

Financial Crisis and the ICT Industry, Cross Market Research on Europe, US, Turkish and Gulf Countries

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Abstract

The ICT industry has been the driver for economic growth for several years before the financial crisis. The purpose of the paper is to look at the effects of last financial crisis on the ICT industry and how this macroeconomic shock was transmitted to households. Since the cost of capital became much higher, this weakened the long-term growth of companies, especially those in needs of financing. Also this had a major effect on consumers, who freeze spending, which eventually decreases revenues for companies. Moreover, we aim to provide new empirical evidence on the impact of world financial crisis on the ICT industry and CPI index in different areas of the world. By using different simulations and analysis, we investigate the effect of the crisis on ICT industries and households. We propose a statistical model based on Pearson's r and linear regression. We use GDP values from four different markets, which are United States, European, Turkish and Gulf Countries and we apply our statistical model with normalization. We use gross domestic product for tracking the financial crisis, consumer price index for households and percentage of ICT Export and Import on the whole export and import of the market as indicator. The statistical model we proposed has a high success rate for between 50% to 77%, depending on the variables and the markets. We also demonstrate the correlation between ICT and GDP in four regions and we show there is 1-year delay between the movement of ICT graph and GDP graph. From this information, it is possible to make predictions about financial crisis via ICT.

Keywords: Financial Crisis, ICT, Data Mining, Business Intelligence.

1. Introduction

Never before has technology been as imbedded in the everyday lives of people as currently. This includes the way we shop, communicated, develop relationships and how we obtain and absorb information (Arslan, Seker, & Kizil, 2014). However, the 2008 financial crisis had an immense impact on the availability and growth of the industry. Firstly through the access to capital: banks were not interested or able to lend to companies in period after crisis. Secondly, severe strains on the disposable income of consumers due to the crisis which in turn resulted in a change in consumer expectations and consumption of goods. The main goal of this investigation is to analyse the impact of the financial crisis on the ICT industry and consumer behaviour.

Subject of analyses are based on statistics of GDP and ICT sales in Turkey, EU countries, US and the Arabian Gulf countries. We propose that analysis of the CPI index, Household Income, GDP Growth, Growth and development of the ICT industry will show a positive correlation between the impacts of the financial crisis had on ICT development and growth as the change in consumer expectations and consumption habits.

Our investigation is structured in three parts. The first part focuses on the financial crisis, its origins as well as the effect the crises had on different aspects of the economy. The second part is a country-by-country analysis of the impact of the financial crisis on ICT sector. The third part focuses on consumer behaviour and how the financial crisis impacted households in general. Finally the concluding remarks focus on the results and impact of the last financial crisis

2. History of Financial crisis

Unlike previous financial crises that happened in emerging economies, the last financial crisis had originated in US. This happened as a result of a bubble, created by the sub-prime mortgage banking products. The total market of these lending products was estimated to be eight trillion dollars (Kroszner 2007). As a result of these loans, market prices of real estate increased significantly: the average market growth of real-estate prices was 3 % on an annual level. However, cheap loans accompanied with fraudulent selling practices led to higher averages after 2000. The average price rise was 11.2% on annual level (The financial crisis inquiry report, 2011). Before the crisis, GDP numbers indicate fascinating growth rates especially for emerging markets. The economic growth for 2007 was 8.7% for emerging countries and 2.8% for developed countries (IMF Economic outlook 2013). In 2012 these numbers shrank to 1.3% in developed countries and 5.1% in emerging markets. Furthermore, the inflated real estate market resulted in the largest number of vacant unsold homes in US history. Similar to the 1989 savings and loans crisis (Georgievski, 2014), July 2006 saw the number of unsold vacant houses in the US increase to 573 000; almost doubling the previous record of 377 000 in 1989.

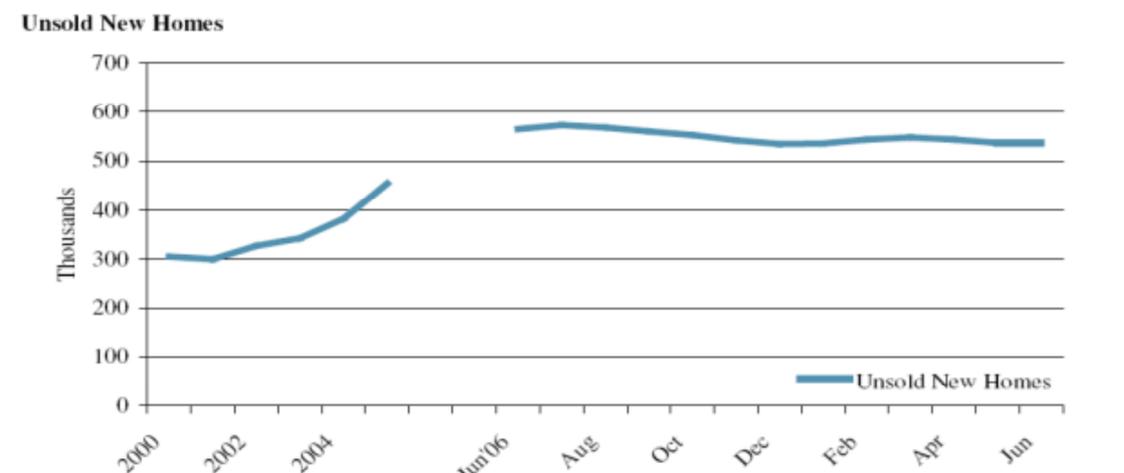


Figure 1. Historical rates of unsold US homes

Whereas the initial effect of the crisis impacted only the US markets, the global markets soon responded which in turn gave lead to a worldwide financial crisis and consequential recession. It affected the global economic growth, more so in the EU region where several countries were in severe financial distresses. A deleterious atmosphere in the financial markets as well as severe losses prevented loan mechanisms from operating, resulting in constrains of lending products to the real sector accompanied with higher costs of credit. The global financial system has yet to recover from this financial crisis and the vulnerabilities that occurred as a result of the global recession.

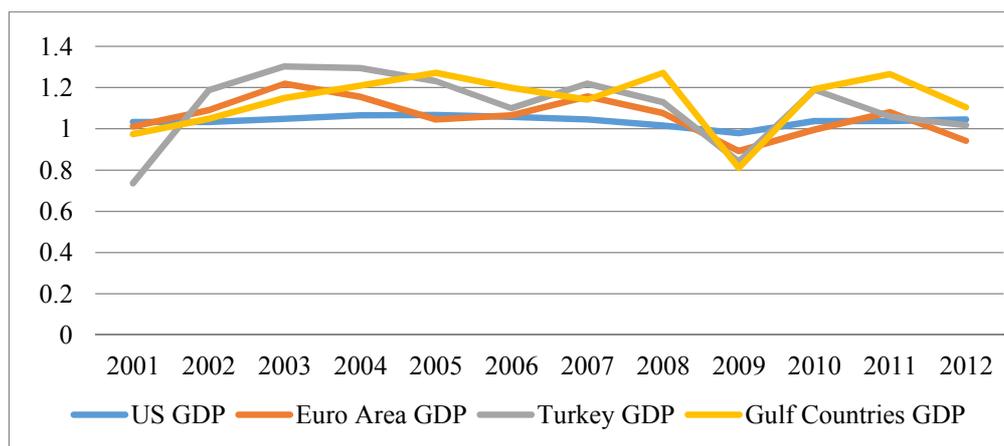


Figure 2- GDP data from 2001-2012

2.1 The effect on US ICT sector and CPI index

The US economy generated the last financial crisis and in an attempt to rescue the economy the US government injected \$700 billion US through the Troubled Asset Relief Program (TARP) in order to stabilize the financial system. The collapse of bigger financial and non-financial companies led to decreasing of activity in the financial sector, which directly impacted the national economy. Negative effects of the financial crisis were as following (Hurd et al 2010):

1. Economic recession that resulted in the loss of 5.5 million American jobs, and increasing unemployment to 11.5 %;
2. Unrealized GDP due to recession was estimated to be almost \$650 Billion;
3. \$ 3.4 trillion in real- estate value.

The ICT sector has been the fuel behind the American economy before the financial crisis. It contributed 7.1% of the total GDP in 2011 to a value of \$1 trillion U.S in total. Counting from 1995 the ICT sector grew for more than 3% per year (Shapiro, 2011). The impact of the financial crisis was felt in several ways in this sector. Not only was the decline felt in all ICT connected areas, including ICT manufacturing, ICT services, unemployment levels increased to 10% in September 2009 (OECD report, 2011).

There is a clear correlation between CPI index and ICT industry (Figure 3). Thus is it is reasonable to propose that consumer behaviour is the driver behind modern US economy. However, the unemployment problem impacted the CPI index in US. Even two years after the financial crisis, unemployment was over 9%,

almost 20% over the pre-crisis level (Amadeo 2011).

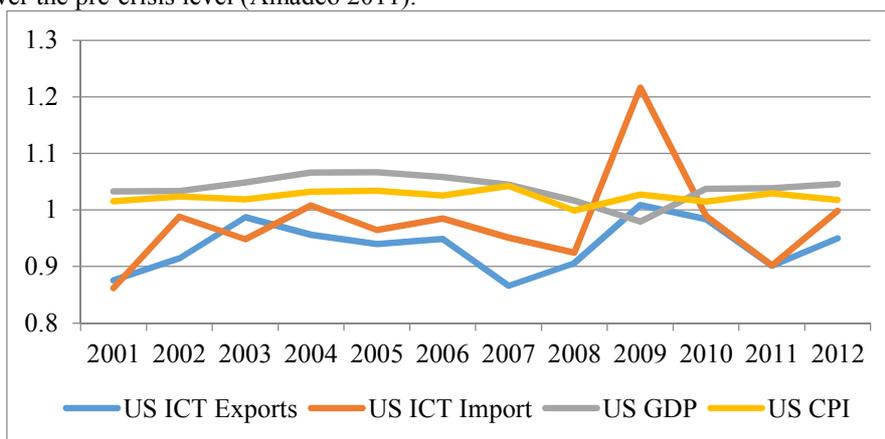


Figure 3- Comparative Chart of US ICT, GDP and CPI

Similarity exists between other factors, for instance, ICT exports in US declined by 20% starting from 2008. This part of the industry has been in downturn since the financial crisis. The US is the world's second largest ICT exporter after China with a sector that accounts for an average of 12.16 % of total US exports in the period of 2005-2009. Similarly, this has also shown decline as a result of the financial crisis. The ICT exports concluded only 10.6% and 10.7 % of total US exports in 2008 and 2009.

The ICT imports accounted for 13.24% of total imports in the GDP. Although they declined from an average of 13.24% in the period of 2005-2009 the ICT imports devaluated to 11.8 in 2008. In general the value of total ICT imports shows a different pattern the ICT exports. After the initial decline in 2007, as a crisis results, the imports skyrocketed to a historical high and increased by 22 % from previous years.

2.2 The effect on EU Countries, ICT and CPI Index

The Contagion effects of US financial crisis led to a fall in international financial markets creating a recession in most countries in the world. The biggest hit was on EU countries, where the GDP growth decreased to 4.1 % in 2009 (IMF World Economic Outlook, 2012). This was the largest decline in EU history with a decline of 20% more than the average in developed economies. Also several countries inside EU faced bankruptcy possibilities including Greece, Spain Ireland and Portugal.

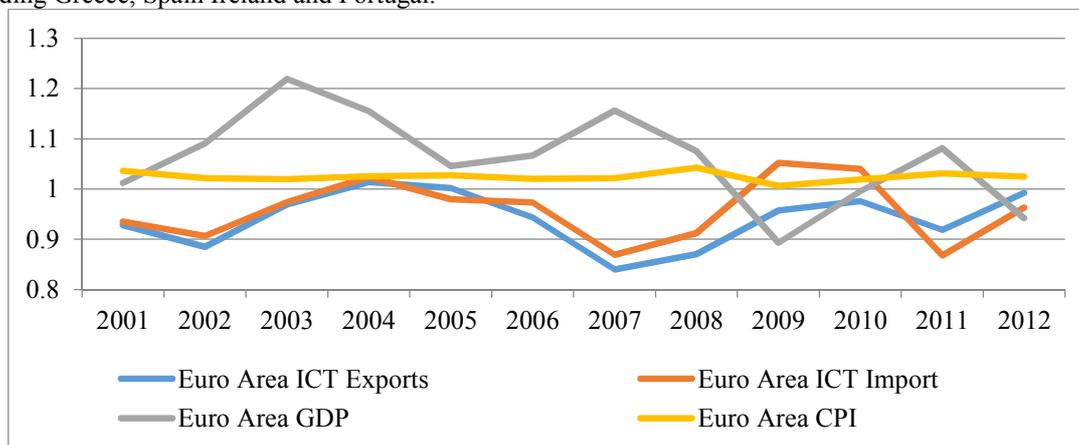


Figure 4- Comparative Chart of European ICT, GDP and CPI

Europe faced the largest problems, as a result of the financial crisis. The markets witnessed the GDP decline of all developed countries and regions. In addition, individual countries in the EURO zone faced severe problems: five countries were on the verge of bankruptcy, and they needed large stimulus packages to remain stable. The ICT industry faced similar pattern.

Large declines in ICT exports in all Euro-Area countries followed suit. The markets that faced the largest declines in ICT exports were Portugal and Finland with a weakening of more than 50%. Ireland had lower ICT exports by 36%, while Germany, France, Sweden and Check Republic faced a drop of over 20% were (UNCTAD + statistics). In total, ICT exports declined by 26% in the period from 2008-2012, without any chance of reaching pre-crisis level in the near future.

Likewise, ICT imports have also decreased for 17%. Unlike the US, where the growth in the years after the financial crisis has set them in an increase in years after the crisis, European ICT exports remain in a

downward spiral. One of the main reasons for these results is the fact that Europe witnessed the hardest blow of all developed countries.

Further to the Euro zone and US, the impact of the global financial instability reached further afield including ten rear middle east in countries such as Turkey and the Gulf economic zone.

2.3 The effect on Turkish ICT sector and CPI index

Turkey witnessed some troubled periods in its recent financial history. They witnessed two economic crises in 1994 and 2001. But after this their economy grew at high growth rates. In the period of 2000-2010, Turkey is in the top 3 countries with the highest GDP growth outside China (alongside Brazil and Singapore). Average growth was at 7% (Uygur, 2010). This was for solid macroeconomic policies that the government imposed after the financial crisis of 2001. The effect of the last financial crisis was significant, but not as hard on other countries.

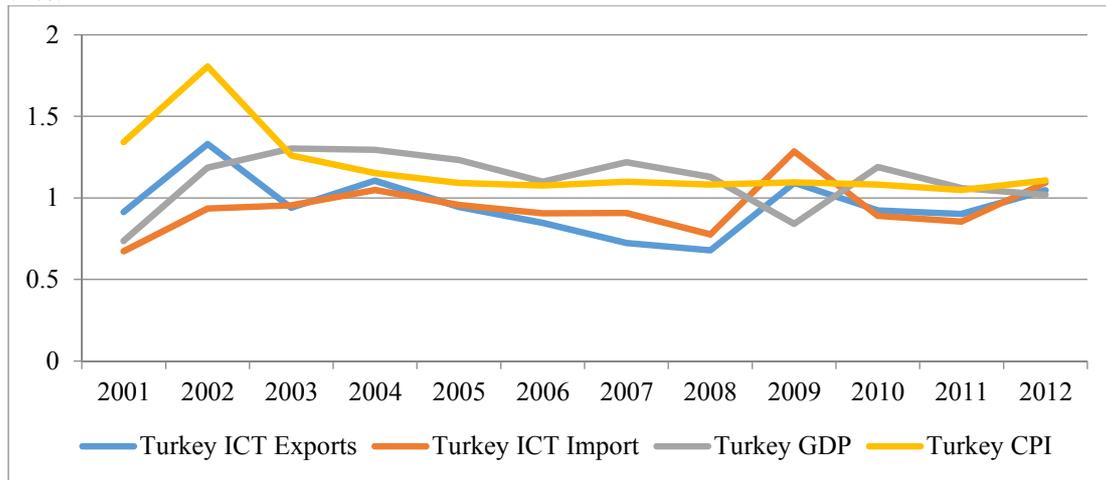


Figure 5- Comparative Chart of Turkish ICT, GDP and CPI

Turkeys ICT shows a similar pattern to the one of European Union. A loss in both ICT exports and imports accrued in Turkey. They also had a decline in of 17 % as the EU region, and an even higher decline in the ICT exports part that was 35 %. Additionally, Turkeys ICT imports are in constant decline from 2000. They declined in total for almost 60 %.

2.4 The effect of ICT sector and CPI index on Gulf Countries

The effects of the financial crisis for the gulf countries were limited compared to other parts of the world. This was mainly because gulf countries have been strengthening their monetary and fiscal policies, stimulating healthy economic growth and improving other economic parameters. The Gulf countries faced two severe stresses as a result from the financial crisis. First, the biggest problem for these countries was the shock of declining of oil prices. Largely, oil exporters these countries, faced troubles as a result in decline in prices. Oil fell from 140 \$ in July 2008 to 50 \$ in about 10 months (Ellaboudy, 2010)

Second, prices on the stock exchange market fell as a result of the financial crisis. Investors withdraw funds as a reaction of the global and economic financial crisis. Stock markets shrink from 25-70 % in the Gulf countries. (European economy,2009)

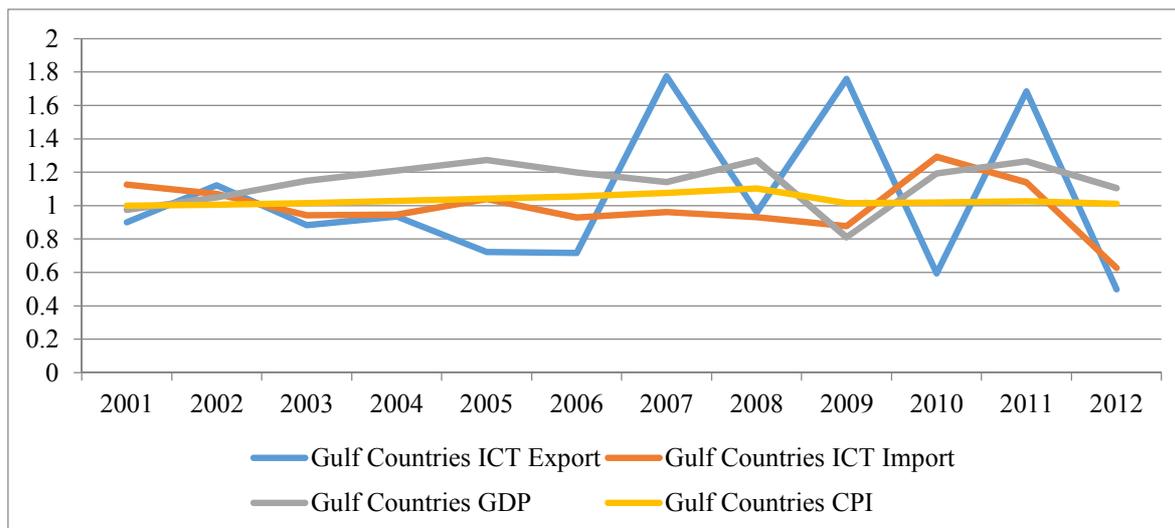


Figure 6- Comparative Chart of ICT, GDP and CPI for Gulf Countries

While ICT import in Gulf countries is following the GDP flow in GCC countries, the ICT exports are following its own path. In the year after the crisis, the ICT exports grew for 75 %, then faced a decline in 2010, and then again a record braking year in 2011 in ICT exports.

Where does this gloomy global picture leave Arab telecom operators? Some facts first:

- Over 318 million people live in the Arab World, with GDP per capita widely ranging from over US\$ 47,000 in Qatar to US\$ 880 in Mauritania.
- Arab telecom markets remain growth markets: With the exception of relatively stagnant fixed lines markets, Arab cellular and broadband markets continue to have very healthy growth. With over 194 million cellular lines by mid 2008, the combined cellular penetration rate for the 19 Arab countries covered by Arab Advisors Group exceeded 61% up from 56% by end of 2007. Arab operators added 18 million new cellular lines in the first six months of 2008 a growth rate of 10%.
- The average cellular monthly ARPU for Arab mobile operators in 2007 was US\$ 23.38 with a median of US\$ 18.02. The Gulf operators; Zain Kuwait, Qtel, Wataniya Kuwait, Oman Mobile, Zain Bahrain and AlJawal have higher cellular monthly ARPU when compared regionally. Zain Kuwait had the highest monthly ARPU of US\$ 69.3 in 2007, followed by Qtel with an ARPU of US\$ 61.2.
- Broadband rates and margins remain very healthy in the region. For example, the average monthly rate for a 512 kbps ADSL connection in the Arab World is US\$ 60.7 with a median of US\$ 45.

The combination of growth and healthy margins results in healthy cash flow levels and profitability for Arab operators. The numbers say it all: of 25 country operators that report financial results, six had EBITDA margins of more than 50%, and thirteen had an EBITDA margin between 30% and 50%. Only one had a negative EBITDA with the rest having EBITDA margins of more than 20%. Of the nineteen that disclosed net profit figures, net profit margin was more than 20% for eight, more than 10% for seven and negative for only three newly launched operators.

The story is the same for the regional telecom groups. Twelve telecom groups operate in multiple countries in the region. By mid-2008, all of them had EBITDA margins of more than 37%: Three had an EBITDA margin of more than 50%, eight more than 40% and one at 37%. All these groups were very profitable with net profit margin coming at more than 30% for five groups, and more than 10% for the remaining seven groups.

There remains a caveat: while cash and profit generation is excellent in virtually all Arab telecom markets, the shareholders of highly leveraged operators may face their own liquidity problems. This could occur as cash generation may not be enough to service the massive debts acquired to fuel growth by some of these regional operators, especially if they had planned on future rights issues and future loans to deal with their leverage. After all, the region is not isolated from the global economy and a global recession has hammered oil prices which would spill over into lower economic growth and result in subdued telecom markets growth. Still, if there will be any winners from this global crises, some Arab telecom operators would be amongst them.

3. Data Set

In this section, details of data set, source of data set and its features will be explained. Data is collected from several sources for multiple countries and then aggregated with an average function for European and Gulf countries. There are four major data series:

1. Information and Communication Technology Export Percentage (ICT Export)
2. Information and Communication Technology Import Percentage (ICT Import)
3. Gross Domestic Product (GDP)
4. Consumer Price Index (CPI)

The ICT Export or Import value is the percentage of ICT related products in whole Export or Import volume including telecommunications, audio and video, computer and related equipment, electronic components and another information and communication technology goods. Software is excluded from ICT data. Data is collected from World Bank(WorldBank, 2014), which is connected to the database of United Nations (UN) and data from UN is published via UN Conference on Trade and Development’s UNCTADstat database. Besides all ICT Export, Import and GDP data, the CPI data was not available on World Bank database. For this reason, we have collected information from Google Public Data (GPD) and source of CPI data of GPD is Eurostat for European countries, US Bureau of Labor for US data. After collection of data for two groups of countries from GDP, the data of GCC countries are collected from The Cooperation Council for the Arab States of Gulf, Secretariat General, Information Sector – Statistical Department (GCC Secretariat General, 2014).

During this study the gulf countries are considered as the gulf coordination commerce (GCC), which are Kuwait, Oman, Bahrain, Saudi Arabia and UAE. ICT and GDP data are collected from world bank, CPI for GCC countries are collected from the web page of GCC. Unfortunately ICT export and import data for UAE is available for only 3 years, 2005, 2007 and 2008 and for this reason we haven’t take UAE into account while calculating ICT export and import data

Another aggregation with average was the European countries. The European countries for this study are the European union (EU) countries plus Croatia, Iceland, Norway, Switzerland and again we have aggregated by average function(European Commision, 2014).

4. Data Mining

After the data collection and aggregation, data is normalized in order to make all indices comparable. In order to normalize, each data index is transformed into yearly percentage change (YPC) with formula in equation (1)(Seker, Cankir, & Arslan, 2014).

$$YPC_{i+1} = \frac{x_{i+1}}{x_i} \tag{1}$$

negative change on each year. From the data set, the change is between 0.498 and 1.805 for all the data set. The minimum change value is for ICT Export for Gulf countries in year 2012 and the maximum change is for CPI for Turkey in year 2002.

During this study, the data mining is mostly applied for investigating the association between time series and correlation between data vectors.

One method we have applied is searching for the correlation between data sets. The correlation algorithm we have utilized in this study is Pearson’s r function, which can be defined as in equation (2)(Seker, Unal, Erdem, & Kocer, 2014).

$$r = \frac{\Sigma(x-\bar{x})(y-\bar{y})}{\sqrt{\Sigma(x-\bar{x})^2 \Sigma(y-\bar{y})^2}} \tag{2}$$

in above formula $x \in Array1$ and $y \in Array2$, where Array1 and Array2 can be any data sets like ICT export, import, GDP or CPI. Also \bar{x} and \bar{y} are the mean values of the Array1 and Array2 relatively and can be formalized as in equation (3)

$$\bar{x} = \frac{1}{n} \sum_{i=1}^n x_i \tag{3}$$

The correlation matrix (Seker et. al. 2013) is built on the binary coupling of all arrays and values are calculated by the Pearson’s r function as given in equation (2).

Finally the correlation matrixes for attributes (ICT Exports, ICT Imports GDPP and CPI) are given as in Table 1 Binary Correlation Coefficients

Table 2 Binary Correlation Coefficients

Correlation Indexes	US	Euro	Turkey	Gulf
ICT Export/Import	0.707332782	0.770306166	0.494665442	0.079325013
ICT Exp /GDP	-0.183482577	-0.233300897	-0.020183035	-0.330617219
ICT Exp/CPI	-0.101103917	-0.274094848	0.664357671	0.150783623
ICT Import/GDP	-0.531715095	-0.392089768	0.041322356	0.187241398
ICT Import/CPI	0.204542394	-0.550299974	-0.145611561	-0.133970697
GDP/CPI	0.336559581	0.219639684	0.013664796	0.517236472

From the correlation matrix, the correlation between ICT Export and import is highest with 0.51, as expected. The only exception of this case is the Gulf countries, where the correlation is exceptionally low as 0.07, where the average is 0.65 for rest of the countries. On the other hand, the highest second correlation is between ICT Exports and CPI with 0.29 in average and third highest correlation is between ICT Import and GDP with 0.28 in average.

The highly correlated cases can also be listed as below:

- US in ICT Export / ICT Import correlation with 0.71
- Euro in ICT Export / ICT import correlation with 0.77
- Turkey in ICT Export / CPI correlation with 0.66
- Gulf countries in GDP / CPI correlation with 0.51

Another method we have utilized is the linear regression method. Linear regression method simply aims to optimize the linear equation (4) with best a and b coefficients and with minimum error rate e in average (Arslan & Seker, 2014).

$$y = ax + b \tag{4}$$

$$e_{avg} = \frac{\sum_{i=0}^n \text{dist}(p_i, \text{line})}{n} \tag{5}$$

e_{avg} is the average error value and linear regression tries to minimize this value. Also the dist function calculates the distance between point p and line in equation 4 for all the n points. For multiple parameter $x \in \text{Parameters}$ and β_i is the coefficient of x_i , linear regression the equation (4) can be modified as in equation (6).

$$y = \beta_1 x_1 + \beta_2 x_2 + \dots + \beta_n x_n + e \tag{6}$$

Where the linear function of y is defined by multiple variables $x_1 \dots x_n$ and coefficients $\beta_1 \dots \beta_n$ and a scalar value e.

We use GDP as an indicator of the financial crisis and we have 3 more variables, which are ICT Export, ICT Import and CPI. We try to calculate the coefficients (β) values for each parameter and the solution is calculated as in equation (7).

$$GDP = 0.372 \times \text{ICT Exports} - 0.318 \times \text{ICT Imports} + 1.3541 \text{CPI} - 0.3842 \tag{7}$$

The equation (7) is calculated for the US data and mean error rate for US data is between 1% and 2%. The same equation applied to the European data is about 7% and 18% for Gulf countries. This show the fact that US and European data, including Turkey has a higher similarity and Gulf countries are far away from this similarity.

Also the countries show a very close correlation for the same index from the perspective of financial crisis. The crisis can easily be seen on the specific GDP data in Figure 7 GDP Graph of 4 Data Sets.

In this study, we mainly focus on catching a correlation between the financial crisis point and other indicators like ICT and CPI. The effect of crisis on GDP is much more distinct.

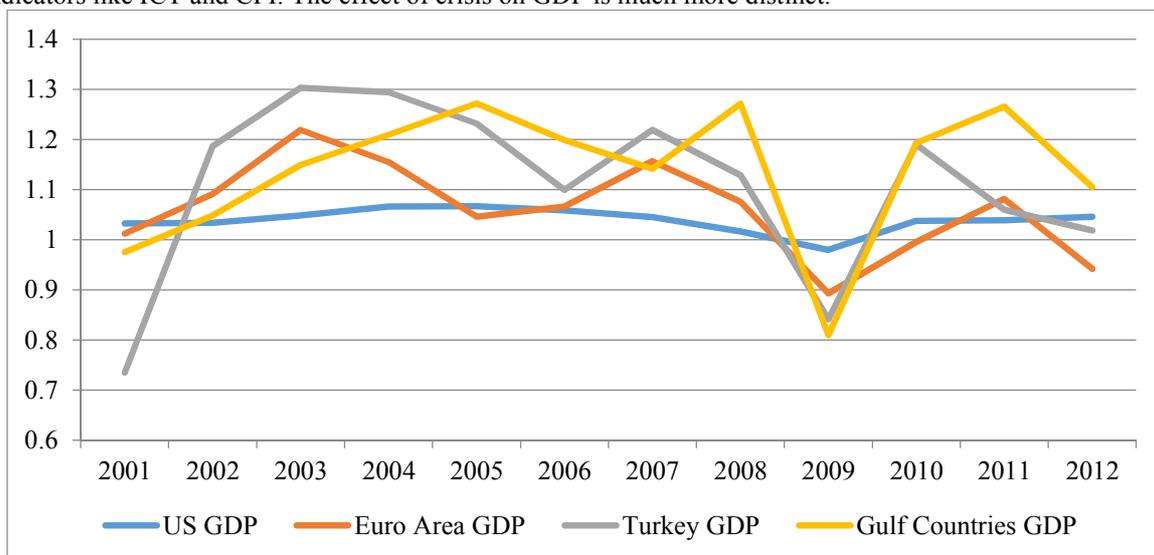


Figure 7 GDP Graph of 4 Data Sets

From the statistical study, the correlation between ICT exports and GDP can be easily notified for Turkey. The similarity can also be observed by comparing “Figure 7 GDP Graph of 4 Data Sets” and “Figure 8 ICT Export Graph for 4 Data Sets”

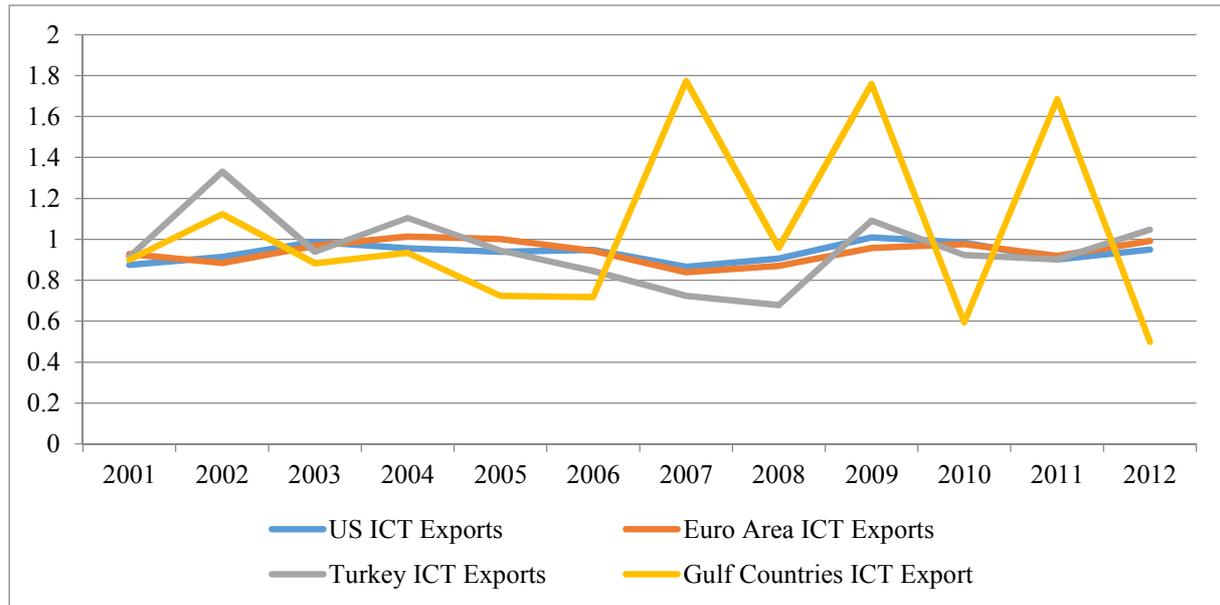


Figure 8 ICT Export Graph for 4 Data Sets

the time delay of 1 year indicates the financial crisis on year 2009 for Turkey case. In order to see it clear the graph holding only Turkey ICT Exports and Turkey GDP is also given in “Figure 9 ICT Exports vs. GDP of Turkey” separately.

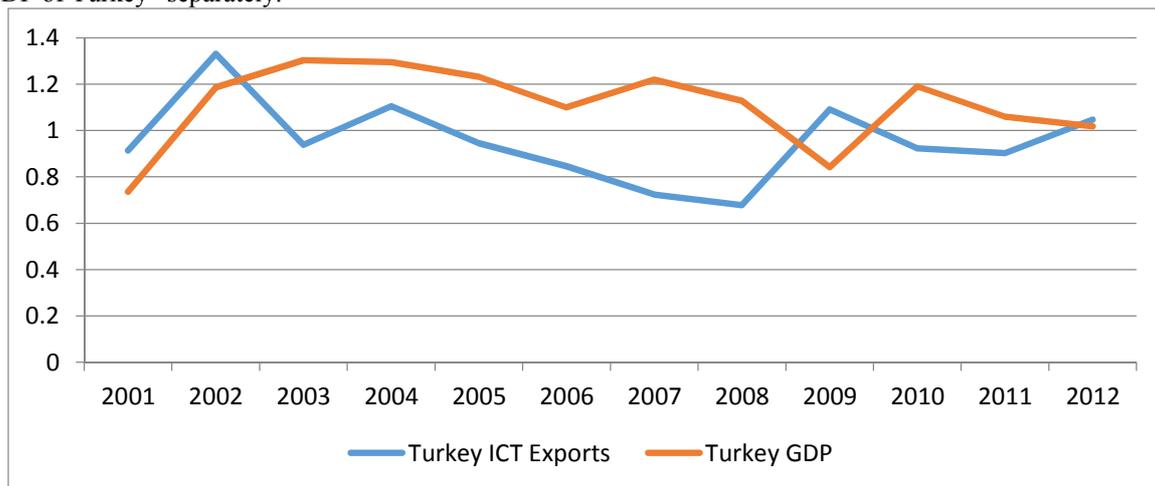


Figure 9 ICT Exports vs. GDP of Turkey

The graph of Turkey ICT Export / GDP can be viewed in 4 regions where in each region ICT Exports is 1 year ahead than the GDP. The first data part is between 2001 and 2002 where there is a parallel increase headed by ICT Export. After 2002 to 2008, there is slight negative slope again headed by ICT exports and followed by the GDP, the third group of data is an increase of ICT Exports between 2008 and 2009 where the increase is exactly copied by GDP just after 1 year period. Finally a slight decrease on ICT Exports is again followed by GDP. From all four regions of data the correlation between ICT Export and GDP can be followed in

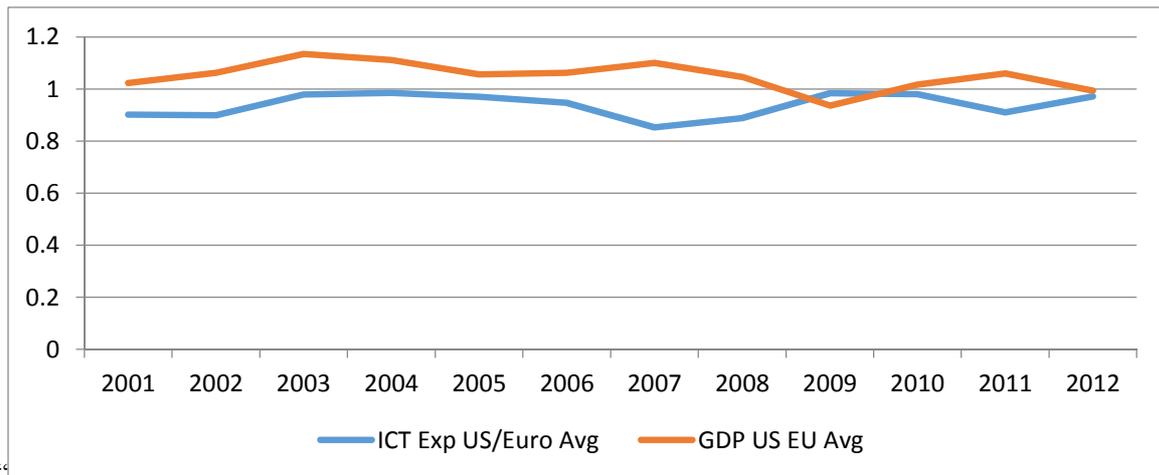


Figure 10 ICT Export and GDP Correlation with 4 Regions for Turkey case”.

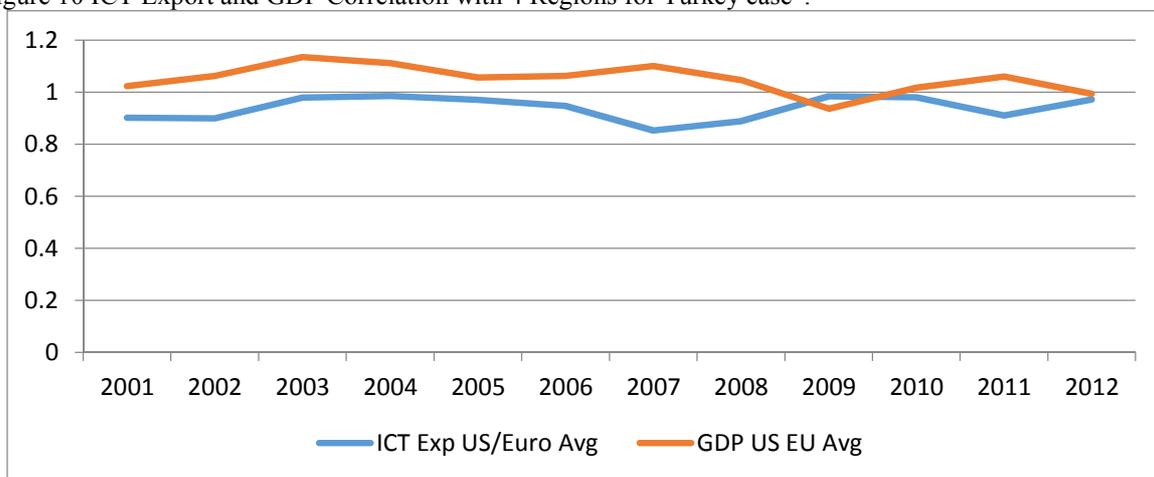


Figure 10 ICT Export and GDP Correlation with 4 Regions for Turkey case

Exactly same regions applies for US and Europe cases as demonstrated in “Figure 11 ICT Exports against GDP in average for Europe”.

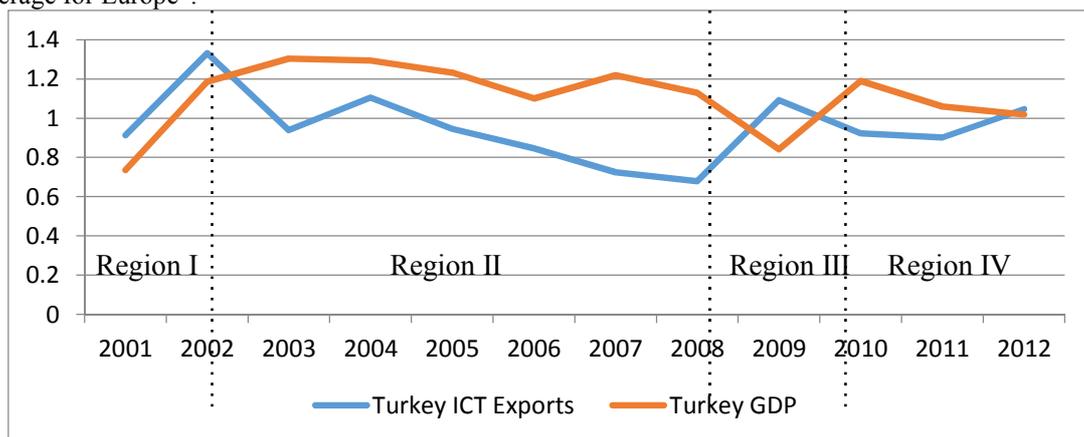


Figure 11 ICT Exports against GDP in average for Europe

From those correlations, one can easily conclude a financial crisis effect can be monitored from ICT Exports values before the effect on GDP. Unfortunately GDP countries do not fit into this pattern.

5. Conclusion

From this study, it is possible to conclude there is a high correlation between ICT Export and Import rates, consumer price index and GDP of the countries or markets. It is first time in this study, this correlation is investigated and a high correlation rate has been modelled in a data-mining pattern by Pearson’s r and linear regression methods. The data mining methods also showed us a time delay between ICT export and GDP of

countries. From this correlation, it is possible to predict any financial crisis 1 year before by simply following the changes on ICT Exports. We believe this research will be useful in future studies and predictions of financial crisis as well as the correlation model will be one of the first models for future studies. Also, correlation of other markets like Asia, South America or Africa can be a subject to a future study.

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Acknowledgement: Work of Sadi Evren SEKER is supported by Istanbul Medeniyet University, research projects department under project number SUA-2013-435.

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