been an academic debate whether it is the institutions that cause economic growth or if it is the opposite – that economic growth and the development of human capital cause solid institutions – there seem to be consensus that institutions cause economic growth (Glaeser et al., 2004, p. 272)[4]. As an example, Hall and Jones argue that the large differences in productivity and output per worker across countries are driven not only by differences in physical and human capital, but also by differences in institutions and government policies (Hall, Jones, 1999, p. 83). Furthermore, they conclude that these institutional differences and differences in governmental policies have shaped countries and caused large differences in productivity, human capital and capital accumulation, which in turn explains why income differ across countries (Hall, Jones, 1999, p. 114).

Institutions are thus an important determinant for economic growth and development. The term institution is rather wide, but institutions are in general assumed to shape and form the rules in the economy. Hodgson defines institutions as "systems of established and prevalent social rules that structure social interactions" (Hodgson, 2006, p. 2). North defines institutions in more detail as "a set of rules, compliance procedures, and moral and ethical behavioural norms designed to *constrain* the behaviour of individuals in the interests of maximizing the wealth or utility of principals" (North, 1981, p. 201-202). Institutions can thus be argued to be a set of social rules, structures and norms that outlines societies and shapes the economic rules for governments, firms and individuals. These social rules and structures can for example be of a political nature where the question of the countries analysed are some sort of democracies or more characterized by dictatorship. The political institutions within countries are highly important since to a large extent they affect how firms and individuals behave and interact with each other.

[4] The authors also refer to, among others, Hall and Jones (1999), Rodrik et al. (2004) and Dollar and Kraay (2003) who all support the hypothesis that institutions cause economic growth.

Furthermore, the financial system constitutes an essential institution in economies both in terms of economic growth and development as well as for investments, capital and transactions between actors within and across nations. Reliable financial institutions are crucial in the modern economy. Furthermore, empirically economic freedom has widely been associated with increased economic growth and the global economic development has during the past decades to a great extent been characterized by the Washington Consensus[5]. In the academic literature, there seems to be consensus regarding the positive effect of economic freedom on economic growth (Justesen, 2008, p. 657). As an example, Gwartney et al. analysed 82 countries and showed that economic freedom has a positive effect on economic growth[6], even after controlling for demographics and physical and human capital (Gwartney et al. 1999, p. 1). Furthermore, more resent research also points to economic freedom as an important factor for economic growth. De Haan et al. presented in 2006 that liberalization, as a measure for economic freedom, did promote growth and Justesen concluded that economic freedom affects growth and furthermore, that some freedoms – such as regulatory policies and government size – are more important than other (Justesen, 2008, p. 657).

Berggren argues that the concept of economic freedom attempts to describe to what degree the economy is a market economy, i.e. to what extent it is possible to enter voluntarily contracts in a situation where a reliable rule of law still exists and where the government has a limited role regarding its interventions (Berggren, 2003, p. 194).

Furthermore, well-functioning financial markets is another important institution for the economies. Efficient markets and increased competition are generally assumed to generate efficient allocation of resources. It is believed that increased competition decreases costs, increases productivity and furthermore, drives innovations forward.[7] As mentioned above, an earlier deregulation of ICT markets has been linked to higher growth in ICT and therefore, increased competition will reasonably increase economic growth as well. Conway and Nicoletti also highlight the fact that increased competition is necessary for the development of ICT

[5] Worth noticing is that the discussion on economic freedom has since the global financial crisis in 2008-09 been under much debate and criticism. See e.g. Hooper (2016) for further analysis.
[6] The authors used an index measuring economic freedom in the four areas money and inflation, international trade, economic structure and takings and discriminatory taxation.
[7] See e.g. Nickell, (1996)

(OECD, 2003, p. 17). Again, this indicates that governmental policies and institutions are highly important for the development of ICT, which in turn is an important determinant of economic growth. Furthermore, Oulton also argues that ICT is an important contributor to growth and that it is thus highly important to remove the obstacles and regulations for the adoption of ICT (Oulton, 2012, p. 1733). Oulton used a growth accounting model and studied 15 European and four non-European countries and concludes that if the ICT intensity would rise to the level of the usage in Sweden, which has one of the highest level of ICT usage in the EU, the ICT use would contribute for another 0.74 percentage points per annum to economic growth.

Markets that previously to a high extent have been characterized by state owned monopolies are for example the postal and telecom markets, since historically, the only actor who could afford the costly investments in these sectors were governments. During the past decades, these publicly owned monopolies have been relaxed and other private firms have been allowed to participate in the industries. The deregulation of the telecom markets increased in the late 1990s in the EU countries, largely driven by liberalisation directives from the EU, whereas the deregulation of the postal sector was of a slower nature (Conway, Nicoletti, 2006, p.18). Earlier deregulation of these markets has been linked to higher growth in ICT[8]. Sweden, Finland, the US and the UK were among the first in the world to deregulate their telecom and ICT markets and have thus benefited economically from the rapid development of ICT. However, the development of the deregulation in the countries in the southern parts of Europe have been of a slower nature. As an example, the ICT markets in Italy are more regulated and consequently, Italy has thus not been able to fully take advantage of the ICT revolution (Andersson, 2015, p. 6).

Furthermore, Conway and Nicoletti (OECD, 2003) highlight the fact that the timing of the reforms to deregulate markets is rather important in this context. During the 1990s when the ICT revolution took place, the product market reforms in southern Europe were of a slower and more cautious nature. These factors could possibly contribute to the explanation as to why these countries have experienced lower economic growth during the past decades than other parts of Europe.

[8] See e.g. OECD (2003).

3. Data and empirical model

3.1 Empirical model

The following part will explain the methodology and describe the different dynamic panel data models which includes data for 11 European Union countries during the time period of 1995-2014.

In order to test the hypothesis that investment in ICT, combined with deregulation of ICT markets, promotes economic growth and that the lack of investment in ICT may contribute to explain the observed lower economic performance in southern Europe the past decades, a dynamic panel data model was first estimated. Dynamic panel data models include a lagged dependent variable as a regressor, which facilitates the analysis of the current economic behaviour since it is often assumed to be dependent on earlier behaviour. This analysis examines the effects on economic growth which in turn is dependent on the growth performances in the past years and, therefore, the dynamic panel data model is a good option. Unfortunately, in dynamic panel data models, the individual specific effects in α_{it} are, by definition, correlated with the lagged dependent variable and the models suffer thus from endogeneity problems. Consequently, the estimations of OLS will be inconsistent and overestimating the true autoregressive coefficient, even for estimations with reasonably large periods of time (Verbeek, 2012, p. 396-97). In order to correct for the endogeneity problem, the model will be corrected by the bias-corrected OLS estimator[9].

The estimation of panel data is rather complex since it combines cross-sectional data and time series data where numerous variables for several countries are observed over a long period of time, which implies that complications may arise. In order to take into account the possible

[9] The OLS in dynamic panel data models generally gives biased coefficients, especially when T is small, and the model must thus be corrected for its bias. Judson and Owen (1999) used a Monte Carlo technique in order to evaluate different methods to correct for the bias in dynamic panel data models and recommend the Anderson-Hsiao estimator for panels with T=20, which therefore was chosen in this analysis. The Anderson-Hsiao estimator corrects the bias of the parameters in the first OLS by creating variance estimates through the bootstrap-bias correction procedure that resamples the observations of the dataset a large number of times (here the number of replicas in the bootstrap was set to 1000) and then compute the mean of the simulation and thus minimizes the bias of the parameters. For more details see e.g. Freedman, Peters (1984).

presence of heteroskedasticity – which is often encountered in cross-sectional data (Verbeek, 2012, p. 97-98) – robust standard errors were included in the estimations to adjust the standard errors. Furthermore, fixed effects control for the observed effects within the countries since it includes individual-specific intercepts in the model (Verbeek, 2012, p. 374). Furthermore, the bias-corrected OLS in this analysis also includes country-fixed effects in the estimation. Additionally, the problem of autocorrelation is likely to arise when estimating panel data, since the different error terms of the countries are most likely correlated (Verbeek, 2012, p. 112). The bootstrap bias-corrected OLS estimator is constructed in order to, among other things, take the possibility of correlated errors and heteroscedasticity into account (Freedman, Peters, 1984, p. 98).

Another common problem when estimating time series data is the possibility that the variables contain unit roots and are therefore not stationary indicating that shocks may have persistent effects for future time periods (Verbeek, 2012, p. 291). The three stationarity tests, Augmented Dickey-Fuller unit root test, Im-Pesaran-Shin test and Phillips-Perron unit root test, were performed in order to account for the possible presence of unit roots in the variables. These three tests are suitable for unbalanced panels and the conclusion that the majority of the variables did not contain a unit root could be made, indicating that shocks can only have temporary effects in the models. See Appendix A4 for the results from the stationarity tests.

The model was log-linearized in order for the coefficients to be interpreted as elasticities. The dynamic panel data model was estimated as follows and then corrected for its bias by the Anderson-Hsiao estimator:

$$\Delta GDP\ per\ capita_{it} = \alpha_{it} + \beta_1 GDP\ per\ capita_{i,t-1} + \beta_2 Index_{i,t-1} + \beta_3 Control_{i,t-1} + \delta_t + \varepsilon_{it} \quad (1)$$

Where α_{it} is the intercept of the dependent variable *economic growth* with indexes *i* = country and *t* = time. $Index_{i,t-1}$ is a vector with the index variables measuring the level of deregulation in the postal and telecom markets, the variable *GFCF by asset* that measure the total level of investment in the economy and the variable *ICT investment* which measure the level of investment in ICT, lagged one period. $Control_{it}$ is a vector including the control variables

interest rate, *exchange rate* and *human capital*, also lagged one period. Furthermore, δ_t captures the fixed time effect and ε_{it} is the error term.

According to theory and the hypothesis of this thesis, the index variables are expected to have a positive effect on economic growth, since increased level of investments are assumed to increase GDP. Furthermore, more deregulation of the ICT markets is assumed to have a positive impact on GDP as well.

The model was then estimated a second time as follows, with first differences included in the index variables, acting as instruments, where the individual effects have been removed from the model. Furthermore, this model will produce consistent estimators in the dynamic model.[10]

$$\Delta GDP\ per\ capita_{it} = \alpha_{it} + \beta_1 GDP\ per\ capita_{i,t-1} + \beta_2 \Delta Index_{i,t-1} + \beta_3 Control_{i,t-1} + \delta_t + \varepsilon_{it} \quad (2)$$

With the purpose of further improving the regression results, the model was estimated once more with the index variables lagged two periods to capture the development of the economic behaviour in the past two periods:

$$\Delta GDP\ per\ capita_{it} = \alpha_{it} + \beta_1 GDP\ per\ capita_{i,t-1} + \beta_2 Index_{i,t-1} + \beta_3 Index_{i,t-2} + \beta_4 Control_{i,t-1} + \delta_t + \varepsilon_{it} \quad (3)$$

Lastly, the model was estimated again with two lags and first differences included in the index variables:

$$\Delta GDP\ per\ capita_{it} = \alpha_{it} + \beta_1 GDP\ per\ capita_{i,t-1} + \beta_2 \Delta Index_{i,t-1} + \beta_3 \Delta Index_{i,t-2} + \beta_4 Control_{i,t-1} + \delta_t + \varepsilon_{it} \quad (4)$$

Furthermore, the observations for every country and variable was also divided into averages of three quarters because the original panel was rather unbalanced. Moreover, this procedure also takes temporary shocks into account. In order to hopefully improve the results of the regression,

[10] See e.g. Kiviet (1995)

the model was then estimated again according to the four versions above with the data divided into averages.

Moreover, as expected, there was a tendency for the variables measuring the level of regulation of the ICT markets to be correlated. As can be seen in the correlation matrix in Appendix A5, the variables in the subgroups within the telecom and postal variables were highly correlated with the variables *Telecom* and *Post*. This is naturally of no surprise since the variables *Post* and *Telecom* measure the overall level of regulation in the economy and will thus be correlated with the variables in their respective subgroups which in turn measure the regulation on different levels in the economy – namely, the market structure, the public ownership of and the entry into the postal- and telecom markets, respectively. Therefore, the models had to be estimated with the variables combined in different ways in order to overcome the problem of correlation and to identify the different individual effects. The models were first estimated with the variables *Post* and *Telecom* to measure the overall effect of regulation and then with the specific variables measuring the effects of regulation on the different levels in the economy.

3.2 Data

This analysis concentrates on 11 EU-countries[11] where data was available during the period of 1995-2014. Unfortunately, Portugal, one of the southern European countries, could not be included in the analysis due to the absence of data. The data was collected from OECD's statistical database, unless otherwise stated[12]. The data were of quarterly observations, indicating that the dynamic panel data models will observe the fluctuations and economic effects in the shorter term. However, this analysis aims at investigating the effects of investments in ICT on economic growth and because economic growth is a long-term phenomenon, data for a longer period of time would clearly have been desirable – preferably some 50-100 years. However, since the IT revolution took place as recent as during the second half of the 1990s and the especially interesting variables in this analysis are the level of investment in ICT and the development of the deregulation of these markets, it is reasonable to start the estimation in the mid 1990s in order to capture the development of ICT.

[11] See Appendix A1 for the list of countries.

[12] See Appendix A3 for the full list of variables, sources etc.

The dependent variable *economic growth* was measured in percentage as the quarterly growth rates of real GDP. Among the explanatory variables, the variable *"GFCF by asset"* (Gross Fixed Capital Formation by asset) takes the overall level of investment in the economy into account, measured in current prices and volume estimates. This variable is divided into groups of asset or product type and by institutional sector. [13] This analysis concentrates on the group *"ICT equipment"* which is included in the sub group "*Machinery and equipment + weapon system"* of *GFCF by asset.* Regarding the countries lacking data on this specific variable[14], the variable *"ICT investment"* was used instead. This variable measure the country's level of investment in ICT equipment and computer software used in production, as a percentage of total non-residential GFCF. This variable was then recalculated to get the same unit as the variable *"ICT equipment"* and can therefore arguably represent the level of investment in ICT for these countries.

The data for the regulation of ICT markets was collected from OECD's indicator *"Regulation in energy, transport and communication"* which measures the level of deregulation in the relevant subsectors - *"Telecom"* and *"Post",* of which each in turn was divided into three subgroups: entry, public ownership and market structure. The variables have been given different scores between 1 and 6 according to several indicators of the regulatory conditions within the countries, where a score of 1 indicates lower restrictions to competition and 6 indicates higher restrictions (Conway, Nicoletti, 2006, p. 7).

Regarding the *entry* regulations for postal and telecom, the indicators measure the legal limitations on the number of competitors allowed in the markets, where the scale ranges from no limitations to limitations in all markets or franchising to a single firm (Conway, Nicoletti, 2006, p. 10). Furthermore, the indicator for *public ownership* covers for example the extent of government control in the markets. To measure the *market structure* in the telecom markets, the indicator covers the share of new entrants in the different telecommunications services, in order to estimate to which extent the present regulations succeed in promoting competition in the markets[15].

[13] See OECD Statistics

[14] See appendix A3 for the full list.

[15] See *OECD* "Regulation in energy, transport and communications (ETCR)" and Conway, Nicoletti (2006), *OECD* "Product Market Regulation in the Non-Manufacturing Sectors of OECD Countries: Measurement and Highlights" for details.

Concerning the variables for the regulation of ICT markets, unfortunately, no data was available for the year of 2014 but since the differences within the countries at the end of the time series are infinitely small, the same value for 2013 was applied for 2014. Furthermore, OECD only presents yearly observations of regulation in energy, transport and communication. Since this analysis requires quarterly data, the missing observations had to be linearly interpolated from the first quarter of every year to the fourth quarter. However, since the variation in these variables was small to begin with and since the development in the deregulation of ICT markets is independent of seasonal variation and does thus not fluctuate noteworthy during the year, this method seemed reasonable. Furthermore, the deregulation of the ICT markets was performed by governments and politics and can thus be assumed to be characterized by a slower nature.

As control variables, *"Interest rates"* and *"Exchange rates"* – measured as the national currency against the USD – was included, since they are connected to the dependent variable economic growth. Furthermore, a third control variable *"Human capital"* was also included in the analysis. In the newer growth theory, human capital is assumed to contribute to economic growth[16] since both a high level of human capital on the individual level as well as on the aggregate level in society is expected to better take advantage of the new technology. Technology and human capital make the labour force more productive and are often assumed to drive the economic development.

In this analysis, the data from Barro and Lee (2010), collected from the World Bank's DataBank, have been used to measure the level of human capital in the countries. The variables of interest measure the educational attainment and measures the percentage share of the population above 25 years of age who have completed primary education, secondary education and, lastly, tertiary education. The IT revolution took place in the second part of the 1990s and it can thus be argued that some of the generations represented in the variable *human capital* in this analysis may not have experienced the development of ICT during their educational lives, but since the theory of human capital and growth concentrates on the knowledge in the economy and the synergies created by the overlapping generations, it is still relevant to include this variable and these generations. Furthermore, as earlier mentioned it is assumed that an overall high level of human capital in the economy is better prepared to take advantage of technological

[16] See e.g. the Lucas Growth Model

developments, innovations etc. and because this analysis aims at explaining the development of ICT as a main driver of economic growth it is a highly relevant variable in this context.

Due to the fact that Barro and Lee's dataset on education only contains yearly observations and this analysis requires quarterly data, the observations for the first quarter of every year was applied to the rest of the quarters of that year as well. There should be no harm in this method, since pupils are assumed to be enrolled for a whole year and the observations should thus be constant during the four quarters of every year. Furthermore, the educational dataset only covers the years up until 2010 indicating that no data was available for the last years in the analysis. Therefore, the observed educational values for 2010 was applied to the last years as well and this procedure was undertaken for all countries and should thus not affect the results to a worryingly high extent.

4. Empirical results

In order to test the hypothesis that investments in ICT and deregulation of ICT markets have a positive impact on economic growth, several empirical estimations were performed. The results from the estimations of the dynamic panel data model with different lags in the explanatory variables and, additionally, first differences in the index variables, are presented in the following tables. *Table 1* and *Table 1.2* show the results from the different estimations with quarterly data, whereas *Table 2* and *Table 2.2* present the results from the regressions with the data divided into averages of three quarters.

Table 1 below presents the results with the variables *Post* and *Telecom* which measure the overall regulation of the postal- and telecom markets. *Table 1.2* shows the results from the more detailed regressions where the regulatory variables are divided into the three sectors entry, market structure and public ownership.

Table 1: Results from the estimations with quarterly data, dependent variable: GDP per capita

Variable	(1) One lag	(2) One lag, first difference	(3) Two lags	(4) Two lags, first difference
GDP per capita$_{t-1}$	0.12*	0.12*	0.12*	0.12*
	(0.07)	(0.07)	(0.07)	(0.07)
Telecom $_{t-1}$	0.10	-0.54*	0.12	-0.46
	(0.32)	(0.31)	(0.28)	(0.47)
			0.13	0.09
			(0.32)	(0.37)
Post $_{t-1}$	0.10	1.10	-0.02	1.15
	(0.89)	(0.91)	(0.75)	(1.27)
			0.01	-0.01
			(0.96)	(0.99)
ICT investment $_{t-1}$	-0.06	0.08	-0.02	-0.06
	(0.67)	(0.07)	(0.02)	(0.72)
			-0.06	0.01
			(0.67)	(0.74)
GFCF$_{t-1}$	-0.01	0.01	0.00	0.03
	(0.73)	(0.79)	(0.47)	(0.74)
			0.03	0.03
			(0.33)	(0.97)
Interest rate $_{t-1}$	-0.07	-0.04	-0.07	-0.05
	(0.49)	(0.51)	(0.43)	(0.52)
Exchange rate $_{t-1}$	0.34	0.31	0.04	0.28
	(0.80)	(0.82)	(0.44)	(0.88)
Primary education $_{t-1}$	-0.13	-0.13	-0.13	-0.15
	(1.01)	(1.07)	(0.95)	(1.01)
Secondary education $_{t-1}$	-0.11	-0.09	-0.06	-0.10
	(0.44)	(0.47)	(0.36)	(0.50)
Tertiary education $_{t-1}$	-0.12	-0.07	-0.44	-0.33
	(1.30)	(1.37)	(0.82)	(0.98)

*** $p< 0.01$, ** $p< 0.05$, * $p< 0.1$.

Standard errors in parenthesis.

From *Table 1* it can be noted that the only significant coefficient is the one for the variable *Telecom* in the second model with one lag in the explanatory variables and first difference in the index variables. If *Telecom* would increase by 1 per cent, GDP per capita would decrease by 0.54 per cent. This result is in accordance with theory, since the variable *Telecom* measures the level of regulation in the telecom market and a higher level of regulation is expected to have a negative impact on GDP.

Furthermore, there is a tendency for the variable *Post* to have a slightly positive impact on economic growth, but the coefficients for this variable are not statistically significant. The coefficients for the variable *GFCF* are close to zero but mostly positive, indicating that an increase in the aggregated level of investment will give rise to a slightly increase in GDP as well. Moreover, the coefficients for *ICT investment* shows mixed evidence.

Table 1.2: Results from the estimations with quarterly data, dependent variable: GDP per capita

Variable	**(2)** **One lag**	**(2)** **One lag, first difference**	**(3)** **Two lags**	**(4)** **Two lags, first difference**
GDP per capita$_{t-1}$	-0.11 (0.09)	-0.15 (0.10)	-0.16 (0.09)	-0.14 (0.10)
Telecom entry $_{t-1}$	-0.051 (0.89)	0.01 (1.16)	0.21 (0.80) 0.21 (0.80)	0.25 (1.19) 0.19 (1.37)
Telecom public ownership $_{t-1}$	0.27 (0.83)	0.36 (1.19)	0.27 (0.78) 0.27 (0.78)	0.41 (1.19) -0.06 (1.37)
Telecom market structure $_{t-1}$	-0.82 (1.20)	-1.14 (1.56)	-1.45 (1.09) -1.45 (1.09)	-1.53 (1.60) -0.36 (1.66)
Post entry $_{t-1}$	-0.09 (0.53)	-0.17 (0.68)	-0.18 (0.49) -0.18 (0.50)	-0.08 (0.68) 0.42 (1.07)
Post public ownership $_{t-1}$	1.94 (4.46)	2.52 (5.65)	1.01 (4.13) 1.01 (4.13)	2.31 (5.71) 0.2 (8.27)
Post market structure $_{t-1}$	0.03 (1.43)	-0.38 (1.79)	-0.50 (1.29) -0.50 (1.29)	-0.40 (1.82) 0.40 (2.44)
ICT investment $_{t-1}$	0.22 (1.07)	-0.05 (1.33)	0.23 (0.89) 0.23 (0.89)	-0.18 (1.35) 1.09 (1.90)
GFCF$_{t-1}$	-1.25 (1.56)	-1.08 (1.95)	-1.04 (1.69) -0.4 (1.69)	-0.44 (2.11) -2.67 (3.81)
Interest rate $_{t-1}$	-0.53 (0.80)	-0.49 (0.92)	-1.09 (1.02)	-0.62 (0.94)

Exchange rate $_{t-1}$	0.65	1.15	-1.38	1.59
	(2.82)	(3.99)	(2.70)	(3.85)
Primary education $_{t-1}$	0.62	0.74	0.91	1.51
	(2.14)	(2.64)	(1.90)	(2.73)
Secondary education $_{t-1}$	4.66	4.45	2.25	2.86
	(4.26)	(5.06)	(4.09)	(5.12)
Tertiary education $_{t-1}$	-0.31	0.14	0.72	0.43
	(2.20)	(2.66)	(2.07)	(2.73)

**** p< 0.01, ** p< 0.05, * p< 0.1.*

Standard errors in parenthesis.

As can be seen from *Table 1.2* above none of the different models with the index variables lagged once respective twice, with or without first differences, provided statistically significant coefficients. Even though the regression results from the dynamic panel data estimations are not significant, some general trends can be noted. There are tendencies for the regulatory variables to have mixed effects on the dependent variable, where the *Telecom* variables seem to have a slightly more positive effect. The coefficients for the variables *Telecom market structure* and *Post entry* are always negative and GDP will thus decrease if these variables increase, which is in accordance with theory. Furthermore, the variable *Post market structure* is negative in all estimations except for the first one, indicating a similar negative impact on GDP as the two previous variables.

There seem to be a tendency for the variable *GFCF by asset* in *Table 1.2* to have a negative impact on economic growth, which contradicts the general economic assumption that more investments should have a positive effect on economic growth. The variable *ICT investment* shows a mixed result, dependent on the different models. In the models with only lags included, the variable seems to have a slightly positive impact on economic growth, but when the first differences in the index variables are included the effect seems to be slightly negative instead. However, it is worth to highlight that no significant results and conclusions can be drawn from these tendencies, since the regression results are not statistically significant.

The following two tables present the results of the regressions with the observations divided into averages of three quarters. Again, the first table, *Table 2* presents the results with the variables *Post* and *Telecom* which measure the overall regulation of the postal- and telecom markets and *Table 2.2* shows the results from the more detailed regressions where the regulatory variables are divided into the three sectors.

Table 2: Results from the estimations with the data divided into averages of three quarters, dependent variable: GDP per capita

Variable	(1) One lag	(2) One lag, first difference	(3) Two lags	(4) Two lags, first difference
GDP per capita$_{t-1}$	0.12*	0.12*	0.12*	0.12*
	(0.07)	(0.07)	(0.07)	(0.07)
Telecom $_{t-1}$	0.09	-0.54*	0.12	-0.46
	(0.32)	(0.31)	(0.28)	(0.47)
			0.13	0.09
			(0.32)	(0.37)
Post $_{t-1}$	0.10	1.10	-0.02	1.15
	(0.89)	(0.91)	(0.75)	(1.27)
			0.01	-0.01
			(0.96)	(0.99)
ICT investment $_{t-1}$	-0.06	0.08	-0.02	0.01
	(0.66)	(0.07)	(0.10)	(0.74)
			-0.06	-0.05
			(0.67)	(0.74)
GFCF$_{t-1}$	-0.01	0.03	0.00	0.03
	(0.73)	(0.33)	(0.47)	(0.97)
			0.01	0.03
			(0.77)	(0.73)
Interest rate $_{t-1}$	-0.07	-0.04	-0.07	-0.05
	(0.49)	(0.51)	(0.43)	(0.52)
Exchange rate $_{t-1}$	0.34	0.31	0.04	0.28
	(0.80)	(0.82)	(0.44)	(0.89)
Primary education $_{t-1}$	-0.13	-0.31	-0.13	-0.15
	(1.01)	(1.07)	(0.95)	(1.01)
Secondary education $_{t-1}$	-0.11	-0.09	-0.06	-0.10
	(0.44)	(0.47)	(0.36)	(0.50)
Tertiary education $_{t-1}$	-0.12	-0.07	-0.44	-0.33
	(1.30)	(1.37)	(0.82)	(0.98)

*** $p< 0.01$, ** $p< 0.05$, * $p< 0.1$.

Standard errors in parenthesis.

From *Table 2* with the data divided into averages of three quarters, only the coefficient for the variable *Telecom* in the second model with the explanatory variables lagged once and first difference in the index variables, was statistically significant. If *Telecom* would increase by 1 per cent, GDP per capita would decrease by 0.54 per cent. As earlier discussed, this result is in accordance with theory. There is a tendency for the variable *Post* to have a positive impact on GDP since three out of four coefficients in the estimations are positive. Again, this contradicts the theory of deregulation of ICT markets.

Table 2.2: Results from the estimations with the data divided into averages of three quarters, dependent variable: GDP per capita

Variable	(1) One lag	(2) One lag, first difference	(3) Two lags	(4) Two lags, first difference
GDP per capita $_{t-1}$	0.64***	0.58***	0.71***	0.58***
	(0.08)	(0.08)	(0.07)	(0.08)
Telecom entry $_{t-1}$	0.12	0.15	0.16	0.17
	(0.58)	(0.64)	(0.22)	(0.67)
			0.16	0.10
			(0.22)	(0.85)
Telecom public ownership $_{t-1}$	0.052	0.078	0.06	0.07
	(0.20)	(0.21)	(0.08)	(0.22)
			0.06	-0.05
			(0.08)	(0.40)
Telecom market structure $_{t-1}$	-0.36	-0.52	-0.49	-0.50
	(1.22)	(1.30)	(0.46)	(1.37)
			-0.49	0.05
			(0.46)	(1.99)
Post entry $_{t-1}$	0.014	0.02	-0.01	0.01
	(0.54)	(0.56)	(0.20)	(0.60)
			-0.01	0.02
			(0.20)	(0.93)
Post public ownership $_{t-1}$	-0.09	0.06	-0.18	-0.25
	(5.13)	(5.43)	(1.93)	(5.75)
			-0.18	-1.96
			(1.93)	(12.39)
Post market structure $_{t-1}$	-0.02	-0.02	-0.11	-0.02
	(1.26)	(1.43)	(0.49)	(1.51)
			-0.11	0.45
			(0.50)	(1.98)
ICT investment $_{t-1}$	-0.21	-0.32	-0.19	-0.27
	(1.06)	(1.12)	(0.41)	(1.19)
			-0.19	-0.10
			(0.41)	(1.73)
GFCF $_{t-1}$	0.012	0.031	0.07	0.04
	(0.26)	(0.31)	(0.10)	(0.33)
			0.07	-0.03
			(0.10)	(0.03)
Interest rate $_{t-1}$	-0.52	-0.60	-0.58	-0.55
	(0.93)	(0.97)	(0.36)	(0.98)
Exchange rate $_{t-1}$	-0.12	0.16	-0.82	0.00
	(2.98)	(3.07)	(1.15)	(3.23)
Primary education $_{t-1}$	0.45	0.64	0.87	0.69
	(2.01)	(2.25)	(0.79)	(2.20)
Secondary education $_{t-1}$	1.051	1.22	2.00	1.83
	(4.91)	(5.42)	(1.85)	(5.36)

Tertiary education $_{t-1}$	-0.27	-0.35	-0.55	-0.41
	(1.41)	(1.53)	(0.53)	(1.52)

**** p< 0.01, ** p< 0.05, * p< 0.1.*
Standard errors in parenthesis.

From *Table 2.2* it can be noted that the second estimation of the dynamic panel data did not provide significant results either. Unfortunately, neither the procedure to analyse the data with observations divided into averages of three quarters nor the inclusion of lagged explanatory variables and first differences in the index variables could manage to improve the results further. However, the coefficients of the lagged dependent variable are highly significant and has a positive impact on growth in GDP per capita, as expected.

Even though the regression results are not significant, some general trends can be observed from the results. According to *Table 2.2 Telecom entry* and *Telecom public ownership* are always positive, indicating that an increase in these variables, i.e. more regulations in the telecom markets, should have a positive impact on GDP. This contradict the theory. On the contrary, the variables *Telecom market structure* and *Post market structure* are always negative, indicating that an increase in these variables would give rise to a decrease in GDP per capita as well, which is more in accordance with theory. Moreover, among the variables measuring the regulation in the postal market, the variable *Post public ownership* is negative in three of the models, meaning that increases in this variable will have negative impacts on GDP. The variable *Post entry* is in general positive and an increase in this variable will thus give rise to an increase in GDP, again contradicting theory.

Furthermore, there is a tendency for the variable *GFCF by asset* to have a positive impact on economic growth, as excepted, since more investment are widely assumed to increase the economic development. The hypothesis of this thesis is that investment in ICT should have a positive effect on economic growth, but from *Table 2.2* above the variable *ICT investment* seem to have a slightly negative impact on the dependent variable. Again, an aspect worth highlighting is that no significant results nor conclusions can be drawn from these tendencies, since the regression results are not statistically significant.

To summarize, the level of significance in the different panel data model estimations was rather low and the only significant coefficients were for the variable *Telecom* in *Table 1* and *Table 2*. If this variable were to increase, the GDP would decrease which is in accordance with theory.

Even though the level of significance was low in the estimations, some general tendencies can be seen. There is a tendency for the coefficients of variable *Telecom market structure* to always be negative and increases in this variable will thus, as expected, decrease GDP per capita. Furthermore, the coefficients for the variable *Post market structure* is in general also negative indicating the same effects as for the variable *Telecom market structure.*

Furthermore, the models were then estimated twice again, the first including three lags in the index variables and the second additionally including first differences in the index variables. Unfortunately, even this procedure did not improve the level of significance in the results and the results are thus not presented here.

As expected, the two variables *Post entry* and *Telecom entry* were highly correlated[17] and these two variables thus had to be estimated independently of each other. This was done by dropping first *Post entry* in all regressions in order to estimate the coefficients for *Telecom entry* and vice versa. This procedure could not further improve the regression results and will thus not be presented in the analysis.

5. Discussion

The different dynamic panel data models performed in this analysis could only provide significant results for the variable *Telecom* in *Table 1* and *Table 2*. If this variable were to increase, the GDP would decrease which is in accordance with theory. Otherwise this analysis could not fully provide any statistical significant results in the short term regarding the relationship between the level of investment in ICT, the deregulation of ICT markets and economic growth in the 11 European Union countries investigated. Even though the model was estimated in several ways, including one and two lags of the explanatory variables and first differences in the index variables, the regression results were not improved and therefore, the same conclusion remains. The hypothesis that investment in ICT and deregulation of ICT markets supposedly promote economic growth could not be fully supported in this specific analysis.

[17] See appendix A5

Even though the regression results from the dynamic panel data estimations are not fully significant, some general trends can be noted. There is a tendency for the coefficients of variable *Telecom market structure* to always be negative and increases in this variable will thus, as expected, decrease GDP per capita. Furthermore, the coefficients for the variable *Post market structure* is in general also negative indicating the same effects as for the variable *Telecom market structure.* These tendencies indicate that the market structure could be important for the postal- and telecom sectors. These variables measure the share of new entrants in the markets and furthermore, how well the regulations perform in promoting competition in the markets. The tendencies in the coefficients indicates that increases in the variables, i.e. lower levels of competition, would have a negative impact on economic growth.

In the model with quarterly data (*Table 1*), there is a tendency for the variable *GFCF by asset* to have a negative impact on economic growth, which contradicts the general economic assumption that more investments should have a positive effect on economic growth. In the model with the data divided into averages of three quarters, the variable *GFCF by asset* tends on the contrary to have a positive impact on economic growth, which is more in line with economic theory, since more investment is widely assumed to increase the economic development. Dependent on the different models, the coefficients for the variable *ICT investment* shows mixed results. In the models with quarterly data, the results from the estimations with only lags, the variable seem to have a slightly positive impact on economic growth, but when the first differences in the index variables are included the effect seems to be slightly negative instead. The hypothesis of this thesis is that investment in ICT should have a positive effect on economic growth, but from *Table 2.2* above there is a tendency for the variable *ICT investment* to have a slightly negative impact on the dependent variable. Furthermore, there are tendencies for the regulatory variables to also have mixed effects on the dependent variable, where the *Telecom* variables seem to have a slightly more positive effect. However, it is worth to highlight that no significant results and conclusions can be drawn from these tendencies, since apart from the coefficient for the variable *Telecom,* the regression results are not statistically significant.

However, it is highly important to denote that the models in this analysis include quarterly data and thus investigates fluctuations in the short term. The fact that the hypothesis could not be supported in the short term does not necessarily mean that there should be no effect in the longer term.

Economic growth is a long-term phenomenon, therefore it is desirable to analyse longer time series. This particular analysis only covered the time period of 1995 to 2014 and it is possible that the analysis would have benefited from a longer period of time. However, the IT revolution took place as late as in the second half of the 1990s and therefore, it was not possible to extend the time period further. However, it can be argued that the real long term effects of the development in IT on economic growth are not yet fully visible. It is highly recommended to perform more research on this specific topic in the future when longer time series are available. The development to even more digitalized societies and economies, with the rapid development of artificial intelligence and other advanced technological innovations, most certainly requires more research and knowledge on how this development will affect the economic system as we know it.

Furthermore, except the above mentioned issue of longer time series, the analysis would possibly have benefited from a larger sample as well. The absence of data for several European Union countries made the sample rather small for being a panel dataset. Hopefully this issue will be corrected in the future when longer time series and thus more observations are available, again indicating that more research is needed within this area.

Even though this particular analysis could not manage to fully support the hypothesis that investments in ICT and the deregulation of ICT markets promote economic growth in the 11 EU countries analysed here, this may not be true in general. It may possibly be the case that this hypothesis can be supported in other samples and areas of the world, during different periods of time etc.

6. Conclusion

This thesis investigated the relationship between the level of investment in information and communications technology, the level of deregulation of ICT markets and the development of economic growth in 11 European Union countries during the time period of 1995-2014. The hypothesis that investments in ICT and early deregulation of ICT markets should promote economic growth – and could be one of the causes as to why southern Europe, e.g. Greece, Italy and Spain, has experience significantly lower economic growth the past decades – could not be fully supported in this analysis. The main conclusion from the different estimations is that the variable *Telecom*, which measures the level of regulation in the telecom sector, does have a statistically significant negative impact on GDP, indicating that if this variable were to increase, the GDP per capita would decrease, which is in accordance with theory.

However, several different dynamic panel data models with different lags, first differences etc. were estimated, but the hypothesis could still not be supported in this specific analysis. Some general tendencies in the variables could be seen, e.g. that the variables *Telecom market structure* and *Post market structure* are always negative, indicating that an increase in these variables would give rise to a decrease in GDP per capita as well, which is more in accordance with theory. Nevertheless, since the regression results were not significant, any certain conclusions could not be drawn. Furthermore, since economic growth is a long-term phenomenon and the IT revolution took place as late as in the second part of the 1990s, it can be argued that the real long term effects of the development in IT on economic growth are not yet fully visible. Furthermore, more research in the future is highly recommended, when longer time series and thus more observations are available.

The models in this analysis used quarterly data and thus investigate fluctuations in the shorter term. The fact that the hypothesis could not be supported in the short term does not necessarily mean that there should be no effect in the longer term.

Even though this particular analysis could not manage to entirely support the hypothesis that investments in ICT and the deregulation of ICT markets promote economic growth in the 11 EU countries analysed here, this may not be true in general. Nevertheless, it might be the case that this hypothesis can be supported in other areas of the world, during different periods of

time etc. Again, more future research in this area is highly recommended – especially since the economic system is moving towards another, even more digitalized era with the development of artificial intelligence and other advanced technological innovations, which undoubtedly will affect economies all over the world to some extent.

The relationship between ICT and economic growth is a rather unexplored area of economic research – the development of ICT is assumed to have facilitated transactions, banking systems etc. and could thus in the longer term be associated with higher levels of economic growth. However, more research within this area is highly recommended in the future when longer time series are available.

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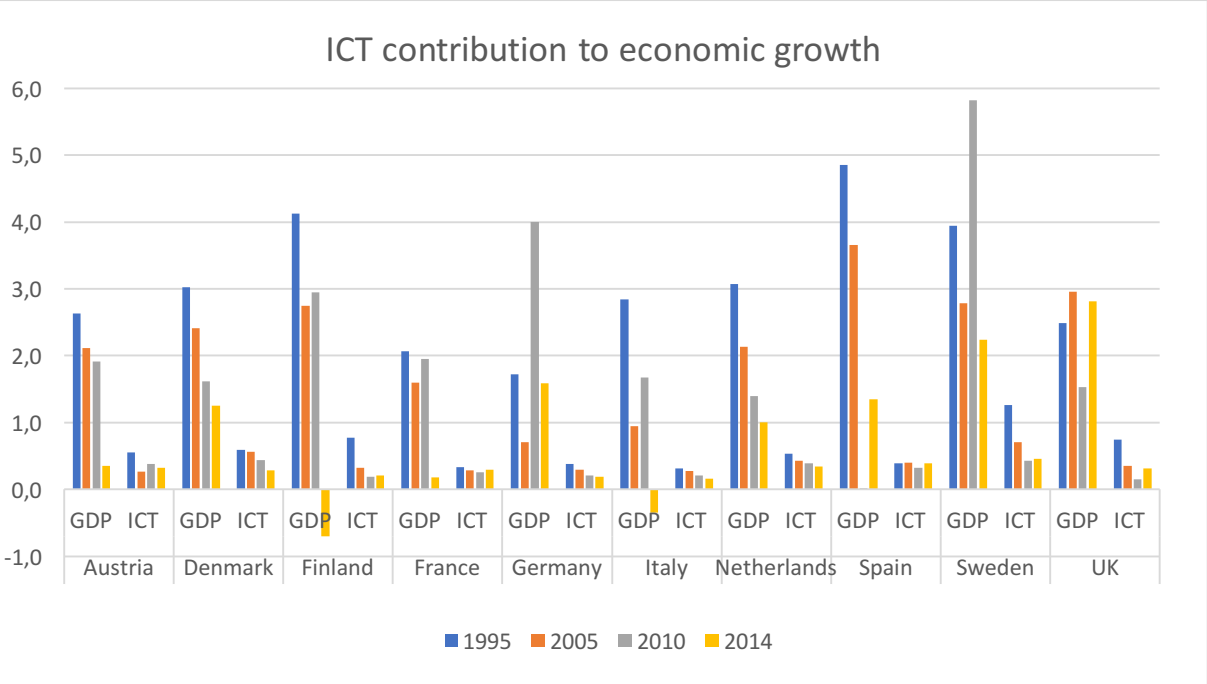
Appendix

A1. List of countries

Austria	Ireland
Denmark	Italy
Estonia	Netherlands
Finland	Spain
France	Sweden
Germany	United Kingdom
Greece	

A2. *Figure 1.* ICT contribution to economic growth



Source: Conference Board. Variables "GDP growth" measured as the growth of GDP, log change, and "ICT contribution" measured as the contribution of Capital Services provided by ICT Assets to GDP growth.

Figure 1 above shows the contribution of ICT to the growth in GDP for selected European Union countries between 1995 and 2014. As can be seen in the figure, Italy and Spain do have

a lower level of ICT contribution to growth compared to the other countries in the sample, especially compared to Sweden and the United Kingdom.

A3. List of variables

Dynamic panel data model:

Variable	Unit	Description	Source
GDP per capita	USD	Quarterly Growth Rates of real GDP, change over previous quarter	OECD
Gross Fixed Capital Formation by asset	National currency	Measured in current prices and volume estimates, broken down separately by type of asset or product and by institutional sector	OECD
ICT equipment	National currency	Measured in current prices and volume estimates, broken down separately by type of asset or product and by institutional sector. Countries: Austria, Denmark, Estonia, Greece, Ireland, the Netherlands, Slovak Sweden, the UK	OECD
Investment in ICT	Percentage	First measured as percentage of total non-residential GFCF. Then recalculated to get the same unit as the variable "ICT equipment". Countries: Finland, France, Germany, Italy, Spain	OECD
Interest rate	Percentage per annum	Real interest rate	OECD, Estonia IMF
Exchange rate	National currency against the USD	National currency against the USD	OECD
Telecom	Score 1-6	Based on several indicators that measure the regulation in the telecom sector.	OECD
Telecom entry	Score 1-6	Based on several indicators that measure the regulation in the telecom sector.	OECD
Telecom public ownership	Score 1-6	Based on several indicators that measure the regulation in the telecom sector.	OECD

Telecom market structure	Score 1-6	Based on several indicators that measure the regulation in the telecom sector.	OECD
Post	Score 1-6	Based on several indicators that measure the regulation in the post sector.	OECD
Post entry	Score 1-6	Based on several indicators that measure the regulation in the post sector.	OECD
Post public ownership	Score 1-6	Based on several indicators that measure the regulation in the post sector.	OECD
Post market structure	Score 1-6	Based on several indicators that measure the regulation in the post sector.	OECD
Primary education	Percentage	Percentage of population age 25+ with primary schooling. Completed Primary	World Bank
Secondary education	Percentage	Percentage of population age 25+ with secondary schooling. Completed Secondary	World Bank
Tertiary education	Percentage	Percentage of population age 25+ with tertiary schooling. Completed Tertiary	World Bank

A4. Stationarity tests

Augmented Dickey-Fuller unit root test (inverse normal statistic)

Variable	Statistic
GDP per capita	-9.98***
GFCF by asset	1.12
Investment in ICT	-2.69***
Interest rate	-2.62***
Exchange rate	-0.88
Telecom	-5.75***
Telecom entry	-4.49***
Telecom public ownership	-2.95***
Telecom market structure	-5.24***
Post	2.23
Post entry	1.97
Post public ownership	2.07
Post market structure	0.37
Primary education	-5.55***
Secondary education	-4.86***
Tertiary education	-3.12***

Im-Pesaran-Shin test

Variable	Statistic
GDP per capita	-14.25***
GFCF by asset	0.69
Investment in ICT	-3.51***
Interest rate	-3.18***
Exchange rate	-0.98
Telecom	-5.56***
Telecom entry	-1.89*
Telecom public ownership	-2.29**

Telecom market structure	-3.77***
Post	2.06
Post entry	-
Post public ownership	-
Post market structure	-
Primary education	-3.8***
Secondary education	-3.19***
Tertiary education	-1.96**

Phillips-Perron unit root test (inverse normal statistic)

Variable	**Statistic**
GDP per capita	-9.61***
GFCF by asset	1.15
Investment in ICT	-2.59***
Interest rate	-2.57***
Exchange rate	-0.97
Telecom	-4.83***
Telecom entry	-3.84***
Telecom public ownership	-2.42***
Telecom market structure	-4.38***
Post	2.32
Post entry	2.01
Post public ownership	2.10
Post market structure	0.51
Primary education	-5.13***
Secondary education	-4.34***
Tertiary education	-2.36***

From the tables above with the results from the stationarity test, the null hypothesis of a unit root in the variables could be rejected for all variables, except the *Post*-variables, *GFCF by asset* and the variable *Exchange rate*. By taking the first differences of these variables, they

were made difference stationary (Verbeek, 2012, p. 239), as can be seen in the tables below. The variables do thus not contain unit roots and are therefore assumed to be stationary.

Augmented Dickey-Fuller unit root test (inverse normal statistic)

Variable	**Statistic**
GFCF by asset	-20.51***
Exchange rate	-18.83***
Post	-24.19***
Post entry	-12.86***
Post market structure	-20.69***
Post public ownership	-14.88***

Im-Pesaran-Shin test [18]

Variable	**Statistic**
GFCF by asset	-22.15***
Exchange rate	-19.14***
Post	-26.03***
Post entry	-
Post market structure	-
Post public ownership	-

Phillips-Perron unit root test (inverse normal statistic)

Variable	**Statistic**
GFCF by asset	-28.98***
Exchange rate	-23.20***
Post	-29.13***
Post entry	-18.98***

[18] The Im-Pesaran-Shin test failed to produce statistics for the different subgroups of the *Post*-variable, but since the other two tests produced significant results for these variables they are assumed to not contain a unit root and furthermore, assumed to be stationary.

Post market structure	-26.56***
Post public ownership	-20.09***

A5. Correlation matrix

	GFCF	ICT	GDP	Interest	Ex-change	Tele com	Tele entry	Tele market structure	Tele Public ownership	Post	Post entry	Post market structure	Post public ownership	Primary	Secondary	Tertiary
GFCF	1.00															
ICT	0.59	1.00														
GDP	-0.11	0.01	1.00													
Interest	-0.23	-0.05	-0.9	1.00												
Exchange	0.55	0.91	0.01	-0.04	1.00											
Telecom	-0.19	-0.03	0.24	0.47	-0.03	1.00										
Tele entry	-0.29	-0.15	0.19	0.45	-0.12	0.88	1.00									
Tele market structure	-0.29	-0.16	0.24	0.43	-0.11	0.89	0.48	1.00								
Tele public ownership	0.03	0.16	0.18	0.33	0.11	0.82	0.38	0.48	1.00							
Post	-0.11	-0.01	0.18	0.38	0.02	0.53	0.53	0.48	0.38	1.00						
Post entry	-0.15	-0.28	0.15	0.27	-0.19	0.48	0.67	0.22	0.52	0.55	1.00					
Post market structure	0.02	0.24	0.13	0.27	0.23	0.42	0.29	0.28	0.37	0.79	0.29	1.00				
Post public ownership	-0.13	-0.06	0.11	0.31	-0.06	0.30	0.31	0.27	0.23	0.75	0.31	0.37	1.00			
Primary	-0.29	-0.23	0.03	0.54	-0.28	0.36	0.34	0.31	0.27	0.42	0.32	0.15	0.49	1.00		
Secondary	0.42	0.36	-0.05	-0.39	0.35	-0.10	0.26	-0.22	0.15	-0.26	-0.22	-0.03	-0.36	-0.69	1.00	
Tertiary	-0.17	0.12	-0.04	-0.11	0.08	-0.36	-0.31	-0.27	-0.34	-0.36	-0.45	-0.23	-0.14	-0.29	0.06	1.00