Mendel University in Brno
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Foreign trade with ICT goods in the Czech Republic

Diploma thesis

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Abstract

Slavík, M. Foreign trade with ICT goods in the Czech Republic. Diploma thesis. Brno: Mendel University, 2015.
The thesis examines quantitative development of foreign trade with ICT goods in the Czech Republic since establishment of the republic in 1993. For this purpose, original data generated from the external trade database gathered by the Czech Statistical Office are used. The main goal of the thesis is to perform thorough description of development of foreign trade with ICT goods in the Czech Republic. Among others, the analysis includes trend and seasonality description, evaluation of impact of the economic crisis in 2008, forecasting of development for 2015, 2016 and 2017, and basic international comparison with several members of the European Union.

Keywords

ICT, Foreign Trade, Forecasting, Granger Causality, Impulse Response Analysis, International Comparison.

Abstrakt

Slavík, M. Zahraniční obchod s ICT zbožím v České republice. Diplomová práce. Brno: Mendelova univerzita v Brně, 2015.
Tato práce zkoumá kvantitativní vývoj zahraničního obchodu s ICT zbožím v rámci České republiky od jejího vzniku v roce 1993. Pro tyto účely jsou použita data vygenerovaná z databáze zahraničního obchodu, která shromažduje Český statistický úřad. Hlavním cílem práce je provést zevrubný popis vývoje zahraničního obchodu s ICT zbožím v České republice. Analýza zahrnuje mimo jiné popis trendové a sezónní složky, zhodnocení vlivu ekonomické krize v roce 2008, prognózy vývoje pro roky 2015, 2016 a 2017, a mezinárodní srovnání s vybranými členy Evropské unie.

Klíčová slova

ICT, zahraniční obchod, prognóza vývoje, Grangerova kauzalita, reakce na impulzy, mezinárodní srovnání.

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1 Introduction

The sector of information and communications technology (ICT) is relatively young and progressive. By the term ICT it is in general intended all the information technology used for communication and information work. Over the last years one may see how important has ICT sector become. Technological development constantly pushes possibilities further, and with growing living standards people can spend more money on less necessary products, such as ICT goods. Generally, with overall rising importance of the ICT goods within foreign trade, it has become necessary to analyze this area separately in detail, as it has significant effects on overall performance of the economy. That was the initial impetus for formation of this thesis.

In the 21st century, role of information and communications technology has become crucial in life of common man. There is a constant development of new ICT goods emerging in the market, while these goods make previous technology early obsolete. Consumer satisfaction does not necessary reflect only fulfilment of a certain need, typically accomplishing a task easier. Using ICT goods often brings alone also an element of consumer experience. This additional value makes consumers spend notable portion of income for ICT goods, but also to repeat those purchases, as they may consider it as matter of prestige. Consumers' willingness to spend money for ICT goods was quickly recognized by pioneer companies in the sector.

The ICT sector consists of many dominant companies with rich tradition. Corporations such as Microsoft, Google, Apple, IBM or others have grown into enormous size, as they have become worldwide recognized multinational companies. Their presence in any national market is commonly desired, as they bring huge direct investments and create jobs for number of domestic inhabitants. Effect on labour market and overall economic performance is then well recognized, not to mention impact on the regional level. Therefore, national and regional authorities often try to attract investments of such companies, for instance by tax reliefs, labour-oriented support or acceleration of local infrastructure works.

Regardless the impact of multinational corporations on the industry, the ICT sector would not develop so rapidly without small start-up companies, which are constantly bringing new ideas for further or completely new development. Competition in the market is what allowed the industry to become more and more important for the economy. This phenomenon was acknowledged and currently there are many innovation centres, which help small businesses to start their activities until they become stable entities. In the Czech Republic, an example of such an agency is the South Moravian Innovation Centre based in Brno, which attracts applicants from all over the republic. Presence of such a center has arguably significant effect on the regional market and its business orientation.

Development of ICT sector has further impact also on businesses which are not engaged in ICT trade, but they use products of ICT sector in order to reach higher effectiveness, easier feasible of work or more fluent workflow of processes. In this sense, automatization of processes is highly desired as a factor which pro-

vides companies with competitive edge. Deployment of ICT products into businesses increases overall competition in the particular market, hence the entire industry prospers. Also customers of these companies gain from decreasing price level brought by higher competitiveness in the market and better effectiveness of production processes.

Combination of consumers' desires, innovative ideas triggered by small local start-up companies, and capability of mid size and multination corporations to deliver these ideas worldwide is what drives foreign trade with ICT goods and services. Since national markets have become more open towards foreign exporters nowadays, especially with expansion of such entities as is the European Union, it has become easier for ICT producers to penetrate other markets, apart from the domestic one.

The presented diploma thesis deals with a topic of foreign trade of ICT goods in the Czech Republic. With respect to the reflection mentioned above, the thesis framework is primarily based on evaluation of development of foreign trade with ICT goods, thorough description of analysed data and comparison with several countries of the European Union. Concerning development description of foreign trade with ICT goods, it is necessary to take into account all crucial milestones, which affected performance of the economy within a specified period. For these purposes, there are considered two important landmarks as a presumption: entry of the Czech Republic to the European Union in 2004, and onset of the economic crisis into the national market in 2008. To analyze such time series, the econometrics is supposed to provide the right tools in order to create informative and meaningful models.

The thesis itself is structured into two main parts. The first one consists of theoretical review of literature over the topic. The chapter summarizes current tendencies in foreign trade and reviews development of foreign trade with ICT goods within the context of the OECD. The theoretical review then creates a basis for further processing within the second part of the thesis, where secondary data from national statistical office are analysed in order to meet specified objectives of the thesis.

1.1 Objectives of the thesis

The thesis will evaluate development of the foreign trade with information and communications technology (ICT) goods in the Czech Republic.

Specifically, focus will be paid to analysing the development of import and export volumes of ICT goods in the sector. These areas will be modelled and evaluated separately. Furthermore, forecasting will be performed based on collected data. Findings will be set into context of the EU through comparison with several EU member states. The thesis will also describe main components of the foreign trade with ICT goods.

Specified objectives of the diploma thesis are:

1. Evaluation of the development of foreign trade with ICT goods in the Czech Republic since 1993 up to the present (respecting the latest available data). This will consist of thorough description of general trends and forecasting future development based on econometric models observing ceteris paribus.
2. Description of the impact of economic crisis on the foreign trade with ICT goods.
3. Description of the main components of the foreign trade with ICT goods based on official statistics.
4. Basic comparison with several countries from the EU in order to put the findings into the European context.
5. Comment on the likely importance of the foreign trade with ICT goods for the Czech economy based on the results of analyzes.

In order to meet objectives of the thesis, following research questions will be addressed and evaluated:

Hypothesis 1: Import of the ICT goods dropped after 2008 due to economic crisis.

Hypothesis 2: Export of the ICT goods dropped after 2008 due to economic crisis.

Hypothesis 3: Trend of the ICT goods import changed after joining the EU.

Hypothesis 4: Trend of the ICT goods export changed after joining the EU.

Hypothesis 5: Development of ICT goods import is influenced by development of Czech GDP.

Hypothesis 6: Development of ICT goods export is influenced by development of GDP in euro area.

Hypothesis 7: Share of foreign trade with ICT goods in overall foreign trade of the Czech Republic significantly increased over a time.

For the purpose of data collection, only trustworthy sources are expected to take place within the thesis. Originally, following sources are expected to be suitable for data collection: Czech Statistical Office, UN Comtrade database, Gartner database. Other reliable sources may be also used based on data relevancy. The key data since 1993 are expected to be collected and analysed up to the last published numbers (2012 or later).

2 Literature review

Following chapter is focused on current knowledge related to the topic examined and represents a theoretical background of the thesis. The chapter is divided into several subchapters.

The first subchapter focuses on global tendencies related to trade. Following subchapter discusses economic crisis, its causes and ways of transmission to the Czech Republic. Next subchapter summarizes ICT sector characteristics, as it is followed by the last subchapter which characterizes ICT as medium for knowledge economy.

2.1 Global trade tendencies

Foreign trade is influenced by current tendencies of social, economical and political environment. Following subchapter provides basic framework of these main tendencies – globalization, integration, internationalization, liberalisation and international trade as theoretical concept.

2.1.1 Globalization

Many different definitions of the term globalization may be found in literature. Ritzer (2010, p. 2) defines globalization as *„a transparentary process or set of processes involving increasing liquidity and the growing multidirectional flows of people, objects, places and information as the structures they encounter and create that are barriers to, or expedite, those flows.“* In contrast, Steger (2010, p. 10) thinks that term globalization *“applies to a set of social processes that appear to transform our present social condition of weakening nationality into one globality. At its core, then, globalization is about shifting forms of human contact.”*

According to Pichanič (2004, p. 12), there are several factors which help to speed up the process of globalization. Among these factors we may mention e.g. development of telecommunication technology, economy of scale, lowering of costs of transportation, emerging markets, homogenization of technology standards, propensity to homogenous demand, and other.

Globalization of the world economy has a major effect on independency of countries, as it leads to greater interdependence among them. In general, developing countries are dependent on resources flows and technology of developed countries, at the same time as developed countries depend on natural resources and markets of industrial goods of developing countries. Consequently, interdependency among countries leads to vulnerability of world economy to market shocks. (Thirlwall, 2006, p. 13-14)

2.1.2 Integration

Globalization and integration are closely connected. Jovanovic (2006, p. 21) defines economic integration as *“a process and a means by which a group of countries*

strives to increase its level of welfare." Molle (2006, p. 4) stresses a notion, that economic integration *"is not an objective in itself, its rationale is to serve higher objectives, both of an economic and of a political nature."*

The process of integration is usually separated into several stages. The first basic stage is called as "free trade area". At this stage, member states of the area eliminate barriers of mutual trade. Once the member states introduce also common custom policy towards third countries, the integration reaches stage of "custom union". Next stage, the "single market" (also referred to as common market or internal market) introduces free movements of all flows regarding with development of trade within the market. After this stage is completed, the integration process may continue with "economical and monetary union", which refers to common monetary policy of the member states and harmonization of economical decisions. The highest stage of integration is then "political union", which also adds political and cultural aspects. (König, Lacina and Přenosil, 2007, p. 91-115)

2.1.3 Internationalization

According to Dana, Welpe, Han and Ratten (2008, p. 671), internationalization is defined as *"continuous process of increasing involvement in international operation"*. Marinov and Marinova (2012, p. 49) mention definition where internationalization *"is considered to be a process through which a firm moves from operating solely in its domestic marketplace to international market."*

It is necessary to distinguish between globalization and internationalization. Regarding internationalization, the term stands for international trade with goods, which are manufactured as organized part of national economy framework. In contrast, term globalization is not limited by state borders concerning manufacturing process. (Sýkora, 2011, p. 59)

2.1.4 Liberalisation

Thirlwall and Pacheco-Lopez (2008, p. 50) define trade liberalisation as *"any policies that reduce the degree of anti-export bias."* In the sense of this definition, it does not imply that abolition of tariffs is necessary, as may be sometimes incorrectly interpreted.

Trade liberalisation can positively influence growth rate of an economy. This premise assumes long run period, as these mechanisms works simultaneously:

- Trade leads to technology transfer and makes total productivity grow faster;
- Trade leads to specialization due to higher volumes of output;
- Trade encourages investment which confers externalities, especially if the investment goods come from abroad. (Thirlwall, 2006, p. 529)

On the other hand, opponents of trade liberalisation argue, that for a country it is necessary to protect the domestic market. Higher level of liberalisation may cause too strong import, unhealthy pressure on competitiveness of domestic producers, and consequently reallocation of factories and increase of unemployment. In addi-

tion, even if a country gains from liberalisation, domestic producers may tend to overexploit natural resources, which can leave environment irretrievably damaged. (Rogowsky, Linkins and Tsuji, 2001, p. 6)

2.1.5 International trade theoretically

According to Bowen, Hollander and Viaene (1998, p. 3), international trade theory is basically just an extension and application of known microeconomic concepts of production and exchange. The focus is transferred to economic transactions between different states and their agents. In addition, international trade theories help to understand the essence of trade, with respect to resource allocation, profit maximalization, export and import benefits, all considered within different counties.

The basic concept linked with international trade comes from David Ricardo and his "principle of comparative advantage". The principle is based on differences in opportunity costs among trading countries. A country has a comparative advantage, if its pre-trade relative price of production is lower than in foreign countries. Nowadays, a country should focus on production of goods where it has the lowest opportunity costs and exports these, and import those goods which would bring a country comparative disadvantage position. With this scenario, all countries benefits from mutual trade. (Bowen, Hollander and Viaene, 1998, p. 4-5)

The gains from trade are measured by the increase in the value of output and real income from domestic resources. Two sorts of gains may be then distinguished – static and dynamic gains. "Static gains" are in this context considered to be the ones coming from specialization of production according to principle of comparative advantage by Ricardo. In contrast, "dynamic gains" are resulting as an effect of economies of scale, international investments or technical knowledge transmission. Furthermore, international trade may serve as a "vent for surpluses", which is another benefit. Because of trade, all the resources may be fully exploited and surpluses of domestic production may be exported. (Thirlwall, 2006, p. 518-519)

2.2 Economic crisis

The latest economic crisis, which has began in the USA where the mortgage market collapsed in 2007, affected economies of many developed countries, including the Czech Republic. The current crisis is often considered to be not only financial crisis, but also social crisis, as this term refers to high level of indebtedness of countries and individuals, and their reluctance to face consequences of their irresponsible actions in the past.

2.2.1 The causes of economic crisis

According to Singer (2010, p. 3, online), a crisis is always a result of several factors operating simultaneously. Regarding the crisis stating in 2007, following imprudence and omissions could have been widely observed:

- Conscious and unconscious underestimation of risks (high financial leverage);
- Rentability collapse of banking sector (overestimation of new financial products);
- Insufficient supervision over financial markets;
- Political attitude toward debt (artificial stimulus of growth);
- Casual monetary policies.

Apart from these factors, there are also psychological factors that need to be mentioned. Those are connected with nature character of human beings, such as naivety, unfamiliarity, apathy, negligence, greed, arrogance and others. (Singer, 2010, p. 3, online)

Roots of the economic crisis are reaching June 2007, when the American mortgage market collapsed, as a result of accumulating problems of the market. Since 2001, the Federal Reserve System (FED) tried to prevent American economy from turning to recession and kept short run interest rates low. The policy seemed to be successful as the economy was growing, mainly because of strong performance of construction industry. But the growth of construction industry was driven by cheap mortgage loans, which were provided even to people with low or instable incomes, or poor knowledge of English. There was no need to prove applicants' income at all when applying for mortgage in the USA by that time. Additionally, real estate agents were selling mortgages to people relatively aggressively, often forcing them to sign the contract without understanding or reading conditions of the contract. As people found out later, the contracts were advantageous only for a certain period of time. Afterwards, the interest rate was usually significantly increased. As a result, the mortgage providers faced a situation when people were not able to pay their mortgage loans due to insolvency, and the mortgage market started to collapse. (Kohout, 2010, p. 12)

As number of unpaid mortgages and loans was increasing, the situation in the market became unsustainable. The second biggest mortgage bank New Century Financial went bankrupt, which created market shock and other renowned mortgage banks experienced difficulties. Only two out of five biggest investment banks survived the crisis, namely Goldman Sachs and Morgan Stanley. When also Lehman Brothers bank went bankrupt, the stock markets all over the world crashed while stability and credibility of other financial institutions was extensively bruised. (Pololáník, 2008, online)

American mortgage crisis turned into world economic crisis shortly after. Mortgage banks financed their assets by assigning their mortgage receivables in the form of securities to the third parties. Investment banks collected these securities and accumulated them in other debt obligations. These were largely purchased by hedge funds, pension funds and other institutions worldwide, as they were

evaluated by the highest AAA rate by rating agencies. When the mortgage market in the USA crashed, the crisis was transferred to other world markets through these mortgage receivables based products. (Brychta, 2008, online)

2.2.2 Transmission of economic crisis to the Czech Republic

Řežábek (2009, online) describes, that the economic crisis was transmitted into the Czech Republic through financial market, as it happened in other European countries. Distrust in world economy development and foreign investment institutions, toxic mortgage based securities in circulation, deflection of earnings and liquidity abroad, and slowdown of financial market development are considered to be the most significant medium of crisis transmission to the Czech Republic.

The crisis entrance into the Czech market may be divided into two phases. The first phase (August 2007 – September 2008) had minimal impact on the Czech economy. Portion of the mortgage based securities from the USA was not high enough to cause immediate crash. Generally, bank institutions had healthy level of liquidity and did not provided loans and mortgages widely dependent on foreign currencies exchange rate development. The second phase (September 2008 – November 2008) affected financial sector significantly. The market had to face general decline in trust. Investors speculated about stability of financial institutions, locally operating institutions acted uncertainly toward their foreign parent companies, and market agents were generally averse against region of east and central Europe. (Řežábek, 2009, online)

As the financial sector faced difficulties, situation erupted into economy crisis shortly after. Before 2008, Czech economy experienced stable growth for several years since 1999. In 2008, decline in foreign demand and foreign investments caused together with crisis in the financial sector speedy slowdown and drop of Czech economy in third and fourth quarter. As a consequence, GDP growth rate fell to -4.8% in 2009. (Řežábek, 2009, online)

2.3 ICT sector

2.3.1 Definition of the ICT sector

"The ICT sector is defined as combination of all economical activities producing goods and providing services, which are primarily intended for processing, communication and distribution of information electronically, including the capture, storage, transmission and display." (CSO, 2014a, online)

Based on main or prevailing economical activities are business entities assigned according to Statistical Classification of Economic Activities in the European Community (CZ-NACE) to following 4 categories:

- **ICT manufacturing industries** – manufacture of electronical components and panels (group 26.1), manufacture of computers and peripheral equipment

(group 26.2), manufacture of communication equipment (group 26.3), manufacture of consumer electronics and media (groups 26.4 and 26.8);

- **ICT trade industries** – wholesale of computer and communication equipment (group 46.5);
- **Telecommunication industries** – activities related to wired telecommunication networks (group 61.1), activities related to wireless telecommunication networks (group 61.2), other telecommunication activities (groups 61.3 and 61.9);
- **ICT services industries** – programming and other IT activities (division 62 and group 58.2), Activities related to data processing and hosting and activities related to web portals (group 63.1), computer and communication equipment repair (group 95.1). (CSO, 2014b, online)

Classification CZ-NACE replaced previously used Industrial classification of economical activities (referred to as "OKEČ") on 1st January 2008. These classifications slightly differ concerning division of ICT related economical activities within the 4 elementary categories. Regarding the OKEČ classification, it distinguished as well between ICT manufacturing industries (divisions 30 and 32), ICT trade industries (classes 5143, 5184 and 5185), Telecommunication (group 642) and ICT services industries (division 72). (CSO, 2014b, online)

2.3.2 Monitored indicators

In the Czech Republic, the Czech Statistical Office is the authority responsible for publishing data regarding ICT sector. Specifically, the office tracks evolution of following indicators related to the industry:

- ICT sector according to CZ-NACE – number of companies, number of employees, personal expenses, sales, performance including margin, performance consumption, value added, expenditures on research and development, purchases of fixed assets, value added per employee, average monthly gross wage per employee, the share of value added to output;
- Investments in ICT – expenditures on ICT equipment and other electronic equipment, expenditures on telecommunications activities, expenditures on IT services, investment in ICT equipment, investments in software;
- Human resources in ICT – students of informatics at universities, number of IT specialists and engineers, average wages;
- Foreign trade with ICT goods – exports and imports of computers and peripheral equipment, communication equipment, consumer electronics, electronic components, parts and components of ICT not elsewhere classified;
- Foreign trade with ICT services – exports and imports of telecommunications services, computer services, software services and license fees;
- Households' expenditures on ICT – landline telephones, mobile phones and expenditures for telecommunications equipment and services, computers and selected consumer electronics.

Apart from the ICT sector, the Czech Statistical Office also monitors the Information and Media sector, which is focused on channels primary used in order to inform, educate or entertain people. Both sectors create together a tracked section of Information Technologies. (CSO, 2014c, online)

2.3.3 Global ICT sector

The ICT sector is considered to be strongly globalised. Globalisation of the sector is powered by global restructuralisation of research, development and production, which are constantly adjusted in order to deliver new and extended goods to the markets. Recently, massive growth in newly emerged ICT markets was noticed, specifically within countries of Eastern Europe or China. Their rise is partially affected by economic crisis, which slowed down growth of developed ICT markets. (OECD, 2010, p. 66, online)

Global ICT trade (exports and imports in total) reached almost 4 trillion USD in 2008, as it more than doubled over the period since 1996. The sector was strongly expanding until 2006, shortly before the economic crisis slowed down the development (figure 1). In 2000, the share of ICT trade in total world merchandise trade approached 18%, although fell down to 12.5% in 2008 due to stronger growth of non-ICT goods trade globally and price effects. As new traders and markets emerged, the share of OECD countries in total world ICT trade fell down from 71% in 1996 to 53% in 2008. This decline shows how internationalized has the sector become. (OECD, 2010, p. 68-69, online)

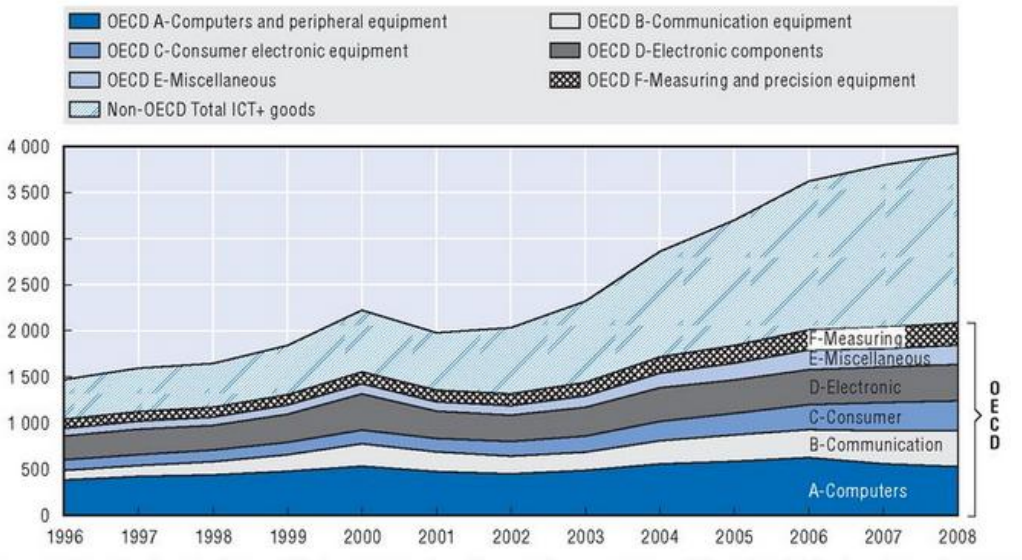

Fig. 1 World trade in ICT goods, 1996-2008 (in USD billions, current prices)

Source: OECD (2010, p. 68, online)

Sector of information and communication technology has already become an elemental part of economic infrastructure, as well as social infrastructure. In the fu-

ture, long term perspective of sustainable growth of the sector is expected within OECD countries. Positive expectation towards future of the sector are mainly based on development of new goods and services, boost of ICT outsourcing, and eco-friendly character of the sector. The ICT sector is also expected to contribute while facing major challenges such as population aging, climate change, continuing globalization and others. (OECD, 2010, p. 40-48, online)

2.3.4 ICT trade slowdown as of 2007

Since 2007, ICT goods trade started to slowdown in parallel with weakening economic environment worldwide. The slowdown was noticed mainly in the USA, Japan and most of the European countries. Non-OECD economies experienced the slowdown also, but with less striking rates. After years of rapid growth, all indicated that ICT sector was reaching its peak numbers by 2007 and 2008, as captured in figure 2. Until then, trade with ICT goods experienced a major drop just once, between 2000 and 2002. The period is often referred to as the dot-com crisis. (OECD, 2010, p. 69-70, online)

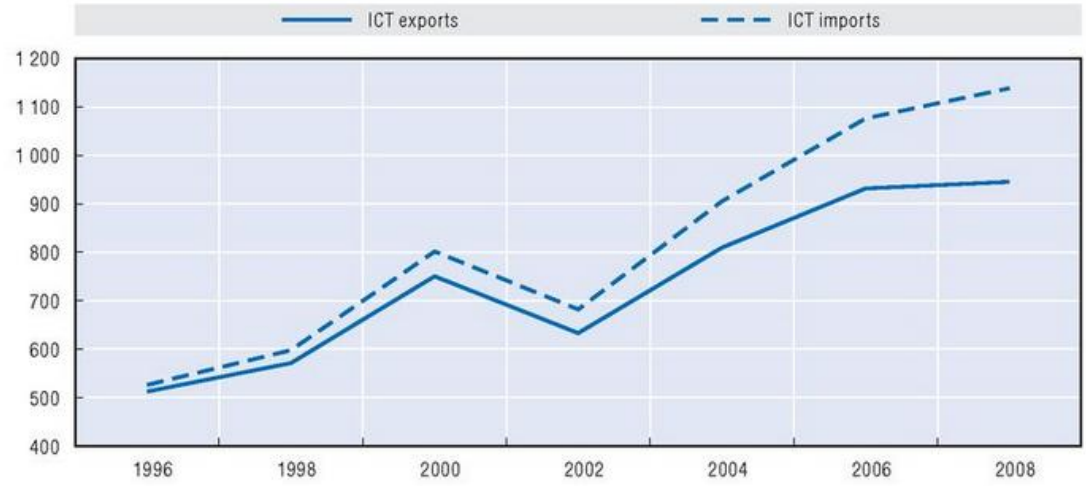

Fig. 2 OECD trade in ICT goods, 1996-2008 (in USD billions, current prices)

Source: OECD (2010, p. 69, online)

Short term national data reveal sharp drop of ICT goods trade volumes in 2008 and slow recovery back starting in late 2009. The drop has developed similarly across number of countries. Figure 3 shows example of development in the USA. Interestingly, growth rate in ICT goods exports reacts to the crisis equally as growth rate in total goods exports in the USA. Such a development is not a necessary pattern for other countries. (OECD, 2010, p. 71, online)

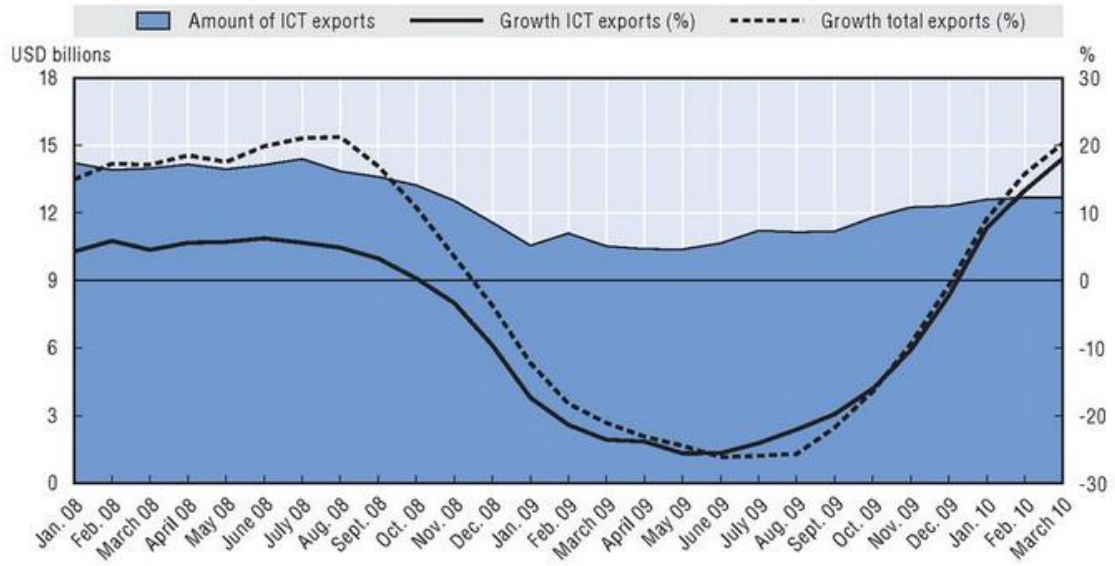

Fig. 3 USA monthly exports of ICT and total goods, January 2008- March 2010 (seasonally adjusted, year on year percentage change)

Source: OECD (2010, p. 73, online)

2.3.5 Czech ICT sector in OECD context

During the period 1996-2008, the Czech Republic was one of three countries with most significant growth in share of ICT in merchandise export, together with the Slovak Republic and Hungary. Figure 4 shows how much better does the sector within one country performs compare to average of OECD countries for the years 1996 and 2008. That may be represented by "revealed comparative advantage" indices. According to these numbers, the three countries mentioned above have been gaining from recent ICT investments as their comparative advantage significantly increased, including the Czech Republic. Recent trends reveal specialisation of ICT manufacture into two stages, distinguishing countries which already had high comparative advantage in the past (such as Finland, Korea), and countries gaining from relatively recent investments (e.g. Hungary, Czech Republic). Overall development shows tendency to reallocate manufacture activities to Eastern Europe. (OECD, 2010, p. 90-91, online)

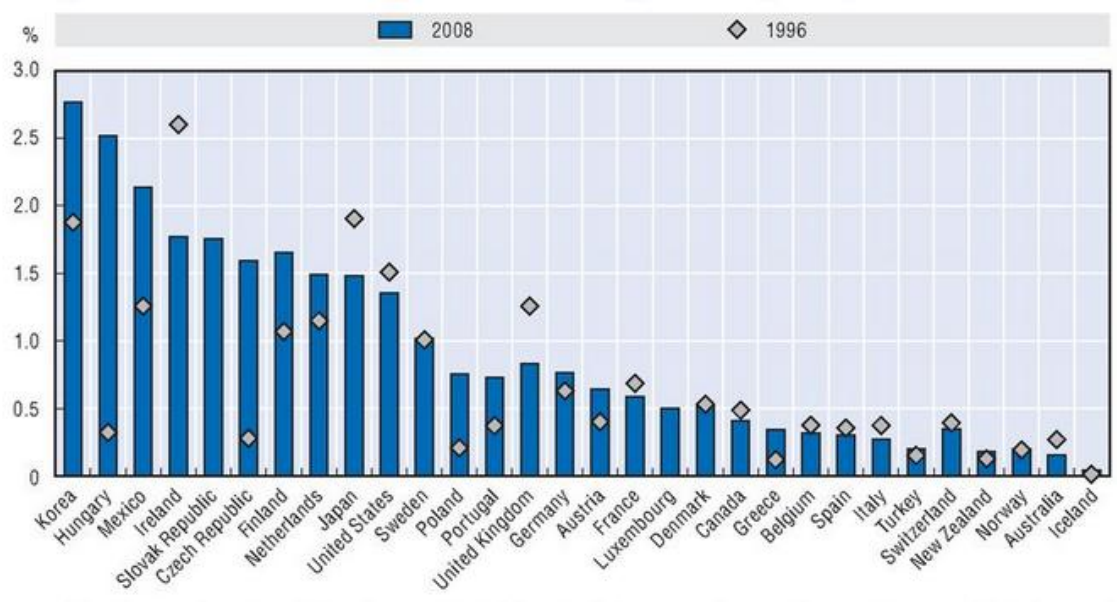

Fig. 4 OECD revealed comparative advantage in ICT goods, 1996 and 2008

Source: OECD (2010, p. 91, online)

Furthermore, according to OECD report the Czech Republic has one of the lowest ICT manufacturing labour productivity within the organization, as well as the Slovak Republic and Hungary. In comparison, the countries with highest ICT manufacturing labour productivity are Finland and Ireland. On the other hand, the countries with low labour productivity have the highest growth in ICT manufacturing labour productivity during 1998-2008. That demonstrates that part of direct foreign investments introduced ICT manufacturing and advanced technologies into the countries such as the Czech Republic. (OECD, 2010, p. 42, online)

2.3.6 Czech ICT perspective

Regarding ICT investments, the Czech Republic is considered to be among top locations within Europe. This statement can be supported by high number of ICT projects organized by famous IT multinational companies. The key factor for successful investments is Czech brilliance in technical fields. Newly established ICT investments grow progressively in the environment of technical universities, institutions and research groups. Among the most recognizable brands which were born in this environment are antivirus software providers AVAST and AVG. The Czech Republic is also the only country of those where the Latin alphabet is used, whose domestic web search provider Seznam.cz successfully competes with Google in the domestic market. (CzechInvest, 2014, online)

Fig. 5 Key IT companies in the Czech market

Source: CzechInvest (2014, online)

2.4 ICT as medium for knowledge economy

The debate about knowledge and information base needs to define barriers, which are supposed to be analysed. According to Dolfsma and Soete (2006, p.2), ICT is *"both source and medium for knowledge to accumulate and diffuse at the micro level of firms, groups or communities, as well as at the macro level within countries and at a global level"*.

Information and communication technology is considered to be a central of knowledge based growth of economy, because it is often connected to significant fraction of spending into research and development activities. Resulting innovations affect economy and may create a spillover effect which initiates further development and growth of economy. (Acs, De Groot, Nijkamp, 2002, p. 9)

Acs, De Groot and Nijkamp (2002, p. 243) also notice, that in March 2000 at Lisbon meeting of the European Council, the European Union stepped towards a new strategic aim *"to become the most competitive and dynamic knowledge based economy of the world capable of sustainable economic growth with more and better jobs and greater social coherence."* That decision moved the European Union towards digital economy. The reason why to focus more on knowledge based economy was connected to permanent lagging compared to the USA in information and communication technologies development and investments. Nevertheless, comparison of the USA and the entire EU is misleading in a way, because within the EU there are several countries, such as Finland, Sweden, and Ireland, which actually

invested into ICT during the second half of 1980s and enjoyed a rapid economic growth and employment performance nearly after. (Acs, De Groot, Nijkamp, 2002, p. 243)

According to World Bank (2007, p. 101), importance of knowledge as an element of competitiveness is increasing. Benefits of ICT driven productions are reduction of transaction costs, eroding of time and space barriers, achievable mass production of customized ICT goods and services, and substituting of limited production factors. To gain these benefits, fully build ICT infrastructure is needed. Martí and Cabrita (2012, p. 25) also add, that benefits from *"ICT investments are complementary to investments into human capital and skills."* Only balanced investments into innovations and human capital may lead to higher productivity and competitiveness.

3 Materials and methods

Following chapter describes materials, which are used for the purpose of this thesis, and reviews methodology in order to summarize statistical and econometrical apparatus necessary to meet objectives of the thesis.

3.1 Materials

Data used to fulfil required objectives of this thesis have secondary character. The data are collected from public databases of the Czech Statistical Office, which is available from czso.cz/eng in the section "External Trade Database", and OECD database, available from stats.oecd.org/ in the section "International Trade by Commodity Statistics".

Data for analysis of import and export with ICT goods in the Czech Republic are gathered internally by the Czech Statistical Office. Data are monthly with initial period in January 1993. The latest published data available come from December 2014, hence the length is 264. The original data are denoted in Czech crown (CZK). Values of goods are assigned at the moment of crossing the national borders.[1] The range of ICT goods was naturally extended over the observed period of 22 years. This fact is also reflected in the statistics, as there have been ongoing updates of classification within the harmonized system of data collection.

Data for international comparison have been collected by the Czech Statistical Office from OECD database. The data are annual, expressed in millions of USD and as a percentage share in total goods export. For the purposes of international comparison, following countries are taken into account: Czech Republic, Germany, Hungary, and Ireland. Data for Germany and Ireland are collected from 1988, data for the Czech Republic from 1993, and data for Hungary from 1992. The latest data published come from 2012 for all countries. Limitations of data collection are the same as noticed in paragraph above.

Data and necessary calculations are meant to be processed by econometric software Gretl (version 1.9.12) and Microsoft Excel. Original data are enclosed in appendices.

3.2 Methods

3.2.1 Statistical hypotheses testing

A statistical hypothesis is considered to be a certain assumption about parameters or distribution of variable. Testing of hypotheses is a process of validity verification based on results of random selection, as investigation over entire data sample is often economically and technically impracticable. An assumption about a certain

[1] The data are affected by so-called "branding effect", which refers to overestimation of values of goods by exporters. This means that real market values of goods are not accounted at the time.

parameter or distribution of sample is called null hypothesis H_0. Against this hypothesis is set so-called alternative hypothesis H_1, which denies a premise of null hypothesis and assumes exact opposite. A decision, whether a null hypothesis is refused or not, depends on the testing criterion *T*. The testing criterion can only take values of 2 subsets:

- Subset *V* including values supporting a null hypothesis (acceptance region);
- Subset *W* including values supporting an alternative hypothesis (rejection region). (Hindls, Hronová and Seger, 2002, p. 133-137)

Statistical hypotheses testing works with a certain level of significance α, which influences acceptance and rejection regions. For the purposes of this thesis, 5% level of significance is assigned.

The F-test is used to verify overall significance of a model. Calculation of the testing statistics is based on analysis of variance, also known as ANOVA table (Gujarati and Porter, 2009, p. 240-242):

$$F = \frac{RSS/(p-1)}{ESS/(n-p)} \sim F_{(p-1,n-p)}$$

RSS stands for regression sum of squares (variability described by model), *ESS* stands for error sum of squares (variability not described by model). Elements *p-1* and *n-p* are degrees of freedom, where *p* stands for number of parameters including a constant, and *n* stands for number of observations. F-test evaluation may be done based on calculated testing statistics or p-value. Null hypothesis defines model as statistically insignificant, meaning that all coefficients $\hat{\beta}$ prove to be equal to zero.

Tab. 1 ANOVA table template

Source of variation	Sum of squares	Degrees of freedom	Mean sum of squares
Regression	RSS	p-1	RSS/(p-1)
Error	ESS	n-p	ESS/(n-p)
Total	TSS	n-1	TSS/(n-1)

Source: Greene, 2003, p.34, modification: own.

The t-test is a statistical test used to verify statistical significance of individual parameters of a model. Calculation of the testing statistics is as follows (Gujarati and Porter, 2009, p. 115-118):

$$t_{\hat{\beta}_j} = \frac{\hat{\beta}_J}{SE(\hat{\beta}_J)} \sim t_{(n-p)}$$

$\widehat{\beta_j}$ stands for OLS estimate of j[th] parameter, $SE(\widehat{\beta_j})$ is its standard error. Evaluation of the test may be done based on calculated testing statistics with *n-p* degrees of freedom, or through p-value. Null hypothesis defines a parameter as statistically insignificant, meaning that coefficient $\widehat{\beta_j}$ is equal to zero. Alternative hypothesis claims that coefficient $\widehat{\beta_j}$ is different from zero.

3.2.2 Time series

Time series is a sequence of values of defined indicator, which is arranged in time from past to present. Analysis of time series hence provides range of methods to describe development of the indicator and eventually predict possible future evolution. (Arlt and Arltová, 2007, p.14)

Several types of time series may be distinguish based on:

- Observing interval length – *long term time series* observing annually or with longer periodicity, *short term time series* observing with periodicity shorted than a year (e.g. month), *high-frequency time series* observing with periodicity shorter than a week;
- Relevant temporal aspect – *interval time series* referencing to length of observing interval, *moment time series* referencing to certain time points; (Arlt and Arltová, 2007, p.14)
- Type of observed indicator – *time series of primary data* (primary observed), *time series of secondary data* (collected by other agents or institutions);
- Data expression unit – *time series of natural indicators* (values expressed as natural units), *time series of monetary indicators* (values expressed as money value). (Hindls, Hronová and Seger, 2002, p. 246)

The simplest model of time series is expressed as a function of time, called **one-dimensional formal model:**

$$y_t = f(t, \varepsilon_t)$$

Here y_t is a value of variable at time t *(t = 1,2,.., T)*, T stands for length of observation and ε_t is a value of error component at time t.

Formal models of time series are usually based on decomposition of series into four components: trend component T_t, seasonal component S_t, cyclic component C_t and random component ε_t.

- **Trend component** – represents long term tendency of series development. A trend may be increasing, decreasing or constant.
- **Seasonal component** – stands for periodically repeated deviation from trend component with periodicity shorted than one year. It is typically related to

seasons of the year, but may be also influenced by holidays, social habits of certain society, different duration of working month, etc.

- **Cyclic component** – means oscillation around a trend component with periodicity higher than one year. It is typically caused by business cycle, but also by demographic or innovation development. The component of often interpreted as a part of trend component.
- **Random component** – represents such a variable, which cannot be described by any function of time. It is a result of several independent causes. It can be described only by using probability, because this component is stochastic.

The first three components are systematic, meaning that it is possible to use them for systematic description of observed processes. It is not necessary to have all four components in a model at once. Time series equation is then:

$$y_t = T_t + S_t + C_t + \varepsilon_t = Y_t + \varepsilon_t$$

Y_t is a theoretical (deterministic, pooled, systematic) component. (Hindls, Hronová and Seger, 2002, p. 254-255)

Other approach how to describe one-dimensional model is via **Box-Jenkins methodology**. Modelling is here based on correlation analysis of more or less dependent observations ordered into a shape of time series. The elementary construction component of the approach is considered to be random component, not systematic component as with formal models. The Box-Jenkins methodology suggests two basic processes – autoregressive process denoted as AR model and moving averages process denoted as MA model. The processes may be further extended by seasonal components and may be combined together as for instance autoregressive moving averages models ARMA etc. (Hindls, Hronová and Seger, 2002, p. 255-256)

3.2.3 Basic characteristics of time series

According to Hindls, Hronová and Seger (2002, p. 252-253), any analysis of time series usually starts with visual analysis of development and calculation of basic statistical characteristics, which provide us with faster orientation with observed data. Visual analysis is beneficial for recognition of long term tendencies in development or certain cyclical changes, but it cannot describe stronger relations and characteristics explicitly. To describe relative and absolute changes in time series, following basic characteristics are used:

- The first difference

$$d_t = y_t - y_{t-1} \quad for\ t = 2,3,\dots,T$$

- Gross returns

$$k_t = \frac{y_t}{y_{t-1}} \quad for\ t = 2,3,\dots,T$$

- Net returns

$$\delta_t = \frac{d_t}{y_{t-1}} = k_t - 1 \quad for\ t = 2,3,\dots,T$$

- Average first difference

$$\bar{d} = \frac{1}{T-1}\sum_{t=2}^{T} d_t = \frac{y_T - y_1}{T-1}$$

- Average gross returns

$$\bar{k} = \sqrt[T-1]{\prod_{t=2}^{T} k_t} = \sqrt[T-1]{\frac{y_T}{y_1}}$$

- Average net returns

$$\bar{\delta} = \bar{k} - 1$$

3.2.4 Trend description

Trend description is generally one of the most important tasks of time series analysis. There are several trend functions which have been successfully applied for trend analysis. Linear trend, quadratic trend and exponential trend are commonly used as elementary functions. Their benefits are unlimited growth and usual absence of asymptote. Other trend functions (modified exponential trend, logistic trend, Gompertz function) are limited by their asymptotes, hence there are more suitable for analysis of limited variables.

To estimate parameters of trend function, method of *Ordinary Least Squares* (OLS) is commonly used. The method is appropriate only if trend function chosen is linear in parameters. Benefits of the method are simplicity, minimization of residual component variance and link to several criterions of suitable trend, which are based on OLS. Furthermore, direct estimation of parameters from OLS method is available for linear and quadratic functions. (Hindls, Hronová and Seger, 2002, p. 256-257)

- **Linear trend** – the simplest and most commonly used type of trend function. It may be applied basically anywhere, if long term development needs to be estimated only approximately. Linear trend function is expressed as:

$$T_t = \beta_0 + \beta_1 t$$

  β_0 and β_1 are unknown parameters and $t=1,2,3,...,T$ is time. To estimate parameters β_0 and β_1, OLS method is used.
- **Quadratic trend** – commonly used type of trend function. The function is also linear in parameters as for linear trend. Quadratic (or parabolic) trend function is expressed as:

$$T_t = \beta_0 + \beta_1 t + \beta_2 t^2$$

  β_0, β_1 and β_2 are unknown parameters and $t=1,2,3,...,T$ is time. To estimate parameters β_0, β_1 and β_2, OLS method is used as well. (Hindls, Hronová and Seger, 2002, p. 257-263)

3.2.5 Linear filters

As Hindls, Hronová and Seger (2002, p. 294-302) describe, linear filters modelling is another alternative how to describe time series. The method equalizes shorter periods of time series, not the entire period as a whole. That is a different approach compared to analytics methods such as trend function modelling, where one function describes the entire period of time series. With method of linear filters, observed values are substituted by average values calculated from observed values, which form a moving part established in advance. Moving part is expressed as $m=2p+1$ for $m<n$, where n stand for total number of observed values of time series.

- **Simple linear filters** – calculation consists of sum of values of particular period divided by number of these values. Weight of all values is considered to be the same.

$$\bar{y_t} = \frac{1}{m}\sum_{i=-p}^{p} y_{t,i} = \frac{y_{t-p} + y_{t-p+1} + \ldots + y_{t+p}}{m}$$

- **Weighted linear filters** – calculation consists of values of particular period multiplied by weight of each value, followed by dividing by sum of weights. Hence, each variable is assigned a certain weight.

$$\overline{y_t} = \sum_{i=-p}^{p} W_i y_{t,i} \quad t = p+1, p+2, \dots, n-p$$

W_i is related to weights of weighted linear filters.

$$W_i = \frac{3}{4m(m^2-4)}(3m^2 - 7 - 20i^2) \quad i = -p, \dots, -1, 0, 1, \dots, p$$

- **Centered linear filters** – calculation consists of *p+1* weights. Corner values are assigned with half weight than the others. The method is used if number of values of moving part is an even number.

$$w_t = \frac{1}{8}[1,2,2,2,1] \quad p = 4$$

3.2.1 Seasonality description

Seasonal impact is understood as a set of direct or indirect causes, which occur on regular basis due to ordinary rotation cycles of the Earth. In reality, seasonality is included in most of time series with periodicity shorter than one year. Seasonality is often associated with climate change during a year, or with social practices and habits such as recurring holidays, weekends, etc.

Seasonality may be modelled as proportional or constant. With proportional seasonality, range of fluctuations evolves with trend development, while constant seasonality does not change amplitude of fluctuations with respect to trend component of the time series. (Hindls, Hronová and Seger, 2002, p. 302)

- **Constant seasonality modelling** – the model considers that seasonal fluctuations do not differ during different years, as the sum of these fluctuations is expected to be zero. (Hindls, Hronová and Seger, 2002, p. 303)

$$y_{tj} = T_{tj} + S_{tj} + \varepsilon_{tj} \quad t = 1,2, \dots, T \quad j = 1,2, \dots, r$$

where *j* stands for jth sub-period in a year *t*. An assumption of the model is:

$$S_{tj} = \beta_{tj}$$

where β_{tj} are unknown seasonal parameters, while the following is valid:

$$\sum_{j=1}^{r} S_{tj} = \sum_{j=1}^{r} \beta_j = 0 \quad \text{for all years } t = 1,2, \dots, T$$

- **Proportional seasonality modelling** – the model considers that seasonal fluctuations evolve proportionality to the level of trend component reached during different years. The sum of these fluctuations is expected to be equal to number of sub-periods within a year. (Hindls, Hronová and Seger, 2002, p. 308-309)

$$Y_{tj} = T_{tj} + S_{tj} + \varepsilon_{tj} = T_{tj} + c_j T_{tj} + \varepsilon_{tj} = (1 + c_j) T_{tj} + \varepsilon_{tj}$$

$$t = 1,2,\dots,T \quad j = 1,2,\dots,r$$

where seasonal component is expressed as function of the trend component:

$$S_{tj} = c_j T_{tj}$$

Seasonal factors are calculated as:

$$(1 + c_j) = \frac{\sum_{t=1}^{T} Y_{tj} T_{tj}}{\sum_{t=1}^{T} T_{tj}^2}$$

while following assumption must be valid:

$$\sum_{j=1}^{r} (1 + c_j) = r$$

For the purposes of time series comparison and consequent analysis, *seasonal adjustment* should be applied if the time series contain seasonal component. Seasonal adjustment is performed in order to exclude seasonal effects from the time series, which may lead to wrong outcome within modelling. There are many methods of seasonal adjustment, most of them are use complicated computer algorithms. (Hindls, Hronová and Seger, 2002, p. 312-313)

An example of such a program is TRAMO/SEATS procedure, which is integrated in Gretl software and used within the thesis.

3.2.2 Quality of model fit

According to Gujarati and Porter (2009, p. 286-289), there are several steps to decide which trend function suits particular time series the best. Basic factor for a decision is based on *objectively economic criterion*, meaning that chosen trend must be economically reasonable. This should be also supported by *visual analysis of graph*, which is a fairly subjective criterion.

Beside these two steps, there are several characteristics commonly used, which are based on *measurement of residual component size* of time series:

- M.E. = Mean Error

$$M.E. = \frac{1}{T}\sum_{t=1}^{T} e_t$$

- M.A.E. = Mean Absolute Error

$$M.A.E. = \frac{1}{T}\sum_{t=1}^{T} |e_t|$$

- M.S.E. = Mean Squared Error

$$M.S.E. = \frac{1}{T}\sum_{t=1}^{T} e_t^2$$

- R.M.S.E. = Root Mean Squared Error

$$R.M.S.E. = \sqrt{M.S.E.}$$

e_t stands for value of residual component at time *t (t = 1,2,.., T)*, *T* stands for length of observation.

M.E. characteristics are usually zero, unless logarithm or inversion of values is taken. To select the most suitable trend form, comparison of these characteristics is performed with preference of minimum values.

3.2.3 Testing for a structural change

With models involving time series, it may happen that there is a structural change, which means that the values of parameters are not the same for the whole period. This may be caused by external forces, policy changes or mixture of other causes. (Gujarati and Porter, 2009, p. 254)

To identify unknown structural breakpoint of a structural change, we use **Quandt likelihood ratio (QLR) test**. The test is based on application of Chow test. Calculation of F-statistic is repeated for different breaking data in a time series. The structural breakpoint is identified based on the highest value of F-statistic. (Brooks, 2008, p. 186-187) **Chow test** is used in case of known structural change. The test is based on an assumption of existence of two or more regimes of relations, which are caused by changes in parameters of a certain model. (Wooldridge, 2008, p. 9) The test assumes that a structural breakpoint is established in advance. Once unsuitable breakpoint is used for the test, it loses its power. (Greene, 2003, p. 258)

3.2.4 Forecasting of time series

Among methods of statistical forecasting, the most common techniques used in reality are extrapolation of time series, modified techniques based on regression analysis and methods of national accounting. For the purposes of statistical and econometrical analysis, the method of extrapolation prevails. The method is based on observing historical and present characteristics of development and transferring these characteristics into future prediction. Hence, the method is based on deterministic principle, as the future development depends on development in the past. The prediction is constructed respecting the principle of *ceteris paribus*, meaning that development of an observing variable tends to be relatively stable. The method of extrapolation brings several benefits:

- Statistical and mathematical apparatus is simplified;
- Independent variable is time, depended variable is the one to be predicted;
- Understandable software available for forecasting;
- No need to predict other variables which explain an observed variable.

The method of extrapolation is though not universal, as there are several limitations that need to be considered:

- Prediction based on observing ceteris paribus;
- System prediction is not supported by the method (each variable is observed separately);
- Quality of analysis is mainly affected by type of model chosen.

The method is suited the best for short term future forecasting, e.g. 1-3 periods in the future. (Hindls, Hronová and Seger, 2002, p. 330)

There are two possible types of forecasting. The first is *point forecasting*, which predicts a single value for the observed variable in given period. The second is *interval forecasting*, which predicts value in given period respecting chosen level of probability. (Hušek and Pelikán, 2003, p. 260)

3.2.5 Random component

Random component ε_t of time series is indicating impact of unspecified set of unsystematic phenomena's and effects. The component may be described as:

$$\varepsilon_t = y_t - Y_t$$

Properties of random component reveal whether the model is well built or not. A well built model contains properties of so-called **white noise**, which are formulated by following assumptions (Hindls, Hronová and Seger, 2002, p. 316):

- Mean values of errors are equal zero – based on assumption that random effects are small, independent of each other and hence compensate each other.

$$E(\varepsilon_t) = 0 \quad t = 1,2, \dots, T$$

- Errors have constant variance in time – condition avoids problems with heteroskedasticity.

$$D(\varepsilon_t) = \sigma^2 \quad t = 1,2,\dots,T$$

- Errors are linearly independent of each other – condition avoids problems with serial correlation of error component.

$$E(\varepsilon_t, \varepsilon_{t'}) = 0 \quad t, t' = 1,2,\dots,T \quad t \neq t'$$

3.2.6 Correlation of time series

Analyses of several time series brings a question, whether these time series possibly have a certain relationship among each other. In that sense, a change of one time series may affect development of other time series in relation. Correlation analysis provides a tool to describe such a relationship of two or more time series. Correlation is based on analysis of relations of variables, not trends. The formula for *coefficient of correlation*, which detects orientation and strength of dependence, is as follows:

$$r_{xy} = \frac{s_{yx}}{\sqrt{s_x^2 s_y^2}}$$

The coefficient may take values of <-1,1>, where sign of the coefficient determines orientation of correlation between the two time series. If the coefficient is equal to 1, there exists direct linear dependence between the time series. Conversely, value of -1 means indirect linear dependence. If value of the coefficient equals zero, there is no linear dependence between the variables. (Hindls, Hronová and Seger, 2002, p. 206, 331-333)

3.2.7 Vector autoregressive model

Vector autoregressive model is a set of linear regression equations, where each variable acts as endogenous. Variables are then described by lagged values of itself and lagged values of other endogenous variables considered in a model. Vector autoregressive model, denoted as VAR model, consists of so many equations as how many variables are involved.

The model is built in several steps, starting with selection of variables. The second step consists of analysis of stationarity of variables, which may be done by Augmented Dickey-Fuller test. In the third step, lag selection is chosen based on information criteria – Akaike information criterion (AIC), Bayesian information criterion (BIC) and Hannan-Quinn information criterion (HQC). Correct lag selec-

tion avoids problems with autocorrelation of random component in all equations. Based on previous steps, the model may be built and verified. Example of VAR model of first order with two variables would be as follows (Hušek, 1999, p. 161-164):

$$Y_t = \beta_0 + \beta_1 Y_{t-1} + \alpha_1 Z_{t-1} + \varepsilon_t$$

$$Z_t = \beta_0 + \beta_1 Z_{t-1} + \alpha_1 Y_{t-1} + \varepsilon_t$$

where Y_t and Z_t are endogenous variables, β_0 is a constant, Y_{t-1} and Z_{t-1} are lagged variables, β_1 and α_1 are coefficients of parameters and ε_t is a random component.

VAR models are used in order to verify so-called **Granger causality**. The causality analyses, whether a variable has an ability to better predict development of other variable or conversely. This is defined within two conditions of the causality (Hušek, 1999, p. 165-167):

- Variable Y_t contributes to better predict variable Z_t, while;
- Variable Z_t cannot contribute to better predict variable Y_t, conditional on other variables in model, or vice versa.

To verify the Granger causality, both t-test and F-test may be used in case of VAR model of first order. For VAR model of higher p order, the causality is verified only by **F-test**, which is calculated as:

$$F = \frac{(e'e)_0 - (e'e)_N}{q(e'e)_N}(T - m) \sim F_{(q,T-m)}$$

where $(e'e)_0$ and $(e'e)_N$ are sum of residual squares in restricted and unrestricted regression, T stands for length of observation, m is a number of parameters in unrestricted regression and q is a number of restrictions of parameters.

Null hypothesis defines that variable Y_t does not granger causes variable Z_t, while alternative hypothesis claims the causality exists. The causality is further verified in reverse direction.

With VAR modelling is related also **Impulse Response Analysis**. The analysis evaluates effect of exogenous shock on present and future values of endogenous variables within a model. If the system is stable, effect of the shock gradually subsides and the system comes back into balance. (Lütkepohl, 2005, p. 51)

4 Results and discussion

Following chapter provides a comprehensive description of development of foreign trade with ICT goods in the Czech Republic. The chapter is divided into three main subchapters.

The first two subchapters analyse separately import and export of ICT goods in the Czech Republic. The third subchapter provides basic comparison of ICT goods export among several EU states, specifically the Czech Republic, Germany, Ireland and Hungary.

4.1 Import of ICT goods

4.1.1 Elementary characteristics

In order to obtain basic idea about time series development, elementary characteristics are calculated initially. All the calculations of elementary characteristics are part of attachments of the thesis.

The first differences, which reflect absolute change compared to the previous period, reveal negative values mainly at the beginning of years, but also randomly during summer months. The highest absolute increase occurs in October 2007, numerically 9,712,188,737 CZK, with matching growth rate of 29.7%. Conversely, the highest absolute drop is observed in January 2013, when the drop is 13,869,139,893 CZK and the matching decrease rate reaches 33.3%.

Overall, Czech ICT goods import reaches its lowest value in January 1993, which is the first observation of 1,847,256,652 CZK. The highest overall observation occurs in November 2014, numerically 51,147,388,157 CZK.

Altogether, the time series reaches average monthly growth of ICT goods import by 1.26%. The average absolute change is 181,502,171 CZK per month.

$$\bar{d} = \frac{49\,582\,327\,691 - 1\,847\,256\,652}{264 - 1} = 181\,502\,171.3$$

$$\bar{k} = \sqrt[264-1]{\frac{49\,582\,327\,691}{1\,847\,256\,652}} = 1.0126$$

$$\bar{\delta} = 1.0126 - 1 = 0.0126$$

Development of the Czech ICT goods import is shown in figure 6. The time series starts in January 1993 and ends in December 2014. It consists of 264 observed values. Overall trend is clearly increasing, with a slight slowdown of the growth around year 2007. The two shadowed areas in the figure 6 indicate recession periods observed in the Czech economy during the latest economic crisis, reflecting quarterly GDP growth development.

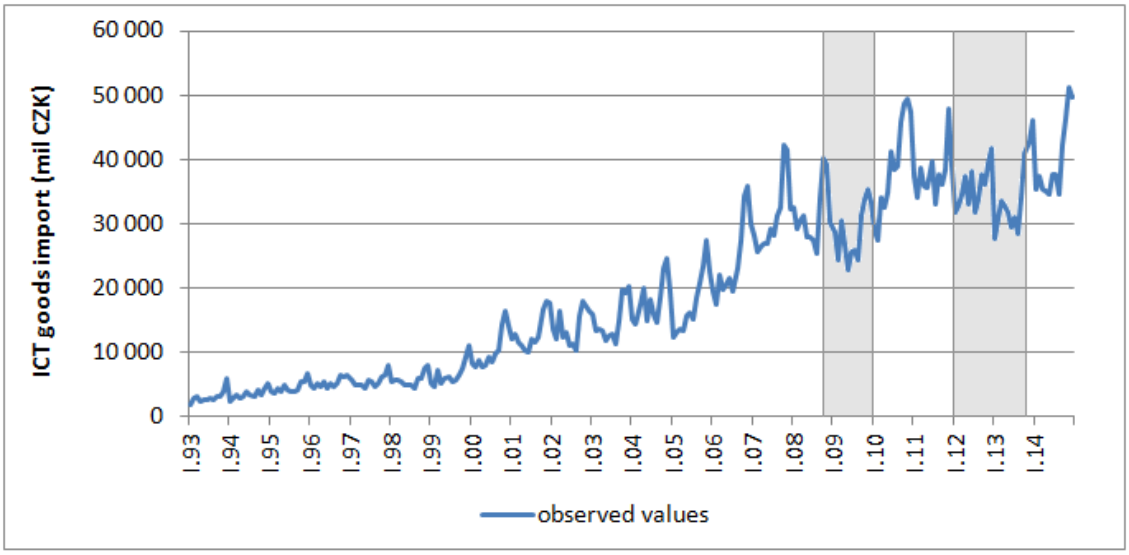

Fig. 6 ICT goods import with marked recession periods in the Czech Republic

At the end of 2006, the time series becomes more volatile. Values for 2007 show strong performance of ICT goods import, ending with the strongest result in November 2007. Subsequently, in 2008 may be seen start of notable drop of ICT goods import. The impact of economic crisis on Czech ICT import may be fully seen during 2009. The import reaches its lowest value since 2006 in May 2009. The development reflects performance of the Czech economy, which was in recession during fourth quarter of 2008 and the entire 2009. The second phase of recession in the Czech Republic during 2012 and first three quarters of 2013 also negatively influenced import of ICT goods, as the time series performs the second noticeable drop.

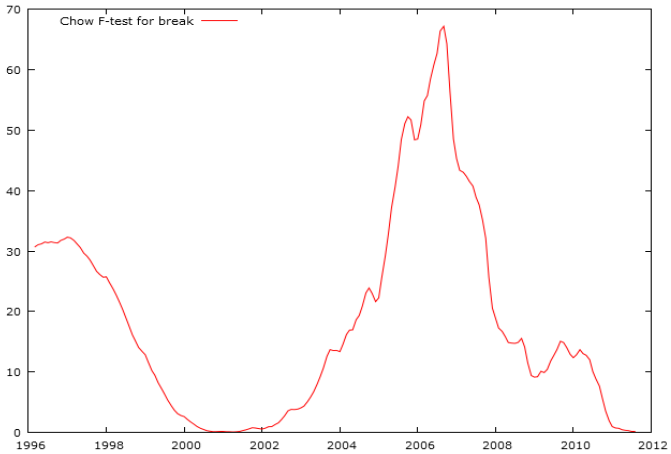

Fig. 7 Graph of QLR test for ICT goods import

The Quandt likelihood ratio test suggests presence of structural breakpoint in September 2006. The maximum value of computed F-statistics is 67.164, while match-

ing p-value is 7.66e–029. Null hypothesis of no presence of structural breakpoint is rejected based on p-value lower than level of significance. The test is used to illustrate development of F-statistics in the time series, there is no further processing above the test, as the time series is better modelled by adaptive method. Results of QLR test are shown in figure 7, where linear trend is considered.

4.1.2 Linear filters

For proper trend description of the Czech ICT goods import, adaptive method needs to be considered, as the time series appears to change trend and cannot be described accurately by mathematical curve with a single set of constant parameters. Therefore, method of centered linear filters was chosen as appropriate. The time series consists of monthly data, thus the moving part consists of 13 weights. Corner values are assigned with half weight than the others.

$$w_t = \frac{1}{24}[1,2,2,2,2,2,2,2,2,2,2,2,1] \quad p = 12$$

The method brings alone a certain limitation, specifically that peripheral values of computed model are lost due to centered basis of calculation. With moving part length 13, the first six values, as well as the last six values of the time series will not be fitted by the model.

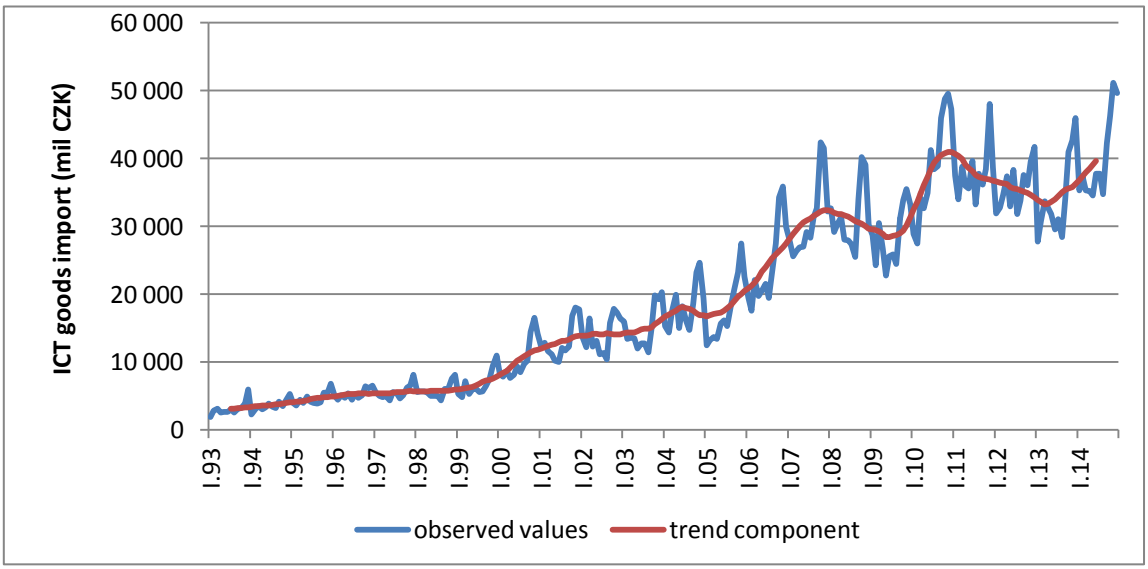

Fig. 8 ICT goods import – observed values with trend component

Figure 8 shows observed values and adaptive trend component. Overall trend proves to be increasing, with two major drops around years 2008/2009 and between 2011 and 2013. Trend of development became notably steeper after 2005, which may be delayed effect of entry of the Czech Republic into the European Union on 1st May 2004.

4.1.3 Seasonal component

As the time series includes also seasonal component, calculation of seasonal factors follows. To do so, trivial seasonality is taken into account, as it turned out to be the best fitting method for this time series. The method is similar to proportional seasonality, but accounts with empirical seasonal indexes.

The values of seasonal indexes characterize scale of seasonal fluctuation. The indexes are calculated as average proportion of observed values to trend values for particular months. The sum of values of all seasonal indexes must give 12, as monthly data are used. This condition is fulfilled after trivial mathematical adjustment.

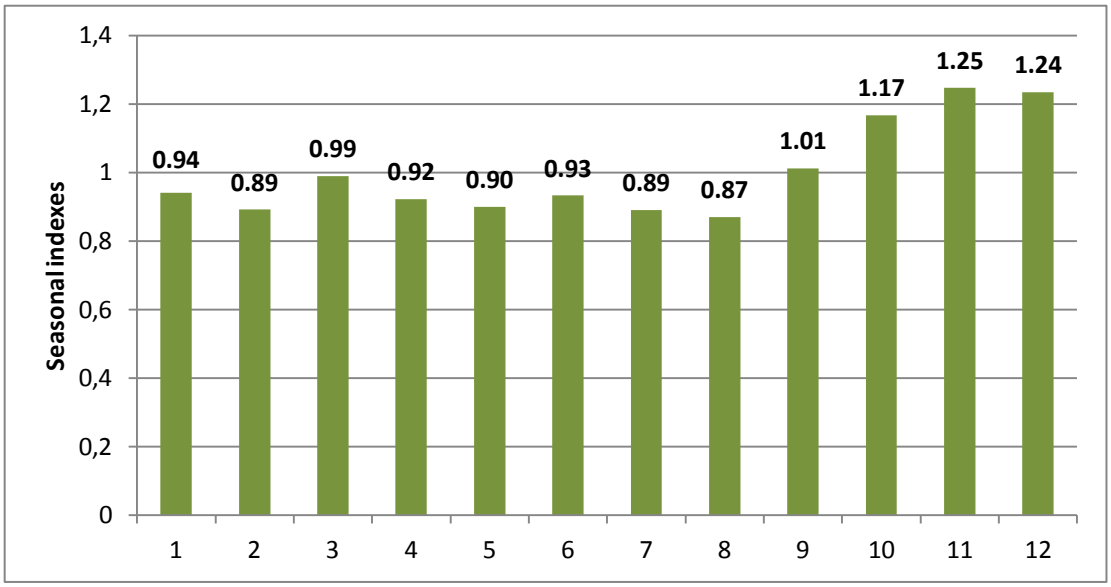

Fig. 9 Graph of seasonal indexes for ICT goods import

Seasonal indexes captured in figure 9 explain characteristic fluctuation of ICT goods import during a year. Concrete interpretation of the highest seasonal index in November suggests that in average the ICT goods import reaches volumes 25% above level of trend in November. Other indexes are interpreted likewise.

Period from January to August is reaching values of seasonal indexes below 1.00. The lowest value of seasonal index is present in August. Indexes at the beginning of a year suggest low consumption of ICT goods by Czech consumers in general, likely due to increased expenditures during Christmas time. Values from March to August may refer to lower willingness of Czech consumers to buy ICT goods during spring and summer times. This may be associated with weather, as people rather spend income for leisure time activities during spring and summer. The advent of autumn brings higher consumption of ICT goods, as weather cools down and Czech import of ICT goods increases. In September, the seasonal index increases from 0.87 to 1.01. The increase continues in October to 1.17, which is the highest increase during a year. The end of a year is generally influenced by Christ-

mas shopping. From foreign exporters' point of view, the most intensive months are November and December, when the index reaches towards 1.25.

After description of trend component and seasonal component of the Czech ICT import, the model may be constructed based on calculation of fitted values. The fitted values are computed as multiplication of trend component and corresponding seasonal index. Figure 10 shows originally observed values fitted by calculated model. Subjectively, the model describes original time series fairly successfully.

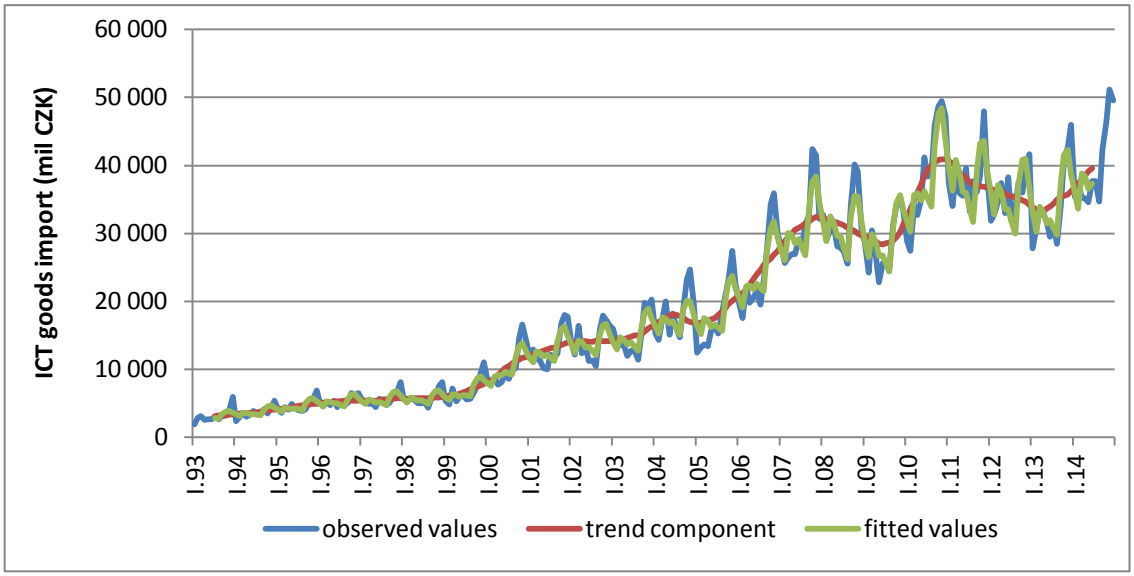

Fig. 10 Fitted values for ICT goods import

The final model is built based on method on centered linear filters, with moving part length 13 and trivial seasonality involved. The model was chosen as the most appropriate with respect to statistical criteria of model fit quality. The lowest possible values are desired. Calculated statistical criteria are presented in table 2.

Tab. 2 Quality of model fit for ICT goods import

M.E.	M.A.E.	M.S.E.	R.M.S.E.
-18554955.58	1362970429.92	3.80027E+18	1949427787.26

4.1.4 Forecasting

For the purpose of forecasting, model based on autoregressive integrated moving averages (ARIMA) is considered, as model based on linear filters has limited possibilities of prediction. Initially, correlogram of the time series of Czech ICT goods import is visually analysed. Figure 11 illustrates ACF and PACF plots. The ACF plot slowly declines towards zero, while the PACF plot declines more rapidly. The plots refer to presence of random walk in the time series. To overcome non-stationarity,

differencing needs to be involved within the model. The correlogram also suggests presence of seasonality in the time series. Therefore, seasonal version of the model (SARIMA) is used.

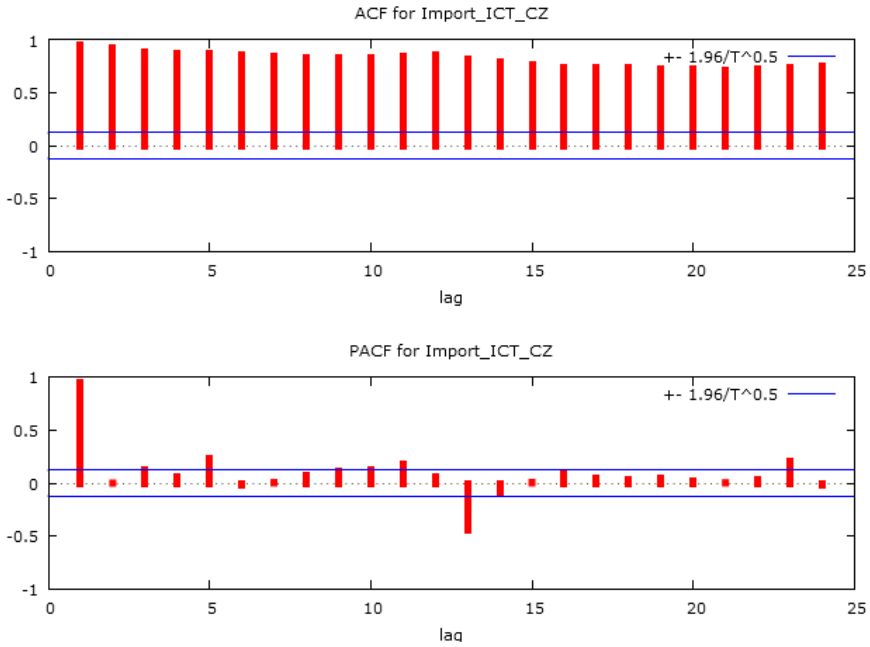

Fig. 11 Correlogram for ICT goods import

After initial evaluation of the correlogram, the final model is further built as SARIMA (011)x(111)$_{12}$ with no constant involved. The model consists of one round of common differencing and one round of seasonal differencing.

The models' parameters are captured in table 3. Coefficients of the parameters have reasonable size and prove to be statistically significant. Coefficients of moving averages term theta_1 and seasonal moving averages term Theta_1 are both significant on the significance level of 5%. Coefficient of seasonal autoregressive term Phi_1 is significant on 10% significance level only.

Tab. 3 SARIMA (011)x(111)$_{12}$ for ICT goods import

Parameter	*Coefficient*	*Std. Error*	*p-value*	*Significance*
Phi_1	0.178577	0.101763	0.07929	*
theta_1	-0.43277	0.0509498	<0.00001	***
Theta_1	-0.713657	0.075858	<0.00001	***

The model was chosen based on the lowest possible values of information criteria, which evaluate quality of model fit. Other interpretable models which were tried do not reach lower values. Values of information criteria are captured in table 4.

Tab. 4 Information criteria for ICT goods import SARIMA model

Akaike criterion	4592.090
Hannan-Quinn criterion	4597.765
Schwarz criterion	4606.192

In the next step, the model is analysed as it should contain white noise of residuals, which is a sign of well built model. Mean value of residuals should be constant, which is a presumption. The model should not contain condition heteroskedasticity, also called as ARCH effect, which is tested by ARCH test. Furthermore, the model should not contain presence of autocorrelation of residuals, which is tested by the Ljung-Box test. Based on p-values of the dedicated tests summarized in table 5, the null hypotheses are rejected. The model contains ARCH effect and has a problem with autocorrelation of residuals.

Tab. 5 White noise evaluation for ICT goods import SARIMA model

Test	*p-value*	*Null hypothesis*
ARCH test of order 12	0.000156747	no ARCH effect
Ljung-Box test of order 12	0.01678	no autocorrelation
Chi-square test	0.000133308	normal distribution

Another statistical test used is Chi-square test of normality. Null hypothesis of normal distribution of residuals is rejected based on p-value. The model has not normal distribution of residuals.

In conclusion, the model does contain neither white noise nor normal distribution of residuals. Nevertheless, the model is used as satisfying for the purpose of forecasting, as it is interpretable, includes statistically significant coefficients and fits original data fairly precisely. Other models with higher order of autoregressive and moving averages terms and multiple rounds of differencing were evaluated as highly risky due to likely overfitting. Therefore, simpler model is preferred regardless absence of white noise.

Application of the model is shown in figure 12. Forecasting of future development of the Czech ICT goods import considers 95% prediction interval, which is represented by shadowed area. The forecast reaches 36 months ahead, starting with January 2015 and ending with December 2017.

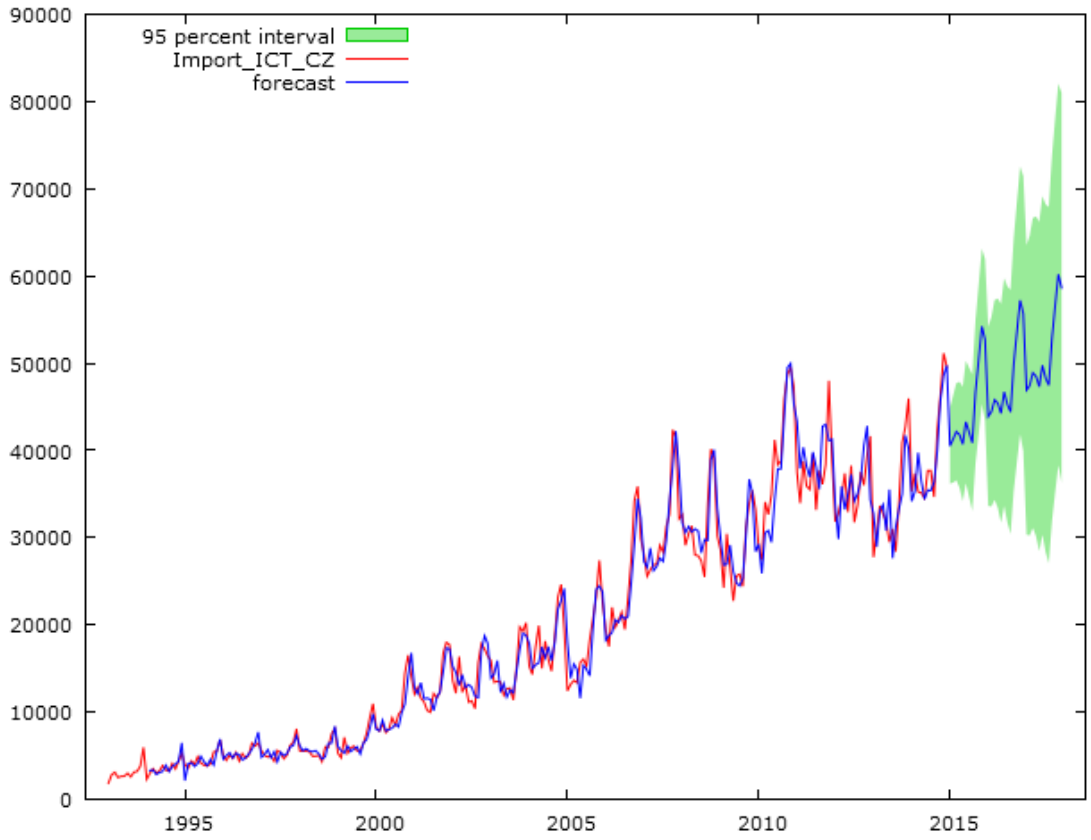

Fig. 12 Forecasting for ICT goods import

The forecast results indicate, that ICT goods import is expected to maintain increasing trend, considering mean values. However within 95% prediction interval even decrease of development is possible in the next 36 months.

Exact information of forecast values is shown in table 6, including mean forecast and prediction interval for each month.

Tab. 6 ICT goods import forecast (2015, 2016, 2017)

Period	*Forecast (mil CZK)*	*Prediction interval (95%)*	*Period*	*Forecast (mil CZK)*	*Prediction interval (95%)*
I.15	40538.9	(36206.2 - 44871.6)	VII.16	45291.8	(31764.6 - 58818.9)
II.15	41319.1	(36337.9 - 46300.3)	VIII.16	44425.3	(30427.3 - 58423.4)
III.15	42158.3	(36603.8 - 47712.8)	IX.16	49885.3	(35431.7 - 64339.0)
IV.15	41809.0	(35735.1 - 47882.9)	X.16	53618.0	(38722.7 - 68513.2)
V.15	40731.8	(34179.5 - 47284.1)	XI.16	57225.4	(41901.2 - 72549.6)
VI.15	43285.6	(36287.5 - 50283.6)	XII.16	55694.8	(39953.3 - 71436.2)
VII.15	42080.4	(34663.4 - 49497.5)	I.17	46932.2	(30353.9 - 63510.5)
VIII.15	40886.4	(33072.7 - 48700.0)	II.17	47446.9	(30266.6 - 64627.1)
IX.15	46674.1	(38483.1 - 54865.1)	III.17	48901.5	(31139.6 - 66663.4)
X.15	50442.2	(41890.4 - 58993.9)	IV.17	48502.9	(30177.9 - 66827.9)
XI.15	54242.4	(45344.5 - 63140.3)	V.17	47326.2	(28454.8 - 66197.5)
XII.15	52706.5	(43475.4 - 61937.6)	VI.17	49758.2	(30355.8 - 69160.5)
I.16	43901.4	(33644.1 - 54158.7)	VII.17	48295.6	(28376.4 - 68214.8)
II.16	44456.3	(33585.5 - 55327.1)	VIII.17	47487.6	(27064.6 - 67910.5)
III.16	45817.7	(34366.3 - 57269.2)	IX.17	52889.1	(31974.5 - 73803.7)
IV.16	45426.6	(33422.5 - 57430.6)	X.17	56615.4	(35220.5 - 78010.3)
V.16	44264.9	(31732.6 - 56797.3)	XI.17	60188.4	(38323.7 - 82053.1)
VI.16	46715.4	(33676.1 - 59754.6)	XII.17	58658.7	(36334.1 - 80983.3)

4.1.5 ICT goods import structure – main components

Structure of ICT goods is divided into five main aggregated components – computers and peripheral equipment, communication equipment, consumer electronics, electronic components, and parts and components not elsewhere classified. Available data from database of the Czech Statistical Office allow comparing development since 1993 until 2013 (annual data).

The most important article of Czech import consists of computers and peripheral equipment. Since late 1990s' the article is oscillating around 30% share in total ICT goods import. In 2011, the article augmented towards 35% share.

Other important article is parts and components not elsewhere classified. The article reaches share of approximately 20% until 2004. Then the share increases up to 37% in 2007 and slowly declines back to 23% share in 2013.

Electronic components together with parts and components not elsewhere classified account for at least 40% share since 1999. In 2005, combined share of the two articles is even 57%. Late development of the two articles is strongly affected by changes in statistical collection based on harmonised system, which changed in 2002 and 2007.

Overall, the import of ICT goods in the Czech Republic appears to be well balanced. The import is driven mainly by computers and peripheral components, together with electronic components and parts and components not elsewhere classified. The import of particular articles remains relatively stable. Data are captured in figure 13.

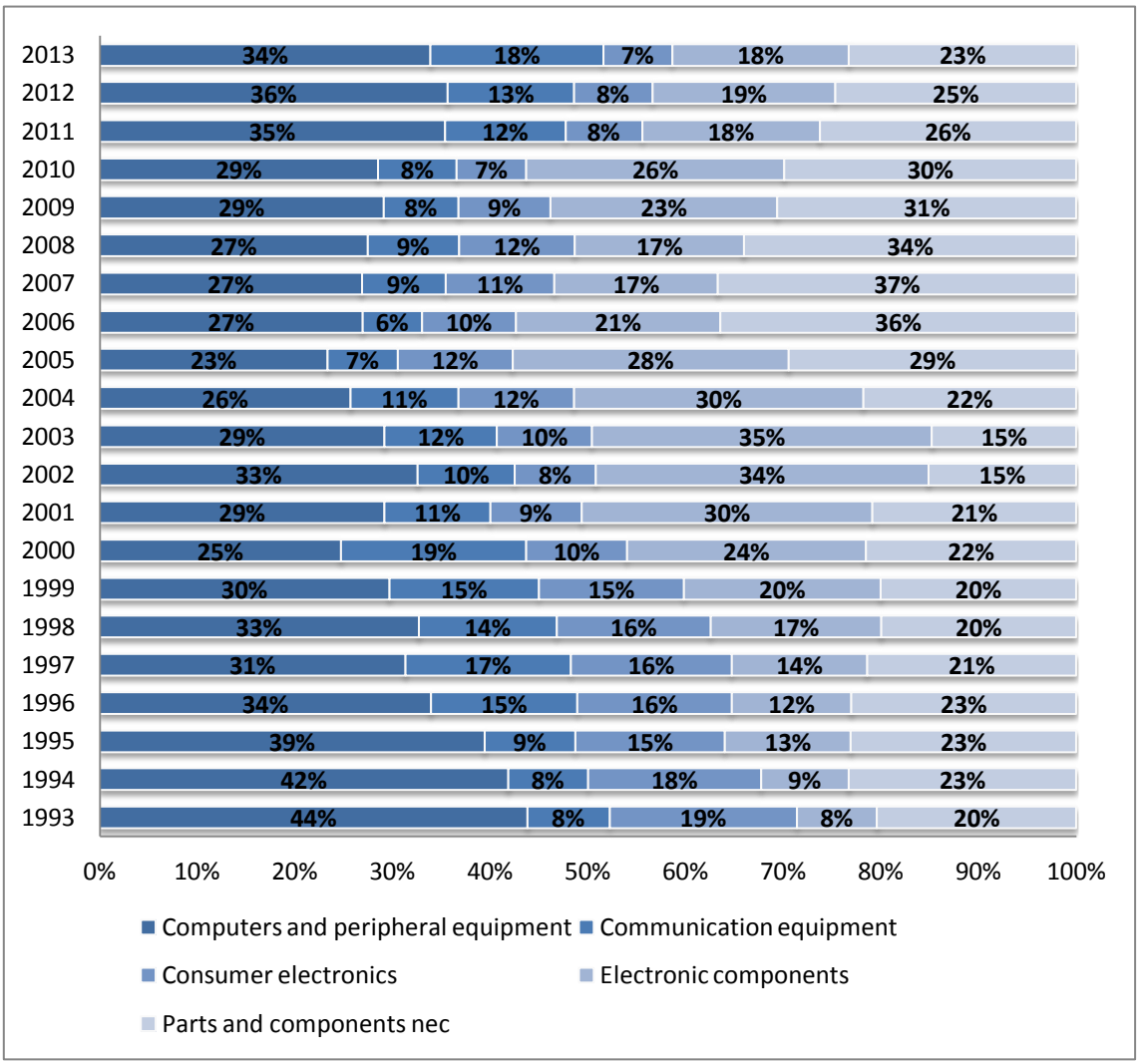

Fig. 13 ICT goods import structure

4.1.6 Relation of Czech ICT goods import and GDP in the Czech Republic

Further analysis consists of examination of relation of Czech ICT goods import and GDP in the Czech Republic. For this purpose, quarterly data are applied. Values of Czech ICT goods import were recalculated from original monthly to quarterly data. Data of Czech GDP are taken from database of the Czech Statistical Official. The values of Czech GDP are expressed in constant prices, where average of a previous

year is equal to the basis of 100. Both time series are recognized from the first quarter 1996 till the fourth quarter 2014, expressed in millions of CZK.

Initially, the original time series were seasonally adjusted using procedure TRAMO/SEATS. Time series before and after seasonal adjustments are illustrated in figure 14. Visual evaluation of the two time series reveals similarities of development.

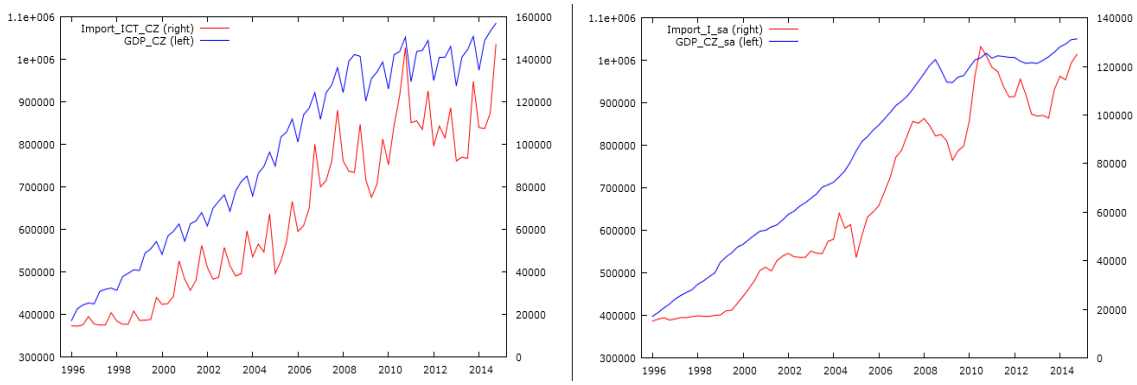

Fig. 14 Original (left) and seasonally adjusted (right) quarterly data for ICT goods import

For the purpose of further modelling, the first differences of the time series are taken, as the original data turned out to be non-stationary for both time series. Augmented Dickey-Fuller test proves that the time series are stationary after seasonal adjustment and first differentiation, as summarized in table 7. All ADF tests in the table apply for models without constant.

Tab. 7 ADF test of stationarity

Variable	*ADF test p-value*	*Significance*
Import_ICT	0.985	
d_Import_ICT_sa	1.145e–009	***
GDP_CZ	0.7685	
d_GDP_CZ_sa	0.002069	***

Data involving first differencing and seasonal adjustment are further analysed in order to detect presence of correlation, as illustrated in figure 15. Cross-correlogram reveals statistically significant correlation of present values of Czech ICT import and lagged values of GDP in the Czech Republic, explicitly for the lags of zero and first order. Strength of correlation is 0.2357 for zero lag order, and 0.3254 for first lag order. Other lags turned out not to be significant on the significance level of 5%.

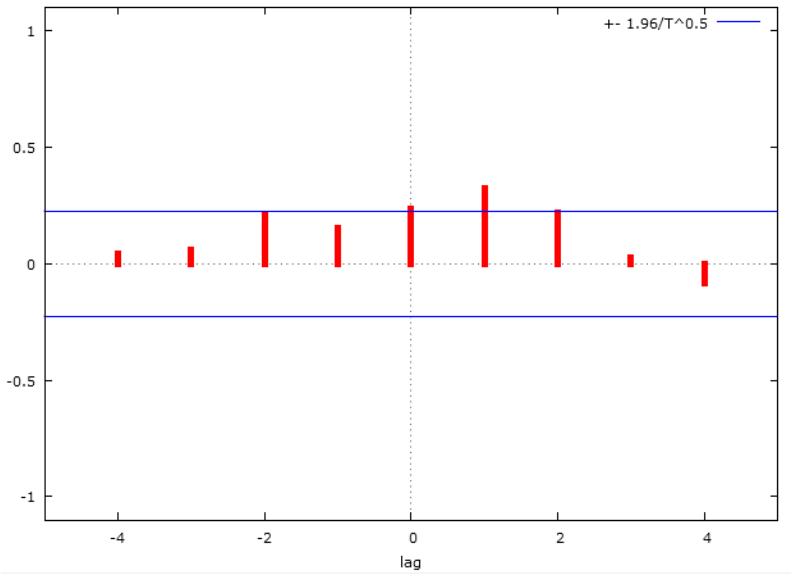

Fig. 15 Correlation of d_Import_ICT_CZ_sa and lagged d_GDP_CZ_sa

Initial analysis over data implies possibility, that there is a relation between current and lagged values of the two time series. The relationship is further described by vector autoregressive model (VAR). Lag order selection for the model is chosen based on lowest possible values of information criteria captured in table 8.

Tab. 8 VAR lag order selection

Lag order	*AIC*	*BIC*	*HQC*
1	40.735518*	40.862993*	40.786211*
2	40.819211	41.074160	40.920596
3	40.883656	41.266081	41.035734
4	40.980388	41.490288	41.183159

The model is further built as vector autoregressive model of first order, denoted VAR(1). As noted, there is no constant involved and the model is run in first differences of seasonally adjusted time series. The model consists of 2 equations, which are captured in table 9.

The first equation detects relation of lagged GDP in the Czech Republic influencing present values of Czech ICT import. Coefficient assigned to the lagged GDP in the Czech Republic is statistically significant based on p-value smaller than the 5% significance level. This means that lagged Czech GDP influences ICT goods import, as is further interpreted.

Tab. 9 VAR(1) model – ICT goods import and Czech GDP

Equation 1: d_Import_ICT_sa				
	Coefficient	*Std. Error*	*p-value*	*Significance*
d_Import_ICT_sa_1	0.180147	0.112853	0.1148	
d_GDP_CZ_sa_1	0.148210	0.0467193	0.0023	***
Equation 2: d_GDP_CZ_sa				
	Coefficient	*Std. Error*	*p-value*	*Significance*
d_Import_ICT_sa_1	0.0585752	0.194242	0.7639	
d_GDP_CZ_sa_1	0.756544	0.0805372	3.88e–014	***

The second equation describes effect of lagged variables on present values of GDP in the Czech Republic. Coefficient assigned to lagged Czech ICT import proved to be statistically insignificant. Only significant parameter in the second equation is lagged GDP in the Czech Republic. This is likely anticipated and intelligible result, meaning that lagged GDP in the Czech Republic influences present values of itself.

Tab. 10 VAR(1) model – verification tests

Statistical test	*First equation p-value*	*Second equation p-value*
F-test	0.000257***	1.14e–14***
ARCH test of order 4	0.223057***	0.378869***
Ljung-Box test of order 4	0.895***	0.449***
Doornik-Hansen test	0.0000	0.0000

Results of verification tests are present in table 10. Results assigned to the first equation are further commented, as it reflects relation of Czech GDP and ICT goods import. The F-test with resultant p-value smaller than 5% level of significance verifies that the final model is statistically significant. To verify conditional homoskedasticity of residuals, the ARCH test is performed. With computed p-value higher than level of significance, null hypothesis is not rejected, hence there is no presence of ARCH effect in the model. Detection of possible autocorrelation is done through the Ljung-Box test. Based on p-value higher than level of significance, null hypothesis is not rejected, meaning there is no problem with autocorrelation of residuals. The Doornik-Hansen test is performed as the last in order to verify normal distribution of residuals. Normality of residuals is however not present within the model, as p-value is smaller than the level of significance.

Based on the results obtained during verification testing, the selected vector autoregressive model of first order contains white noise. Thus, the model is built appropriately. The model is however missing normal distribution of residuals.

Interpretation of the coefficient assigned to parameter d_GDP_CZ_sa_1 (first equation) suggests, that if GDP of the Czech Republic was increased by 1 unit (mil CZK) in the preceding period, Czech ICT goods import would increase by 0.148 units (mil CZK) in the present, conditional on other variables in consideration.

Based on the VAR model, the relation between GDP in the Czech Republic and Czech ICT goods import may be described as follows:

Lagged GDP of the Czech Republic granger causes current Czech ICT goods import.

Granger causality is here verified by dedicated t-test, which is possible only in case of VAR model of first order. The causality implies that Czech GDP helps better predict values of Czech ICT goods import.

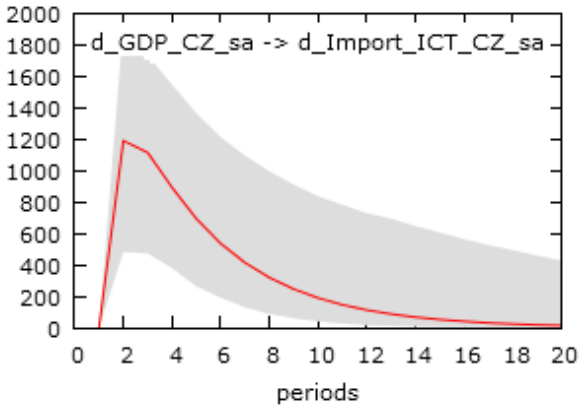

Fig. 16 Impulse response analysis – Czech GDP and ICT goods import

To illustrate verified relation between Czech GDP and Czech ICT goods import, impulse response analysis is performed. Figure 16 consists of 20 periods forecast horizon. Bootstrap confidence interval (shadowed area) shows 95% limits to response of Czech ICT goods import when Czech GDP changes due to exogenous impulse. The response of ICT goods import reflects causing impulse of 1 standard deviation in Czech GDP. From the graphical illustration may be observed noticeable tendency of Czech ICT goods import development to respond to changes of GDP development in the Czech Republic. The impulse subsides within the system arguably slowly.

4.2 Export of ICT goods

4.2.1 Elementary characteristics

The analysis of the time series begins with calculation of elementary characteristics. The calculations are included in the annexes of the thesis.

Analysing the first differences, which provide information about absolute change compared to the previous period, negative values are usually observed at the beginning of years and during summer months. The highest absolute increase is observed in March 2011, with corresponding growth rate of 40.7%. Contrary, the highest absolute decrease is observed in February 2014, which corresponds to decrease by 21%.

The time series reaches its lowest value in January 1993, which is the first observed value of 310,047,657 CZK. The highest overall value is observed in December 2014, numerically 52,730,582,090 CZK.

Overall, the data show average monthly growth of ICT goods export by 1.97%, which is an equivalent of average absolute change of 199,317,621 CZK per month.

$$\bar{d} = \frac{52\,730\,582\,090 - 310\,047\,657}{264 - 1} = 199\,317\,621.4$$

$$\bar{k} = \sqrt[264-1]{\frac{52\,730\,582\,090}{310\,047\,657}} = 1.0197$$

$$\bar{\delta} = 1.0197 - 1 = 0.0197$$

Development of the time series is captured in figure 17. Overall trend is increasing, with notable change of trend in late 1990s' and around year 2007. If the time series was modelled using simple linear trend, these two structural changes would be considered. The two shadowed areas in the figure 17 signify recession periods observed in euro area during the latest economic crisis, reflecting quarterly GDP growth development. Link to development of economy in euro area is involved, as the relation between Czech ICT goods export and GDP in euro area is further evaluated in this work.

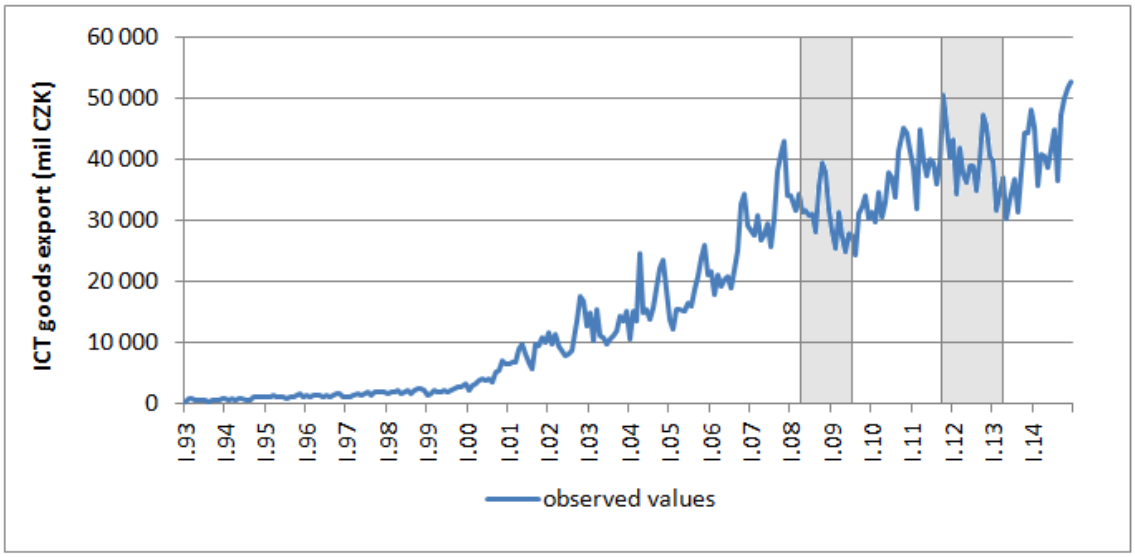

Fig. 17 ICT goods export with marked recession periods in euro area

The Quandt likelihood ratio test shows presence of structural breakpoints in November 1998 and later in September 2006. In November 1998, the maximum value

of computed F-statistics was 181.388 with assigned p-value of 1.187e–080. Null hypothesis of no presence of structural breakpoint is rejected based on p-value lower than level of significance. The structural change may be associated with introduction of euro to the financial markets as an accounting currency on 1st January 1999. Earlier presence of the structural breakpoint may be explained through increased sales during winter time. From this point of view, introduction of euro to the world financial markets had arguably positive impact on export of Czech ICT goods.

Other structural change has been observed in September 2006. The maximum value of computed F-statistics was 148.673 with assigned p-value of 9.823e–066. Presence of structural breakpoint is hence statistically significant. After this breakpoint, the time series becomes more volatile. Values for 2007 show strong performance of ICT goods export, ending with the strongest result in November 2007. In 2008 may be seen start of notable drop of ICT goods export. The impact of economic crisis on Czech ICT export may be fully seen, as the export reaches its lowest value since 2006 in August 2009. Furthermore, year 2009 is the only year which has no characteristic peak by the end of the year. The latter reflects performance of euro area economy, which was in recession during first two quarters of 2009. The second phase of recession during 2012 and surrounding quarters also negatively influenced export of ICT goods, as may be seen in the figure 17.

The QLR test is used only to illustrate development of F-statistics in the time series. No further processing above the test is considered, as the time series is better modelled using adaptive method. Results of F-statistics computed by QLR test are shown in figure 18, where linear trend is considered.

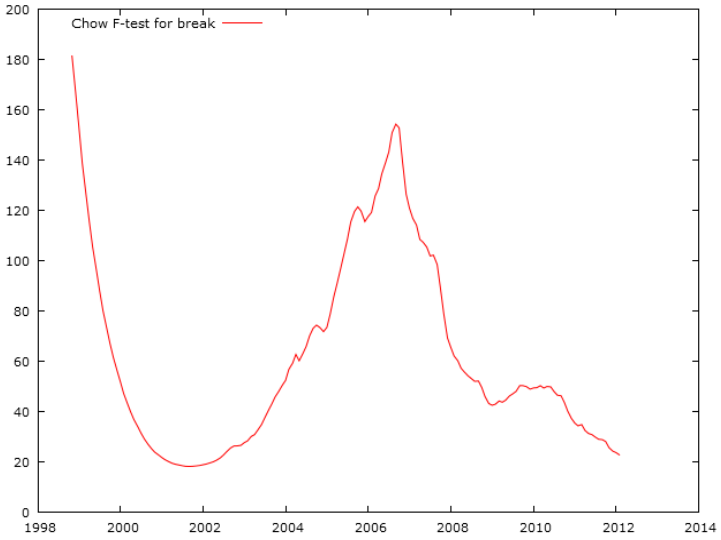

Fig. 18 Graph of QLR test for ICT goods export

4.2.2 Linear filters

For the purpose of trend description of the time series, adaptive method needs to be considered again, as the time series appears to change trend. Therefore, method of centered linear filters was chosen as appropriate. The time series consists of monthly data, thus the moving part consists of 13 weights. Corner values are assigned with half weight than the others.

$$w_t = \frac{1}{24}[1,2,2,2,2,2,2,2,2,2,2,2,1] \quad p = 12$$

With moving part length 13, the first six peripheral values, as well as the last six peripheral values of the time series are not fitted from the nature of the method.

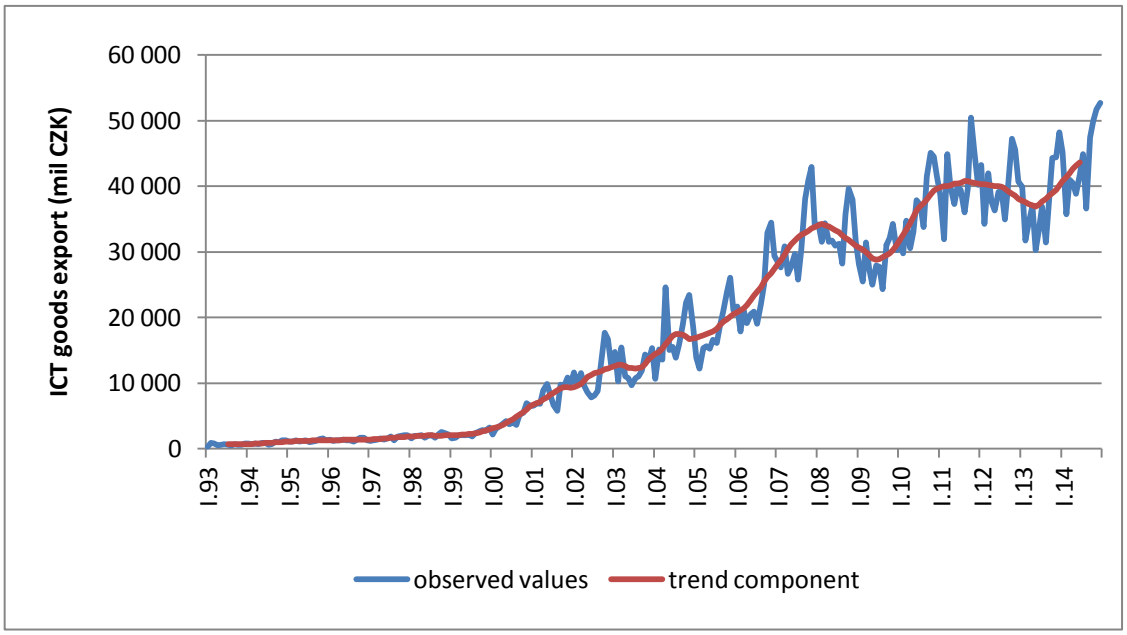

Fig. 19 ICT goods export – observed values with trend component

Figure 19 shows observed values and adaptive trend component. Overall trend proves to be increasing, with two major drops around years 2008/2009 and during 2012 and 2013. Effect of entry of the Czech Republic into the European Union is not particularly evident, although trend of development became slightly steeper between 2005 and 2008.

4.2.3 Seasonal component

In order to describe also the seasonal component, calculation of seasonal factors follows. To do so, proportional seasonality is taken into account, and turns out to be the best fitting.

The values of seasonal factors represent scale of seasonal fluctuation. The factors are calculated as sum of multiplication of observed values and trend values,

divided by squared trend values for particular months. The sum of values of all seasonal factors must give 12, as monthly data are used. This condition is fulfilled after minor mathematical adjustment.

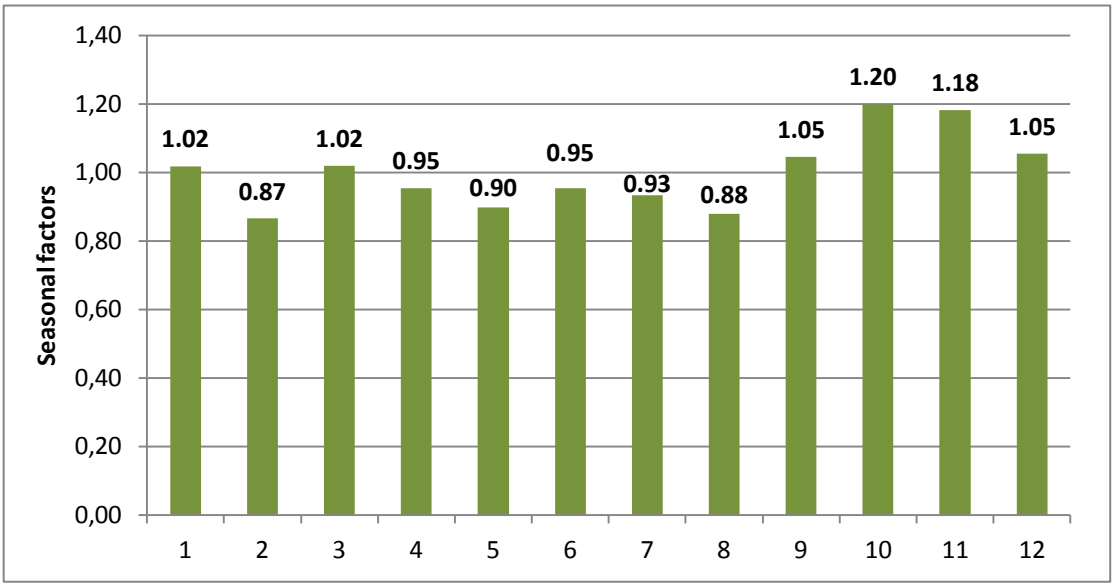

Fig. 20 Graph of seasonal factors for ICT goods export

Seasonal factors shown in figure 20 explain characteristic fluctuation of ICT goods export during a year. Concrete interpretation of the lowest seasonal factor in February suggests that in average the ICT goods export reaches volumes 13% below level of trend in November. Other factors are interpreted with the same construction.

The lowest value of seasonal factor in February likely corresponds with low consumption of consumers in general after Christmas time and New Year's sales. Values of seasonal factor below 1.00 are also present from April to August. These values may refer to lower willingness of consumers to buy ICT goods during spring and summer times, when people rather spend income for leisure time activities. A strong link of seasonal fluctuation to weather may be seen starting with September, when seasonal factor increase the most from 0.88 to 1.05, the increase continues in October to 1.20. Generally, with cooled down weather consumption of ICT goods increases, and so does export. The end of a year is also affected by Christmas shopping. From domestic exporters' point of view, the most intensive months are October and November. This may be associated with frontloading of foreign dealers before Christmas.

The model may be completed with calculation of fitted values, as description of trend component and seasonal factors was accomplished. The fitted values are computed as multiplication of trend component and corresponding seasonal factor. Figure 21 shows originally observed values fitted with calculated model. The model fits original time series subjectively successfully.

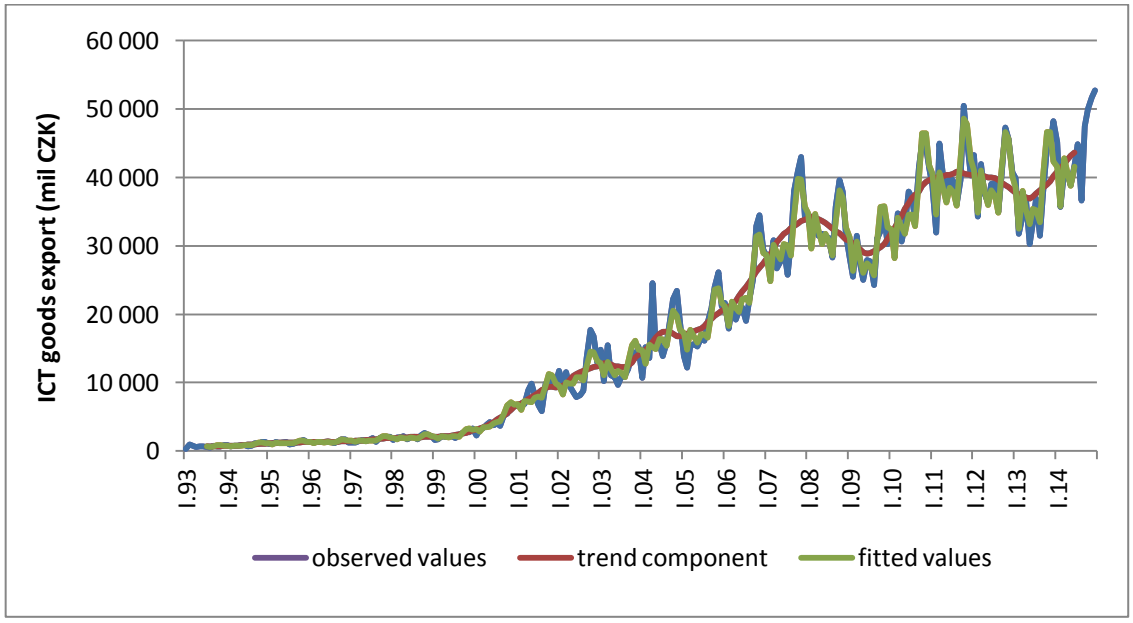

Fig. 21 Fitted values for ICT goods export

In summary, the final model was built based on method on centered linear filters, with moving part length 13 and proportional seasonality involved. The model was chosen as the most suitable with respect to statistical criteria of model fit quality, where the lowest possible values are favoured. Calculated statistical criteria are shown in table 11.

Tab. 11 Quality of model fit for ICT goods export

M.E.	M.A.E.	M.S.E.	R.M.S.E.
-11483571.12	1036503198	2.51137E+18	1584731178

4.2.4 Forecasting

Forecasting of future development of the time series is performed based on auto-regressive integrated moving averages (ARIMA) model, as it allows better prediction possibilities than adaptive methods. Firstly, correlogram of the time series is visually analyzed. Figure 22 shows ACF and PACF plots, which refer to presence of random walk. To overcome non-stationarity of the time series, differencing needs to be involved as the model is built. The ACF plot also suggests presence of seasonality in the time series. Therefore, seasonal version of the model (SARIMA) is applied.

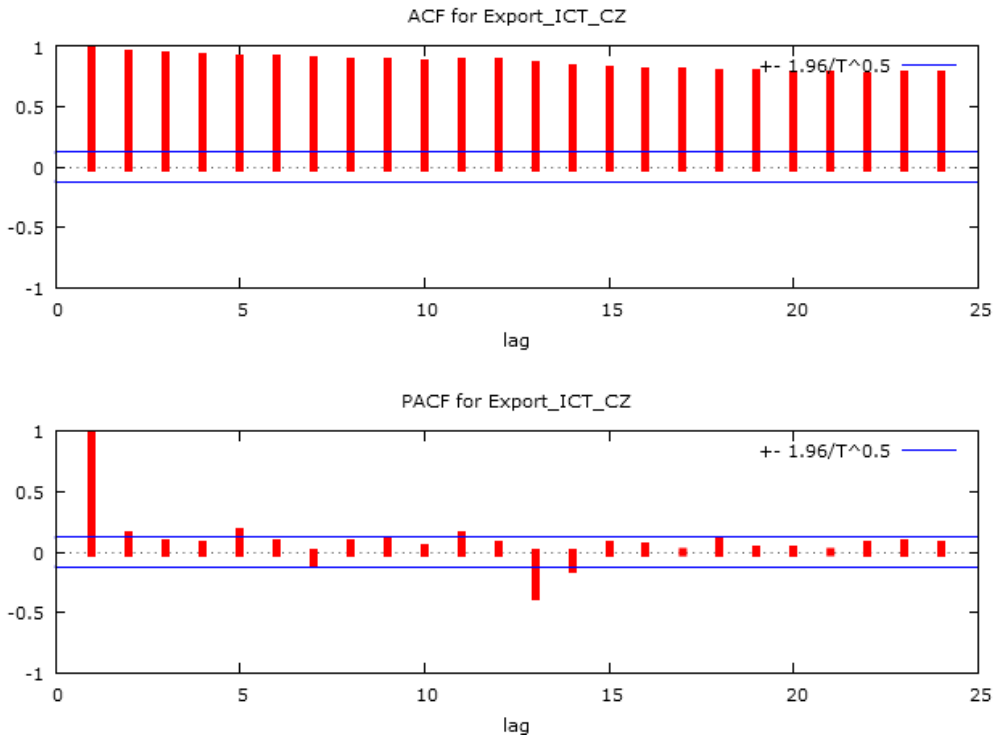

Fig. 22 Correlogram for ICT goods export

Respecting initial evaluation, the model is built as SARIMA $(011)x(011)_{12}$, with no constant involved. The model includes of one round of common differencing and one round of seasonal differencing.

Parameters of the model are captured in table 12. Coefficients of moving averages term theta_1 and seasonal moving averages term Theta_1 both prove to be significant on the 5% significance level. Size of coefficients of the parameters may be considered as reasonable.

Tab. 12 SARIMA $(011)x(011)_{12}$ for ICT goods export

Parameter	*Coefficient*	*Std. Error*	*p-value*	*Significance*
theta_1	-0.464393	0.0523766	<0.00001	***
Theta_1	-0.554846	0.0572605	<0.00001	***

Regarding information criteria which evaluate quality of model fit, the model reaches lowest possible values of criteria compared to other models tried, implying well built model with correct parameters chosen. Values of information criteria are captured in table 13.

Tab. 13 Information criteria for ICT goods export SARIMA model

Akaike criterion	4591.549
Hannan-Quinn criterion	4595.805
Schwarz criterion	4602.125

Well built model of time series needs to contain white noise of residuals, which is a matter of table 14. Mean value of residuals should be constant, which is a presumption. The model should not contain condition heteroskedasticity, also called as ARCH effect, which is tested by ARCH test. Null hypothesis of no ARCH effect presence is not rejected based on p-value, the model does not contain ARCH effect. The next test is Ljung-Box test, which tests presence of autocorrelation of residuals. Based on p-value, the null hypothesis of no autocorrelation is not rejected. The model does not have a problem with autocorrelation of residuals.

The last statistical test used is Chi-square test of normality. Null hypothesis of normal distribution of residuals is rejected based on p-value. Normal distribution of residuals does not occur in the model. Nevertheless, normal distribution of residuals is not compulsory condition of white noise. Based on results of all statistical tests performed, the model contains white noise without normality of residuals.

Tab. 14 White noise evaluation for ICT goods export SARIMA model

Test	*p-value*	*Null hypothesis*
ARCH test of order 12	0.257244***	no ARCH effect
Ljung-Box test of order 12	0.8065***	no autocorrelation
Chi-square test	4.43638e-014	normal distribution

After econometric verification, application of the model may be done in order to perform forecasting of future development of the time series. To do so, 95% prediction interval is considered. The forecast reaches 36 months ahead, starting with January 2015 and ending with December 2017. Graphical results of the forecasting are shown in figure 23, where shadowed area represents 95% prediction interval.

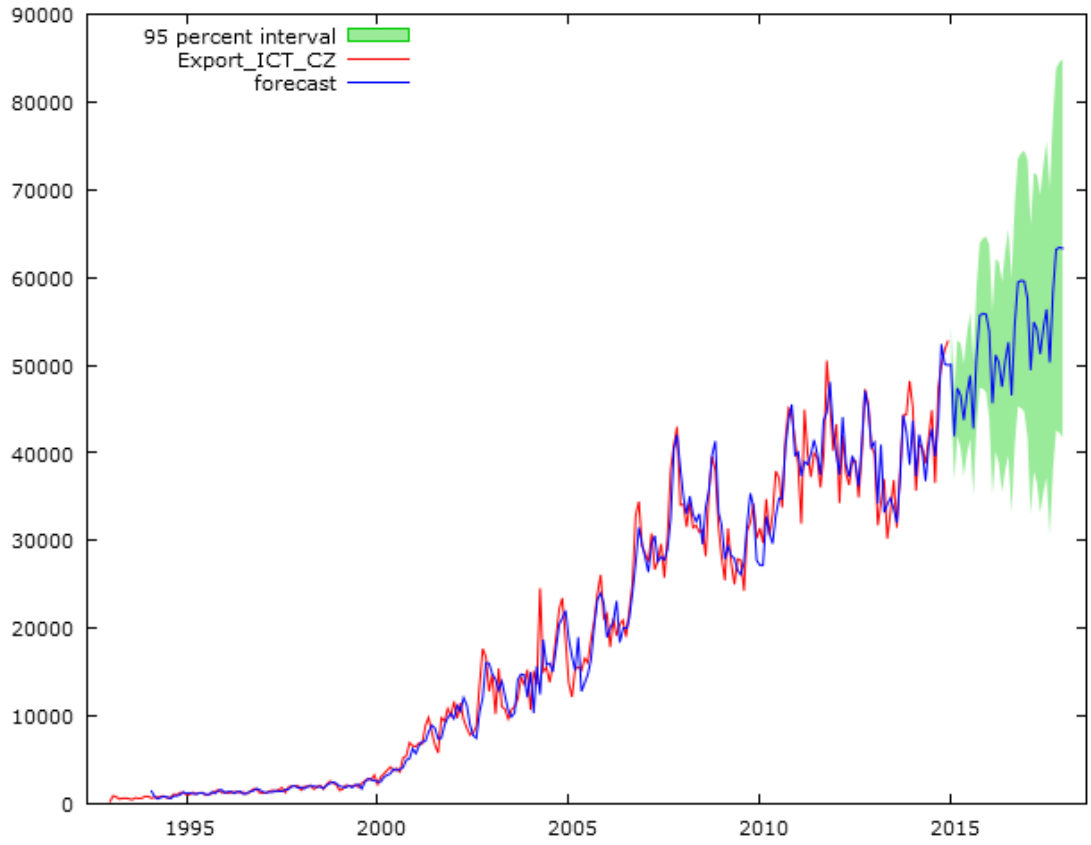

Fig. 23 Forecasting for ICT goods export

The forecast suggests, that mean value of ICT goods export is expected to maintain increasing trend, nevertheless with 95% prediction interval even decrease of development is possible within the next 36 months.

Exact numbers of forecast are shown in table 15, including mean forecast and prediction interval.

Tab. 15 ICT goods export forecast (2015, 2016, 2017)

Period	*Forecast (mil CZK)*	*Prediction interval (95%)*	*Period*	*Forecast (mil CZK)*	*Prediction interval (95%)*
I.15	50077.8	(45722.0 - 54433.6)	VII.16	52623.0	(39766.1 - 65479.9)
II.15	41910.4	(36969.2 - 46851.7)	VIII.16	46559.7	(33268.1 - 59851.3)
III.15	47393.1	(41928.7 - 52857.4)	IX.16	54610.1	(40897.6 - 68322.7)
IV.15	46562.8	(40621.3 - 52504.3)	X.16	59442.2	(45321.2 - 73563.1)
V.15	43768.6	(37385.5 - 50151.8)	XI.16	59649.6	(45131.7 - 74167.5)
VI.15	46711.2	(39915.0 - 53507.3)	XII.16	59563.1	(44658.8 - 74467.3)
VII.15	48858.9	(41673.5 - 56044.4)	I.17	57606.0	(41783.9 - 73428.1)
VIII.15	42795.6	(35240.9 - 50350.3)	II.17	49438.6	(33013.4 - 65863.8)
IX.15	50846.0	(42939.3 - 58752.8)	III.17	54921.2	(37914.3 - 71928.2)
X.15	55678.1	(47434.3 - 63921.8)	IV.17	54091.0	(36521.5 - 71660.4)
XI.15	55885.5	(47318.0 - 64453.0)	V.17	51296.8	(33182.3 - 69411.3)
XII.15	55799.0	(46919.5 - 64678.5)	VI.17	54239.3	(35595.7 - 72882.9)
I.16	53841.9	(43988.2 - 63695.6)	VII.17	56387.1	(37229.0 - 75545.2)
II.16	45674.5	(35260.0 - 56089.1)	VIII.17	50323.8	(30664.7 - 69982.9)
III.16	51157.1	(40210.5 - 62103.8)	IX.17	58374.2	(38226.5 - 78521.9)
IV.16	50326.9	(38872.7 - 61781.0)	X.17	63206.2	(42581.5 - 83831.0)
V.16	47532.7	(35592.7 - 59472.8)	XI.17	63413.7	(42322.7 - 84504.6)
VI.16	50475.2	(38068.3 - 62882.2)	XII.17	63327.2	(41780.1 - 84874.3)

4.2.5 ICT goods export structure – main components

Data available from database of the Czech Statistical Office allow comparing development of ICT goods main components since 1993 until 2013. The components are again divided into five main aggregated groups – computers and peripheral equipment, communication equipment, consumer electronics, electronic components, and parts and components not elsewhere classified.

The most important articles of export are computers and peripheral equipment, which reach almost 50% share of all ICT export in 2013. These goods became crucial part of Czech ICT export in 2002, as before the share was oscillating around 20%.

The opposite may apply for electronic components and parts and components not elsewhere classified. Share of these two articles together was oscillating around 50% of total ICT goods export before 2001. Since that time, portion of both articles quickly dropped towards 10% mark each.

Export of consumer electronics remains approximately the same over the period since 1993, reaching share of about 20%. Communication equipment export

has performed slow enlargement of share, developing from portion below 5% in 1990s' towards 17% share in 2013.

Overall, the export of ICT goods used to be driven mainly by export of electronic components together with parts and components not elsewhere classified, however with start of new millennium the key articles for export became computers and peripheral equipment, representing roughly half of total ICT goods export. Data are captured in figure 24.

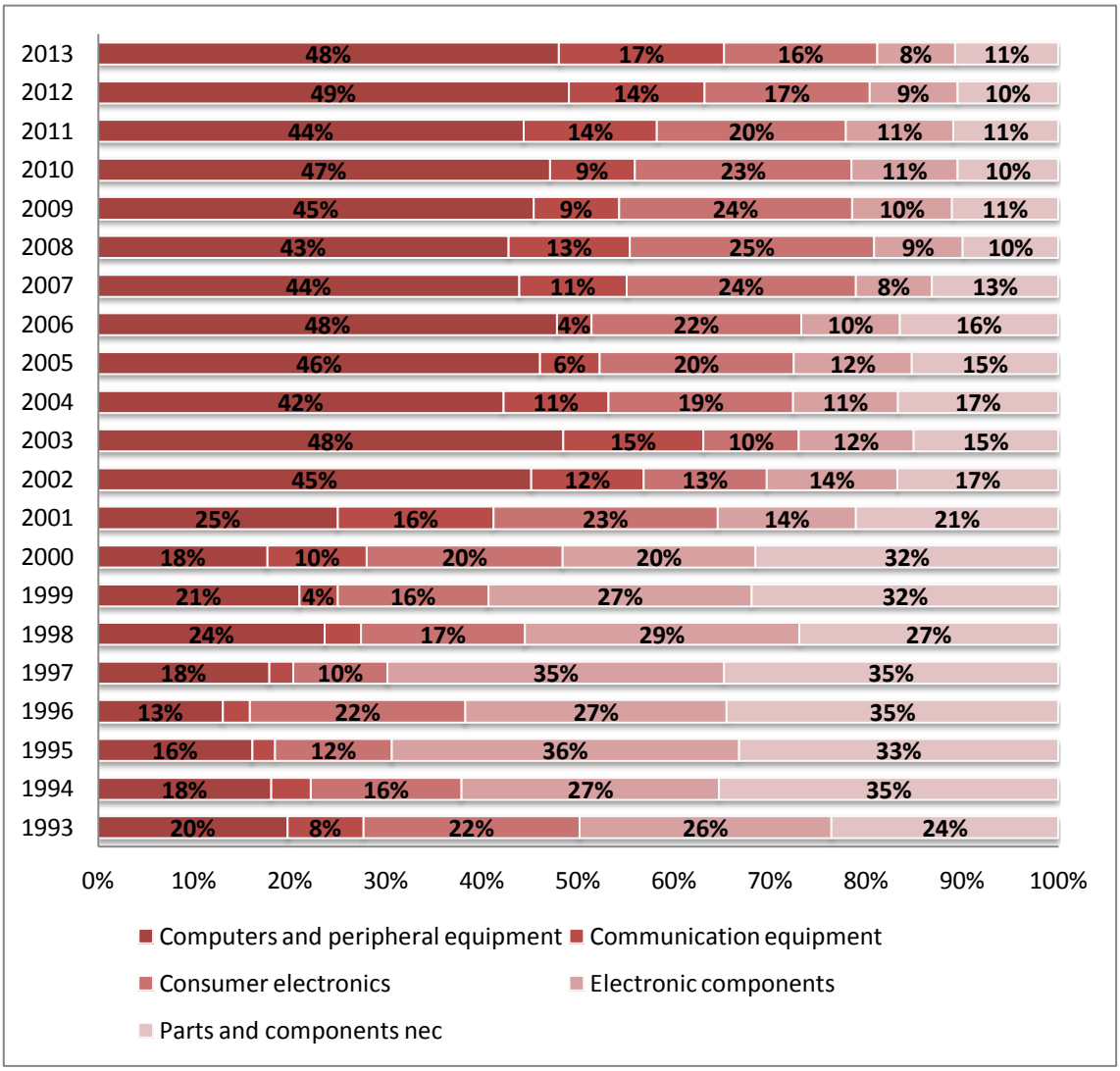

Fig. 24 ICT goods export structure

4.2.6 Relation of Czech ICT goods export and GDP in the euro area

To analyse relation of Czech ICT goods export and GDP in the euro area, quarterly data are used for this purpose. Values of Czech ICT goods export were recalculated from original monthly to quarterly data, expressed in millions of CZK. Data for the euro area are taken from official Eurostat database. These data are reflecting grad-

ual enlargement of the euro area. The values are expressed in millions of euro as chain link values with basis year 2010, available from the first quarter 1995 till the third quarter 2014.

Original time series were seasonally adjusted using TRAMO/SEAT procedure. Figure 25 shows the time series before and after adjustment. Visual evaluation of development of the two time series suggests that GDP of euro area is the indicator that changes firstly, followed by change of Czech ICT export development.

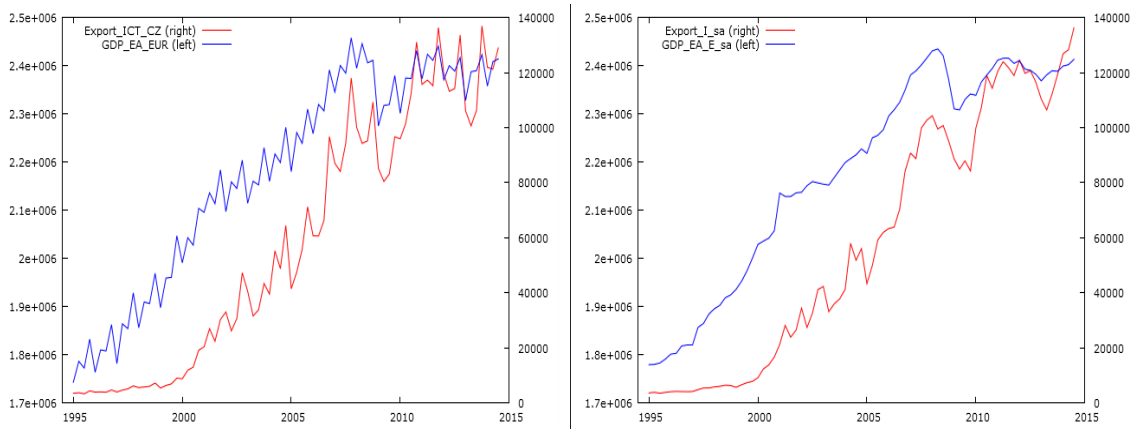

Fig. 25 Original (left) and seasonally adjusted (right) quarterly data for ICT goods export

Original data turn out to be non-stationary. Therefore, the first differences of both time series are taken. Augmented Dickey-Fuller test proves that the time series are stationary after seasonal adjustment and first differentiation, as captured in table 16. Modelling applied in the next steps includes no constant.

Tab. 16 ADF test of stationarity

Variable	*ADF test p-value*	*Significance*
Export_ICT	0.9762	
d_Export_ICT_sa	0.002182	***
GDP_EA	0.9774	
d_GDP_EA_sa	0.01813	***

After overcoming non-stationarity of the original data through first differencing, correlation of the two adjusted time series is analysed. Cross-correlogram reveals statistically significant correlation of present values of ICT export and lagged values of GDP in euro area, specifically for the lags of zero and first order, as may be seen in figure 26. Strength of correlation is 0.3451 for zero lag order, and 0.3120 for first lag order.

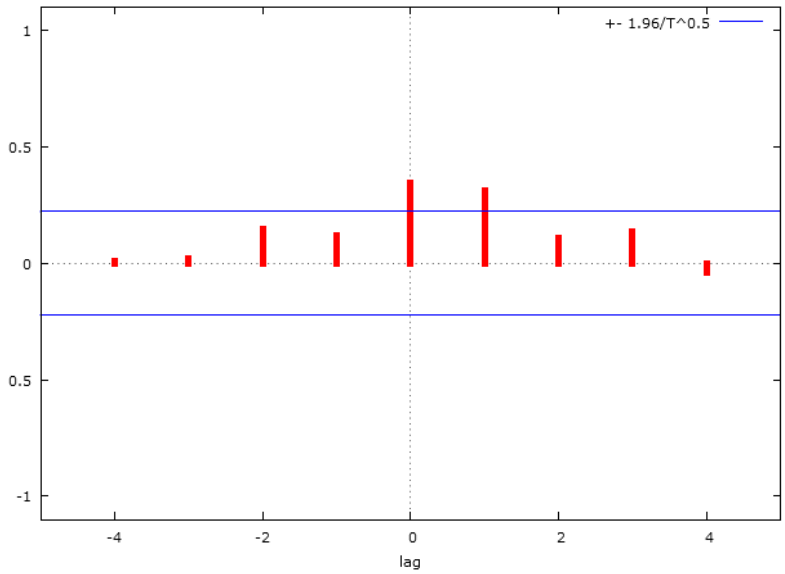

Fig. 26 Correlation of d_Export_ICT_CZ_sa and lagged d_GDP_EA_sa

The relationship between current and lagged values of the two time series is further described by vector autoregressive model (VAR). Selection of the lag order for the model is based on the lowest possible values of information criteria captured in table 17.

Tab. 17 VAR lag order selection

Lag order	*AIC*	*BIC*	*HQC*
1	42.316786*	42.441330*	42.366468*
2	42.389438	42.638526	42.488803
3	42.451277	42.824910	42.600324
4	42.554853	43.053029	42.753581

The model is further built as vector autoregressive model of first order. No constant is involved, and the model is run in first differences of seasonally adjusted time series. The model consists of 2 equations, which are shown in table 18.

The first equation detects relation of lagged GDP in euro area influencing present values of Czech ICT export. Coefficient assigned to lagged GDP of euro area is statistically significant based on p-value smaller than 0.05. This means that lagged GDP in euro area influences ICT goods export, as is further described.

Tab. 18 VAR(1) model – ICT goods export and GDP in euro area

Equation 1: d_Export_ICT_sa				
	Coefficient	*Std. Error*	*p-value*	*Significance*
d_Export_ICT_sa_1	-0.0920275	0.117901	0.4375	
d_GDP_EA_sa_1	0.132166	0.0351684	0.0003	***
Equation 2: d_GDP_EA_sa				
	Coefficient	*Std. Error*	*p-value*	*Significance*
d_Export_ICT_sa_1	0.150214	0.380622	0.6942	
d_GDP_EA_sa_1	0.438240	0.113535	0.0002	***

The second equation describes effect of lagged variables on present values of GDP in euro area. Coefficient of lagged variable of Czech ICT export proved to be statistically insignificant. Only significant variable in the second equation is lagged GDP of euro area. This is understandable and predictable, meaning that lagged GDP in euro area determines present values of itself.

Tab. 19 VAR(1) model – verification tests

Statistical test	*First equation p-value*	*Second equation p-value*
F-test	0.001110***	0.000147***
ARCH test of order 4	0.190003***	0.142072***
Ljung-Box test of order 4	0.561***	0.792***
Doornik-Hansen test	0.0000	0.0000

Table 19 shows results of basic verification tests. Relation of GDP in euro area and Czech ICT goods export is a matter of the first equation. The chosen model is statistically significant, which is verified by F-test with corresponding p-value smaller than 0.05. ARCH test is used to verify conditional homoskedasticity of residuals. Based on p-value higher than level of significance, null hypothesis is not rejected, as there is no presence of ARCH effect in the model. Ljung-Box test is used to detect possible autocorrelation. With p-value higher than level of significance, null hypothesis is not rejected, there is no problem with autocorrelation within the model. The last test is focused on normal distribution of residuals. Doornik-Hansen test detects, that normal distribution is not present within the model, as p-value is smaller than level of significance.

The chosen vector autoregressive model of first order is built appropriately, as white noise is present. The model is although missing normal distribution of residuals.

Interpretation of the coefficient assigned to parameter d_GDP_EA_sa_1 (first equation) suggests, that if GDP in euro area was increased by 1 unit (mil EUR) in the preceding period, Czech ICT goods export would increase by 0.132 units (mil CZK) in the present, conditional on other variables in consideration.

Based on the model, the relation between GDP in euro area and Czech ICT goods export may be described as follows:

Lagged GDP in euro area granger causes current Czech ICT goods export.

Granger causality is verified by corresponding t-test, which is possible in case of VAR model of first order only. The causality implies that GDP in euro area helps better predict values of Czech ICT goods export.

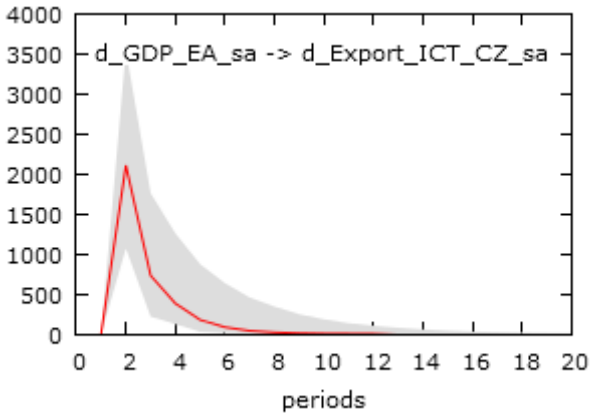

Fig. 27 Impulse response analysis – euro area GDP and ICT goods export

After description of relation between GDP of euro area and Czech ICT goods export, impulse response analysis is performed to illustrate verified relationship. Figure 27 accounts with 20 periods forecast horizon. Bootstrap confidence interval (shadowed area) shows 95% limits to response of Czech ICT goods export when GDP in euro area changes as a result of exogenous impulse. The reaction of ICT goods export refers to causing impulse of 1 standard deviation in GDP in euro area. The figure clearly captures tendency of ICT goods export development to adjust to changes of GDP development in euro area. The impulse is fully subsided within 16 period horizon.

4.3 International comparison – ICT goods export

Following subchapter provides international comparison of ICT goods export within the Czech Republic, Germany, Ireland and Hungary. Goal of the comparison is to stress out similarities and differences in terms of ICT goods export development, and mainly to comment on importance of ICT goods export for particular economies.

Data used for the comparison come from the Czech Statistical Office, although originally taken from OECD database. The data consists of yearly observations, allowing comparison until 2012, which is the latest year published by OECD. The

time series of particular countries have different length. The data are expressed in millions of USD.

4.3.1 Czech Republic

ICT goods export development in the Czech Republic is thoroughly described in chapter 4.2. For the purpose of this international comparison, data for the Czech Republic are used as basic element to be compared with.

Absolute values of ICT goods export are corresponding with findings described in the previous subchapter. To summarize, overall trend is increasing with two major drops due to economic crisis, one at the turn of 2008 and 2009, second starting in 2012.

To provide statement about importance of ICT goods export for the Czech Republic, share of ICT goods export in total goods export is assumed for this purpose. The share in total goods export is generally very low after the republic was established in 1993. Before the new millennium, the share reached values from 1.3% to 3.3%. After this period, the share started to increase rapidly and attacked higher than 10% share in 2002 for the first time, resulting from the direct foreign ICT investments made in the territory. Since then, the growth slowed down, but continuously increased towards 15.2% in 2011. In 2012, the share slightly dropped to 14.5% as a result of the second phase of economic recession in the Czech Republic.

Based on these observations, ICT goods export may be considered as important for the Czech economy, as it has recently reached share in total goods export of about 15% and its share in total goods significantly increased since 1993.

Fig. 28 Czech Republic – ICT goods export (left) and share in total goods exports (right)

4.3.2 Federal Republic of Germany

Germany is considered to be the leading economy of the European Union. With population of more than 80 million inhabitants, Germany is the most populous country in the European Union. Such a numerous labour force allowed Germany to

develop into a stable economy, with developed infrastructure and high level of competitiveness.

In absolute values, Germany understandably achieves higher levels of ICT goods export than the Czech Republic. In 2006, Germany reached ICT goods export level 6.6 times higher than the Czech Republic. The latest data show that in 2012 Germany performed only 2.8 times better ICT goods export than the Czech Republic. Overall trend was increasing till 2006. After economic crisis in 2008, a huge drop occurred also in Germany. Unlike the Czech Republic, Germany never recovered back to the levels reached before the crisis.

Numbers representing share of ICT goods export in total goods export show that Germany is more consistent in its export structure compare to the Czech Republic. Early statistic around 1990 reveals share between 5 to 6%. The share later increased above 7% level, where it remained during 1999 and 2006. After this period, the share decreased rapidly back toward 5% share. The downturn was multiplied by effect of the economic crisis, as the share in total goods export ended 2012 with only 4.4%.

Germany is less dependent of ICT goods export than the Czech Republic. Developed economy of Germany is known to be more oriented on machinery industry. Nevertheless, the portion of ICT goods export is not negligible, as machinery and technology industries are interconnected. The decrease of share of ICT goods export in total goods export after 2006 may be explained by outflow of ICT investments and manufacturing into less developed countries of Eastern Europe, combined with impact of the economic crisis in 2008.

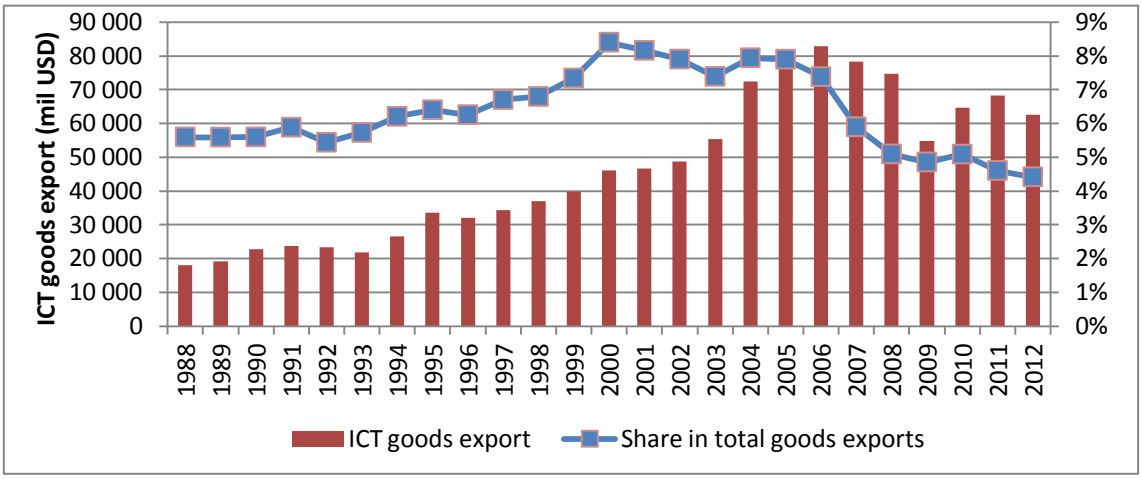

Fig. 29 Germany – ICT goods export (left) and share in total goods exports (right)

4.3.3 Republic of Ireland

Ireland experienced quite opposite development from the Czech Republic in terms of ICT goods export. Irish economy, often referred to as the "Celtic Tiger" before the economic crisis, used to be the fastest growing economy in the Western

Europe. Low corporate tax rate and investment incentives caused rapid growth of the economy fuelled mainly by direct foreign investments. Ireland became a hub for ICT industry, with investments from global ICT leaders such as Microsoft, Dell, Intel, HP, IBM or Apple. Nevertheless, the economy was seriously hit by the economic crisis early in 2008 as one of the first European country.

ICT goods export in Ireland went through a huge up and down in the last 24 years. The highest increase in absolute values of ICT goods export came between 1993 and 2001, when the numbers almost quadrupled over the period. After 2001, possible effect of "dot-com bubble"[2] may be seen. Another decrease of development came after the economic crisis in 2008, which pushed the level of ICT goods export back to level reached before 1993.

Irish economy used to be very dependent of ICT goods export. The share of ICT goods in total goods export reached level of 25% already in late 1980s'. After the boom of the economy during 1990s', the share increased to 36.8% in 2001. Since then, impact of the dot-com bubble and economic crisis pushed the share towards 5.8% mark in 2012, as a result of removal ICT manufacturing processes from the country.

In summary, the Celtic Tiger experienced significant changes in export structure over the observed period. The economy enjoyed massive investments into ICT and associated boom of the economy, however experienced also a huge outflow of manufacturing processes related to economic downturn. It is worth mentioning, that the country is still considered as the ICT hub of Europe, regardless the economy is recently driven by other industries.

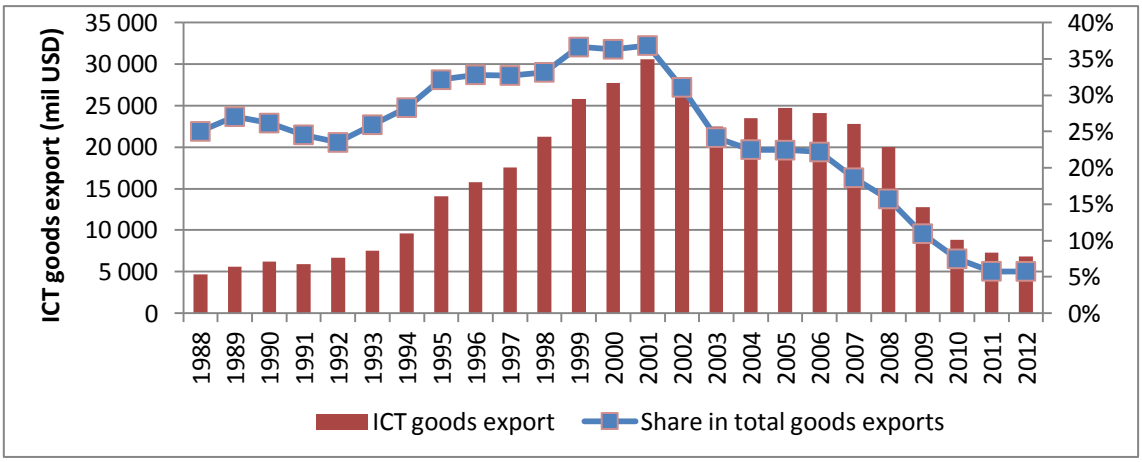

Fig. 30 Ireland – ICT goods export (left) and share in total goods exports (right)

[2] The dot-com bubble, also referred to as "IT bubble", was a historic speculative bubble, which burst in March 2000. It was characteristic with a rapid rise in equity markets fuelled by speculative or fad-based investments into internet oriented companies and start-ups. (Galbraith and Hale, 2004, online)

4.3.4 Republic of Hungary

Hungary is a good example of a country similar to the Czech economy. Both countries entered the European Union in 2004. Both countries are also members of the Visegrad Group[3]. In terms of population, Hungary has almost 10 million inhibitors, which is only half a million less than the Czech Republic.

Interestingly, ICT goods export reaches similar levels as in the Czech Republic. Also development is quite alike. In the early 1990s', there was minimum export of ICT goods in absolute numbers. Trend started to increase since 1997, approximately 3 years earlier than in the Czech Republic. Growth of ICT goods export continued to rose towards 24,522 millions USD in 2008, which is about 4,000 millions USD more than in the Czech Republic at that time. Due to the economic crisis, the ICT goods export experienced drop in 2009, but just a year later was able to recover back to almost the same value as in 2008, comparably as in the Czech Republic. Since then although, the ICT goods export further decreased in 2011 and 2012.

Share of ICT goods export in total goods export experienced rapid growth in Hungary after 1996, when the rate increased from 3.7% towards 25% level in 2000. The growth came earlier than in the Czech Republic and reached higher rates. Over the next decade, the share was oscillating around 25%, but decreased to 17.4% as a result of overall bad performance of the economy in 2012.

Conclusively, Hungary gained from ICT investments in the mid 1990s'. As a result, the ICT boom significantly influenced entire goods export of the country by representing roughly 25% share in total goods export. The country experienced similar ICT goods export development as the Czech Republic, although turned out to be more dependent on ICT goods export performance than the Czech Republic.

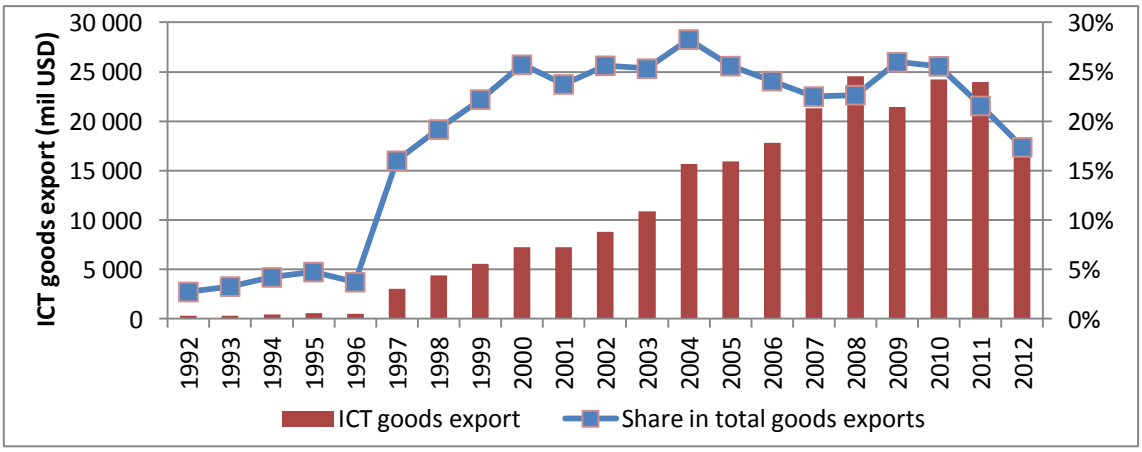

Fig. 31 Hungary – ICT goods export (left) and share in total goods exports (right)

[3] Visegrad Group is an alliance of the Czech Republic, Hungary, Poland and Slovakia formed on 15th February 1991. The purpose of the alliance is to work together in a number of fields of common interest within the all-European integration. (The Visegrad Group, 2014, online)

5 Conclusions

In this thesis, topic of foreign trade with ICT goods in the Czech Republic was examined. Motive of compilation of such a thesis was to demonstrate ICT goods as independent article of foreign trade, as it has become an important element influencing Czech economy and its performance. Therefore, the main focus of the thesis was to describe quantitative development of ICT goods export and import in the Czech Republic. The task is examined in particular steps, where specified objectives are addressed. Besides evaluation of development of foreign trade with ICT goods in the Czech Republic, the objectives further suppose to describe impact of economic crisis on the foreign trade with ICT goods, describe main components of the foreign trade with ICT goods, compare foreign trade with ICT goods between several countries from the EU, and comment on likely importance of ICT goods trade for the Czech economy.

Initially, description of the time series for ICT goods export and import is performed on monthly data. To do so, adaptive method of linear filters is used, as the time series trends are oscillating irregularly. Seasonal component is further involved using proportional, respectively trivial seasonality. The analysis reveals overall increasing trend for both time series. There are two major drops, which are in parallel with performance of Czech economy, respectively euro area economy. The first drop starts in 2008 and reaches its bottom in mid of 2009. The drop is clearly related to economic crisis, which held the Czech Republic in recession during last quarter of 2008 and entire year 2009. After the crisis, ICT goods foreign trade recovered and reached volumes greater than before start of the first drop. Nevertheless, with the second phase of recession starting in 2012 another drop of ICT goods foreign trade occurred. After end of recession by the end of 2013, the development showed obvious tendency to quickly recover and grow again. Besides recent economic crisis, there were observed also other interesting milestones. In case of ICT goods export, the development starts to increase rapidly since introduction of euro in 1999, which may refer to simplified trade conditions within the euro area, but mainly to inflow of investments of ICT manufacturing companies in the Czech market. After entry of the Czech Republic to the European Union in 2004, Czech ICT goods export starts increasing slightly steeper until entry of the crisis in 2008. Steeper development is more evident for ICT goods import. Both time series react slightly delayed to the entry in the EU.

Forecasting of development is performed using the Box-Jenkins methodology, specifically seasonal autoregressive integrated moving averages (SARIMA) modelling. The forecast consists of years 2015, 2016 and 2017, considering 95% prediction interval. Both time series are expected to grow within the period, presenting forecast mean values predicted ceteris paribus. Considering prediction interval, decrease of ICT goods import or export is however possible within the 95% prediction limits.

The thesis also describes main components of foreign trade with ICT goods, as it consists of broad range of articles. Harmonised system used by the Czech Statis-

tical Office distinguishes five main aggregate components – computers and peripheral equipment, communication equipment, consumer electronics, electronic components, and parts and components not elsewhere classified. From import point of view, the structure is well balanced and relatively stable. The import is driven mainly by computers and peripheral components, together with electronic components and parts and components not elsewhere classified. Export side used to be driven mainly by export of electronic components together with parts and components not elsewhere classified, nevertheless with start of new millennium the key articles for export became computers and peripheral equipment, representing roughly half of total ICT goods export nowadays.

The thesis further addresses hypothesis, that Czech ICT goods foreign trade is possibly influenced by development of GDP. To do so, vector autoregressive modelling is performed. Specifically, relations of Czech ICT goods import and Czech GDP, and correspondingly Czech ICT goods export and GDP in the euro area are analysed. Data for GDP were collected in constant prices, as it removes effect of inflation and allows observing real change in output performance. The models were built on data seasonally adjusted using TRAMO/SEATS procedure, and involving one round of differencing due to non-stationarity of the time series. Lag order selection suggested to choose VAR models of first order. In summary, it is determined that lagged GDP of the Czech Republic influences present volumes of Czech ICT goods import. Based on the VAR model, granger causality is verified. The causality suggests that lagged GDP of the Czech Republic helps better predict present Czech ICT goods import. Correspondingly in the second model related to ICT goods export, it is verified that lagged GDP in euro area influences Czech ICT goods export. Granger causality arising from the relation hence suggests that lagged GDP in euro area helps better predict present Czech ICT goods export.

The relation between foreign trade with ICT goods and GDP is further illustrated by impulse response analysis. Obvious tendency of Czech foreign trade with ICT goods to adjust to changes in development of GDP caused by exogenous impulse was recognized, especially in case of export. If GDP in euro area suffers with an impulse, Czech ICT goods export is able to absorb the impulse within 16 period horizon, and the system returns to balance.

Another goal of the thesis is to perform international comparison with several states from the EU. For this purpose, development of ICT goods export in the Czech Republic is compared with development in Germany, Ireland and Hungary. The comparison stresses out not only similarities and differences in development, but also comments on importance of ICT goods export for particular economies. Development of Czech ICT goods export was thoroughly described and evaluated within the thesis in the first place. Further observed from the data, share of ICT goods in total goods export significantly increased over a time, which is in accordance with one of the thesis' presumption. Specifically, the share held below 3.3% level till the beginning of new millennium, when the share started rapidly increasing towards 15% share, which is level high enough to call ICT goods export as important part of Czech export.

The Republic of Hungary interestingly reached similar volumes and experienced similar development of ICT goods export as the Czech Republic. Boom of the sector came approximately 3 years earlier than in the Czech Republic. Along with the Czech Republic, Hungary is the only country considered in the comparison, which managed to fully recover from the crisis in 2008 in terms of ICT goods export. The main difference between Czech and Hungarian ICT export is overall dependency on the sector. Share of ICT goods export in total goods export reached much higher rates in Hungary, roughly 25%, making Hungary notably dependent on ICT goods export performance.

The Federal Republic of Germany understandably reaches higher volumes of ICT goods export than the Czech Republic. The volume was 6.6 times higher in 2006, but due to inability to recover from a drop caused by the economic crisis, the volume was only 2.8 times higher than in the Czech Republic in 2012. Nevertheless, Germany is less dependent on ICT goods export, as the share in total goods export oscillated around 7% mark. Due to economic crisis, the share dropped toward 4.4% mark, which was perhaps multiplied by outflow of ICT investments and manufacturing processes into less developed countries of Eastern Europe, eventually Asia.

The Republic of Ireland was included, as its development of ICT goods export is quite unique and uncommon. The economy enjoyed massive investments into ICT infrastructure and associated boom of the economy during 1990s', as the share of ICT goods export in total goods export rose toward 36.8% in 2001. However since then, impact of the dot-com bubble and economic crisis pushed the share towards 5.8% mark in 2012, as a result of removal of ICT manufacturing processes from the country.

One of the biggest challenges of the research was to collect proper data. That was done with advised assistance of Czech Statistical Offices' staff. Collected data allowed fulfilling all the objectives of the thesis within the analysis. Real contribution of the thesis lies mainly in detailed description of foreign trade with ICT goods in the Czech Republic in broad perspective, execution of forecasting of ICT goods export and import in the Czech Republic for years 2015, 2016 and 2017, and verification of relation between Czech ICT goods import and Czech GDP, respectively Czech ICT goods export and GDP in the euro area.

Topic of foreign trade with ICT development is broad enough to be further analysed. Author of the thesis sees opportunity in analysing relation between ICT goods market and processing industries, for example worldwide semiconductor market. The matter may be topic of other diploma thesis.

6 References

ACS, Z.J., DE GROOT, H. AND NIJKAMP, P. *The Emergence of the Knowledge Economy* [online]. 2002 [cit. 2014-11-30]. ISBN 3-540-43722-3. Available from: <http://books.google.cz/books?id=33qYWb_sJ3oC&pg=PA246&dq=ICT+knowledge+economy&hl=en&sa=X&ei=94h3VKX0HcjqaLjsgtAN&ved=0CE0Q6AEwCA#v=onepage&q=ICT%20knowledge%20economy&f=false>.

ARLT, J. AND ARLTOVÁ, M. *Ekonomické časové řady: [vlastnosti, metody modelování, příklady a aplikace]*. 1st ed. Praha: Grada, 2007, 285 p. ISBN 978-80-247-1319-9.

BOWEN, H., HOLLANDER A., AND VIAENE, J. *Applied International Trade Analysis*. 1st ed. Basingstoke: Macmillan Press, 1998, 654 p. ISBN 0-333-61458-5.

BROOKS, CH. *Introductory Econometrics for Finance*. 2nd ed. Leiden: Cambridge University Press, 2008. ISBN 978-051-1398-483.

BRYCHTA, J. *Hypoteční krize a její dopad na americký dolar.* Finance.cz [online]. 7. 3. 2008 [cit. 2014-11-30]. Available from: <http://www.finance.cz/zpravy/finance/154527-hypotecni-krize-a-jeji-dopad-na-americky-dolar/>.

CZECH STATISTICAL OFFICE. *ICT sektor* [online]. [cit. 2014-11-16]. Available from: <http://www.czso.cz/csu/redakce.nsf/i/ict_sektor>. (CSO, 2014a)

CZECH STATISTICAL OFFICE. *Definice a vymezení ICT sektoru* [online]. [cit. 2014-11-16]. Available from: <http://www.czso.cz/csu/redakce.nsf/i/definice_a_vymezeni_ict_sektoru/$File/definice_a_vymezeni_ict_sektoru.pdf>. (CSO, 2014b)

CZECH STATISTICAL OFFICE. *Informační ekonomika* [online]. [cit. 2014-11-17]. Availabe from: <http://www.czso.cz/csu/redakce.nsf/i/informacni_ekonomika>. (CSO, 2014c)

CZECHINVEST. *ICT* [online]. [cit. 2014-11-20]. Available from: <http://www.czechinvest.org/en/ict>.

DANA, L., WELPE, I., HAN, M. AND RATTEN, V. *Handbook of Research on European Business and Entrepreneurship* [online]. 2008 [cit. 2014-11-21]. ISBN 978-1-84542-501-2. Available from: <http://books.google.cz/books?id=OsAMhoDSFQwC&pg=PA671&dq=definition+of+internationalization&hl=en&sa=X&ei=rNRvVNPEJcfTaM2HgfgK&ved=0CDQQ6AEwAg#v=onepage&q=definition%20of%20internationalization&f=false>.

DOLFSMA, W. AND SOETE, L. *Understanding the Dynamics of a Knowledge Economy*. Cheltenham, UK: Edward Elgar, 2006, 263 p. ISBN 1-84542-307-0.

GALBRAITH, J. AND HALE, T. *Income Distribution and the Information Technology Bubble* [online]. 2004 [cit. 2015-04-18]. Available from: <http://utip.gov.utexas.edu/papers/utip_27.pdf>.

GREENE, H. *Econometric Analysis*. 5th ed. Upper Saddle River: Prentice Hall, 2003, 1026 p. ISBN 0-13-066189-9.

GUJARATI, N AND PORTER, C. *Basic Econometrics*. 5th ed. Boston: McGraw-Hill Irwin, 2009, 922 p. ISBN 978-007-127625-2.

HINDLS, R., HRONOVÁ, S. AND SEGER J. *Statistika pro ekonomy*. 2nd edition. Praha: Professional Publishing, 2002, 415 p. ISBN 80-86419-30-4.

HUŠEK, R. AND PELIKÁN, J. *Aplikovaná ekonometrie: teorie a praxe*. 1st edition. Praha: Professional Publishing, 2003, 263 p. ISBN 80-86419-29-0.

HUŠEK, R. *Ekonometrická analýza*. 1st edition. Praha: Ekopress, 1999, 303 p. ISBN 80-86119-19-x.

JOVANOVIC, M. *The Economics of Internal Integration* [online]. 2006 [cit. 2014-11-21]. ISBN 978-1-84542-271-4. Available from: <http://books.google.cz/books?id=Q_Lb2Z_HtJMC&pg=PA16&dq=integration+definition&hl=en&sa=X&ei=L6tvVMmEJc_naraXgOAE&sqi=2&ved=0CDcQ6AEwBQ#v=onepage&q=integration%20definition&f=false>.

KOHOUT, P. *Finance po krizi: důsledky hospodářské recese a sco bude dál.* 2nd edition. Prague: Grada, 2010, 266 p. ISBN 978-80-247-3583-2.

KÖNIG, P., LACINA, L. AND PŘENOSIL, J. *Učebnice evropské integrace*. 2nd edition, Brno: Barrister & Principal, 2007, 414 p. ISBN 978-80-7364-044-6.

LÜTKEPOHL, H. *New Introduction to Multiple Time Series Analysis.* Berlin: Heidelberg New York, 2005, 764 p. ISBN 3-540-40172-5.

MARINOV, M. AND MARINOVA, S. *Impacts of Emerging Economies and Firms on International Business* [online]. 2012 [cit. 2014-11-21]. ISBN 978-1-137-03253-9. Available from: <http://books.google.cz/books?id=TT-3zCGLscsC&pg=PA49&dq=definition+of+internationalization&hl=en&sa=X&ei=TNdvVI2AMuHXyQOJjoLoDw&ved=0CDgQ6AEwAzgK#v=onepage&q=definition%20of%20internationalization&f=false>.

MARTÍ, J. AND CABRITA M. *Entrepreneurial Excellence in the Knowledge Economy* [online]. 2012 [cit. 2014-11-30]. ISBN 978-1-137-02406-0. Available from: <http://books.google.cz/books?id=F7cLJtVjeqIC&pg=PA24&dq=ICT+knowledge+economy&hl=en&sa=X&ei=94h3VKX0HcjqaLjsgtAN&ved=0CCwQ6AEwAg#v=onepage&q=ICT%20knowledge%20economy&f=false>.

MOLLE, W. *The Economics of European Integration* [online]. 2006 [cit. 2014-11-21]. ISBN 13-978-0-7546-4812-5. Available from: <http://books.google.cz/books?id=XLDeOlqKlwwC&printsec=frontcover&dq=integration+theory&hl=en&sa=X&ei=Ga9vVKvRJM3naNfhgvgC&ved=0CCsQ6AEwAg#v=onepage&q=integration%20theory&f=false>.

OECD (2010), *OECD Information Technology Outlook 2010*, OECD Publishing. ISBN 978-92-64-08873-3. Available from: <http://dx.doi.org/10.1787/it_outlook-2010-en>.

PICHANIČ, M. *Mezinárodní management a globalizace.* 1st edition, Praha: C.H. Beck, 2004. 176 p. ISBN 80-717-9886-X.

POLOLÁNÍK, L. *Finanční krize – jak to začalo.* Finance.cz [online]. 14. 10. 2008 [cit. 2014-11-30]. Available from: <http://www.finance.cz/zpravy/finance/195113-financni-krize-jak-to-zacalo/>.

ŘEŽÁBEK, P. *Dopady finanční krize na podnikání v ČR* [online]. 2009 [cit. 2014-11-30]. Available from: <http://www.cnb.cz/miranda2/export/sites/www.cnb.cz/cs/verejnost/pro_media/konference_projevy/vystoupeni_projevy/download/rezabek_20090317_caki.pdf>.

RITZER, G. *Globalization: A Basic Text* [online]. 2010 [cit. 2014-11-20]. ISBN 978-1-4051-3271-8. Available from: <http://books.google.cz/books?id=52o86uUBRRsC&printsec=frontcover&dq=ritzer&hl=en&sa=X&ei=MlduVLKoAsX8ygOVtYDoCA&redir_esc=y#v=onepage&q=ritzer&f=false>.

ROGOWSKY, R., LINKINS, L. AND TSUJI, K. *Trade Liberalization: Fears and Facts* [online]. 2001 [cit. 2014-11-23]. ISBN 0-275-97402-2. Available from: <http://books.google.cz/books?id=MPBQTMMqBVUC&pg=PA5&dq=trade+liberalization&hl=en&sa=X&ei=-EFyVJj-HJ4L8aJikgKAL&redir_esc=y#v=onepage&q=trade%20liberalization&f=false>

SINGER, M. *Česká ekonomika a krize* [online]. [cit. 2014-11-28]. Available from: <http://www.cnb.cz/miranda2/export/sites/www.cnb.cz/cs/verejnost/pro_media/konference_projevy/vystoupeni_projevy/download/singer_20100115_khk_plzen.pdf>.

STEGER, M. *Globalization* [online]. 2010 [cit. 2014-11-20]. ISBN 978-1-4027-6878-1. Available from: <http://books.google.cz/books?id=1ExsTX8z4j8C&printsec=frontcover&dq=globalization&hl=en&sa=X&ei=11puVJKWOqr9ywPMhYCIBA&ved=0CE8Q6AEwCA#v=onepage&q=globalization&f=false>.

SÝKORA, L. *Globalizace a její společenské a geografické důsledky* [online]. 2011 [cit. 2014-11-21]. Available from: <http://web.natur.cuni.cz/~sykora/pdf/Sykora_2000_Globalizace.pdf>.

THE VISEGRAD GROUP. *About the Visegrad Group* [online]. 2014 [cit. 2015-04-18]. Available from: <http://www.visegradgroup.eu/about>.

THIRLWALL, A. *Growth & Development with Special Reference to Developing Economies*. 8th ed. New York: Palgrave Macmillan, 2006, 685 p. ISBN 1-4039-9600-8.

THIRLWALL, A. AND PACHECO-LOPEZ, P. *Trade Liberalisation and the Poverty of Nations* [online]. 2008 [cit. 2014-11-23]. ISBN 978-1-84720-822-4. Available from: <http://books.google.cz/books?id=x_vT8uERrZQC&pg=PA50&dq=trade+liberalisation+definition&hl=en&sa=X&ei=RERyVIG0CqT4yQOv_IFY&redir_esc=y#v=snippet&q=can%20be%20defined&f=false>.

WOOLDRIDGE, M. *Introductory Econometrics: A Modern Approach*. 4th ed. Mason, Ohio: South-Western, 2008, 865 p. ISBN 978-0-324-66054-8.

WORLD BANK PUBLICATIONS. *Building Knowledge Economies: Advanced Strategies for Development* [online]. 2007 [cit. 2014-11-30]. ISBN 978-0-8213-6958-6. Available from: <http://books.google.cz/books?id=cZyvZX0JCfAC&pg=PA101&dq=ICT+knowledge+economy&hl=en&sa=X&ei=94h3VKX0HcjqaLjsgtAN&ved=0CDcQ6AEwBA#v=onepage&q=ICT%20knowledge%20economy&f=false>.

Appendices

A Source data – foreign trade with ICT goods

Period	Export (CZK)	Import (CZK)	Period	Export (CZK)	Import (CZK)
I.93	310 047 657	1 847 256 652	I.97	1 246 987 356	5 605 665 473
II.93	929 599 485	2 843 689 157	II.97	1 268 209 291	5 046 621 266
III.93	789 367 132	3 104 583 593	III.97	1 445 223 058	4 861 613 776
IV.93	566 816 699	2 513 463 699	IV.97	1 573 910 616	5 022 634 860
V.93	655 826 827	2 650 192 309	V.97	1 404 947 373	4 378 720 770
VI.93	677 071 147	2 665 433 714	VI.97	1 644 345 850	5 611 721 049
VII.93	587 058 458	3 003 593 949	VII.97	1 852 700 506	5 350 211 850
VIII.93	488 458 794	2 598 039 339	VIII.97	1 303 883 357	4 666 141 915
IX.93	720 638 994	3 136 925 440	IX.97	1 925 104 768	5 077 224 609
X.93	628 989 263	3 207 391 791	X.97	2 035 575 804	6 195 212 217
XI.93	670 688 707	3 834 000 616	XI.97	2 042 095 365	6 555 171 957
XII.93	862 156 678	5 958 368 522	XII.97	2 091 212 515	8 090 171 553
I.94	848 441 218	2 313 741 084	I.98	1 589 022 876	5 566 066 359
II.94	674 496 053	3 011 788 313	II.98	1 998 293 371	5 636 408 500
III.94	779 181 244	3 517 527 936	III.98	1 954 054 136	5 637 642 435
IV.94	760 091 986	3 027 071 538	IV.98	2 133 704 541	5 498 475 255
V.94	879 884 614	3 272 370 780	V.98	1 685 604 228	4 967 331 330
VI.94	888 835 757	3 872 564 005	VI.98	1 950 341 661	4 981 224 601
VII.94	670 461 081	3 362 722 290	VII.98	2 115 640 624	5 047 420 528
VIII.94	745 607 351	3 252 949 779	VIII.98	1 701 988 601	4 332 402 047
IX.94	1 115 183 406	4 122 945 977	IX.98	2 218 955 419	6 019 811 958
X.94	1 037 634 376	3 501 987 039	X.98	2 596 056 449	5 993 780 472
XI.94	1 297 051 728	4 362 004 522	XI.98	2 399 373 792	7 525 995 207
XII.94	1 286 428 743	5 313 605 488	XII.98	2 210 841 250	8 129 874 182
I.95	1 071 777 477	3 989 473 901	I.99	1 562 027 652	5 308 271 459
II.95	1 069 328 432	3 574 232 073	II.99	1 683 484 235	4 781 715 256
III.95	1 317 471 207	4 408 840 491	III.99	2 135 827 410	7 132 424 785
IV.95	1 129 116 836	4 011 738 626	IV.99	2 075 843 637	5 292 731 733
V.95	1 253 483 144	4 906 752 917	V.99	2 068 947 224	5 931 069 217
VI.95	1 297 123 534	4 176 719 313	VI.99	2 157 808 099	6 104 914 369
VII.95	993 144 037	3 922 549 077	VII.99	1 908 259 642	5 558 798 057
VIII.95	1 084 639 836	3 841 930 054	VIII.99	2 358 455 629	5 632 245 278
IX.95	1 200 368 475	4 085 347 815	IX.99	2 631 827 604	6 444 431 588
X.95	1 465 355 599	5 450 274 897	X.99	2 896 960 823	7 589 684 051
XI.95	1 585 614 214	5 498 231 973	XI.99	2 777 070 373	9 396 185 410
XII.95	1 297 091 136	6 843 421 870	XII.99	3 306 214 304	10 975 792 153
I.96	1 363 515 631	5 047 593 244	I.00	2 224 416 542	8 224 064 869
II.96	1 224 381 515	4 477 626 934	II.00	3 099 389 644	7 838 286 885
III.96	1 316 414 902	5 125 028 669	III.00	3 432 360 983	8 671 659 256
IV.96	1 349 501 954	4 705 383 400	IV.00	3 838 770 465	7 667 822 381
V.96	1 371 936 840	5 386 328 936	V.00	4 215 662 481	8 073 374 020
VI.96	1 285 549 424	4 402 041 987	VI.00	3 769 188 413	9 375 268 620
VII.96	1 314 162 132	5 257 942 367	VII.00	4 062 239 665	8 519 220 636
VIII.96	1 141 175 121	4 733 916 183	VIII.00	3 656 595 730	9 752 744 251
IX.96	1 422 323 751	5 079 117 238	IX.00	5 255 194 048	10 203 462 061
X.96	1 719 106 945	6 450 073 798	X.00	5 482 858 162	14 468 075 009
XI.96	1 683 521 174	6 120 513 570	XI.00	6 980 890 751	16 530 756 500
XII.96	1 273 323 487	6 468 559 600	XII.00	6 619 875 112	14 187 112 221

Period	Export (CZK)	Import (CZK)	Period	Export (CZK)	Import (CZK)
I.01	6 550 557 234	12 079 090 799	I.05	13 856 826 625	12 455 341 059
II.01	6 947 570 551	12 870 007 468	II.05	12 201 109 048	13 205 676 909
III.01	6 859 487 476	11 622 459 924	III.05	15 366 407 693	13 651 007 800
IV.01	8 923 908 999	11 173 356 412	IV.05	15 618 708 437	13 387 825 054
V.01	9 846 583 905	10 201 961 779	V.05	15 237 287 167	15 700 329 649
VI.01	8 184 252 027	9 998 608 403	VI.05	16 607 564 444	16 090 119 097
VII.01	6 708 077 223	12 123 656 804	VII.05	16 109 616 223	15 284 871 998
VIII.01	5 824 295 659	11 669 799 046	VIII.05	18 761 511 342	18 372 896 620
IX.01	9 830 258 999	12 289 771 908	IX.05	20 892 921 392	20 704 065 838
X.01	9 432 893 400	16 761 606 768	X.05	23 945 979 338	23 221 193 300
XI.01	10 859 162 315	17 996 920 023	XI.05	26 107 945 477	27 409 390 010
XII.01	10 012 326 353	17 740 303 427	XII.05	21 135 605 853	22 579 391 501
I.02	11 691 511 932	13 654 479 203	I.06	21 669 517 486	19 487 329 140
II.02	9 780 324 298	12 174 497 487	II.06	17 884 651 019	17 523 195 624
III.02	11 526 866 940	16 371 998 321	III.06	21 115 389 196	22 031 942 066
IV.02	9 611 008 154	12 287 798 750	IV.06	19 169 063 348	19 749 294 535
V.02	8 650 131 735	13 155 585 393	V.06	20 475 767 958	20 508 442 555
VI.02	7 868 643 304	11 160 778 602	VI.06	20 949 425 034	21 467 224 224
VII.02	8 130 434 020	11 298 461 816	VII.06	19 053 320 838	19 482 088 911
VIII.02	8 848 638 315	10 416 584 084	VIII.06	22 048 129 938	23 068 106 366
IX.02	13 605 159 331	15 727 549 381	IX.06	25 140 109 497	27 490 487 526
X.02	17 688 889 096	17 854 147 962	X.06	32 866 588 798	34 269 543 498
XI.02	16 751 469 534	17 228 257 627	XI.06	34 460 108 264	35 883 482 272
XII.02	12 824 607 585	16 429 570 578	XII.06	29 377 674 370	29 910 086 381
I.03	14 810 557 679	15 914 564 918	I.07	28 539 539 072	28 139 535 996
II.03	10 261 196 152	13 422 958 848	II.07	27 615 149 276	25 586 181 100
III.03	15 456 463 621	13 545 394 555	III.07	30 839 082 902	26 342 865 728
IV.03	11 087 749 822	13 448 276 722	IV.07	26 710 774 734	26 907 715 104
V.03	10 783 465 366	11 942 204 789	V.07	27 728 550 120	26 942 376 360
VI.03	9 689 273 435	12 696 640 630	VI.07	29 649 954 717	29 147 538 013
VII.03	10 737 025 474	12 762 927 920	VII.07	25 787 625 874	28 329 910 519
VIII.03	11 101 777 205	11 398 480 222	VIII.07	30 421 657 856	31 281 626 719
IX.03	11 954 704 074	15 027 877 573	IX.07	38 068 236 493	32 661 113 525
X.03	14 425 758 104	19 772 390 071	X.07	40 905 816 586	42 373 302 262
XI.03	13 626 019 788	19 269 622 267	XI.07	42 979 915 433	41 483 443 791
XII.03	15 310 446 316	20 247 105 736	XII.07	34 096 293 321	32 166 448 743
I.04	10 718 355 313	15 257 680 105	I.08	34 152 708 524	32 670 920 151
II.04	15 157 248 784	14 334 262 970	II.08	31 559 698 282	29 130 768 958
III.04	13 620 704 344	17 503 718 183	III.08	34 353 072 091	30 457 130 739
IV.04	24 573 942 028	19 928 835 075	IV.08	31 511 277 633	31 365 149 988
V.04	15 078 460 985	15 023 398 630	V.08	31 756 226 720	28 030 377 024
VI.04	15 553 559 976	18 162 299 973	VI.08	30 970 620 567	27 928 222 382
VII.04	13 868 505 006	16 052 368 675	VII.08	31 211 901 425	27 339 707 833
VIII.04	15 886 445 001	14 720 440 289	VIII.08	28 249 135 239	25 503 044 815
IX.04	18 971 588 882	18 568 292 132	IX.08	35 713 699 009	33 984 890 063
X.04	22 251 326 753	23 200 003 791	X.08	39 601 753 451	40 153 276 934
XI.04	23 464 250 228	24 642 130 581	XI.08	37 958 502 349	39 092 485 318
XII.04	18 696 952 521	19 454 838 816	XII.08	31 659 112 836	30 203 773 401

Period	Export (CZK)	Import (CZK)	Period	Export (CZK)	Import (CZK)
I.09	28 169 169 216	28 650 426 032	I.12	43 272 376 506	31 856 429 273
II.09	25 502 482 713	24 253 917 507	II.12	34 294 108 152	32 775 451 361
III.09	31 439 181 918	30 454 834 088	III.12	42 011 833 492	34 638 797 821
IV.09	27 478 673 278	26 724 107 157	IV.12	37 733 672 616	37 391 180 189
V.09	25 019 761 378	22 763 717 999	V.12	36 358 056 051	32 951 476 211
VI.09	27 919 844 144	25 601 862 366	VI.12	39 104 639 653	38 265 864 975
VII.09	27 762 184 904	25 819 206 278	VII.12	39 110 758 041	31 768 951 118
VIII.09	24 292 140 229	24 429 499 821	VIII.12	34 943 517 930	33 755 311 322
IX.09	31 073 439 904	31 149 279 227	IX.12	40 155 518 793	37 549 823 099
X.09	32 149 975 009	33 893 753 594	X.12	47 276 171 692	36 030 485 608
XI.09	34 228 848 164	35 423 412 567	XI.12	45 601 548 256	39 495 084 054
XII.09	30 268 554 989	33 228 458 261	XII.12	40 739 323 282	41 650 992 170
I.10	31 436 755 024	28 843 130 134	I.13	39 914 562 454	27 781 852 277
II.10	29 746 620 575	27 451 061 615	II.13	31 757 660 198	30 743 039 922
III.10	34 741 631 556	34 104 571 783	III.13	34 378 678 356	33 665 502 147
IV.10	30 606 120 276	32 666 481 819	IV.13	37 041 204 358	32 729 200 770
V.10	32 962 814 113	34 933 889 169	V.13	30 227 833 350	31 766 690 969
VI.10	37 932 165 314	41 219 991 227	VI.13	33 313 584 654	29 512 789 612
VII.10	37 133 890 019	38 380 189 265	VII.13	36 913 969 165	31 003 608 661
VIII.10	33 800 474 739	38 825 562 924	VIII.13	31 478 559 724	28 422 596 071
IX.10	41 505 622 068	45 942 574 859	IX.13	37 840 225 920	34 015 549 243
X.10	45 109 461 318	48 743 236 112	X.13	44 302 744 497	40 938 289 273
XI.10	44 519 607 190	49 505 604 456	XI.13	44 377 369 156	42 678 094 658
XII.10	41 406 147 546	47 262 747 844	XII.13	48 206 797 827	45 968 293 948
I.11	38 768 846 499	37 472 196 241	I.14	45 160 956 103	35 318 773 096
II.11	31 941 340 190	33 970 835 705	II.14	35 698 860 957	37 360 424 364
III.11	44 942 742 630	38 782 052 927	III.14	40 994 708 675	35 275 237 777
IV.11	39 968 567 446	35 935 490 533	IV.14	40 562 152 667	35 160 481 537
V.11	37 276 951 929	35 533 620 096	V.14	38 848 439 920	34 556 416 083
VI.11	39 997 603 294	39 599 148 593	VI.14	41 795 338 727	37 688 571 976
VII.11	39 465 097 099	33 183 140 346	VII.14	44 873 953 062	37 706 676 370
VIII.11	36 062 388 939	37 694 399 632	VIII.14	36 596 648 000	34 678 268 387
IX.11	39 658 989 378	36 135 728 731	IX.14	47 449 478 889	42 301 008 592
X.11	50 513 842 817	38 419 998 314	X.14	50 013 792 901	46 267 566 191
XI.11	45 539 903 044	47 991 880 599	XI.14	51 736 964 490	51 147 388 157
XII.11	40 270 580 845	38 719 314 228	XII.14	52 730 582 090	49 582 327 691

B ICT goods import – elementary characteristics

Period	y_t	d_t	k_t	δ_t
I.93	1 847 256 652	-	-	-
II.93	2 843 689 157	996 432 505	1.539412	0.539412
III.93	3 104 583 593	260 894 436	1.091745	0.091745
IV.93	2 513 463 699	-591 119 894	0.809598	-0.1904
V.93	2 650 192 309	136 728 610	1.054398	0.054398
VI.93	2 665 433 714	15 241 405	1.005751	0.005751
VII.93	3 003 593 949	338 160 235	1.126869	0.126869
VIII.93	2 598 039 339	-405 554 610	0.864977	-0.13502
IX.93	3 136 925 440	538 886 101	1.20742	0.20742
X.93	3 207 391 791	70 466 351	1.022464	0.022464
XI.93	3 834 000 616	626 608 825	1.195364	0.195364
XII.93	5 958 368 522	2 124 367 906	1.554086	0.554086
I.94	2 313 741 084	-3 644 627 438	0.388318	-0.61168
II.94	3 011 788 313	698 047 229	1.301696	0.301696
III.94	3 517 527 936	505 739 623	1.16792	0.16792
IV.94	3 027 071 538	-490 456 398	0.860568	-0.13943
V.94	3 272 370 780	245 299 242	1.081035	0.081035
VI.94	3 872 564 005	600 193 225	1.183412	0.183412
VII.94	3 362 722 290	-509 841 715	0.868345	-0.13165
VIII.94	3 252 949 779	-109 772 511	0.967356	-0.03264
IX.94	4 122 945 977	869 996 198	1.267448	0.267448
X.94	3 501 987 039	-620 958 938	0.84939	-0.15061
XI.94	4 362 004 522	860 017 483	1.24558	0.24558
XII.94	5 313 605 488	951 600 966	1.218157	0.218157
I.95	3 989 473 901	-1 324 131 587	0.750804	-0.2492
II.95	3 574 232 073	-415 241 828	0.895916	-0.10408
III.95	4 408 840 491	834 608 418	1.233507	0.233507
IV.95	4 011 738 626	-397 101 865	0.909931	-0.09007
V.95	4 906 752 917	895 014 291	1.223099	0.223099
VI.95	4 176 719 313	-730 033 604	0.851219	-0.14878
VII.95	3 922 549 077	-254 170 236	0.939146	-0.06085
VIII.95	3 841 930 054	-80 619 023	0.979447	-0.02055
IX.95	4 085 347 815	243 417 761	1.063358	0.063358
X.95	5 450 274 897	1 364 927 082	1.334103	0.334103
XI.95	5 498 231 973	47 957 076	1.008799	0.008799
XII.95	6 843 421 870	1 345 189 897	1.244659	0.244659
I.96	5 047 593 244	-1 795 828 626	0.737583	-0.26242
II.96	4 477 626 934	-569 966 310	0.887082	-0.11292
III.96	5 125 028 669	647 401 735	1.144586	0.144586
IV.96	4 705 383 400	-419 645 269	0.918118	-0.08188
V.96	5 386 328 936	680 945 536	1.144716	0.144716
VI.96	4 402 041 987	-984 286 949	0.817262	-0.18274

Period	y_t	d_t	k_t	δ_t
VII.96	5 257 942 367	855 900 380	1.194433	0.194433
VIII.96	4 733 916 183	-524 026 184	0.900336	-0.09966
IX.96	5 079 117 238	345 201 055	1.072921	0.072921
X.96	6 450 073 798	1 370 956 560	1.26992	0.26992
XI.96	6 120 513 570	-329 560 228	0.948906	-0.05109
XII.96	6 468 559 600	348 046 030	1.056865	0.056865
I.97	5 605 665 473	-862 894 127	0.866602	-0.1334
II.97	5 046 621 266	-559 044 207	0.900272	-0.09973
III.97	4 861 613 776	-185 007 490	0.96334	-0.03666
IV.97	5 022 634 860	161 021 084	1.033121	0.033121
V.97	4 378 720 770	-643 914 090	0.871798	-0.1282
VI.97	5 611 721 049	1 233 000 279	1.281589	0.281589
VII.97	5 350 211 850	-261 509 199	0.953399	-0.0466
VIII.97	4 666 141 915	-684 069 935	0.872142	-0.12786
IX.97	5 077 224 609	411 082 694	1.088099	0.088099
X.97	6 195 212 217	1 117 987 608	1.220197	0.220197
XI.97	6 555 171 957	359 959 740	1.058103	0.058103
XII.97	8 090 171 553	1 534 999 596	1.234166	0.234166
I.98	5 566 066 359	-2 524 105 194	0.688004	-0.312
II.98	5 636 408 500	70 342 141	1.012638	0.012638
III.98	5 637 642 435	1 233 935	1.000219	0.000219
IV.98	5 498 475 255	-139 167 180	0.975315	-0.02469
V.98	4 967 331 330	-531 143 925	0.903402	-0.0966
VI.98	4 981 224 601	13 893 271	1.002797	0.002797
VII.98	5 047 420 528	66 195 927	1.013289	0.013289
VIII.98	4 332 402 047	-715 018 481	0.85834	-0.14166
IX.98	6 019 811 958	1 687 409 911	1.389486	0.389486
X.98	5 993 780 472	-26 031 486	0.995676	-0.00432
XI.98	7 525 995 207	1 532 214 735	1.255634	0.255634
XII.98	8 129 874 182	603 878 975	1.080239	0.080239
I.99	5 308 271 459	-2 821 602 723	0.652934	-0.34707
II.99	4 781 715 256	-526 556 203	0.900805	-0.0992
III.99	7 132 424 785	2 350 709 529	1.491604	0.491604
IV.99	5 292 731 733	-1 839 693 052	0.742066	-0.25793
V.99	5 931 069 217	638 337 484	1.120606	0.120606
VI.99	6 104 914 369	173 845 152	1.029311	0.029311
VII.99	5 558 798 057	-546 116 312	0.910545	-0.08946
VIII.99	5 632 245 278	73 447 221	1.013213	0.013213
IX.99	6 444 431 588	812 186 310	1.144203	0.144203
X.99	7 589 684 051	1 145 252 463	1.177712	0.177712
XI.99	9 396 185 410	1 806 501 359	1.238021	0.238021
XII.99	10 975 792 153	1 579 606 743	1.168111	0.168111
I.00	8 224 064 869	-2 751 727 284	0.749291	-0.25071
II.00	7 838 286 885	-385 777 984	0.953092	-0.04691
III.00	8 671 659 256	833 372 371	1.106321	0.106321
IV.00	7 667 822 381	-1 003 836 875	0.884239	-0.11576
V.00	8 073 374 020	405 551 639	1.05289	0.05289
VI.00	9 375 268 620	1 301 894 600	1.161258	0.161258

Period	y_t	d_t	k_t	δ_t
VII.00	8 519 220 636	-856 047 984	0.908691	-0.09131
VIII.00	9 752 744 251	1 233 523 615	1.144793	0.144793
IX.00	10 203 462 061	450 717 810	1.046214	0.046214
X.00	14 468 075 009	4 264 612 948	1.417957	0.417957
XI.00	16 530 756 500	2 062 681 491	1.142568	0.142568
XII.00	14 187 112 221	-2 343 644 279	0.858225	-0.14177
I.01	12 079 090 799	-2 108 021 422	0.851413	-0.14859
II.01	12 870 007 468	790 916 669	1.065478	0.065478
III.01	11 622 459 924	-1 247 547 544	0.903066	-0.09693
IV.01	11 173 356 412	-449 103 512	0.961359	-0.03864
V.01	10 201 961 779	-971 394 633	0.913062	-0.08694
VI.01	9 998 608 403	-203 353 376	0.980067	-0.01993
VII.01	12 123 656 804	2 125 048 401	1.212534	0.212534
VIII.01	11 669 799 046	-453 857 758	0.962564	-0.03744
IX.01	12 289 771 908	619 972 862	1.053126	0.053126
X.01	16 761 606 768	4 471 834 860	1.363866	0.363866
XI.01	17 996 920 023	1 235 313 255	1.073699	0.073699
XII.01	17 740 303 427	-256 616 596	0.985741	-0.01426
I.02	13 654 479 203	-4 085 824 224	0.769687	-0.23031
II.02	12 174 497 487	-1 479 981 716	0.891612	-0.10839
III.02	16 371 998 321	4 197 500 834	1.344778	0.344778
IV.02	12 287 798 750	-4 084 199 571	0.750538	-0.24946
V.02	13 155 585 393	867 786 643	1.070622	0.070622
VI.02	11 160 778 602	-1 994 806 791	0.848368	-0.15163
VII.02	11 298 461 816	137 683 214	1.012336	0.012336
VIII.02	10 416 584 084	-881 877 732	0.921947	-0.07805
IX.02	15 727 549 381	5 310 965 297	1.509857	0.509857
X.02	17 854 147 962	2 126 598 581	1.135215	0.135215
XI.02	17 228 257 627	-625 890 335	0.964944	-0.03506
XII.02	16 429 570 578	-798 687 049	0.953641	-0.04636
I.03	15 914 564 918	-515 005 660	0.968654	-0.03135
II.03	13 422 958 848	-2 491 606 070	0.843439	-0.15656
III.03	13 545 394 555	122 435 707	1.009121	0.009121
IV.03	13 448 276 722	-97 117 833	0.99283	-0.00717
V.03	11 942 204 789	-1 506 071 933	0.88801	-0.11199
VI.03	12 696 640 630	754 435 841	1.063174	0.063174
VII.03	12 762 927 920	66 287 290	1.005221	0.005221
VIII.03	11 398 480 222	-1 364 447 698	0.893093	-0.10691
IX.03	15 027 877 573	3 629 397 351	1.318411	0.318411
X.03	19 772 390 071	4 744 512 498	1.315714	0.315714
XI.03	19 269 622 267	-502 767 804	0.974572	-0.02543
XII.03	20 247 105 736	977 483 469	1.050727	0.050727
I.04	15 257 680 105	-4 989 425 631	0.753573	-0.24643
II.04	14 334 262 970	-923 417 135	0.939479	-0.06052
III.04	17 503 718 183	3 169 455 213	1.22111	0.22111
IV.04	19 928 835 075	2 425 116 892	1.138549	0.138549
V.04	15 023 398 630	-4 905 436 445	0.753852	-0.24615
VI.04	18 162 299 973	3 138 901 343	1.208934	0.208934

Period	y_t	d_t	k_t	δ_t
VII.04	16 052 368 675	-2 109 931 298	0.883829	-0.11617
VIII.04	14 720 440 289	-1 331 928 386	0.917026	-0.08297
IX.04	18 568 292 132	3 847 851 843	1.261395	0.261395
X.04	23 200 003 791	4 631 711 659	1.249442	0.249442
XI.04	24 642 130 581	1 442 126 790	1.062161	0.062161
XII.04	19 454 838 816	-5 187 291 765	0.789495	-0.21051
I.05	12 455 341 059	-6 999 497 757	0.640218	-0.35978
II.05	13 205 676 909	750 335 850	1.060242	0.060242
III.05	13 651 007 800	445 330 891	1.033723	0.033723
IV.05	13 387 825 054	-263 182 746	0.980721	-0.01928
V.05	15 700 329 649	2 312 504 595	1.172732	0.172732
VI.05	16 090 119 097	389 789 448	1.024827	0.024827
VII.05	15 284 871 998	-805 247 099	0.949954	-0.05005
VIII.05	18 372 896 620	3 088 024 622	1.202031	0.202031
IX.05	20 704 065 838	2 331 169 218	1.126881	0.126881
X.05	23 221 193 300	2 517 127 462	1.121576	0.121576
XI.05	27 409 390 010	4 188 196 710	1.180361	0.180361
XII.05	22 579 391 501	-4 829 998 509	0.823783	-0.17622
I.06	19 487 329 140	-3 092 062 361	0.863058	-0.13694
II.06	17 523 195 624	-1 964 133 516	0.89921	-0.10079
III.06	22 031 942 066	4 508 746 442	1.257302	0.257302
IV.06	19 749 294 535	-2 282 647 531	0.896394	-0.10361
V.06	20 508 442 555	759 148 020	1.038439	0.038439
VI.06	21 467 224 224	958 781 669	1.046751	0.046751
VII.06	19 482 088 911	-1 985 135 313	0.907527	-0.09247
VIII.06	23 068 106 366	3 586 017 455	1.184067	0.184067
IX.06	27 490 487 526	4 422 381 160	1.19171	0.19171
X.06	34 269 543 498	6 779 055 972	1.246596	0.246596
XI.06	35 883 482 272	1 613 938 774	1.047095	0.047095
XII.06	29 910 086 381	-5 973 395 891	0.833534	-0.16647
I.07	28 139 535 996	-1 770 550 385	0.940804	-0.0592
II.07	25 586 181 100	-2 553 354 896	0.909261	-0.09074
III.07	26 342 865 728	756 684 628	1.029574	0.029574
IV.07	26 907 715 104	564 849 376	1.021442	0.021442
V.07	26 942 376 360	34 661 256	1.001288	0.001288
VI.07	29 147 538 013	2 205 161 653	1.081847	0.081847
VII.07	28 329 910 519	-817 627 494	0.971949	-0.02805
VIII.07	31 281 626 719	2 951 716 200	1.104191	0.104191
IX.07	32 661 113 525	1 379 486 806	1.044099	0.044099
X.07	42 373 302 262	9 712 188 737	1.297362	0.297362
XI.07	41 483 443 791	-889 858 471	0.979	-0.021
XII.07	32 166 448 743	-9 316 995 048	0.775404	-0.2246
I.08	32 670 920 151	504 471 408	1.015683	0.015683
II.08	29 130 768 958	-3 540 151 193	0.891642	-0.10836
III.08	30 457 130 739	1 326 361 781	1.045531	0.045531
IV.08	31 365 149 988	908 019 249	1.029813	0.029813
V.08	28 030 377 024	-3 334 772 964	0.893679	-0.10632
VI.08	27 928 222 382	-102 154 642	0.996356	-0.00364

Period	y_t	d_t	k_t	δ_t
VII.08	27 339 707 833	-588 514 549	0.978928	-0.02107
VIII.08	25 503 044 815	-1 836 663 018	0.932821	-0.06718
IX.08	33 984 890 063	8 481 845 248	1.332582	0.332582
X.08	40 153 276 934	6 168 386 871	1.181504	0.181504
XI.08	39 092 485 318	-1 060 791 616	0.973581	-0.02642
XII.08	30 203 773 401	-8 888 711 917	0.772624	-0.22738
I.09	28 650 426 032	-1 553 347 369	0.948571	-0.05143
II.09	24 253 917 507	-4 396 508 525	0.846546	-0.15345
III.09	30 454 834 088	6 200 916 581	1.255667	0.255667
IV.09	26 724 107 157	-3 730 726 931	0.8775	-0.1225
V.09	22 763 717 999	-3 960 389 158	0.851805	-0.1482
VI.09	25 601 862 366	2 838 144 367	1.124678	0.124678
VII.09	25 819 206 278	217 343 912	1.008489	0.008489
VIII.09	24 429 499 821	-1 389 706 457	0.946175	-0.05382
IX.09	31 149 279 227	6 719 779 406	1.275068	0.275068
X.09	33 893 753 594	2 744 474 367	1.088107	0.088107
XI.09	35 423 412 567	1 529 658 973	1.045131	0.045131
XII.09	33 228 458 261	-2 194 954 306	0.938037	-0.06196
I.10	28 843 130 134	-4 385 328 127	0.868025	-0.13198
II.10	27 451 061 615	-1 392 068 519	0.951737	-0.04826
III.10	34 104 571 783	6 653 510 168	1.242377	0.242377
IV.10	32 666 481 819	-1 438 089 964	0.957833	-0.04217
V.10	34 933 889 169	2 267 407 350	1.069411	0.069411
VI.10	41 219 991 227	6 286 102 058	1.179943	0.179943
VII.10	38 380 189 265	-2 839 801 962	0.931106	-0.06889
VIII.10	38 825 562 924	445 373 659	1.011604	0.011604
IX.10	45 942 574 859	7 117 011 935	1.183307	0.183307
X.10	48 743 236 112	2 800 661 253	1.06096	0.06096
XI.10	49 505 604 456	762 368 344	1.01564	0.01564
XII.10	47 262 747 844	-2 242 856 612	0.954695	-0.04531
I.11	37 472 196 241	-9 790 551 603	0.792848	-0.20715
II.11	33 970 835 705	-3 501 360 536	0.906561	-0.09344
III.11	38 782 052 927	4 811 217 222	1.141628	0.141628
IV.11	35 935 490 533	-2 846 562 394	0.926601	-0.0734
V.11	35 533 620 096	-401 870 437	0.988817	-0.01118
VI.11	39 599 148 593	4 065 528 497	1.114414	0.114414
VII.11	33 183 140 346	-6 416 008 247	0.837976	-0.16202
VIII.11	37 694 399 632	4 511 259 286	1.13595	0.13595
IX.11	36 135 728 731	-1 558 670 901	0.95865	-0.04135
X.11	38 419 998 314	2 284 269 583	1.063214	0.063214
XI.11	47 991 880 599	9 571 882 285	1.249138	0.249138
XII.11	38 719 314 228	-9 272 566 371	0.806789	-0.19321
I.12	31 856 429 273	-6 862 884 955	0.822753	-0.17725
II.12	32 775 451 361	919 022 088	1.028849	0.028849
III.12	34 638 797 821	1 863 346 460	1.056852	0.056852
IV.12	37 391 180 189	2 752 382 368	1.07946	0.07946
V.12	32 951 476 211	-4 439 703 978	0.881263	-0.11874
VI.12	38 265 864 975	5 314 388 764	1.161279	0.161279

Period	y_t	d_t	k_t	δ_t
VII.12	31 768 951 118	-6 496 913 857	0.830216	-0.16978
VIII.12	33 755 311 322	1 986 360 204	1.062525	0.062525
IX.12	37 549 823 099	3 794 511 777	1.112412	0.112412
X.12	36 030 485 608	-1 519 337 491	0.959538	-0.04046
XI.12	39 495 084 054	3 464 598 446	1.096157	0.096157
XII.12	41 650 992 170	2 155 908 116	1.054587	0.054587
I.13	27 781 852 277	-13 869 139 893	0.667015	-0.33298
II.13	30 743 039 922	2 961 187 645	1.106587	0.106587
III.13	33 665 502 147	2 922 462 225	1.095061	0.095061
IV.13	32 729 200 770	-936 301 377	0.972188	-0.02781
V.13	31 766 690 969	-962 509 801	0.970592	-0.02941
VI.13	29 512 789 612	-2 253 901 357	0.929048	-0.07095
VII.13	31 003 608 661	1 490 819 049	1.050514	0.050514
VIII.13	28 422 596 071	-2 581 012 590	0.916751	-0.08325
IX.13	34 015 549 243	5 592 953 172	1.196778	0.196778
X.13	40 938 289 273	6 922 740 030	1.203517	0.203517
XI.13	42 678 094 658	1 739 805 385	1.042498	0.042498
XII.13	45 968 293 948	3 290 199 290	1.077093	0.077093
I.14	35 318 773 096	-10 649 520 852	0.768329	-0.23167
II.14	37 360 424 364	2 041 651 268	1.057806	0.057806
III.14	35 275 237 777	-2 085 186 587	0.944187	-0.05581
IV.14	35 160 481 537	-114 756 240	0.996747	-0.00325
V.14	34 556 416 083	-604 065 454	0.98282	-0.01718
VI.14	37 688 571 976	3 132 155 893	1.090639	0.090639
VII.14	37 706 676 370	18 104 394	1.00048	0.00048
VIII.14	34 678 268 387	-3 028 407 983	0.919685	-0.08031
IX.14	42 301 008 592	7 622 740 205	1.219813	0.219813
X.14	46 267 566 191	3 966 557 599	1.09377	0.09377
XI.14	51 147 388 157	4 879 821 966	1.10547	0.10547
XII.14	49 582 327 691	-1 565 060 466	0.969401	-0.0306

C ICT goods export – elementary characteristics

Period	y_t	d_t	k_t	δ_t
I.93	310 047 657	-	-	-
II.93	929 599 485	619 551 828	2.998247	1.998247
III.93	789 367 132	-140 232 353	0.849148	-0.15085
IV.93	566 816 699	-222 550 433	0.718065	-0.28194
V.93	655 826 827	89 010 128	1.157035	0.157035
VI.93	677 071 147	21 244 320	1.032393	0.032393
VII.93	587 058 458	-90 012 689	0.867056	-0.13294
VIII.93	488 458 794	-98 599 664	0.832045	-0.16796
IX.93	720 638 994	232 180 200	1.475332	0.475332
X.93	628 989 263	-91 649 731	0.872822	-0.12718
XI.93	670 688 707	41 699 444	1.066296	0.066296
XII.93	862 156 678	191 467 971	1.28548	0.28548
I.94	848 441 218	-13 715 460	0.984092	-0.01591
II.94	674 496 053	-173 945 165	0.794983	-0.20502
III.94	779 181 244	104 685 191	1.155205	0.155205
IV.94	760 091 986	-19 089 258	0.975501	-0.0245
V.94	879 884 614	119 792 628	1.157603	0.157603
VI.94	888 835 757	8 951 143	1.010173	0.010173
VII.94	670 461 081	-218 374 676	0.754314	-0.24569
VIII.94	745 607 351	75 146 270	1.112081	0.112081
IX.94	1 115 183 406	369 576 055	1.495671	0.495671
X.94	1 037 634 376	-77 549 030	0.930461	-0.06954
XI.94	1 297 051 728	259 417 352	1.250008	0.250008
XII.94	1 286 428 743	-10 622 985	0.99181	-0.00819
I.95	1 071 777 477	-214 651 266	0.833142	-0.16686
II.95	1 069 328 432	-2 449 045	0.997715	-0.00229
III.95	1 317 471 207	248 142 775	1.232055	0.232055
IV.95	1 129 116 836	-188 354 371	0.857033	-0.14297
V.95	1 253 483 144	124 366 308	1.110145	0.110145
VI.95	1 297 123 534	43 640 390	1.034815	0.034815
VII.95	993 144 037	-303 979 497	0.765651	-0.23435
VIII.95	1 084 639 836	91 495 799	1.092127	0.092127
IX.95	1 200 368 475	115 728 639	1.106698	0.106698
X.95	1 465 355 599	264 987 124	1.220755	0.220755
XI.95	1 585 614 214	120 258 615	1.082068	0.082068
XII.95	1 297 091 136	-288 523 078	0.818037	-0.18196
I.96	1 363 515 631	66 424 495	1.05121	0.05121
II.96	1 224 381 515	-139 134 116	0.897959	-0.10204
III.96	1 316 414 902	92 033 387	1.075167	0.075167
IV.96	1 349 501 954	33 087 052	1.025134	0.025134
V.96	1 371 936 840	22 434 886	1.016625	0.016625
VI.96	1 285 549 424	-86 387 416	0.937033	-0.06297

Period	y_t	d_t	k_t	δ_t
VII.96	1 314 162 132	28 612 708	1.022257	0.022257
VIII.96	1 141 175 121	-172 987 011	0.868367	-0.13163
IX.96	1 422 323 751	281 148 630	1.246368	0.246368
X.96	1 719 106 945	296 783 194	1.208661	0.208661
XI.96	1 683 521 174	-35 585 771	0.9793	-0.0207
XII.96	1 273 323 487	-410 197 687	0.756345	-0.24365
I.97	1 246 987 356	-26 336 131	0.979317	-0.02068
II.97	1 268 209 291	21 221 935	1.017019	0.017019
III.97	1 445 223 058	177 013 767	1.139578	0.139578
IV.97	1 573 910 616	128 687 558	1.089043	0.089043
V.97	1 404 947 373	-168 963 243	0.892647	-0.10735
VI.97	1 644 345 850	239 398 477	1.170397	0.170397
VII.97	1 852 700 506	208 354 656	1.12671	0.12671
VIII.97	1 303 883 357	-548 817 149	0.703774	-0.29623
IX.97	1 925 104 768	621 221 411	1.476439	0.476439
X.97	2 035 575 804	110 471 036	1.057384	0.057384
XI.97	2 042 095 365	6 519 561	1.003203	0.003203
XII.97	2 091 212 515	49 117 150	1.024052	0.024052
I.98	1 589 022 876	-502 189 639	0.759857	-0.24014
II.98	1 998 293 371	409 270 495	1.257561	0.257561
III.98	1 954 054 136	-44 239 235	0.977861	-0.02214
IV.98	2 133 704 541	179 650 405	1.091937	0.091937
V.98	1 685 604 228	-448 100 313	0.78999	-0.21001
VI.98	1 950 341 661	264 737 433	1.157058	0.157058
VII.98	2 115 640 624	165 298 963	1.084754	0.084754
VIII.98	1 701 988 601	-413 652 023	0.804479	-0.19552
IX.98	2 218 955 419	516 966 818	1.303743	0.303743
X.98	2 596 056 449	377 101 030	1.169945	0.169945
XI.98	2 399 373 792	-196 682 657	0.924238	-0.07576
XII.98	2 210 841 250	-188 532 542	0.921424	-0.07858
I.99	1 562 027 652	-648 813 598	0.706531	-0.29347
II.99	1 683 484 235	121 456 583	1.077756	0.077756
III.99	2 135 827 410	452 343 175	1.268695	0.268695
IV.99	2 075 843 637	-59 983 773	0.971915	-0.02808
V.99	2 068 947 224	-6 896 413	0.996678	-0.00332
VI.99	2 157 808 099	88 860 875	1.04295	0.04295
VII.99	1 908 259 642	-249 548 457	0.884351	-0.11565
VIII.99	2 358 455 629	450 195 987	1.23592	0.23592
IX.99	2 631 827 604	273 371 975	1.115911	0.115911
X.99	2 896 960 823	265 133 219	1.100741	0.100741
XI.99	2 777 070 373	-119 890 450	0.958615	-0.04138
XII.99	3 306 214 304	529 143 931	1.19054	0.19054
I.00	2 224 416 542	-1 081 797 762	0.672799	-0.3272
II.00	3 099 389 644	874 973 102	1.393349	0.393349
III.00	3 432 360 983	332 971 339	1.107431	0.107431
IV.00	3 838 770 465	406 409 482	1.118405	0.118405
V.00	4 215 662 481	376 892 016	1.09818	0.09818
VI.00	3 769 188 413	-446 474 068	0.894092	-0.10591

Period	y_t	d_t	k_t	δ_t
VII.00	4 062 239 665	293 051 252	1.077749	0.077749
VIII.00	3 656 595 730	-405 643 935	0.900143	-0.09986
IX.00	5 255 194 048	1 598 598 318	1.437182	0.437182
X.00	5 482 858 162	227 664 114	1.043322	0.043322
XI.00	6 980 890 751	1 498 032 589	1.273221	0.273221
XII.00	6 619 875 112	-361 015 639	0.948285	-0.05171
I.01	6 550 557 234	-69 317 878	0.989529	-0.01047
II.01	6 947 570 551	397 013 317	1.060608	0.060608
III.01	6 859 487 476	-88 083 075	0.987322	-0.01268
IV.01	8 923 908 999	2 064 421 523	1.300959	0.300959
V.01	9 846 583 905	922 674 906	1.103394	0.103394
VI.01	8 184 252 027	-1 662 331 878	0.831177	-0.16882
VII.01	6 708 077 223	-1 476 174 804	0.819632	-0.18037
VIII.01	5 824 295 659	-883 781 564	0.868251	-0.13175
IX.01	9 830 258 999	4 005 963 340	1.687802	0.687802
X.01	9 432 893 400	-397 365 599	0.959577	-0.04042
XI.01	10 859 162 315	1 426 268 915	1.151202	0.151202
XII.01	10 012 326 353	-846 835 962	0.922016	-0.07798
I.02	11 691 511 932	1 679 185 579	1.167712	0.167712
II.02	9 780 324 298	-1 911 187 634	0.836532	-0.16347
III.02	11 526 866 940	1 746 542 642	1.178577	0.178577
IV.02	9 611 008 154	-1 915 858 786	0.833792	-0.16621
V.02	8 650 131 735	-960 876 419	0.900023	-0.09998
VI.02	7 868 643 304	-781 488 431	0.909656	-0.09034
VII.02	8 130 434 020	261 790 716	1.03327	0.03327
VIII.02	8 848 638 315	718 204 295	1.088335	0.088335
IX.02	13 605 159 331	4 756 521 016	1.537543	0.537543
X.02	17 688 889 096	4 083 729 765	1.30016	0.30016
XI.02	16 751 469 534	-937 419 562	0.947005	-0.05299
XII.02	12 824 607 585	-3 926 861 949	0.765581	-0.23442
I.03	14 810 557 679	1 985 950 094	1.154855	0.154855
II.03	10 261 196 152	-4 549 361 527	0.69283	-0.30717
III.03	15 456 463 621	5 195 267 469	1.506302	0.506302
IV.03	11 087 749 822	-4 368 713 799	0.717354	-0.28265
V.03	10 783 465 366	-304 284 456	0.972557	-0.02744
VI.03	9 689 273 435	-1 094 191 931	0.898531	-0.10147
VII.03	10 737 025 474	1 047 752 039	1.108135	0.108135
VIII.03	11 101 777 205	364 751 731	1.033971	0.033971
IX.03	11 954 704 074	852 926 869	1.076828	0.076828
X.03	14 425 758 104	2 471 054 030	1.206701	0.206701
XI.03	13 626 019 788	-799 738 316	0.944562	-0.05544
XII.03	15 310 446 316	1 684 426 528	1.123618	0.123618
I.04	10 718 355 313	-4 592 091 003	0.700068	-0.29993
II.04	15 157 248 784	4 438 893 471	1.414139	0.414139
III.04	13 620 704 344	-1 536 544 440	0.898626	-0.10137
IV.04	24 573 942 028	10 953 237 684	1.804161	0.804161
V.04	15 078 460 985	-9 495 481 043	0.613596	-0.3864
VI.04	15 553 559 976	475 098 991	1.031508	0.031508

Period	y_t	d_t	k_t	δ_t
VII.04	13 868 505 006	-1 685 054 970	0.891661	-0.10834
VIII.04	15 886 445 001	2 017 939 995	1.145505	0.145505
IX.04	18 971 588 882	3 085 143 881	1.1942	0.1942
X.04	22 251 326 753	3 279 737 871	1.172876	0.172876
XI.04	23 464 250 228	1 212 923 475	1.05451	0.05451
XII.04	18 696 952 521	-4 767 297 707	0.796827	-0.20317
I.05	13 856 826 625	-4 840 125 896	0.741128	-0.25887
II.05	12 201 109 048	-1 655 717 577	0.880512	-0.11949
III.05	15 366 407 693	3 165 298 645	1.259427	0.259427
IV.05	15 618 708 437	252 300 744	1.016419	0.016419
V.05	15 237 287 167	-381 421 270	0.975579	-0.02442
VI.05	16 607 564 444	1 370 277 277	1.089929	0.089929
VII.05	16 109 616 223	-497 948 221	0.970017	-0.02998
VIII.05	18 761 511 342	2 651 895 119	1.164616	0.164616
IX.05	20 892 921 392	2 131 410 050	1.113605	0.113605
X.05	23 945 979 338	3 053 057 946	1.146129	0.146129
XI.05	26 107 945 477	2 161 966 139	1.090285	0.090285
XII.05	21 135 605 853	-4 972 339 624	0.809547	-0.19045
I.06	21 669 517 486	533 911 633	1.025261	0.025261
II.06	17 884 651 019	-3 784 866 467	0.825337	-0.17466
III.06	21 115 389 196	3 230 738 177	1.180643	0.180643
IV.06	19 169 063 348	-1 946 325 848	0.907824	-0.09218
V.06	20 475 767 958	1 306 704 610	1.068167	0.068167
VI.06	20 949 425 034	473 657 076	1.023133	0.023133
VII.06	19 053 320 838	-1 896 104 196	0.909491	-0.09051
VIII.06	22 048 129 938	2 994 809 100	1.15718	0.15718
IX.06	25 140 109 497	3 091 979 559	1.140238	0.140238
X.06	32 866 588 798	7 726 479 301	1.307337	0.307337
XI.06	34 460 108 264	1 593 519 466	1.048484	0.048484
XII.06	29 377 674 370	-5 082 433 894	0.852513	-0.14749
I.07	28 539 539 072	-838 135 298	0.97147	-0.02853
II.07	27 615 149 276	-924 389 796	0.96761	-0.03239
III.07	30 839 082 902	3 223 933 626	1.116745	0.116745
IV.07	26 710 774 734	-4 128 308 168	0.866134	-0.13387
V.07	27 728 550 120	1 017 775 386	1.038104	0.038104
VI.07	29 649 954 717	1 921 404 597	1.069293	0.069293
VII.07	25 787 625 874	-3 862 328 843	0.869736	-0.13026
VIII.07	30 421 657 856	4 634 031 982	1.1797	0.1797
IX.07	38 068 236 493	7 646 578 637	1.251353	0.251353
X.07	40 905 816 586	2 837 580 093	1.074539	0.074539
XI.07	42 979 915 433	2 074 098 847	1.050704	0.050704
XII.07	34 096 293 321	-8 883 622 112	0.793308	-0.20669
I.08	34 152 708 524	56 415 203	1.001655	0.001655
II.08	31 559 698 282	-2 593 010 242	0.924076	-0.07592
III.08	34 353 072 091	2 793 373 809	1.088511	0.088511
IV.08	31 511 277 633	-2 841 794 458	0.917277	-0.08272
V.08	31 756 226 720	244 949 087	1.007773	0.007773
VI.08	30 970 620 567	-785 606 153	0.975261	-0.02474

Period	y_t	d_t	k_t	δ_t
VII.08	31 211 901 425	241 280 858	1.007791	0.007791
VIII.08	28 249 135 239	-2 962 766 186	0.905076	-0.09492
IX.08	35 713 699 009	7 464 563 770	1.26424	0.26424
X.08	39 601 753 451	3 888 054 442	1.108867	0.108867
XI.08	37 958 502 349	-1 643 251 102	0.958506	-0.04149
XII.08	31 659 112 836	-6 299 389 513	0.834045	-0.16595
I.09	28 169 169 216	-3 489 943 620	0.889765	-0.11024
II.09	25 502 482 713	-2 666 686 503	0.905333	-0.09467
III.09	31 439 181 918	5 936 699 205	1.232789	0.232789
IV.09	27 478 673 278	-3 960 508 640	0.874026	-0.12597
V.09	25 019 761 378	-2 458 911 900	0.910516	-0.08948
VI.09	27 919 844 144	2 900 082 766	1.115912	0.115912
VII.09	27 762 184 904	-157 659 240	0.994353	-0.00565
VIII.09	24 292 140 229	-3 470 044 675	0.875008	-0.12499
IX.09	31 073 439 904	6 781 299 675	1.279156	0.279156
X.09	32 149 975 009	1 076 535 105	1.034645	0.034645
XI.09	34 228 848 164	2 078 873 155	1.064662	0.064662
XII.09	30 268 554 989	-3 960 293 175	0.8843	-0.1157
I.10	31 436 755 024	1 168 200 035	1.038595	0.038595
II.10	29 746 620 575	-1 690 134 449	0.946237	-0.05376
III.10	34 741 631 556	4 995 010 981	1.167919	0.167919
IV.10	30 606 120 276	-4 135 511 280	0.880964	-0.11904
V.10	32 962 814 113	2 356 693 837	1.077001	0.077001
VI.10	37 932 165 314	4 969 351 201	1.150756	0.150756
VII.10	37 133 890 019	-798 275 295	0.978955	-0.02104
VIII.10	33 800 474 739	-3 333 415 280	0.910233	-0.08977
IX.10	41 505 622 068	7 705 147 329	1.22796	0.22796
X.10	45 109 461 318	3 603 839 250	1.086828	0.086828
XI.10	44 519 607 190	-589 854 128	0.986924	-0.01308
XII.10	41 406 147 546	-3 113 459 644	0.930065	-0.06993
I.11	38 768 846 499	-2 637 301 047	0.936307	-0.06369
II.11	31 941 340 190	-6 827 506 309	0.823892	-0.17611
III.11	44 942 742 630	13 001 402 440	1.40704	0.40704
IV.11	39 968 567 446	-4 974 175 184	0.889322	-0.11068
V.11	37 276 951 929	-2 691 615 517	0.932657	-0.06734
VI.11	39 997 603 294	2 720 651 365	1.072985	0.072985
VII.11	39 465 097 099	-532 506 195	0.986687	-0.01331
VIII.11	36 062 388 939	-3 402 708 160	0.913779	-0.08622
IX.11	39 658 989 378	3 596 600 439	1.099733	0.099733
X.11	50 513 842 817	10 854 853 439	1.273705	0.273705
XI.11	45 539 903 044	-4 973 939 773	0.901533	-0.09847
XII.11	40 270 580 845	-5 269 322 199	0.884292	-0.11571
I.12	43 272 376 506	3 001 795 661	1.074541	0.074541
II.12	34 294 108 152	-8 978 268 354	0.792517	-0.20748
III.12	42 011 833 492	7 717 725 340	1.225045	0.225045
IV.12	37 733 672 616	-4 278 160 876	0.898168	-0.10183
V.12	36 358 056 051	-1 375 616 565	0.963544	-0.03646
VI.12	39 104 639 653	2 746 583 602	1.075543	0.075543

Period	y_t	d_t	k_t	δ_t
VII.12	39 110 758 041	6 118 388	1.000156	0.000156
VIII.12	34 943 517 930	-4 167 240 111	0.89345	-0.10655
IX.12	40 155 518 793	5 212 000 863	1.149155	0.149155
X.12	47 276 171 692	7 120 652 899	1.177327	0.177327
XI.12	45 601 548 256	-1 674 623 436	0.964578	-0.03542
XII.12	40 739 323 282	-4 862 224 974	0.893376	-0.10662
I.13	39 914 562 454	-824 760 828	0.979755	-0.02024
II.13	31 757 660 198	-8 156 902 256	0.795641	-0.20436
III.13	34 378 678 356	2 621 018 158	1.082532	0.082532
IV.13	37 041 204 358	2 662 526 002	1.077447	0.077447
V.13	30 227 833 350	-6 813 371 008	0.81606	-0.18394
VI.13	33 313 584 654	3 085 751 304	1.102083	0.102083
VII.13	36 913 969 165	3 600 384 511	1.108076	0.108076
VIII.13	31 478 559 724	-5 435 409 441	0.852755	-0.14725
IX.13	37 840 225 920	6 361 666 196	1.202095	0.202095
X.13	44 302 744 497	6 462 518 577	1.170784	0.170784
XI.13	44 377 369 156	74 624 659	1.001684	0.001684
XII.13	48 206 797 827	3 829 428 671	1.086292	0.086292
I.14	45 160 956 103	-3 045 841 724	0.936817	-0.06318
II.14	35 698 860 957	-9 462 095 146	0.790481	-0.20952
III.14	40 994 708 675	5 295 847 718	1.148348	0.148348
IV.14	40 562 152 667	-432 556 008	0.989448	-0.01055
V.14	38 848 439 920	-1 713 712 747	0.957751	-0.04225
VI.14	41 795 338 727	2 946 898 807	1.075856	0.075856
VII.14	44 873 953 062	3 078 614 335	1.073659	0.073659
VIII.14	36 596 648 000	-8 277 305 062	0.815543	-0.18446
IX.14	47 449 478 889	10 852 830 889	1.296553	0.296553
X.14	50 013 792 901	2 564 314 012	1.054043	0.054043
XI.14	51 736 964 490	1 723 171 589	1.034454	0.034454
XII.14	52 730 582 090	993 617 600	1.019205	0.019205

D ICT goods components – import

	ICT goods import (mil CZK)				
	Computers and peripheral equipment	Communi-cation equi-pment	Consumer electronics	Electronic compo-nents	Parts and compo-nents nec
1993	15 476	2 977	6 774	2 906	7 202
1994	17 248	3 371	7 304	3 707	9 603
1995	20 954	4 938	8 142	6 862	12 261
1996	20 948	9 280	9 756	7 569	14 218
1997	20 630	11 146	10 855	9 138	14 090
1998	22 475	9 722	10 859	12 016	13 732
1999	23 427	12 095	11 718	15 907	15 813
2000	29 975	23 027	12 463	29 680	26 114
2001	45 109	16 730	14 479	46 005	32 263
2002	53 404	16 316	13 599	55 853	24 812
2003	51 204	20 201	17 052	61 104	25 919
2004	54 368	23 259	25 041	62 641	46 075
2005	48 094	14 778	24 184	58 237	60 643
2006	77 137	17 408	27 399	60 018	104 290
2007	93 500	29 823	38 862	58 331	127 682
2008	94 842	32 307	40 944	59 753	117 494
2009	91 653	24 276	29 644	73 223	96 451
2010	123 278	34 751	30 825	114 187	129 137
2011	149 274	52 182	33 166	76 710	110 900
2012	143 980	52 758	32 078	75 150	98 465
2013	129 839	67 707	27 003	69 362	89 099

E ICT goods components – export

	ICT goods export (mil CZK)				
	Computers and peripheral equipment	**Communication equipment**	**Consumer electronics**	**Electronic components**	**Parts and components nec**
1993	1 400	559	1 593	1 861	1 671
1994	1 744	400	1 524	2 598	3 418
1995	2 214	331	1 670	4 989	4 582
1996	2 281	498	3 950	4 782	6 067
1997	3 139	443	1 730	6 169	6 129
1998	5 285	839	3 824	6 387	6 035
1999	5 267	1 012	3 935	6 899	8 017
2000	8 909	5 220	10 294	10 140	15 908
2001	24 352	15 791	22 775	14 063	20 513
2002	60 386	15 723	17 126	18 192	22 464
2003	70 727	21 323	14 532	17 421	22 016
2004	85 714	22 159	39 103	22 097	33 921
2005	96 514	12 902	42 373	25 844	31 900
2006	132 958	9 958	60 790	28 531	45 874
2007	152 333	38 910	82 916	27 655	45 616
2008	154 488	45 716	91 879	33 466	35 878
2009	142 412	27 953	76 171	32 812	34 655
2010	186 551	35 220	89 274	44 080	41 383
2011	194 971	61 281	86 460	49 246	48 094
2012	217 710	63 240	76 073	40 656	46 476
2013	198 836	71 383	66 078	33 610	44 498

F International comparison – ICT goods export

	Export ICT goods (mil. USD)					The share in total goods exports			
	Czech R.	**Ireland**	**Hungary**	**Germany**		**Czech R.**	**Ireland**	**Hungary**	**Germany**
1988	-	4 672	-	18 076	1988	-	25.0%	-	5.6%
1989	-	5 583	-	19 112	1989	-	27.0%	-	5.6%
1990	-	6 210	-	22 741	1990	-	26.2%	-	5.6%
1991	-	5 936	-	23 692	1991	-	24.5%	-	5.9%
1992	-	6 702	294	23 389	1992	-	23.5%	2.8%	5.4%
1993	171	7 531	293	21 766	1993	1.3%	25.9%	3.3%	5.7%
1994	258	9 637	452	26 514	1994	1.8%	28.3%	4.2%	6.2%
1995	263	14 064	614	33 535	1995	1.6%	32.1%	4.8%	6.4%
1996	639	15 795	492	32 063	1996	2.9%	32.8%	3.7%	6.3%
1997	559	17 524	3 061	34 349	1997	2.5%	32.7%	16.0%	6.7%
1998	944	21 282	4 413	36 943	1998	3.3%	33.1%	19.2%	6.8%
1999	727	25 824	5 557	39 849	1999	2.7%	36.6%	22.2%	7.3%
2000	1 334	27 685	7 231	46 169	2000	4.6%	36.3%	25.7%	8.4%
2001	2 582	30 550	7 244	46 625	2001	7.7%	36.8%	23.8%	8.2%
2002	5 145	27 490	8 804	48 665	2002	11.6%	31.1%	25.6%	7.9%
2003	5 207	22 481	10 899	55 304	2003	10.7%	24.2%	25.3%	7.4%
2004	7 907	23 482	15 694	72 388	2004	12.0%	22.5%	28.3%	7.9%
2005	8 668	24 675	15 944	77 168	2005	11.1%	22.4%	25.6%	7.9%
2006	12 330	24 121	17 841	82 809	2006	13.0%	22.2%	24.1%	7.4%
2007	16 806	22 780	21 301	78 319	2007	13.9%	18.6%	22.5%	5.9%
2008	20 614	19 989	24 522	74 643	2008	14.1%	15.7%	22.7%	5.1%
2009	16 305	12 802	21 465	54 743	2009	14.4%	11.0%	26.0%	4.9%
2010	19 835	8 866	24 242	64 652	2010	15.0%	7.5%	25.6%	5.1%
2011	24 892	7 336	23 999	68 219	2011	15.3%	5.8%	21.6%	4.6%
2012	22 730	6 817	17 912	62 514	2012	14.5%	5.8%	17.4%	4.4%

G GDP in euro area and the Czech Republic (constant prices)

Period	GDP_CZ (mil CZK)	GDP_EA (mil EUR)	Period	GDP_CZ (mil CZK)	GDP_EA (mil EUR)
Q1: 1995	-	1 742 799	Q1: 2005	749 167	2 179 897
Q2: 1995	-	1 786 178	Q2: 2005	817 234	2 261 107
Q3: 1995	-	1 772 339	Q3: 2005	828 676	2 238 591
Q4: 1995	-	1 832 358	Q4: 2005	859 566	2 309 592
Q1: 1996	385 719	1 763 410	Q1: 2006	805 571	2 258 771
Q2: 1996	413 006	1 809 827	Q2: 2006	869 149	2 319 465
Q3: 1996	422 157	1 807 871	Q3: 2006	885 634	2 306 080
Q4: 1996	426 906	1 862 425	Q4: 2006	921 653	2 391 104
Q1: 1997	424 987	1 781 527	Q1: 2007	858 956	2 344 997
Q2: 1997	454 126	1 863 955	Q2: 2007	921 598	2 400 231
Q3: 1997	459 294	1 854 096	Q3: 2007	939 928	2 384 350
Q4: 1997	461 993	1 928 266	Q4: 2007	980 568	2 457 533
Q1: 1998	456 696	1 855 861	Q1: 2008	921 838	2 394 491
Q2: 1998	488 578	1 909 428	Q2: 2008	995 341	2 445 521
Q3: 1998	496 783	1 906 210	Q3: 2008	1 011 383	2 405 887
Q4: 1998	505 081	1 968 795	Q4: 2008	1 007 136	2 411 053
Q1: 1999	503 313	1 897 426	Q1: 2009	901 655	2 274 648
Q2: 1999	544 408	1 958 965	Q2: 2009	955 050	2 317 227
Q3: 1999	554 076	1 960 573	Q3: 2009	970 508	2 319 247
Q4: 1999	571 602	2 046 746	Q4: 2009	993 719	2 379 323
Q1: 2000	541 195	1 990 620	Q1: 2010	930 367	2 300 844
Q2: 2000	583 812	2 042 790	Q2: 2010	1 010 652	2 374 372
Q3: 2000	595 491	2 027 296	Q3: 2010	1 018 549	2 373 192
Q4: 2000	612 874	2 103 679	Q4: 2010	1 052 268	2 430 995
Q1: 2001	572 319	2 095 449	Q1: 2011	947 372	2 372 277
Q2: 2001	613 041	2 136 072	Q2: 2011	1 018 450	2 423 410
Q3: 2001	619 906	2 113 382	Q3: 2011	1 020 983	2 410 893
Q4: 2001	639 766	2 183 543	Q4: 2011	1 044 487	2 440 377
Q1: 2002	608 023	2 096 986	Q1: 2012	950 001	2 370 495
Q2: 2002	649 770	2 158 747	Q2: 2012	1 004 578	2 399 954
Q3: 2002	665 970	2 144 922	Q3: 2012	1 004 915	2 388 531
Q4: 2002	681 122	2 203 759	Q4: 2012	1 030 399	2 416 659
Q1: 2003	642 604	2 114 296	Q1: 2013	937 265	2 327 738
Q2: 2003	690 419	2 160 037	Q2: 2013	1 005 304	2 387 337
Q3: 2003	712 578	2 152 436	Q3: 2013	1 022 734	2 389 580
Q4: 2003	725 369	2 229 546	Q4: 2013	1 053 971	2 422 827
Q1: 2004	678 500	2 159 773	Q1: 2014	974 432	2 357 524
Q2: 2004	731 532	2 216 644	Q2: 2014	1 043 869	2 408 053
Q3: 2004	748 172	2 198 790	Q3: 2014	1 066 128	2 413 958
Q4: 2004	781 545	2 271 795	Q4: 2014	1 084 528	-