ERASMUS UNIVERSITY ROTTERDAM
ERASMUS SCHOOL OF ECONOMICS
BSc Economics & Business

Effect of weather on European consumer confidence

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Preface

Dear reader,

This bachelor thesis is my final act before graduating as a Bachelor of Economics at the Erasmus School of Economics. After these years, the Erasmus University has learned me a lot on both a scientific level as well as social level. I had the honour of organising the EFR Business Week, which has taught me very valuable skills in addition to my academic study. Which would be very hard to teach in a college, and therefore I am very thankful for this opportunity.

On a more academic side I have met great people during these years with who I have had great academic discussions on hundreds of topics. Choosing a subject for my thesis was not very easy but a great challenge. My Frisian heritage pushed me softly and almost automatically in weather related topic.

I hope this new view on the Consumer Confidence Index will be an interesting read.

Lastly I want to give a very special thank you to Dana Sisak who gave me a lot of critical reviews, which helped this paper a lot. I also want to thank the people who did a very extensive spell check on this paper.

Yours sincerely,

Vincent van Wingerden

1. Intro

1.1 Introduction

In the Netherlands the most bespoke topic is probably the weather, which might be due to our history with water. The earliest civilisations in the “Lower lands” (currently the Netherlands) built “terpen”. These were man-made hills where houses were built upon. Much later (around 1100 AC) the Dutch started to build dikes, these here also very necessary. Because the Dutch population kept growing and so did the chance of flooding. There was a constant battle with the water in the Netherlands. To keep our agricultural land dry and suitable for agricultural products, windmills were built; in 1409 the first water management windmill was motioned in historical documents. These worked so well that more parts of wetlands were pumped dry to be utilised as farming land. This water management was taken to the next level by building the “Afsluitdijk” in 1932 to prevent flooding in the country. The latest act of big water management was the reclamation of land: “Zuidelijk Flevoland”. This 430 km^2 of land was pumped dry in 1968. The building of “Maasvlakte 2” is the latest land reclamation with the size of 20km^2. This water management is extremely important in the Netherlands. If we did not have these measures we would lose 26% of our land surface.
Not only water plays a big role in the Dutch culture. The very unpredictable temperatures and weather conditions make the weather an important factor in the daily life of many Dutch people.

Around the world, every year we see various disasters induced by weather, for example flooding’s, hurricanes etc. These have extreme effects on both local and nation-wide economies. The most costly hurricane in the United States was Hurricane Katrina in September 2005, which has induced damages of 108 billion dollar (Blake, 2011) and 1200 deaths. This had big influence on economic factors. The after-effects are still visible today.
However, bad weather conditions do not only have a negative effect. Belasen (2007) shows that after small hurricanes the earnings and employment of people in the hit area rise by as much as 4%. This effect is the contrary for a neighbour area.

After realising that weather has such a big effect on people, I wondered if weather effects could be found in macro-economic indicators. Because many macro-economic variables are on a quarterly basis, these variables could not be used, since the weather effect would probably vanish. Therefore I chose to research the effect of weather on the consumer confidence index (CCI). Also because I hope a direct weather effect is visible and this is a monthly indicator.

The layout of this document will be as follows: I start with a literature review on the effect of weather on people in chapter 2. In chapter 3 I will look at the used data, the weather data and the consumer confidence index data. In the fourth chapter I will discuss the results.

1.2 Goal

This thesis will try to answer the question if weather influences the consumer confidence index in Europe, and if so how big this effect is. This leads to my main question:

Does weather effect the consumer confidence index in Europe?

To answer this question I start with a literature survey on the effect of weather on the behaviour of people. This is done to get a grasp on the previous literature to better understand the decision making process of people under various weather conditions.
With this, I will be able to analyse the result of my research better.

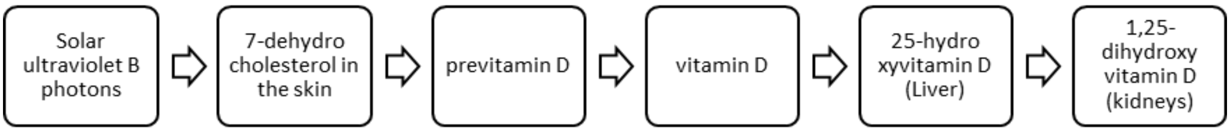
The economic research will consist out of econometric models to regress various weather variables on the consumer confidence index. This will hopefully answer the main hypothesis.

2. Literary review on the effect of weather on people

Before making models and frameworks, I will first do a literary review on the effect of weather on people. First I will look at the biological physical effect to see what our bodies do with sunshine. This will be a basis to better understand the actions people take when under the influence of sun. Then I will look for the short-term economic effect of weather change. Finally I will be looking at the long-term economic effect of being exposed to good or bad weather for a longer period.
My research shows that the biggest influence of weather on people is due to sunshine so I will focus on this effect for the first part.

2.1 Physical effect of weather on people

Because sunshine is a weather effect people will encounter every day, and has a big effect on the human body I will start with this effect. The biological process of sunshine on to a human body is as follows (Holick 2004):



In words: the sun emits ultraviolet B photons, which are absorbed by the skin and transformed to 7-dehydrocholesterol in the skin. This is transformed to previtamin D, which then is converted to vitamin D. In the liver this is converted to 25-hydroxyvitamin D, this is transformed in the liver again to the working substance 1,25- dihydroxyvitamin D. The amount of vitamin D produced depends on various variables, like: aging, skin pigment and whether you are sitting behind glass. A shortage of vitamin D can cause big physical problems. For example children can form the disease Rickets, a deforming of legs from a vitamin D shortage. For adults a vitamin D shortage can lead to osteomalacia; a bone disease which makes bones very fragile. Besides this, a vitamin D shortage is also linked to cancer and type one diabetes. This shortage can be cured with a couple of minutes of direct sunlight every day.
In general the effect of vitamin D aids in the absorption of calcium, iron magnesium and zinc. The shortage of these substances can cause the diseases described above.
But not only physical diseases are caused by a vitamin D deficiency also mental effects are shown. An example is Seasonal Affective Disorder (SAD). People with this disorder present significant other behaviour in certain seasons, for example during winter (Harmatz, 2000). People suffering from SAD are significantly angrier, hostile, irritated and more anxious during winter months. This effect is stronger for women than for men. The regular

treatment is light therapy, which means being exposed to special artificial sunlight. Studies have shown that also vitamin D can help people recover from SAD (Gloth, 1999).

As shown above, vitamin D has a big influence on the human body, not only physical but also mental. Therefore I expect that this also influence the behaviour of people. I will investigate if this effect is present in the next two parts, where I look at the short-term and long-term effects.

2.2 Short term decision-making effect

To start I will look at the effect of weather on the stock exchange. Because weather has effect on people's mood, this might be reflected in the stock exchange. If so, the markets are not perfectly efficient, which is generally assumed. This is a subject of various papers with various outcomes. Sanders and Hirshleifer (1992) and Shumway (2001) say that there is a weather effect on the stock market. This means markets are not efficient and traders are influenced by weather. This could be a promising discovery for this research. The significant weather variable in these studies are sunshine- / cloud cover, and because these are perfection correlated these can both be used. Although these papers show a strong significant effect, Pardo and Valor (2003) and Trombley (1997) say these effects do not exist, or are not significant and too small. These finding would be good for the efficient market prediction. So the effect of weather on the stock market is yet to be determent.
Other studies study the short time effect of weather on people's mood, for example Denissen (2008). This study shows there is a significant effect of six weather variables on people's mood: temperature, wind, sunlight, precipitation, air pressure and photoperiod. The effect was the biggest for photoperiod, which is the time people are exposed to sunlight. This could be related to vitamin D production discussed earlier. More exposure to sunlight results in a better mood.
Finally I researched the effect of weather on consumer behaviour. It is shown that weather has a significant effect on the sales of a department store (Steele, 1951). The data was gathered in the 50's so this could lead to questions in the current day and time. There was a newer study (Kyle, 2010), which conducted 5 different studies in different places with various conditions. This shows that there is a strong significant relation between consumer spending and weather conditions. The study also experimented with exposing participants to artificial sunlight via a "sun lamp". These studies show that there is a significant effect of sunlight on consumer spending however the size of this effect does differ per research.
Weather also shows a significant effect on elections (Sofra, 2014). With better weather the turn up for elections is higher. The research showed the weather affected the outcome in the recent elections in Italy. When it is sunnier outside, the protest party 'Movimento 5 Stelle', performed better during the elections in Italy of 2013.

As shown in all these studies, weather, and mostly sunlight, does have a significant direct effect on people's behaviour, which makes the hypothesis of this research more plausible.
Next I will take a look if weather effects also show a significant effect on human behaviour for longer periods of certain weather.

2.3 Long term decision-making effect

There are fewer studies on the long-term effects of weather impacts on human behaviour than the short-term effects.
I have already shown that seasonal changes do affect people; for example people who suffer from Seasonal Affective Disorder (SAD). These people are not directly influenced by bad weather, however if this bad weather remains for longer times, this can leads to emotional unstable behaviour. Besides the studies on the physical effect of weather, there have also been some studies on the behavioural effect. For example, it is shown that monthly weather influences the department store sales (Star-McCluer, 2000). This study shows that if a month has different weather than people would have expected for that time of year, this has a modest but significant effect on sales. This effect however gets smaller if you monitor yearly quarters instead of months. This could be due to averaging, or people are just less affected by the weather on the longer therm.
Engle (1986) has shown there is a relation between monthly weather and the monthly energy bills in households. The study found a significant effect. This is explained because people like comfort. When it is freezing outside the heater will be turned up, and when it is very warm people might be using cooling to get the desired temperature.
Although the effect of monthly weather is researched less, it shows that monthly weather changes have a significant effect on people. However, to get a better understanding of decision making of consumers under various weather conditions, some more research has to be done.

3. Data

In this chapter I will present the data I obtained and try to see whether there can be found trends. I will both look at the weather data as well as the Consumer Confidence Index.
The timescale of the study is from 1970 to 2008. To make the study robust I have used 10 countries, namely: Belgium, Denmark, Germany, Spain, France, Italy, Luxembourg, the Netherlands, Portugal and the United Kingdom. I selected these countries because they are roughly in the same geographical area and all have the same statistical methods to collect CCI information.

3.1 Weather data

For the weather variables I have used maximum temperature, minimum temperature, average temperature, precipitation and wind, these are averages from one month. As seen from the previous chapter, sunshine is a very influencing factor, although this variable is not available for this entire time period and all these countries. I have tried to get all the weather data from 1970 to 2008. My data set is not complete because some measuring weather stations do not go back so far. This is not a problem because the consumer confidence index is registered from 1985. Except for a few data points the entire weather data set is complete, all the values are monthly. The data source is www.tutiempo.net. For every country I used the Capital City as weather station. Because the site did not have the option to download all the data needed at once, I have written a custom software tool to automate downloading. This enabled me to download all the data I needed in a fraction of time for the time it would have cost to do this manually. The source code of the software can be found in Appendix B. This source code can be used without permission but is licensed "as is". Complete disclaimer can be found in Appendix B.

3.1.1 Explore temperature variables

There is an endless discussion on whether the earth is heating up or not. On one side we have the 'climate-worried people' who believe the warming of the earth will be very harmful to the nature and humankind. They even say that a heating of the earth could lead to an early nature disaster like a snow age. On the other side there are commercial, corporate and non-corporate companies, who are 'polluting' the environment and believe this does not harm nature or people.
Scientists' opinions are also divided whether the earth is warming up or not. As a source I will use the NASA (Riebeek, 2010) on the global warming outlook. This paper investigates the average earth surface temperature in the past. It also tries to predict future developments. This paper shows that earth warming and cooling is a natural cycle. However it is pointed out

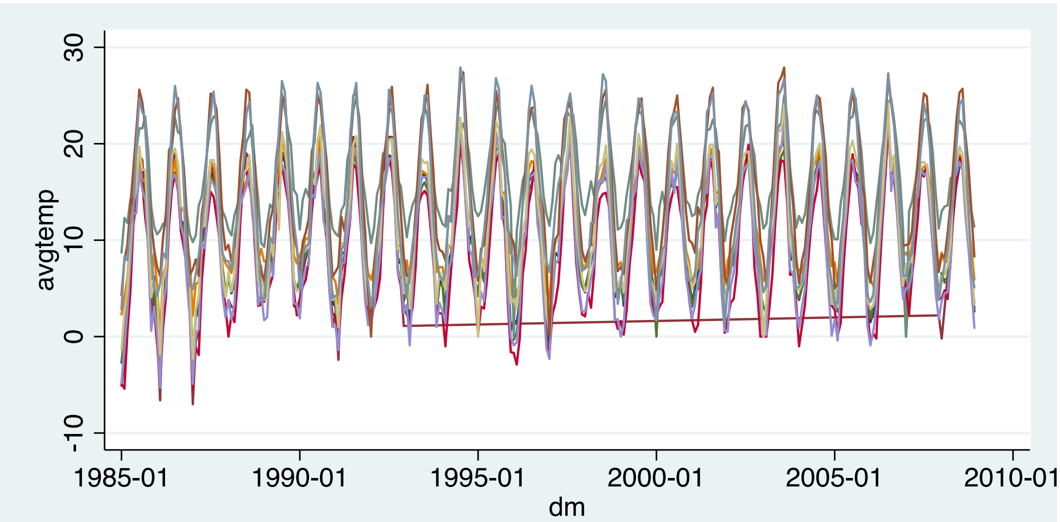
that the current earth warming is too fast to be caused by nature alone. The paper points out that greenhouse gasses produced by people and industry is the main source of the heating. The paper expects the earth to warm up even further in the near future.
The paper states when the greenhouse gas production would stop immediately, the average temperature would still rise 0.6 degrees Celsius until 2100. If the production of greenhouse gasses grows in a moderate rate the average temperature at 2100 will probably be 2-3,5 degrees Celsius higher than today. The highest scenario predicts a growth of 6 degrees Celsius at the year 2100. Al these growth models show an exceptional trend.

For all the future regressions I will use a 5% significance rate.

I will start looking at my data whether I can see the same pattern in all the temperature variables. I will first do a simple regression, which will check the effect of time on the temperature variables. This can show if the temperature is indeed increasing as NASA expected. I will do this for the average temperature, maximal temperature and minimal temperature. This gives the following regression:

$tempvariable = c + \beta * time$ (1)

See table 10 in Appendix A for the full results.
This shows a significant effect, although this effect is small. The model shows a small increase in temperature per month. However as seen in the graph the average temperature is not very easily explained by a linear effect.



Graph 1 Average temperature from 1985 to 2010

What is shown is that the average temperature has a cyclical flow throughout the years, E.G the seasons; this effect is shown for all the temperature variables. To correct for this effect I will use fixed effects. The fixed effect I have chosen is the variable *month*, because every year the average temperature will follow roughly the same flow. The fixed effect model takes this into account. The following regression follows from the fixed effect model:

$avgtemp = c + \beta * time + month\ (fixed\ effect)$ (2)

The effect of time on the average temperature is still significant. Also the months have a very significant effect on the temperature. This is expected because the weather roughly follows the same seasonal flow every year.
As stated above, the NASA expects the average temperature to rise between 0.6 and 6 Degrees Celsius in 2100. This model expects a temperature increase of 5.46 degrees Celsius. Last observed data point December 12 2008. Until 2100 91 years and 91*12= 1092 months, multiplied by the monthly effect (0.005) equals 5.46. So the model predicts a big temperature change, which will have big effects on our daily lives. Although this simplified model concurs with the NASA does not mean that it has a big explanatory value. Because it is widely acknowledged that the temperature will grow expansionary, and not linear, as this model assumes.

For the next chapter it is important to know if the temperature variables have Multicollinearity. Multicollinearity means that two or more predictor variables are highly correlated. If the temperature variables do indeed have multicollinearity this means that these variables might not predict the right coefficients in a multi regression model. The results of the multicollinearity can be found in table 11 in Appendix A. The results show that there is a big multicollinearity between the temperature variables which means that models with multiple temperature values have to be interpreted carefully.

3.1.2 Explore wind

Wind is measured in average kilometres per hour in a month. In contrary to the temperature data, the wind does not have a strong seasonal flow. When using the same method as used with the temperatures it will be interesting to see whether months have a significant effect on wind. To find out the effect of time on wind I start with the following regression:

$wind = c + \beta * time$ (7)

The full results can be found in table 10 appendix A. This yields a very interesting result. The coefficient is slightly negative: -0.002, which means that the average wind speed would be falling when time progresses. The coefficient is barely significant with a P value of 0.045.
Because wind did not show a strong seasonal effect in the graph it will be interesting to see the effect if the fixed effect model increase the predictive value of the model.

$wind = c + \beta * time + month\ (fixed\ effect)$ (8)

Also in this model the coefficient of time is slightly negative: -0.001. This effect however is not significant: P value = 0.051. However, the model does show that certain months do have a significant effect, which would mean that average wind speed is a seasonal trend.

3.1.3 Explore precipitation

Precipitation is measured in millimetres per month. Also this data does not show a strong seasonal effect when plotted in a graph. To check for a time trend I again used this regression:

$precipitation = c + \beta * time$ (9)

Full results can be found in table 10 Appendix A. Time has a small positive effect on the amount of precipitation, with a coefficient of 0.04, which would mean that the amount of precipitation would increase a little over time. To check for seasonal effect I will again deploy the fixes effect model:

$precipitation = c + \beta * time + month\ (fixed\ effect)$ (10)

This model shows almost the same results as the previous models, a small significant effect of time. However it is interesting to see that 6 of the 12 months do not have a significant effect. This means that precipitation does not have a strong seasonal effect.

As shown there is a weather trend in Europe. The temperatures are rising. By the end of this century the temperature will be significantly higher. This strong trend is not shown in the other variables; wind and precipitation do not show a significant trend.

3.2 Economical data:

All the economic data has been taken from Eurostat. I used two different variables: consumer confidence index seasonally adjusted and not seasonally adjusted. The time period is from 1985 to 2009. Not all countries have data from so far back, for example Luxembourg goes back to 2001. However, all other counties have data from June 1986 onwards. ‘Directorate General for Economic and Financial Affairs’ a committee of the European Commission, performs the survey. This committee is responsible for the design of the research and the harmonisation of the results. The goal is to provide harmonised figures to be able to compare between countries. The data is gathered every month, within the first

10 working days (Jansema, 2003). Monthly 41 060 Europeans fill out the questionnaire (Directorate-General for Economic and Financial Affairs, 2014).
The following topics are discussed during the interview:

- Financial situation, past 12 months Purchase of a car, next 12 months
- Financial situation, next 12 months Purchase of a house, next 12 months
- General economic situation, past 12 months Home improvements, next 12 months
- General economic situation, next 12 months
- Consumer prices, past 12 months
- Consumer prices, next 12 months
- Unemployment, next 12 months
- Major purchases of durable consumer goods, current environment
- Major purchases intentions, next 12 months
- Savings, current environment
- Savings intentions, next 12 months
- Capacity to save

The questions are the same for all the countries; it is possible to have extra questions per country, this discussion is made per country. All questions are closed with the possible answers: very likely, fairly likely, not likely, not at all likely and do not know. The index goes from -100 to 100 where -100 means no confidence, 0 neutral and 100 extreme confidence.

The seasonally adjusted data is generated from the same research, however this is adjusted by software for seasonal moves. The algorithm used to adjust for season effect is Dainties, this algorithm was made by the Eurostat. This corrects for big peaks in consumer confidence in seasonal trend because of the holidays for example.
The DNB (Dutch National Bank) has research which components compose the CCI, for the Netherlands. It followed that the CCI index is made up from broadly two views namely, the information view and the Animal spirit. The information view says the CCI is made up from rational expectations of future expenditures and earnings. Where the Animal spirit explains the CCI with a more irrational view, this means that people are overly pessimistic or optimistic about future expectations. The research shows that both these two views together can explain the economic situation from 1980 to 2000. The current crisis however has another explanatory variable, namely trust. Trust does not only refer to trust in the economic situation but also to the political situation. Trust can be very low in unstable political situations, for example when a government is not stable. In the Netherlands, the last cabinet that completed the four-year term was from 1994 – 1998, this causes some insecurity in the political landscape, which is translated into low political trust. Also De Boef (2004) researched the cause of CCI, the paper challenges the assumptions that the CCI is largely based on objective economic conditions. The paper shows that politics have a big effect on the CCI, both on the long and short term. This is not only due to the decisions

made by the politician, but also by the trust that people have in the economic management skills of their president. These decisions and skills are aggravated in the media, which is presented to the public.

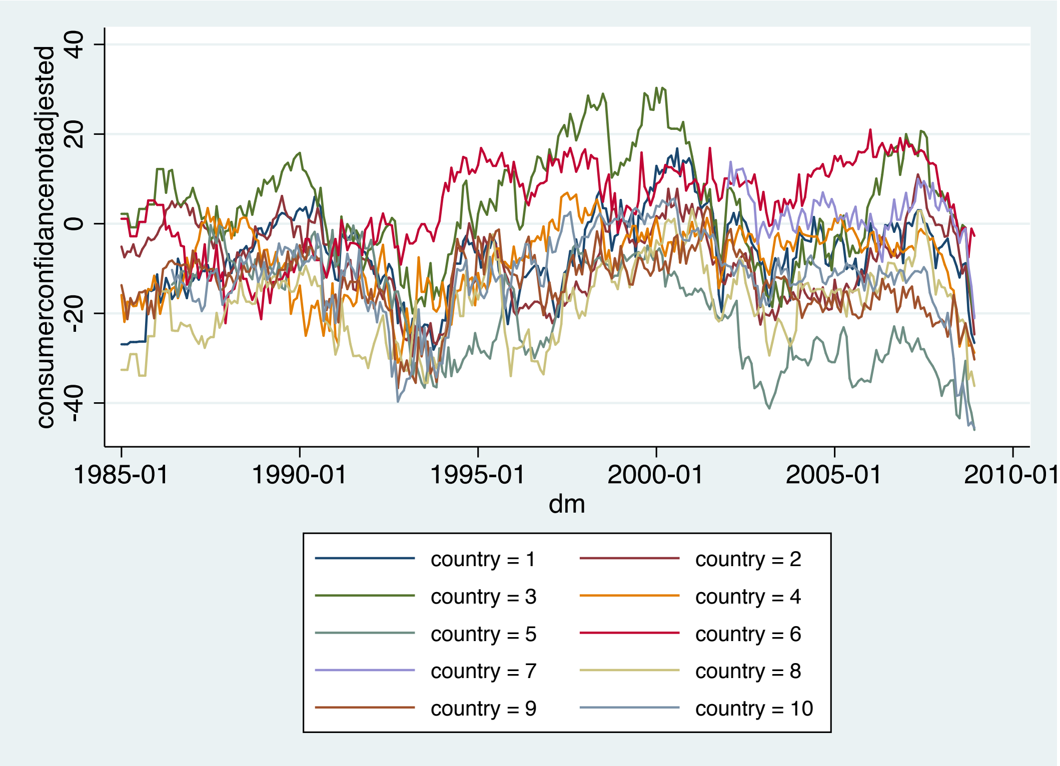
The media therefore also plays a role in the CCI. It was already clear that the CCI affects politics and policy decisions. However this research shows that the relation is also the other way around.

In previous research (Lemmens, 2007) it shows that consumer confidence is specific for every European country on the short run. Which implies multinational companies should adapt different policies for every county. However in the long run the CCI becomes more homogeneous. This would mean that the European countries are going towards a single CCI line. Another research (Preat, 1989) looks into the forecasting power of the CCI. This study shows that the CCI can be a useful variable when forecasting economic models. In this research the oil prices are compared to the private consumption of oil. The research shows with a higher CCI the consumption of oil is higher even when correcting for the price levels. The research of Matasusaka (1995) goes even further, this research shows that a drop in CCI precedes a recessions. This paper shows that CCI not only precedes the recessions but also can be used to foresee recessions. It is shown that fundamental economic factors are not the only important reasons for a recession. The CCI plays a very big role in this economical process. Keynes talked about the "mass psychology of the market" where he emphasised how important the spirit of the population was for the economy. This psychology can force an economy into a recession.

Like with the average temperature, I will also see if the CCI and CCIa show trends.

3.2.1 Explore consumer confidence index

I will use the same approach as with the weather data. I will first check for a trend with a simple regression, with the data set as panel data. Afterwards I will see if months have a significant effect on the variables. To explore the data before doing regression I have first plotted all the data shown in this graph:



Graph 2 consumer confidence index not adjusted for seasonal effects

Country id: 1= Belgium, 2= Denmark, 3= England, 4= France, 5= Italy, 6= Luxemburg, 7= Netherlands, 8= Portugal, 9 = Spain

As can be seen, there is no strong seasonal trend in the data. However it can be seen that when in 2008 the economic crisis started, this had a strong effect on the consumer confidence.

To start, I will look at the consumer confidence index not adjusted for seasonal effects. I will perform the following regressions:

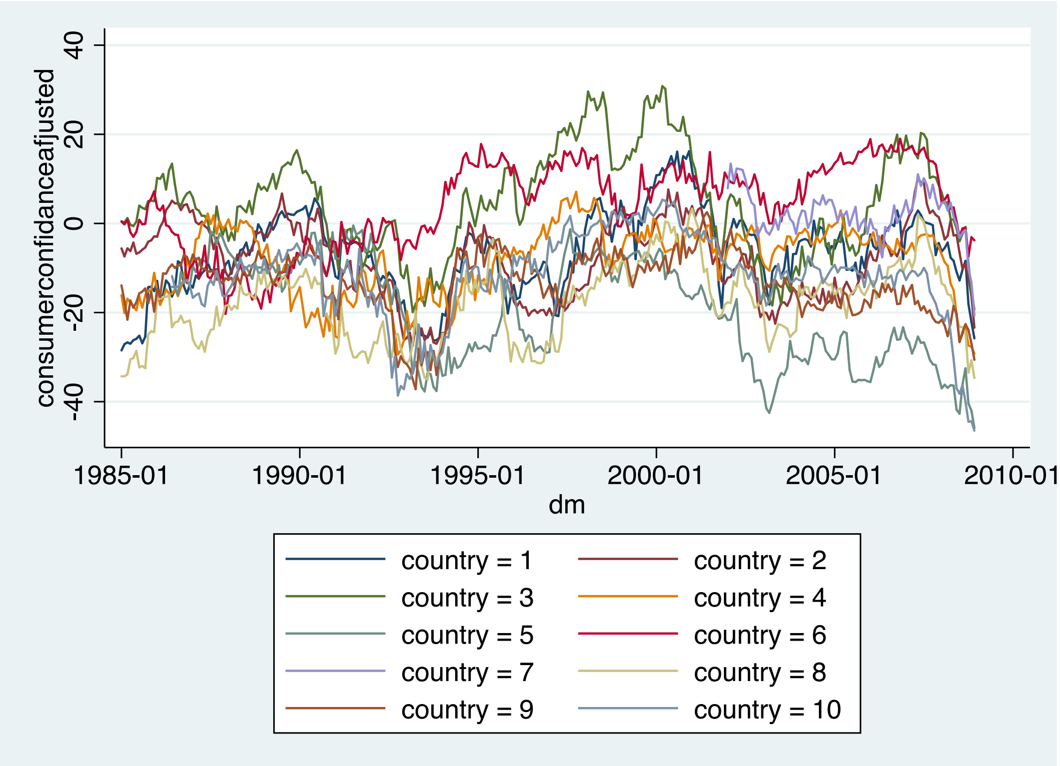
$CCI = c + \beta * time$ (11)
$CCI = c + \beta * time + month\ (fixed\ effect)$ (12)

All the results can be found in table 14 in appendix A. The consumer confidence raises slowly, with 0.01 index point per month, this is a significant effect. However seeing the graph the model fit is not very good. Looking at the fixed effect model the results are exactly the same as the model without the fixed effects. The only interesting thing to see is that months only show a significant effect in the last three months of the year.
Before regressing the weather variables with the CCI variables I will check if there is multicollinearity, between the CCI and the weather variables. The results can be found in table 12, Appendix A. As can be seen the weather variables individually do not have high multicollinearity with the CCI. However when including multiple temperature variables the multicollinearity is very high. Interesting is that the combination of temperature variables

and wind or precipitation do not give a high multicollinearity. This is positive for the relation between CCI and weather, because if a relation between weather and CCI as shown, this will not be due to multicollinearity.

3.2.2 Explore seasonal adjusted consumer behaviour

When looking at the previous regressions and this graph it is expected that also this model does not show a strong time or seasonal trend. However to see if this prediction is true I will first do the regular regression:



Graph 3 consumer confidence index adjusted for seasonal effects

Country id: 1= Belgium, 2= Denmark, 3= England, 4= France, 5= Italy, 6= Luxemburg, 7= Netherlands, 8= Portugal, 9 = Spain

$CCI = c + \beta * time$ (13)

$CCI = c + \beta * time + month\ (fixed\ effect)$ (14)

Unfortunately the outcomes do not differ from the previous results, as seen in table 14 in appendix A. The coefficient of the first model is still small. It will be interesting to see if the seasonal adjusted model will show a significant monthly effect. It is expected that the data will not show this because it should be corrected for by the season adjustment. The model shows the same characteristics with the average temperature. However, looking at the monthly effect, it shows that there is not a single month with a significant effect on the not seasonal adjusted consumer confidence. This confirms the prediction and shows that the data is correct fully adjusted for seasonal effects. The results for the multicollinearity test are in table 13, appendix A. The results are almost exactly the same as for the CCI.

As shown above both data sets are not really affected by either a time effect or a seasonal effect. This can be very important for the results of this research, because the temperature variables are affected by time, and mostly months. In the next chapter I will discuss the results from the regressions made.

4. Results

In this chapter I will see if there are effects of weather on the CCI and the CCIa. I will first look at the regular CCI with a more extensive result explanation, afterwards I will do the same test for CCIa, however with less extensive explanation.

4.1 Weather effect on consumer confidence index not seasonally adjusted

As seen in the previous chapter the results are not spelled out, actually the results are a bit contradictory. This will make it very interesting to see whether the weather does or does not affect the consumer confidence index, both seasonal and not seasonal adjusted. I will first regress all the weather variables with the consumer index to see which variable shows a strong relation. I have set the data set to be panel data with country as a panel variable. The results are in the table below. The regressions is as follows:

$CCI = c + \beta * (varibles)$ (15)

	Avgtemp	Mintemp	Maxtemp	Wind	Precipitation
Slope	0,15	0,18	0,13	-0,13	0,00
P (slope)	0,00	0,00	0,00	0,02	0,39
Con	-9,13	-8,71	-9,39	-5,44	-7,47
P (con)	0,00	0,00	0,00	0,04	0,00
R^2	0,02	0,02	0,03	0,06	0,05
Obs	2691	2691	2691	2666	2691

Table 1

The results are not very unexpected. The temperature relations are significant, however this effect is not very big. One degree of extra average temperature only increases the consumer index with 0,15 points. Knowing that the consumer index goes from -100 to 100 shows that temperature has a very small effect on the CCI. The wind shows an interesting significant negative slope. This would impose that harder winds will decrease the CCI. Lastly the precipitation, which does not show a significant P, which means it probably does not affect the CCI.

As seen in the previous chapter the temperatures have a big monthly effect. In the previous model these monthly fixed effects are not included. To make this model more representative I will introduce the fixed effect of *months* in the following model, to better represent the weather variables.

$CCI = c + \beta * (varibles) + fixed\ effect$ (16)

	Avgtemp	Mintemp	Maxtemp	Wind	Precipitation
Slope	0,59	0,69	0,45	-0,11	0,01
P (slope)	0,00	0,00	0,00	0,07	0,30
Con	-10,04	-8,56	-10,75	-5,75	-7,54
P (Con)	0,00	0,00	0,00	0,00	0,00
#Months*	11	11	12	3	3
R^2	0,07	0,07	0,08	0,00	0,02
Obs	2691	2691	2691	2666	2691

Tabel 2

*The number of months, which have a significant effect

These models show interesting changes. Only the temperature variables have significant effects. However these effects did get bigger, the effect of the variables almost got four times bigger than the previous model showed. So this model shows that when the average temperature rises one degree the CCI increases 0,6 index point. Knowing that a better fitting model shows higher slopes means that temperatures have a big effect on the CCI.

The weather variables are not independent as seen in the first chapter the temperatures move parallel up. I used a model with all the weather variables to see what effect the variables have when packed in one model. I will make one model with fixed effects and one without. As seen in the previous chapter in these situations the VIF (measurement for multicollinearity) does get very big which means that there is multicollinearity. Therefore this model cannot be used to make an accurate prediction of the CCI, however it is interesting to see the size of the slopes when incorporated into one model. This results in the following models:

$$CCI = c + \beta * avg + \beta * max + \beta * min + \beta * wind + \beta * precipitation \quad (16)$$

$$CCI = c + \beta * avg + \beta * max + \beta * min + \beta * wind + \beta * precipitation + fixed\ effect \quad (17)$$

	Without fixed effect		With fixed effect	
	Slope	P	Slope	P
Avgtemp	1,17	0,13	0,08	0,93
Maxtemp	-0,64	0,11	-0,10	0,83
Mintemp	-0,36	0,40	0,73	0,11
Wind	0,00	0,52	-0,16	0,01
Precipitation	-0,09	0,14	0,00	0,47
Constant	-7,05	0,00	-5,97	0,00
R^2	0,01	-	0,08	-
#Months	-	-	11	-
Obs	2428		2428	

Tabel 3

*The number of months, which have a significant effect

As can be seen, this model contradicts the results that have been seen previously. The average temperature and the maximum temperature are not significant, whilst minimum temperature wind and precipitation are. In the fixed effect model it can be seen that none of the weather effects are significant except for wind.

The previous model does not show strong weather effects on CCI. However, as shown the weather variables have very high multicollinearity, which can explain these completely different results. Although the model includes a fixed effect for months, other external effects are not included in this model. These effects can be economical effects or social effects, for example the GDP growth or the unemployment rate. I will try to include these effects to make a better fitting model. To do so I will introduce an autoregressive model. Autoregressive (AR) models include the value of the previous independent variable. This is called a 'lag', which gives this model: $y = c + \beta x + y_{t-1}$. These models attempt to include external effects, which are not included in the dependent variables. In this case an external effect can be the GDP growth or the unemployment rate. To use this model it is important to know how many lags to include, e.g. if I include two lags this means the value of the previous two independent variables is included in the model. To know how many lags to include, I will use the Log like likelihood, AIC, HQIC and SBIC tests. These test select a model with one lag. Therefore I will perform the following regression to have a good image of the lag effect:

1. $CCI = c + \beta * \ avgtemp + CCI_{t-1}$
2. $CCI = c + \ \beta * avgtemp + \beta * maxtemp + \beta * mintemp + \beta * wind + \beta * percipitation + CCI_{t-1} + fixed\ effect$
3. $CCI = c + \ \beta * avgtemp + \beta * maxtemp + \beta * mintemp + \beta * wind + \beta * percipitation + CCI_{t-1}$

	1		2		3	
	Slope	P	Slope	P	Slope	P
Lag	0,97	0,00	0,95	0,00	0,97	0,00
Avgtemp	-0,32	0,00	0,47	0,01	1,04	0,00
Maxtemp	-	-	-0,19	0,22	-0,46	0,00
Mintemp	-	-	-0,16	0,30	-0,56	0,00
Wind	-	-	0,05	0,00	0,02	0,25
Precipitation	-	-	0,00	0,74	0,00	0,53
Con	0,07	0,64	0,74	0,14	-1,24	0,00
R^2	0,93	-	0,93	-	0,93	
#Months*	-	-	12	-	-	-
Observations	2433		2433		2433	

Tabel 4:

*The number of months, which have a significant effect

These results are very interesting. The first model shows that average temperature does have an influence on the CCI, this was already expected in the previous chapter and confirmed here. However, it is interesting to see that this effect is negative, whereas in the previous models average temperature had a positive effect. The lag coefficient shows a significant big effect on the CCI. But when combining the lag and average temperature slope, the combined slope is almost the same as the simple fixed effect model. When adding more weather variables the average temperature has the biggest effect on the CCI, together with the lag this is a big significant effect. Also wind has a significant effect although this effect is extremely small. As we saw before, the other weather variables have an insignificant effect. The last model is very different as to the other models. Here it shows that the maximum temperature and the minimum temperature have a significant effect, but this effect is negative, which is not shown before. This effect can be explained because the fixed effect is not included in the model.

In the previous models I only used months as fixed effects to correct for monthly effects. This only corrects for the seasonal effects for all the countries. If a certain country reacts different to weather effects than another country, this effect will not be taken into account. Therefore lastly I will use a model with a dummy variable as fixed effect. The dummy variables are a combination of the variables $year$, $country$ and $month$. With the dummy variables $year * country$ a unique dummy variable is create for every unique combination of $year$ and $country$.
These are the models I will use:

1. $CCI = c + \beta * (avgtemp) + fi\square ed\ effect(year * county)$ (17)
2. $CCI = c + \beta * (avgtemp) + fixed\ effect(month * county)$ (18)
3. $CCI = c + \beta * (avgtemp) + \beta * (maxtemp) + \beta * (mintemp) + \beta * (wind) + \beta * (\text{precipitation}) + fixed\ effect(month * county)$ (19)
4. $CCI = c + \beta * (avgtemp) + \beta * (maxtemp) + \beta * (mintemp) + \beta * (wind) + \beta * (\text{precipitation}) + fixed\ effect(month * county)$ (20)

	1		2		3		4	
	Slope	P	Slope	P	Slope	P	Slope	P
Avgtemp	0,12	0,00	0,68	0,00	1,11	0,00	0,66	0,53
Maxtemp	-		-		-0,35	0,07	0,30	0,59
Mintemp	-		-		-0,69	0,00	1,19	0,04
Wind	-		-		-0,01	0,75	-0,20	0,00
Precipitation	-		-		-0,00	0,91	0,00	0,44
R^2	0,42		0,00		0,30		0,00	
Obs	2445		2445		2420		2420	
Groups	10		10		10		10	

Tabel 5

The results are very interesting; in the first tree models average temperate has a positive and significant influence. In the third model it is interesting to see that the other weather variables (minimal temperature and maximal temperature) have a negative influence in CCI, although the maximum temperature variable is not significant. The fourth model is completely different. Where only two temperature variables are significant. Although the effect of weather is not completely clear, e.g. the models give other outcomes on both the significance and the slope. It can be seen that the weather does influence the CCI, however these models do not show clearly how.

I will finally test the same CCI and weather dataset, however not set as panel data. Instead I will use a regular OLS model. I will use fixed effects to see whether a significant effect can be found and see what causes this effect. Before testing the OLS I will test if all the criteria of the Gauss–Markov (BLUE) theorem are met. These criteria are:

1. The residuals are homoscedastic
2. No perfect collinearity
3. Linear regression
4. Zero conditional mean

As seen in the table 15 and 16 in Appendix A, the residuals are homoscedastic and are not normally distributed. The 25th equation did reject the null hypothesis with the heteroscedasticity test, but this can be ignored because it has a lagged variable. The previous part already showed there is no collinearity. The assumptions are met so the test can be performed. The OLS model will try to minimalize the residuals to the fitted value. This is much used method of modelling because of its broad applicability, Alan B. Krueger (2001) called OLS the workhorse of statistics. The tests I will perform are:

1. $CCI = c + \beta * avgtemp + country(fixed\ effect) + month(fixed\ effect) + year(fixed\ effect)$ (21)
2. $CCI = c + \beta * avgtemp + country(fixed\ effect) + month(fixed\ effect)$ (22)
3. $CCI = c + \beta * avgtemp + country(fixed\ effect) + year(fixed\ effect)$ (23)
4. $CCI = c + \beta * avgtemp + \beta * (maxtemp) + \beta * (mintemp) + \beta * (wind) + \beta * (\text{precipitation}) + country(fixed\ effect) + month(fixed\ effect) + year(fixed\ effect)$ (24)
5. $CCI = c + \beta * avgtemp + country(fixed\ effect) + month(fixed\ effect) + year(fixed\ effect)$ + L1.CCI (25)

	1		2		3		4		5	
	Slope	P	Slope	P	Slope	P	Slope	P	Slope	P
Avgtemp	0,33	0,00	0,59	0,00	0,13	0,00	1,36	0,03	0,08	0,03
Maxtemp							-0,62	0,07		
Mintemp							-0,42	0,25		
Wind							-0,16	0,00		
Precipitation							0,00	0,42		
Con	-13,58	0,00	-7,78	0,00	-15,01	0,00	-10,91	0,00	0,88	0,06
R^2	0,67		0,47		0,67		0,67		0,94	
Adjusted R^2	0,67		0,47		0,66		0,67		0,94	
#Years	20				20		20		5	
#Month	12		12				12		12	
#Country	10		10		10		10		8	
lag									0,91	0,00

Tabel 6

The results are very similar to the results found in the panel data models. The average temperature has a significant and positive effect in all the models. Also interesting to see in models 1-4 is that all the countries have a significant fixed effects. This shows that all the countries do have different effects of weather on their CCI. This also shows for the monthly effect and the year effect. However here it also shows that although the average temperature has a significant effect this effect is not very big.

4.2 Weather effect on consumer confidence index seasonally adjusted

I will perform the same test on the seasonally adjusted consumer confidence index (CCIa) to see if the results are equal. Before regressing I will see if there is a significant difference between the CCI and the CCIa by performing a T-test this shows there is no significant difference within the groups. It will be interesting to see if the results will be different, when the groups do not significantly differ.

It is expected that the fixed effects of the months and years are not as significant, as in the CCI model, because the season adjustment should filter out a big part of this effect. If this model also shows a significant effect of weather on the CCIa this will greatly increase the reliability of the previous conclusion. To make sure I am not to repetitive I will only perform the following regressions with panel data:

$CCIa = c + \beta * avgtemp$ (26)

$CCIa = c + \beta * avgtemp + fixedeffect(month)$ (27)

$CCIa = c + \beta * avg + \beta * max + \beta * min + \beta * wind + \beta * precipitation$

$$CCIa = c + \beta * avg + \beta * max + \beta * min + \beta * wind + \beta * precipitation + fixedeffect(month)$$

	1		2		3		4	
	Slope	P	Slope	P	Slope	P	Slope	P
Avgtemp	0,11	0,00	0,53	0,00	0,46	0,55	-0,48	0,55
Maxtemp					-0,41	0,30	0,13	0,76
Mintemp					0,12	0,77	1,01	0,02
Wind					-0,07	0,20	-0,14	0,02
Precipitation					0,00	0,54	0,00	0,54
Con	-8,59	0,00	-10,34	0,00	-6,17	0,01	-6,55	0,00
R^2	0,03		0.1172		0,01		0,12	
#Month			11				10	

Tabel 7

It is interesting to see that the months still have a very significant effect on the CCIa, this can be seen because almost all fixed effects are significant. The first two models show only a very small effect of temperature. This effect is smaller than the temperature effect in CCI model. This means that the season adjustment filters out a part of the weather effect. The second thing that stands out is that in model three not a single variable has a significant effect. It has to be stated that this model has a lot of multicollinearity, which can cause wrongly estimated coefficients. The fourth model does have a significant effect and this effect is quite big, but also here the multicollinearity can cause wrongfully estimated coefficients. Also these models show a very strong resemblance with the CCI model. It is important to see whether there is really a significant difference because this model uses a fixed effect panel data model, this is very hard to find out. I will test significant difference between the coefficients with the regular OLS model.

Like in the previous chapter I will try to exclude external factors from the model to make it as reliable as possible. Again I used the method of various fixed effects. Because the previous model did not divert a lot form the model with CCI, I do not expect that this model will.

1. $CCIa = c + \beta * (avgtemp) + fixed\ effect(year * county)$
2. $CCIa = c + \beta * (avgtemp) + fixed\ effect(month * county)$
3. $CCIa = c + \beta * (avgtemp) + \beta * (maxtemp) + \beta * (mintemp) + \beta * (wind) + \beta * (\text{precipitation}) + fixed\ effect(month * county)$
4. $CCIa = c + \beta * (avgtemp) + \beta * (maxtemp) + \beta * (mintemp) + \beta * (wind) + \beta * (\text{precipitation}) + fixed\ effect(month * county)$

	1		2		3		4	
	Slope	P	Slope	P	Slope	P	Slope	P
Avgtemp	0,07	0,00	0,68	0,00	0,32	0,36	-0,29	0,78
Maxtemp					-0,09	0,61	0,06	0,91
Mintemp					-0,16	0,40	1,06	0,07
Wind					0,00	0,98	-0,20	0,00
Precipitation					0,00	0,98	0,00	0,60
R^2	0,49		0,01		0,12		0,02	
Obs	2453		2453		2428		2428	
Groups	10		10		10		10	

Tabel 8

When corrected for these fixed effects the models show a little different results compared to the series without the season adjusting. In the third model there is not a single significant variable, while in the fourth model there is only one significant variable (wind), this effect is negative and small. This again shows that the seasonal adjustment filters out some effect of weather on the CCI.

I will also perform exactly the same non-panel data regression as with the not seasonally adjusted index.

1. $CCI = c + \beta * avgtemp + country(fixed\ effect) + month(fixed\ effect) + year(fixed\ effect)$
2. $CCI = c + \beta * avgtemp + country(fixed\ effect) + month(fixed\ effect)$
3. $CCI = c + \beta * avgtemp + country(fixed\ effect) + year(fixed\ effect)$
4. $CCI = c + \beta * avgtemp + \beta * (maxtemp) + \beta * (mintemp) + \beta * (wind) + \beta * (\text{precipitation}) + country(fixed\ effect) + month(fixed\ effect) + year(fixed\ effect)$

5. $CCI = c + \beta * avgtemp + country(fixed\ effect) + month(fixed\ effect) + year(fixed\ effect)$ + L1.CCI

	1		2		3		4		5	
	Slope	P	Slope	P	Slope	P	Slope	P	Slope	P
Avgtemp	0,27	0,00	0,53	0,00	0,09	0,00	0,84	0,19	0,08	0
Maxtemp							-0,40	0,25		
Mintemp							-0,16	0,66		
Wind							-0,14	0,00		
Precipitation							0,00	0,47		
Con	-13,97	0,00	-8,15	0,00	-14,56	0,00	-11,50	0,00		
R^2	0,68		0,47		0,67		0,67			
Adjusted R^2	0,67		0,46		0,67		0,67			
#Years	20				20		22			
#Month	10		11				9		12	
#County	10		10		10		10			
Lag									0,92	0,0
Obs	2453		2453		2453		2453		2443	

Tabel 9

The differences between the CCI and the CCIa are not very big. Because I have not set the dataset as a panel data, it is possible to see if the coefficients are significantly different compared to the CCI model. The results can be found in table 17 in Appendix A. This shows that the effect of average temperature is significantly different in this model. From this the conclusion is justified that the weather variables have a smaller effect. However because there still is an effect in the CCIa model this shows that seasonal weather effects did not only cause the effect of weather in the CCI model.

To conclude the results, both the seasonally adjusted and non-seasonally adjusted data sets are affected by the weather variables. The effect however is not very big, and varies across various models. Especially when adding fixed effects the weather variables get a bigger effect. Although it can be shown that the weather variables do have an effect on the CCI and the CCIa, this does not necessary mean this is a direct effect. This paper does not prove when the average temperature is higher that this inevitable increases the CCI. Weather can have a direct effect on a not-taken-into-account variable, which in turn affects the CCI. However when this is the case, it still can be stated that the weather does indirectly positively influence the CCI and CCIa.

This result is both surprising and not surprising. It is not surprising because when reading the literature it shows that weather has a significant effect on people. This effect can be measured both in consumer behaviour and physiological analysis. However when keeping in mind that the CCI does not show a trend while the temperature variables do show a strong trend this effect is not directly expected.

5. Conclusion

Weather has a big influence on people, both physically and mentally. The physical effect of sunshine is positive because it produces vitamin D, which has a positive effect on both the physical and mental health. Also the mental effect is positive; with more sunshine the willingness to buy products is higher and people feel happier. This effect is stronger in the short term than for the long term.
Besides positive effects, the weather also has negative effects; people who suffer from Seasonal Affective Disorder can get depressed from long-term weather changes.

Before looking at the effect of weather on consumer confidence, I first looked at the weather data. This shows that the average temperature, maximum temperature and minimum temperature are increasing parallel. The models predict a significant temperature increase of 5,46 degrees Celsius until 2100. This big increase in global temperature will have a big effect on various important factors. For example this will probably increase the chance of natural disasters, which has big economical effect. However shown in the introduction these natural disasters can have a positive monetary effect. Besides temperature I have also looked at wind and precipitation as weather variables. It shows that in my models these factors do not have a significant trend.

Consumer confidence has been measured in the EU since 1985; it tries to measure the confidence that people have in the economy. It does so by interviewing 40 060 Europeans every month, this research is performed by the European Union. The topics discussed include: trust in the economic situation, ability to do big purchases and price indices. In contrast to weather this index does not show a significant time trend. In this research I both researched the regular consumer confidence and the seasonal adjusted consumer confidence. In the adjusted version it is attempted to remove all the seasonal effects such as seasonal employment. Because weather is strongly correlated with seasonal effects, it would be expected that weather does not have a strong significant effect on this variable.
The goal of the paper is to research the effect of weather on the consumer confidence index. Therefore I have made models to examine the effect of weather on the CCI. I have tested both the CCI and the CCIa to see the difference in the effects of weather variables.
When regressing the weather variables with the consumer confidence indices it shows that weather variables do have a significant effect on both the CCI and the CCIa. However this effect is not very big and depended on which model was used. Besides this, it does not show that weather has a direct effect on these indices. Weather can indirectly effect the CCI by effecting other variables.

To conclude, my research question was:
'Does weather affect the consumer confidence index in Europe?'

To answer this question: yes, weather does influence the consumer confidence index in Europe. The size of the effect becomes not very clear in this research, but is does strongly show that there is an effect on both the CCI and the CCIa. The temperature variables have the most effect on the CCI and the CCIa.

6. Discussion and further research:

Discussion:

There has been quite some research on the effect of weather on people, which mostly points in the direction that weather has a big impact on people. There is still a discussion on how big this effect is in both the long and short term. A lot of discussed papers stated that weather has an effect on consumer behaviour. My research also points in this direction; I show that weather has an influence on the consumer confidence index. However, my study does not show a definite size of the effect. I therefore concur with the stream of research, which points out that weather has an effect on people. The research to weather variables might be one of the most researched fields in the past years.

When looking at the global warming research, there is some variance in the results. However most research does show that there is a significant upward trend in global temperature. The effects of this temperature change are expected to have big influence on a lot of factors. For example: more natural disasters and higher sea levels. Also this research shows a big significant positive trend of temperature rise in the future.

The CCI is a widely used variable for economic research. The research on the cause of CCI is way more thin then the research to the effect of CCI on the economy. The research shows that the cause of CCI lies more towards political situations than economic fundamentals. Previous research also shows that the CCI can be a very useful estimator when looking for economic trends. Although CCI is subject of a lot of papers I have not found a paper, which links the CCI to the weather. This research also concurs with the trend that the CCI is not based on rational economical expectations. Because if it was there would be no weather effect, in the CCI or CCIa.

Further research:

The models used in the paper all relied on monthly consumer confidence data, whilst shown in most papers that the effect of weather is strongest in the short run. In further research an experimental setting can be used to collect data in a smaller time period, for example daily or weekly. It will be interesting to see if weather has a bigger effect on the short term. This can further help to increase the reliability of this research. On the weather data side further research can take other weather variables into account, for example sun hours. The Wall Street study showed that this particular variable had a big effect on the Stock market traders.

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Appendix A:

	Avg		max		min		wind		precipitation	
	non fixed	fixed	non fixed	fixed	non fixed	fixed	non fixed	fixed	non fixed	fixed
slope	0,006	0,005	0,006	0,005	0,006	0,005	-0,002	-0,001	0,049	0,04
p	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,05	0,00	0,00
# months	-	12	-	12	-	12		10	-	7
r2	0,007	0,749	0.0056	0,732	0,087	0,719	0,002	0,041	0,008	0,022
obs	2691	2691	2691	2691	2691	2691	2666	2666	2691	2691
groups	10	10	10	10	10	10	10	10	10	10

Tabel 10 Effect of time on various weather variables both fixed and non fixed effect

	avg * max	avg * min	min * max	min * max * avg	avg * wind	avg * precipitation
VIF	49,78	25,1	9,42	278,68	1,1	1,02
obs	2691	2691	2691	2691	2666	2691
R^2	0,98	0,96	0,89	0,89	0,87	0,016

Tabel 11 Multicollinearity between weather variables

	CCI*AVG	CCI*Max	CCI*min	CCI*wind	CCI*per	CCI*avg*min*max	CCI*avg*min*max*wind*per	CCI*avg*wind
VIF	1,02	1,03	1,02	1,07	1,05	219.3	150,89	1,12
obs	2445	2445	2445	2420	2445	2445	2420	2428
R^2	0,02	0,028	0,0216	0,064	0,049			

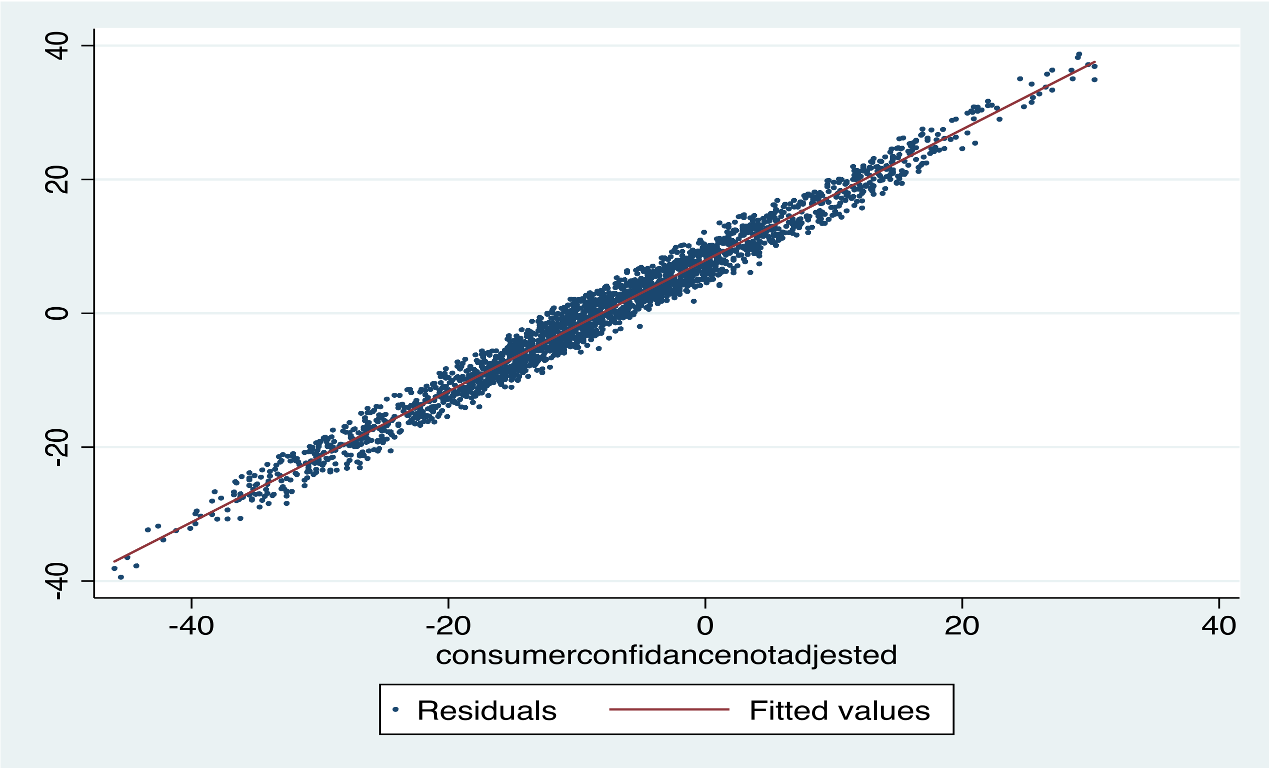
Tabel 12 Multicollinearity between the weather effects and the CCI

	CCIa*avg	CCIa*Max	CCIa*min	CCIa*wind	CCIa*per	CCIa*avg*min*max	CCIa*avg*min*max*wind*percipation	CCIa*avg*wind
VIF	1,03	1,04	1,03	1,07	1,05	217,58	149,87	1,12
obs	2453	2453	2453	2428	2453	2453	2428	2428
R^2	0,03	0,04	0,03	0,07	0,05			

Tabel 13 Multicollinearity between the weather effects and the CCIa

	not adjusted		adjusted	
	11	12	13	14
Slope	0,01	0,01	0,01	0,01
p	0,00	0,00	0,00	0,00
# months	-	3	-	0
R^2	0,01	0,02	0,01	0,01
obs	2634	2634	2642	2642
groups	10	10	10	10

Tabel 14 Effects of time on the CCI and the CCIa



Graph 4 Breuch-Pagan test for hetroskedasticity model = CCI = c + avgtemp

	1	2	3	4	5
P	0,879	0,407	0,6942	0,943	0
obs	2445	2445	2445	2420	2433

Tabel 15 Breuch-Pagan test for hetroskedasticity

	avg	max	min	wind	per	CCI	CCIa
Shapiro-Wilk	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Shapiro-Francia	0,00	0,00	0,00	0,00	0,00	0,00	0,00

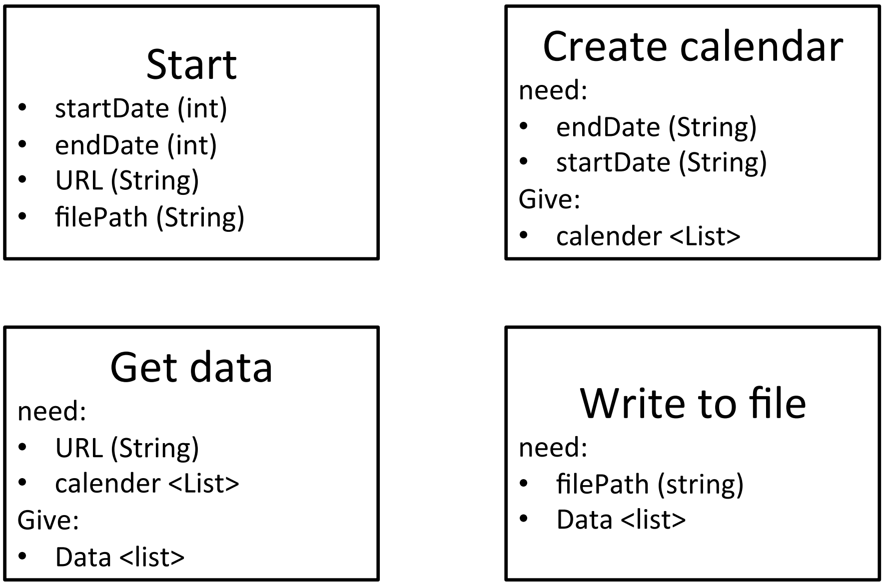
Tabel 16 test for normality

	1	2	3	4	5
P	0,00	0,00	0,01	0,00	0,7
Obs	2453	2453	2453	2428	2443

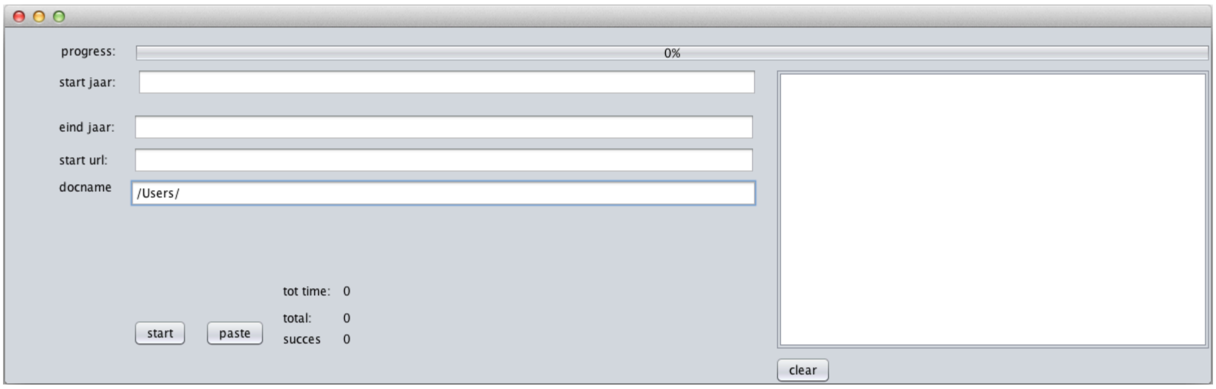
Tabel 17 Test for significant difference between average temperature variable CCI and CCIa models

Appendix B:

The scraper I have used is a very easy Java application.
The programme works as follows graphically:



When the programme starts it needs four variables: starting date, end data, URL and a file path. The begin and end date are years only, and presented as integer values, so it is not possible to fetch data per month. The URL has to be the entire URL of a certain month in a country, it does not matter for which date, for example: http://www.tutiempo.net/en/Climate/Amsterdam_Airport_Schiphol/01-2000/62400.htm. The variable file path has to be the file path and the name of the document, for example: /desktop/testmessage.txt. When all these variables are present the calendar can be created. The created calendar is a simple method with a 'for' loop. It creates and List with the values 01-(begin date); 02-(begin date);.....;12-(end date). This List is then returned as a List<String> variable. If all these variables are present the data can be fetched. When the 'getData' method is called, it will start a 'for' loop for the amount of values the calendar variables has. So for one year the loop will be 12. Within the loop an asynchronous request is performed to fetch the raw html content of every URL. The date part of the URL will be replaced with a date from the calendar List. The webpage that is loaded (picture in the main text), has the text "Monthly means and totals". After this text an html table with one row shows, this entire table is selected and stored in a String. Al the values in this table are separated by table tags e.g "</td>". The string is then split into multiple strings and the program split the string after every </td> tag, so there are 16 String's created. These are all saved in an array. All the columns with relevant variables are saved in a List. This process is done until every month is fetched. When this process is finished the List will be written to the path specified by the user. To make the user-experience as easy as possible I have also made a user interface. The interface is very simple it just allows users to fill in all the variables. This also shows the progress and the fails and success for each month. In the right blank field the data download stream can be shown, to check if the data is right.



Underneath is the code, which is also commented for easier understanding. A working program with user interface is available upon request.

```
/*
 * THIS SOFTWARE IS PROVIDED "AS IS" AND ANY EXPRESSED OR
IMPLIED WARRANTIES,
 * INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF
MERCHANTABILITY AND
 * FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO
EVENT SHALL THE
 * REGENTS OR CONTRIBUTORS BE LIABLE FOR ANY DIRECT, INDIRECT,
INCIDENTAL,
 * SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING,
BUT NOT LIMITED
 * TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF
USE, DATA, OR
 * PROFITS; OR BUSINESS INTERRUPTION)
HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN
CONTRACT, STRICT
* LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE)
ARISING IN ANY WAY
* OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE
POSSIBILITY OF SUCH
* DAMAGE.
 */
package ui.index;

import java.io.IOException;
```

```
import java.nio.charset.Charset;
import java.nio.charset.StandardCharsets;
import java.nio.file.Files;
import java.nio.file.Path;
import java.nio.file.Paths;
import java.util.ArrayList;
import java.util.List;
import org.jsoup.Jsoup;
import org.jsoup.nodes.Document;

/**
 *
 * @author vincent
 */
public class FileScraper {
    final static Charset ENCODING = StandardCharsets.UTF_8;
    int begin;
    int end;
    String startUrl;
    String endUrl;
    String docName;
    public static int succes =0;
    public static int fail =0;

    public FileScraper(){

    }
    public FileScraper(int begin, int end,
            String startUrl,
            String endUrl,
            String docName){
        this.begin = begin;
        this.end = end;
        this.startUrl = startUrl;
        this.endUrl = endUrl;
        this.docName = docName;

    }


    public void writeSmallTextFile(List<String> aLines, String
aFileName)
            throws IOException {
        Path path = Paths.get(aFileName);
        Files.write(path, aLines, ENCODING);
```

```
    }

    public List<String> getDates(int start, int end) {
        List<String> dat = new ArrayList<String>();
        //create array with all dates

        int y = 0;
        for (int i = start; i < end; i++) {
            for (int j = 1; j < 13; j++) {
                if (j < 10) {
                    dat.add("0" + j + "-" + i);
                } else {
                    dat.add(j + "-" + i);
                }
                y++;
            }
        }

        return dat;
    }

    public void getData(List<String> dat, String docName,
String URL)
            throws IOException {
        succes = 0;
        fail = 0;

        //create before and afther url
        String afterURl = URL.substring(URL.length() - 10);
        URL = URL.substring(0, URL.length() - 17);

        //tem array for all data
        String array[][] = new String[500][15];
        //end array for usefull data
        String end[][] = new String[500][5];

        List<String> jan = new ArrayList<String>();

        //convert date list to array
        String[] dates = dat.toArray(new String[dat.size()]);

        //create loop for the lenght of the array
        for (int j = 0; j < dat.size(); j++) {
            System.out.println("start getting: " + j);
            //load web pages
            try {
```

```
                //connect tot the webpage
                Document doc = Jsoup.connect(URL + dates[j] +
afterURl).get();

                //get the raw html of the web page
                String title = doc.outerHtml();

                //search for the table with the values of
interest
                int begin = title.indexOf
                        ("<strong>Monthly means and
totals:</strong></td>")
                        + 108;
                //get the usefull part of the webpages
                String exB = title.substring(begin, begin +
400);
                array[j] = exB.split("</td>");
                //cut the table open

                //printAll(array);
                //get a the usefull data in the end array
                for (int i = 0; i < 15; i++) {
                    if (i == 0) {
                        end[j][0] = array[j][i].substring(21);
                    }
                    if (i == 1) {
                        end[j][1] = array[j][i].substring(27);
                    }
                    if (i == 2) {
                        end[j][2] = array[j][i].substring(27);
                    }
                    if (i == 5) {
                        end[j][3] = array[j][i].substring(27);
                    }

                    if (i == 7) {
                        end[j][4] = array[j][i].substring(27);
                    }

                }
                String x = dates[j] + "; " + end[j][0] + "; "
+ end[j][1] +
                        "; " + end[j][2] + "; " + end[j][3] +
"; " + end[j][4];
                jan.add(x);
                writeSmallTextFile(jan,
```

```
                    "/Users/ +
                    docName + ".txt");
                //printAll(end);
                succes++;
            } catch (IOException e) {
                String x = dates[j] + "; 0; 0; 0; 0; 0";
                jan.add(x);
                writeSmallTextFile(jan,
                        "/Users/
                        + docName + ".txt");
                System.out.println(e);
                fail++;
            }
        }
        System.out.println("succes: " + succes + " fails: " +
fail);
    }

}
```