School of Business, Economics and IT
Division of Law, Economics, Statistics and Politics

What are the effects of a cashless society on VAT evasion?

– A study on Denmark, Finland & Sweden

Authors: Zarema Alieva & Jennifer Ramare

Bachelor's Thesis, 15 HE credits
Thesis work in economics
Spring term 2020

Supervisor: Yuna Liu
Examiner: Clas Wihlborg

Abstract

The title of this essay is “What are the effects of a cashless society on VAT evasion – A study on Denmark, Finland & Sweden”. Due to an increasingly digitalized world there will be different effects on the economy. We are getting closer to a cashless society every day, but we do not know the consequences that this will have. VAT evasion has long been a problem and has been easy to go through with, due to all the payments made with cash. It would be interesting to see if there is going to be a change in VAT evasion now as we go towards a cashless society. The aim of the study was therefore to answer the question: what are the effects of a cashless society on VAT evasion. To answer this question we focused on collecting data from three Scandinavian countries: Denmark, Finland and Sweden. Many articles were read on the subject before interesting data was collected to be analyzed. The data, mostly gathered from the European Central Bank, included the VAT gap, number of payment terminals, number of ATMs, percentage of total payments made with cards, GDP and the Consumer Price Index for each of the three chosen countries. In the theoretical framework the theory around VAT is presented as well as a short discussion about the underlying factors on VAT evasion. There is also a section on how we have chosen to represent the cashless society and how this will be measured in the paper. In order with previous research the hypothesis of the study was formed to be that the VAT gap will decrease as we go towards a cashless society. Multiple regressions were made on the data collected and the result analyzed. There was no significant relationship found between the VAT gap and any of the three explanatory variables. Instead the VAT gap seemed to be connected to what country that was studied. The coefficients of the variables seemed to indicate that there might be a positive relationship between the VAT gap divided by GDP and the number of payment terminals. The reason for this relationship was discussed to possibly be blamed on the fact that card usage increases the total transactions due to the speed and simplicity of card payments. In order to make the results more reliable it was suggested that the study would be enlarged to include more countries and specifically countries that are less digitalized and perceived to be more corrupt.

Keywords: VAT evasion, Cashless society, digitalization, ATM, VAT gap, Scandinavian Countries

Table of contents

List of tables

1. Introduction

Humans have been trading with each other since the beginning and the payment methods have developed and evolved ever since. Today we are on the verge of change as we transition from cash into a fully digitalized payment system. There is still some time left until we reach the point where cash will become obsolete but in some countries this change are going faster than in others. For example, the Scandinavian countries are evolving quickly in this aspect compared to most other European countries such as the eastern states and some Mediterranean countries including Greece and Croatia. The most likely explanation for this is the widespread use of internet in the countries and the fact that the Scandinavian people are very tech savvy. This also means that the Scandinavians want faster and easier payments, and many have already started paying by simply holding their phone or watch over the card reader in stores. The simplicity and speed is what have brought the Scandinavians to mostly give up on plain cash. Nevertheless cash does still occur as a payment method in Scandinavia, but it is not accepted as a payment everywhere. And as it looks right now we can expect to see an even bigger decrease of cash usage in the future as the rest of the world also goes towards a more digitalized society. (European Payments Council, 2019)

The concept of a cashless society has not yet been achieved anywhere in the world and the consequences of a society without cash are for now mostly guesses. With that said we can still try to predict the consequences and by looking at the countries in the front of this transformation we might have a chance to already see some visible effects. One interesting effect is the change in VAT (Value Added Tax) evasion. Due to the decrease in cash usage it is reasonable to assume that it will become harder and harder to avoid paying the proper amount of VAT since the transactions will be documented digitally. So far there is not much research made on the subject of the cashless society and its effect on tax evasion. Therefore this paper aims to explore this subject further and try to answer the question: What are the effects of a cashless society on VAT evasion? To analyze this specific effect we used data from three Scandinavian countries: Denmark, Finland and Sweden. The data used shows the VAT gap, which is a measure of VAT evasion, the number of ATMs, the number of payment terminals and the percentage of total transactions made with cards for each country. Our hypotheses are:

1. We will find a positive relationship between the VAT gap and the number of ATMs.
2. We will find a negative relationship between the VAT gap and the number of payment terminals.
3. We will find a negative relationship between the VAT gap and the percentage of total transactions made with cards.

We have read various articles on the subject to get a grip of previous findings about the effects of a cashless society but also about what affects VAT evasion. The data has been collected from the European Central Bank which then has been used to run regressions in order to see if there is any real effect of the cashless society on VAT evasion.

2. Literature review

The relationship between the cashless society and the VAT gap is not something that has been intensively studied thus far. Nevertheless, there is some prominent research on the area. First off all it needs to be said that the VAT gap is a calculated variable and is not directly measured. Therefore, there are some debates on how to best calculate the VAT gap in order to make it as accurate as possible. Reckon (2009) mentions two of these approaches. The first is called the top-down approach, also called VTTL, and involves using data collected from national accounts. This method estimates the VAT gap by calculating a theoretical value of the tax liability with the help of economic data and compares this value to the actually collected tax receipts. The second method that Reckon (2009) mentions is commonly called the bottom-up approach and this method involves getting data from individual companies or exposed frauds. Reckon (2009) also mentions the limitations to the top-down approach because of the use of data from national accounts. They mention three different types of limitations based on how accurate the data available is, how well the national accounts measure the taxable activity and last if the data actually measures what it is supposed to. Nerudova & Dobranschi (2019) talks about a third approach to measure the VAT gap. Instead of using the VTTL approach they talk about something called the Stochastic tax frontier model approach (STFM). Nerudova & Dobranschi concludes in their report that the STFM might give a better estimate of the VAT gap than the VTTL since it also gives

the ability to see what external factors affect the VAT inefficiency. But since the data for a top-down approach is more easily accessible, this is the method that is most commonly used even though it has some limitations. In this paper we will be using data on the VAT gap from CASE (2013, 2018 & 2019) which also uses the top-down approach.

Another important note that Reckon (2009) points out is the fact that the value of the VAT gap is not the same as the value of VAT fraud, in other words the VAT gap is not a measure of VAT fraud. The VAT gap might also include tax not paid because of legitimate measures and it does not take into account any taxable activities that are not covered by the national accounts. The VAT gap also includes tax that has not been collected due to insolvencies.

As mentioned earlier the cashless society and its effects on the VAT gap has not been studied much. Immordino & Flaviano Russo (2018) is one of the few so far to start looking into this relationship. The variables they use that are connected to the digitalization of payments are the number of card transactions, the volume of card transactions per capita, the number of cash withdrawals from ATMs per capita and the volume of cash withdrawals from ATMs per capita. They have also used data on the VAT gap measured by the top-down approach. Immordino & Flaviano Russo (2018) finds through their regressions of the data that the usage of cards instead of cash reduces the VAT evasion. Another result that they find is that withdrawals from ATMs instead increase the tax evasion. In summation they thereby give some proof that as we go towards a cashless society the VAT evasion may decrease. Another study that has gotten the same sort of results is the article “The effect of card payments on VAT revenue: New evidence from Greece" written by Hondroyiannis & Papaoikonomou (2017). They use data from Greece and studies how the increased use of card payments instead of cash increases the VAT revenue. What they find is a positive relationship between card usage and VAT revenue. If the VAT revenue increases the value of the VAT gap should also increase even if the percentage of VAT evasion stays the same. So, as we increase the VAT revenue, we can expect an increase in the VAT gap.

Another article touching the subject on VAT and the cashless society is called “Will that be cash or credit? Payment preferences and increasing VAT in Argentina” written

by Mitchell & Scott (2019). The authors aim with the study was to find the reasons for the increase in the VAT to GDP ratio in Argentina. There had not been much change in imports, commodity prices or interest rates which would be the first explanation for the large increase. The authors decided to take a look into the increasing bank using population and also the increase of credit and debit cards. Their regression results showed that the increase of the bank going population and the card usage both increased the VAT to GDP ratio. This article points out some control variables that could be used and also shows some relationship between the VAT and the cashless society.

3. Theorethical framework

3.1 VAT

VAT, which is short for value-added tax, is a consumption tax that is exacted on the value added to goods and services. It refers to all products that are sold and bought and thus, goods that are, for example, sold for export are not subject to the VAT. It is determined by the state as a percentage of the finished product's price. It could be explained in other words as a production process where the product gets more valuable at each stage of the process. When the finished product hits the market and is bought by a consumer, they have not only paid for the VAT of the product but also the production process behind it. VAT is included in the price from the start of production. (European Union, 2019).

VAT gap is the difference between the collected VAT and the VTTL. VTTL stands for VAT Total Tax Liability, and it is an estimate of the amount of VAT that is, in theory, collectible.

The equation for VAT gap:
VAT gap = (total amounts of VAT theoretically collectable based on the applicable tax law) – (total amounts of VAT collected)
VTTL: (total amounts of VAT theoretically collectable based on the applicable tax law)
VTTL = VAT gap + (total amounts of VAT collected)
(FISCALIS TGPG, 2016)

The VAT gap is an indicator of the effectiveness of VAT enforcement and compliance measures, as it gives an estimate of revenue loss due to fraud, tax evasion, financial insolvencies, bankruptcies, and miscalculations (European Commission, 2015).

VAT evasion refers to the deliberation of under-reporting taxable transactions, but it can also refer to cover the non-reporting of taxable transactions. These can be both legal and illegal economic activities (FISCALIS TGPG, 2016).

Critics of VAT say that value-added tax is a burden put on the consumer that buys the finished product. Other critics also consider the VAT to be a regressive tax, which implies that the poor pay more. Defenders contradict the critics, saying that the VAT is a proportional tax, because people with higher incomes consume more and therefore, pay more VAT than the people with lower incomes. VAT avoidance is a method used by individuals to lower the amount of income tax owed. This differs from VAT evasion which uses illegal arrangements where tax liability is covered to avoid paying for taxes. (Kagan, 2018)

3.2 Underlying factors to VAT evasion

In a paper by Keen, M. & Smith, S. (IMF, 2007), they discuss which possible causes there are for VAT evasion and fraud. They bring up frauds that can arise under VAT. For example a trader may report only a proportion of his sales, distort records to match, and/or make his sales off the books entirely. The implications for VAT is also brought up, one of these implications is the rate differentiation. Multiple rates form scope for misclassification fraud. Furthermore, where rate differentials are sufficiently large they can also give an increase to refund entitlements for trades, which in return creates opportunities for fraud. Another implication is the VAT rates. The higher the rate of VAT, the higher is the incentive to fraudulent behavior. High VAT rates are likely to encourage informality and thus lead to increase VAT evasion and fraud.

3.3 To measure the cashless society

What we in this paper refers to as a cashless society is a society with the absence of cash as a payment method, in other words a society where 100% of the transactions that are made are digital in some way. It is very difficult to accurately measure the exact amount of transactions that are made with cash versus digital payments. Therefore we have decided to use available data connected to the concept of a cashless society instead. First off we have a measure of the number of ATMs in each country. The use of ATMs is one way to get your money transferred into cash. If we decrease the number of ATMs in a country we thereby decrease the availability of cash and in the other direction, if we decrease the demand for cash, the banks will have to decrease the amount of ATMs. This shows that the number of ATMs has a negative relationship with the cashless society, in other words, as we go towards a cashless society we will reduce the numbers of ATMs.

Next we have the number of payment terminals in each country. This variable measures the availability for card payments in each country. The more payment terminals there are, the easier it will be to pay with cards. If the population stops using cash as payment and thereby increases the demand for card use, the demand for payment terminals will increase as well and we will see a rise in these numbers. This means that as we go towards a cashless society we will see an increase in the number of payment terminals and there should be a positive relationship between the number of payment terminals and the cashless society.

Lastly we have the data for percentage of total transactions made with cards. This variable will increase as we go towards a cashless society since now more transactions will be made with cards and less with cash. However there might be other digital payment methods that also increase as we go towards a cashless society. This variable is therefore best used as long as the major payment methods consist of cards and cash, otherwise it might give an unfair presentation of how cashless the society in question is.

4. Methodology

4.1 Method of the study

To obtain the answer to our research question, what the effects of a cashless society are on VAT evasion, we gathered information about this topic through articles and data that support our topic. The articles were selected through University West's library and their databases. After narrowing the options, we picked the most preferable articles that matched our research question. We also gathered data about the topic from for example ECB (the European central bank). This data was then used in order to study the effects in form of regression as well as to help with the discussion of possible effects. We chose to use data from three countries Sweden, Denmark and Finland since these three countries have a similar structure to their economic systems and the data was easily accessible through the ECBs website.

4.2 Empirical model

4.2.1 Relevant variables

The dependent variable that we are going to analyze is the VAT gap in our three chosen countries: Denmark, Finland and Sweden. The data on the VAT gap has been collected from all the three countries and put together into one variable, in other words, we are using panel data. We have also added two dummy variables one for Finland and one for Denmark, to be able to accurately analyze the data.

To analyze the impact of a cashless society on the VAT gap we will use some explanatory variables connected to the concept of a cashless society. Our explanatory variables are as follows:

1. PT, this variable stands for the number of payment terminals in each of the three countries and is measured in terminals per million inhabitants.
2. ATM, this variable stands for the number of ATMs in each of the three countries and is measured in ATMs per million inhabitants.

3. CARD, this variable stands for the percentages of total number of transactions that are made with cards in each of the three countries.

We will also add some control variables that are not so much connected to the cashless society as the ones presented above. From previous research it is seen that the VAT gap is affected by the GDP, corruption perception index (CPI) and unemployment which will be our three control variables. The GDP was chosen due to its reflection of the wealth and/or the level of development in the country. The CPI was chosen since it represents the level of corruption in the country. Lastly the unemployment was chosen as another control variable to reflect the economic level of the country.

4.2.2 Hypothesis

Since it should become more difficult to evade taxes due to less cash in the society, we believe that the VAT gap will become smaller when we enter a cashless society. This means that our hypothesis is that VAT evasion will decrease as we go towards a cashless society. So, in theory we expect to see a negative relationship between VAT gap and CARD as well as between VAT gap and PT. In a cashless society the number of ATMs should decrease and therefore we also expect to see a positive relationship between our variables ATM and VAT gap.

4.2.3 The model and its estimation techniques

What we want to analyze is the effect that the changes in our explanatory variables will have on the VAT gap. From previous research we can see that there seem to be many different variables that can affect the VAT gap but most of the estimations of the VAT gap are calculated using the VTTL method. The data for the VAT gap for our three countries were all collected from the same source and were also calculated with the VTTL method. In order for us to analyze the effect of a cashless society on the VAT gap we will use the following equation:

$$VATGAP = \alpha + PT \cdot \beta_{PT} + ATM \cdot \beta_{ATM} + CARD \cdot \beta_{CARD} + GDP \cdot \beta_{GDP} + CPI \cdot \beta_{CPI} + Uneployment \cdot \beta_{Unemployment} + D_{Denmark} + D_{Finland}$$

Where α is a constant, β stands for a coefficient for each of our variables that are explained in section 4.2.1 above, $D_{Denmark}$ is the dummy variable for Denmark, $D_{Finland}$ is the dummy variable for Finland. The equation above is our starting model for our regression and will help us look into which variables in the equation that are statistically significant and see how they affect the VAT gap. We are using multiple regression and the estimation will be made with the enter variable selection methods. Another method that could be used is the stepwise variable selection method but due to the many problems that arise with this method, such as biased high R-squared values and biased regression coefficients, we have chosen to take another approach. We start by looking into if any of our variables have a serious multicollinearity problem and in the case that they do we will transform them before running the enter regression. After this we analyze the output from the regression to try to determine if the cashless society has any effects on the VAT gap. (STATA)

In order to get clear results we will make four different regressions. The first model will include all of our explanatory variables. The second, third and fourth model will only include one explanatory variable each.

Since we are going to analyze time series we need to check if our variables are stationary. This is done by using the Dickey-Fuller test which shows if a variable has a unit root or if it is stationary. The Dickey-Fuller test is made by lagging and differencing the variable that is going to be analyzed. A regression is made with the difference of the first order as the dependent variable and the lag of the first order as the independent variable. From the regression we take a look at the t-value for the independent variable and if this value is more negative than -2.89 we conclude that the series is stationary, otherwise, it has a unit root. If we find that our variables are non-stationary we then also need to check for cointegration. If our variables are cointegrated, it means that they trend together and the non-stationarity is not a problem. To check for cointegration we use the Engle-Granger test. Here we start by running a regression of

our dependent variable, VAT gap divided by GDP, with our chosen independent variables. From this regression we save the residuals and then we make a unit root test on these residuals. In the same way as in the Dickey-Fuller test we now look at the t-stat value for the lag of the first order. If this value is more negative than -2.89 we can conclude that the variables are cointegrated.

To make sure that our results are accurate we will also look at the tolerance and the VIF of the variables. Both the tolerance and the VIF will help us to see if there is a multicollinearity problem with our variables. The tolerance is a number between 0 and 1 and should be as close to 1 as possible in order for the variable in question to not have any collinearity problem. If the tolerance is close to 0 it means that this variable is almost perfectly described by a linear relationship between some of the other independent variables and should therefore not be added to the regression. A rule of thumb is to not accept any tolerance that is lower than 0.1 and in that case you should investigate the variable further for multicollinearity. The VIF value is a number that measures how much impact the collinearity between the variables have on the regression model. The VIF is always larger than or equal to 1. The VIF doesn't have a precise value that will tell if there is a problem with multicollinearity but many say a value above 10 should not be accepted while others say a value above 5 is too high too. What value of the VIF that you can accept depends on the strength of your model so if the model is weak you should keep an extra eye on the VIF even for a bit lower values. (Research Consultation, 2007)

5. Empirical work

5.1 Data description

Most of the data in this study has been collected from the European Central bank (ECB) which is a highly reliable source. The data for VAT gap in Denmark, Finland and Sweden was collected from the ECB and their report on the VAT gap for European countries. This data is described in millions of Euro and ranges from the year 2000 to the year 2017. This data has some weaknesses since it is calculated data and not collected. The VAT gap has been calculated in the reports from ECB by using

collected data from the European countries in question. This means that we cannot be certain if the VAT gap is correct since there might be missed data or the estimation of the VAT gap from the calculations can be wrong. Another weakness with the data is that when you look at the different yearly reports you can see different values of the VAT gap for the same year, so if you for example look at the VAT gap for year 2013 it is not the same in the report from 2013 and 2016. Nevertheless, we have tried to estimate this data and use the most reasonable values for the VAT gap from these reports. The data should however be reliable due to the fact that it is updated every year and comes from a reliable source.

The data used for variable PT was also collected from the ECB. This data contains 18 data points from each of the three different countries, which gives a total of 54 observations, and spans from the year 2000 to 2017. The same is true for the data on the variable ATM. The data for both of these variables should therefore be fairly reliable since they come from the same trustworthy source.

The data on how many percentages of total transactions that are made with cards were gathered from the ECB and their yearly press release on payment statistics in Europe. This data does not go back as far as the previous mentioned data and only reflects the years 2009-2017. This means that this variable has 9 data points from each country totaling in 27observations.

The data on GDP was also collected from the ECB and should be highly reliable since it is a very important economic measurement and it also comes from a very dependable source. The same goes for the unemployment rate and the corruption perceptions index. ECB has however collected this data from different authorities for every country and the data may therefore be missing values or been calculated a bit differently for the different countries. Nevertheless, he data from the ECB should be as accurate of data as you can find.

5.2 Descriptive statistics

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
VAT gap (million EUR)	54	225,00	3366,00	1789,0556	727,11878
Valid N (listwise)	54				

Table 1. *Descriptive statistics for VAT gap.* Source: Own calculations.

Table 1 above shows the descriptive statistics for the dependent variable VAT gap which contains data from three different countries: Denmark, Finland and Sweden. From the table we can see that the lowest VAT gap over the years 2000-2017 was 225 million Euros and the highest was 3366 million Euros. We can also see that the mean of the VAT gap between 2000 and 2017 was 1789 million Euros and that the standard deviation was 727 million Euros. Table 1 also shows that VAT gap has 54 observations.

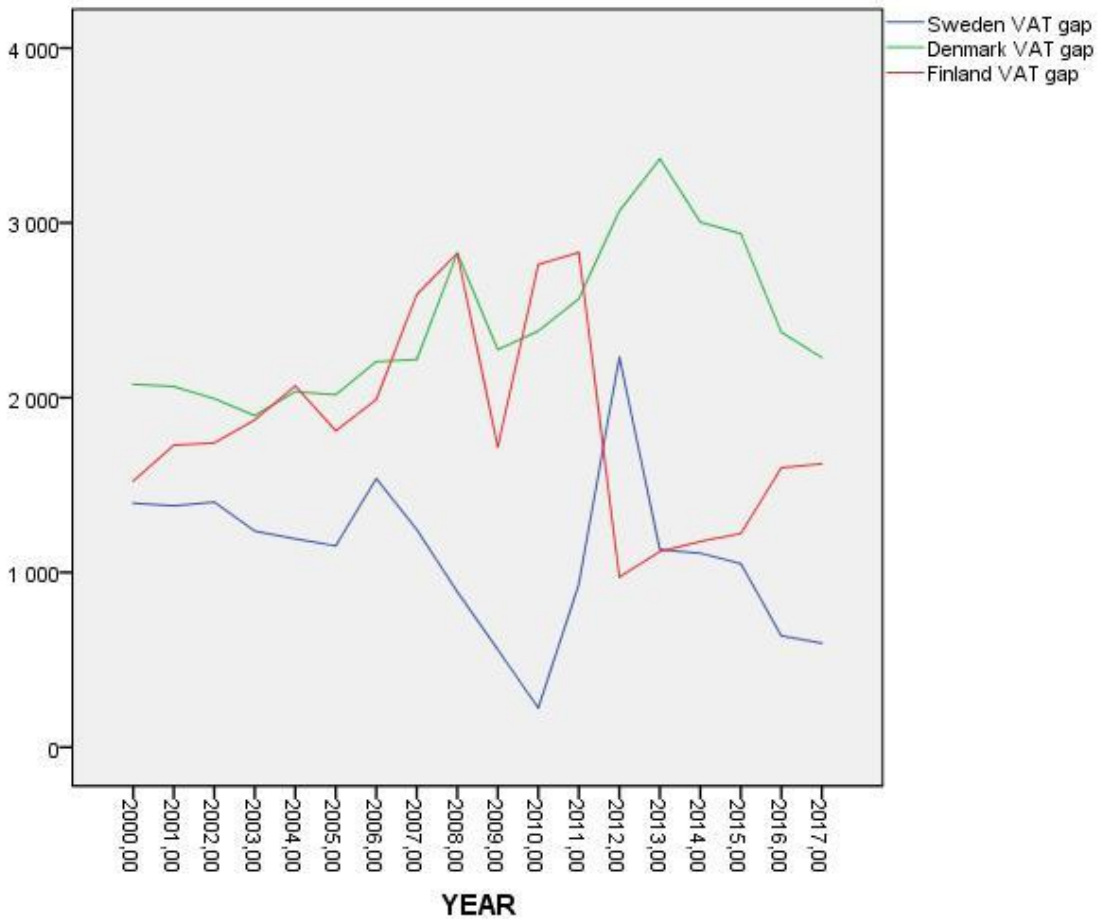

Figure 1. *Value of VAT gap for year 2000-2017.* Source: Own calculations.

Figure 1 shows how VAT gap has changed between the years 2000-2017 for our three chosen countries. What we can see from figure 1 is that the VAT gap has, under these 18 years, had both ups and downs for all of the countries in question. The Swedish VAT gap has decreased from 2000 to 2017, the Danish VAT gap has increased from 2000 to 2017 and the Finish VAT gap is approximately the same in year 2000 and year 2017. We see a common decline in the VAT gap during the years 2008-2009, probably due to the financial crisis occurring during these years.

We ran the Dickey-Fuller test on the VAT gap and found that the lagged variable of the first order had a t-value of -2.38 which means that this variable is non-stationary.

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
GDP (Euro per capita)	54	30510,00	47360,00	39258,7037	4692,94897
Valid N (listwise)	54				

Table 2. *Descriptive statistics for GDP.* Source: Own calculations.

In table 2 we see the descriptive statistics for GDP. This variable contains data on the real GDP per capita. The variable has 54 observations which mean that it is ranging from year 2000 to 2017 for all three countries. The GDP had a minimum of 30510 Euro per capita and a maximum of 47360 Euro per capita. The variable also had a mean of 39258 Euro per capita.

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Number of payment terminals per million inhabitants	51	9821,01	36730,43	21845,7607	6129,01841
Valid N (listwise)	51				

Table 3. *Descriptive statistics for number of payment terminals per million inhabitants.* Source: Own calculations.

In table 3 we see the descriptive statistics for the number of payment terminals per million inhabitants. We have a minimum of 9821 payment terminals and a maximum of

36730 terminals. The mean for this variable is 21845 payment terminals per million inhabitants.

We ran the Dickey-Fuller test on this variable and it shows that it is also non-stationary since the t-value for the lagged variable of the first order is -2.27.

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Number of ATMs per million inhabitants	54	263,98	879,41	465,8289	147,29374
Valid N (listwise)	54				

Table 4. *Descriptive statistics for number of ATMs per million inhabitants.* Source: Own calculations.

Table 4 shows the descriptive statistics for the number of ATMs per million inhabitants. Here we see a minimum of 263 ATMs per million inhabitants and a maximum of 879 ATMs per million inhabitants. We can also see the mean that is 465 ATMs per million inhabitants.

When we ran the Dickey-Fuller test on this variable we found that the t-value for the lagged variable of the first order was -2.049 and therefore we concluded that the variable is non-stationary.

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Percentage of total number of transactions made with cards	27	46,79	81,40	64,1363	9,75354
Valid N (listwise)	27				

Table 5. *Descriptive statistics for percentage of total transactions made with cards.* Source: Own calculations.

Above is table 5 which shows the descriptive statistics for the percentage of total transactions made with cards. The minimum of this variable is 46% and the maximum is 81%. We can also see that the mean is 64%.

We ran the Dickey-Fuller test on this variable and found that it is also non-stationary with a t-value of -0.166.

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Unemplyment rate	54	3	10	7,05	1,545
Valid N (listwise)	54				

Table 6. *Descriptive statistics for unemployment rate.* Source: Own calculations.

Above is the table over descriptive statistics for the variable for unemployment rate. The unemployment rate shows the annual average of the percentage of the population that was unemployed during the years 2000-2017. The variable has 54 observations which mean it includes data for the years 2000-2017 for all three countries. It has a minimum of 3% and a maximum of 10% and the mean is 7.05%.

Running the Dickey-Fuller test shows us that the t-value is -2.286 which is not more negative than -2.89 and we can thereby conclude that this variable is non-stationary.

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Corruption perceptions index	18	84,00	92,00	88,8333	2,00734
Valid N (listwise)	18				

Table 7. *Descriptive statistics for the corruption perceptions index.* Source: Own calculations.

Table 7 shows the descriptive statistics for the variable corruption perceptions index. The corruption perceptions index shows on a scale of 0 to 100 how corrupt the country is perceived, where 0 is maximum corruption perception and 100 is means no corruption is perceived. Here we see a minimum of 84 and a maximum of 92 with a mean of 88.8.

The Dickey-Fuller test on this variable shows a t-value of -0.206 which is not more negative than -2.89 and this variable is therefore non-stationary.

6. Regression results

To start off we check the correlation between our variables. Below is a table showing the correlation between the different variables. The correlations that are significant on the 5 % level are shown in bold font.

	VAT gap	GDP	PT	ATM	CARD	Denmark	Finland	Unemploymen t	Corruption
VAT gap	1	**0,335**	0,196	**0,433**	0,355	**0,618**	0,053	**-0,298**	**0,579**
GDP		1	0,078	-0,229	**0,924**	**0,787**	**-0,743**	**-0,685**	0,146
PT			1	-0,069	**-0,735**	0,012	**0,365**	0,151	0,260
ATM				1	-0,039	0,196	**0,495**	0,109	**0,749**
CARD					1	**0,738**	**-0,782**	**-0,722**	0,177
Denmark						1	**-0,500**	**-0,678**	**0,544**
Finland							1	**0,619**	-0,060
Unemployment								1	-0,135
Corruption									1

Table 8. *Correlations for the variables.* Source: Own calculations

First off we can see that there are five variables that have significant correlation with the VAT gap. This means that as these variables change the VAT gap also tends to change. For example the variable ATM and the VAT gap have a positive correlation which means that as the number of ATMs increases the VAT gap tends to increase as well. We also see a positive correlation between the VAT gap and the variables GDP, Denmark and corruption. There is also a negative significance between the VAT gap and the unemployment rate. As can be seen from the table we only have one correlation above 0.9 which is the correlation between the variable CARD and the GDP. In order to not run into any massive multicorrelation problems in our regression we therefore chose to divide the VAT gap over GDP and use this new variable as our dependent variable. Below is the table showing the correlation with the new dependent variable VAT gap divided by GDP.

	VAT gap	PT	ATM	CARD	Denmark	Finland	Unemployment	Corruption
VAT gap / GDP	1	0,187	**0,558**	0,135	**0,366**	**0,327**	-0,077	**0,582**
PT		1	-0,069	**-0,735**	0,012	**0,365**	0,151	0,260
ATM			1	-0,039	0,196	**0,495**	0,109	**0,749**
CARD				1	**0,738**	**-0,782**	**-0,722**	0,177
Denmark					1	**-0,500**	**-0,678**	**0,544**
Finland						1	**0,619**	-0,060
Unemployment							1	-0,135
Corruption								1

Table 9. *Correlation with new dependent variable.* Source: Own calculations

Here we see four variables that have a significant correlation with the VAT gap divided by GDP. The VAT gap divided by GDP has a significant positive correlation with the variables ATM, Denmark, Finland and corruption and no significant negative correlations this time. So what can be seen is that as for example as the number of ATMs increase we tend to see an increase in the VAT gap divided by GDP as well. As can be seen in table 9, it is only the top row that has changed its numbers and that the correlations between the other variables are still the same. We now have no correlations exceeding 0.9 and can continue with the analyzing of the variables.

From the previous section we have run unit tests on all the variables to check if they are stationary. Since we now have a new dependent variable we also have to check if this one is stationary or not. The unit root test on the VAT gap divided by GDP shows that the t-value of the variable lagged one period is equal to -2.380 which is less negative than -2.89 and we can thereby conclude that this variable is non-stationary. Since our dependent variable and all of our independent variables are non-stationary we need to see that our variables are cointegrated.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1	(Constant)	-,001	,002		-,676	,513		
	LAGS(RES_5,1)	-,838	,233	-,736	-3,603	,004	1,000	1,000

a. Dependent Variable: DIFF(RES_5,1)

Table 10. *Unit root test on residuals.* Source: Own calculations.

In the table above are the results from the Engle-Granger test. As can be seen from the table the t-value for the variable lagged of the first order is -3.603 which is more negative than -2.89. We can therefore conclude that the variables are cointegrated and can now begin to analyze our data properly.

Model 1:

We will start with making a regression that includes all of our explanatory variables. The result from the regression is seen below.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1	(Constant)	-,175	,158		-1,111	,299		
	Number of payment terminals per million inhabitants	1,384E-6	,000	,320	1,190	,268	,136	7,367
	Number of ATMs per million inhabitants	,000	,000	,698	1,907	,093	,073	13,663
	Percentage of total number of transactions made with cards	,001	,001	,277	,692	,508	,061	16,317
	Denmark dummy	,009	,021	,213	,397	,702	,034	29,420
	Finland dummy	-,029	,012	-,650	-2,498	,037	,145	6,884
	Unemplyment rate	,010	,005	,497	2,218	,057	,196	5,110
	Corruption perceptions index	-9,691E-5	,002	-,009	-,055	,958	,350	2,861

a. Dependent Variable: VAT gap divided by GDP

Table 11. *Coefficients for model 1.* Source: Own calculations.

With a significance level of 5 percent we can see that the only variable that is significant is the dummy variable for Finland. This shows that there are some differences in the VAT gap divided by GDP depending on if we look at Sweden or if we look at Finland. We can see some high VIF values which could indicate some multicollinearity but since we have checked the collinearity matrix and do not have any correlations that are too high we will leave the VIF values as are. Something worth to mention is that none of our three cashless society related explanatory variables are significant. As can be seen from the table above we also see that the coefficient for our first explanatory variable, the number of payment terminals, is very small at 0.000001384. The dependent variable also has very small values since we divided with the GDP and is now in the range of 0.01-0.08. This means that the coefficient for the number of payment terminals is not as small as it might look but the effect of a one unit increase in the number of payment

terminals will not affect the dependent variable much. The second explanatory variable, the number of ATMs, has the coefficient equal to 0 which shows that this variable will not have any effect on the dependent variable in this model. If we increase the number of ATMs by one unit we will not see any change in the dependent variable. For our third explanatory variable, the percentage of total transactions made with cards, we have a coefficient of 0.001 which means that an increase in this variable by one unit will increase the dependent variable with 0.001. However, as said earlier none of these three explanatory variables are significant in this regression. If we look at the coefficient we can see that the variable affecting the VAT gap divided by GDP the most is the unemployment rate followed by the Finland dummy and the Denmark dummy. We can also look at the sign of the coefficients and we see that the unemployment variable, the Denmark dummy, the variable for number of payment terminals and the CARD variable all have positive signs which indicate a positive relationship to the VAT gap over GDP. The constant, the Finland dummy and the corruption perceptions index all have negative coefficients which indicates a negative relationship with the VAT gap over GDP.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,960[a]	,921	,853	,00765

a. Predictors: (Constant), Corruption perceptions index, Unemplyment rate, Number of payment terminals per million inhabitants, Number of ATMs per million inhabitants, Finland dummy, Percentage of total number of transactions made with cards, Denmark dummy

Table 12. *Model summary for model 1.* Source: Own calculations.

Above is the model summary which shows that our R-square is equal to 0.921 and the adjusted R-square is 0.853. These values should show how well our independent variables explain the changes in the dependent variable. What these numbers say is that our data explains 92.1%, or adjusted value 85.3%, or the changes in the VAT gap divided by GDP.

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	,005	7	,001	13,404	,001[b]
	Residual	,000	8	,000		
	Total	,006	15			

a. Dependent Variable: VAT gap divided by GDP

b. Predictors: (Constant), Corruption perceptions index, Unemplyment rate, Number of payment terminals per million inhabitants, Number of ATMs per million inhabitants, Finland dummy, Percentage of total number of transactions made with cards, Denmark dummy

Table 13. *ANOVA for model 1.* Source: Own calculations.

The ANOVA table shows us that we have a p-value lower than 5% which means that we can reject the null hypothesis that all our coefficients are equal to 0. This means that our regression coefficients all improved the fit of the model.

Model 2:

In model 2, 3 and 4 we have chosen to exclude two of our three explanatory variables in order to get a better sense of the effect that one of our explanatory variables have on their own. We start in model 2 and exclude the number of ATMs and the percentage of total transactions made with cards. Which mean that we focus on the variable with the number of payment terminals. Below follows the regression results.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1	(Constant)	-,219	,142		-1,540	,155		
	Number of payment terminals per million inhabitants	1,399E-6	,000	,324	1,451	,177	,232	4,318
	Denmark dummy	,041	,009	1,033	4,690	,001	,237	4,211
	Finland dummy	-,025	,012	-,557	-2,013	,072	,150	6,650
	Unemplyment rate	,014	,004	,676	3,191	,010	,257	3,897
	Corruption perceptions index	,001	,002	,123	,741	,476	,420	2,382

a. Dependent Variable: VAT gap divided by GDP

Table 14. *Coefficients for model 2.* Source: Own calculations.

From the regression above we can see that we now have two other significant variables which are the Denmark dummy and the unemployment rate. We also see that the coefficient for the number of payment terminals is almost the same as from the first model. What we can conclude from this model is that when we have only the number of payment terminals as our explanatory variable we see that there is some significance to what country you are observing. We can also tell that the unemployment rate, which is one of our control variables, is significantly affecting the dependent variable. We do not have any super high VIF values or too low tolerances which means that in this model there should not be any problem with multicollinearity and the variables should be able to be analyzed properly. If we look at the coefficients we see that the variable affecting the dependent variable the most is the Denmark dummy followed by the Finland dummy and then the unemployment rate. We see almost the same results as in the first model if we look at the signs of the coefficients. We still have a positive sign for the number of payment terminals, the Denmark dummy and the unemployment rate as well as a negative sign for the constant and the Finland dummy. The corruption perceptions index also has a positive sign on its coefficient, which differs from the first model. As said earlier, the positive sign indicates a positive relationship with the dependent variable and a negative sign a negative relationship.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,941[a]	,885	,827	,00828

a. Predictors: (Constant), Corruption perceptions index, Unemplyment rate, Number of payment terminals per million inhabitants, Denmark dummy, Finland dummy

Table 15. *Model summary for model 2.* Source: Own calculations.

In model 2 we have a bit lower R-square than in the previous model. Here we see that our data explains 88.5%, or an adjusted 82.7%, of the changes in the dependent variable.

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	,005	5	,001	15,371	,000[b]
	Residual	,001	10	,000		
	Total	,006	15			

a. Dependent Variable: VAT gap divided by GDP

b. Predictors: (Constant), Corruption perceptions index, Unemplyment rate, Number of payment terminals per million inhabitants, Denmark dummy, Finland dummy

Table 16. *ANOVA for model 2.* Source: Own calculations.

The ANOVA table shows us, just as before, that we have a p-value at 0 and therefore we can conclude that not all of the coefficients in the regression are equal to zero and that the variables have all improved the fit of the model.

Model 3:

In this model we have chosen to exclude the variables number of payment terminals and the percentage of total transactions made with cards. That is, this model focuses on the variable number of ATMs. Below follows the regression results.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1	(Constant)	-,009	,130		-,070	,946		
	Number of ATMs per million inhabitants	,000	,000	,342	1,109	,289	,137	7,300
	Denmark dummy	,036	,013	,933	2,679	,020	,107	9,304
	Finland dummy	-,009	,008	-,244	-1,249	,235	,340	2,939
	Unemplyment rate	,012	,004	,659	2,871	,014	,247	4,043
	Corruption perceptions index	-,001	,002	-,107	-,603	,558	,413	2,422

a. Dependent Variable: VAT gap divided by GDP

Table 17. *Coefficients for model 3.* Source: Own calculations.

In this model we once again see that the Denmark dummy and the unemployment rate are the only two significant variables in the regression. We can also see that the coefficient for the number of ATMs is the same as in model 1. In this model we do not have any problems with the VIF values or the tolerances and can therefore conclude that we do not have any problems with multicollinearity and the coefficients accumulated should be accurate. If we once again look at the coefficients, we can see that the one

that affects the dependent variable the most is the Denmark dummy followed by the unemployment rate and then the Finland dummy. The signs of the coefficients are the same as in model 1.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,919[a]	,844	,779	,00882

a. Predictors: (Constant), Corruption perceptions index, Finland dummy, Denmark dummy, Unemplyment rate, Number of ATMs per million inhabitants

Table 18. *Model summary for model 3.* Source: Own calculations.

In model 3 we have an R-squared of 0.844 and an adjusted R-square of 0.779. This means that our data explains 84.4%, or adjusted value 77.9%, of the changes in the dependent variable.

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	,005	5	,001	12,960	,000[b]
	Residual	,001	12	,000		
	Total	,006	17			

a. Dependent Variable: VAT gap divided by GDP

b. Predictors: (Constant), Corruption perceptions index, Finland dummy, Denmark dummy, Unemplyment rate, Number of ATMs per million inhabitants

Table 19. *ANOVA for model 3.* Source: Own calculations.

Once again we have a p-value equal to 0 in the ANOVA table and can then conclude that all of our coefficients are not equal to zero and the variables all improved the fit of the model.

Model 4:

In this model we removed the variables number of ATMs and number of payment terminals in order to focus on the variable percentage of total transactions made with cards. Below follows the regression results.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1	(Constant)	-,032	,150		-,213	,835		
	Percentage of total number of transactions made with cards	,000	,001	-,140	-,459	,654	,152	6,574
	Denmark dummy	,051	,011	1,331	4,520	,001	,163	6,147
	Finland dummy	-,008	,009	-,208	-,881	,395	,253	3,954
	Unemployment rate	,014	,004	,741	3,249	,007	,271	3,684
	Corruption perceptions index	,000	,002	-,030	-,178	,862	,501	1,994

a. Dependent Variable: VAT gap divided by GDP

Table 20. *Coefficients for model 4.* Source: Own calculations.

The last model shows the same significant variables, the Denmark dummy and the unemployment rate, as the previous two models. Here we have a change in the coefficient for the percentage of total transactions made with cards from model 1. Now the coefficient is equal to 0 instead of 0.001. In this model we do not have any very high VIF values and no too low tolerances which mean that the coefficients should be accurate. If we look at the coefficients we see that the one affecting the dependent variable the most is the Denmark dummy followed by the unemployment rate and then the Finland dummy. If we look at the signs of the coefficients, we see the same signs as in previous models except for the corruption perceptions index which now has its coefficient equal to 0.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,911[a]	,831	,760	,00918

a. Predictors: (Constant), Corruption perceptions index, Finland dummy, Denmark dummy, Unemployment rate, Percentage of total number of transactions made with cards

Table 21. *Model summary for model 4.* Source: Own calculations.

In model 4 we can see that our data explains 83.1%, or adjusted value 76.0%, of the changes in the dependent variable.

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	,005	5	,001	11,777	,000[b]
	Residual	,001	12	,000		
	Total	,006	17			

a. Dependent Variable: VAT gap divided by GDP

b. Predictors: (Constant), Corruption perceptions index, Finland dummy, Denmark dummy, Unemplyment rate, Percentage of total number of transactions made with cards

Table 22. *ANOVA for model 4.* Source: Own calculations.

The ANOVA table for model 4 shows that the p-value is equal to 0 and we can then conclude that not all of our regression coefficients should be equal to zero and that all variables have improved the fit of the model.

7. Conclusion

This paper has taken a look into the relationship between the approaching cashless society and VAT evasion. From previous research we saw a negative relationship between the VAT gap and the variables that grow as we go towards a cashless society such as the usage of cards. We also saw a positive relationship between the VAT gap and cash usage. This means that from previous research it seems as if the VAT gap will decrease when we go towards a cashless society. On this basis we had formed our hypotheses that we would find a negative relationship for the VAT gap and our two variables the number of payment terminals and the percentage of total transactions made with cards as well as a positive relationship between the VAT gap and the number of ATMs. When we looked at the correlation matrix, we saw a positive relationship between the dependent variable and the number of ATMs. This should indicate that as we decrease the number of ATMs the VAT gap also tends to decrease which aligns with previous research and our hypotheses. However, the regression results were not consistent with previous research and therefore not with our hypotheses either. What was found in the regressions was that none of the selected explanatory variables actually had a significant relationship with the dependent variable. Instead we found that the

VAT gap divided by GDP depended on what country that was observed. For all four of our regression models, it was found that either the Denmark dummy or the Finland dummy had a significant relationship with the dependent variable. Significance aside, we saw indications of a small positive relationship between the VAT gap divided by GDP and the variable on the number of payment terminals. This relationship stayed the same as we looked at the regression model that included all three explanatory variables as well as the model that only included the number of payment terminals as an explanatory variable. A positive relationship between the number of payment terminals and the VAT gap divided by GDP would mean that the VAT gap might increase as we transition into a cashless society. A possible explanation for the positive relationship between our variable PT and the VAT gap might be that the usage of cards makes it easier and faster to go through with transactions which would increase the amount of total purchases. The VAT gap might therefore just increase because there are now more total transactions being made. If the VAT gap stayed at the same percentage of the VAT Total Tax Liability and we had an increase in the Tax actually collected the VAT gap would have to increase as well.

It is important to note that even though we did not find any significant relationship between the dependent variable and our explanatory variables, there might still be some sort of effect on the VAT gap due to the increasingly digitalized payment methods. The results we got are true for the three Scandinavian countries that were included in the study, but this does not mean that different results cannot be achieved if we look elsewhere. The previous research did include more countries which would be something that could be done for this study as well in order to increase the reliability of the results. The reason to why our results differed may be the fact that we chose these three specific countries. Denmark, Finland and Sweden are all highly digitalized already and have come far on their way to becoming cashless societies. The three countries also have some of the highest corruption perceptions indexes in Europe. There may therefore be some connection to how the VAT gap will change if look at countries that are in the beginning of changing into a cashless society or countries that have already come far in this change. It may also be interesting to look into how the VAT gap will change during the transition into a cashless society based on where the country in question places on the corruption perceptions index. If we would have included some of the countries perceived as more corrupt would this have changed the results? Another

thing that could have improved the study is if the top-down method that was used to calculate the VAT gap would have been compared to the VAT gap calculated with the bottom-up approach. By doing this comparison it would be easier to see that the VAT gap included the correct numbers which would have strengthened the reliability of the results.

References

CASE (July 2013). *Study to quantify and analyze the VAT Gap in the EU-27 Member States.* [Electronic] Warsaw: CASE-Center for Social and Economic Research. Available: https://ec.europa.eu/taxation_customs/sites/taxation/files/resources/documents/common/publications/studies/vat-gap.pdf [Accessed: 26 April 2020]

CASE (2018-09-11). *Study and Reports on the VAT Gap in the EU-28 Member States: 2018 Final Report.* [Electronic] Warsaw: CASE-Center for Social and Economic Research. Available: https://ec.europa.eu/taxation_customs/sites/taxation/files/2018_vat_gap_report_en.pdf [Accessed: 26 April 2020]

CASE (2019-09-04). *Study and Reports on the VAT Gap in the EU-28 Member States: 2019 Final Report.* [Electronic] Warsaw: CASE-Center for Social and Economic Research. Available:https://ec.europa.eu/taxation_customs/sites/taxation/files/vat-gap-full-report-2019_en.pdf [Accessed: 26 April 2020]

Dobranschi, M. Nerudova, D. (2019). *Alternative method to measure the VAT gap in the EU: Stochastic tax frontier model approach.* PLoS ONE: Volume 14, issue 1 (2019)

European Central Bank. (13 September 2010). *Payment Statistics for 2009.* [Electronic] Available: https://www.ecb.europa.eu/press/pr/date/2010/html/pr100913.en.html [Accessed: 10 May 2020]

European Central Bank. (12 September 2011). *Payment Statistics for 2010.* [Electronic] Available: https://www.ecb.europa.eu/press/pr/date/2011/html/pr110912.en.html [Accessed: 10 May 2020]

European Central Bank. (10 September 2012). *Payment Statistics for 2011.* [Electronic] Available: https://www.ecb.europa.eu/press/pr/date/2012/html/pr120910.en.html [Accessed: 10 May 2020]

European Central Bank. (10 September 2013). *Payment Statistics for 2012.* [Electronic] Available: https://www.ecb.europa.eu/press/pr/date/2013/html/pr130910.en.html [Accessed: 10 May 2020]

European Central Bank. (9 September 2014). *Payment Statistics for 2013.* [Electronic] Available: https://www.ecb.europa.eu/press/pdf/pis/pis2013.pdf [Accessed: 10 May 2020]

European Central Bank. (July 2019). *Payment Statistics.* [Electronic] Available: http://sdw.ecb.europa.eu/servlet/desis?node=1000001388 [Accessed: 10 May 2020]

European Central Bank – Statistical Data Warehouse. *Denmark – Number of terminals – All types of payment services – Via customer terminals provided by resident PSPs – ATMs – Number per million inhabitants – Non-MFIs counterpart.* [Electronic] Available: http://sdw.ecb.europa.eu/quickview.do?SERIES_KEY=169.PSS.A.DK.S102.I00.I100.NC.X0.20.Z0Z.Z [Accessed: 10 May 2020]

European Central Bank – Statistical Data Warehouse. *Finland – Number of terminals – All types of payment services – Via customer terminals provided by resident PSPs – ATMs – Number per million inhabitants – Non-MFIs counterpart.* [Electronic] Available: http://sdw.ecb.europa.eu/quickview.do?SERIES_KEY=169.PSS.A.FI.S102.I00.I100.NC.X0.20.Z0Z.Z [Accessed: 10 May 2020]

European Central Bank – Statistical Data Warehouse. *Sweden – Number of terminals – All types of payment services – Via customer terminals provided by resident PSPs – ATMs – Number per million inhabitants – Non-MFIs counterpart.* [Electronic] Available: http://sdw.ecb.europa.eu/quickview.do?SERIES_KEY=169.PSS.A.SE.S102.I00.I100.NC.X0.20.Z0Z.Z [Accessed: 10 May 2020]

European Central Bank – Statistical Data Warehouse. *Denmark – Number of terminals – All types of payment services – Via customer terminals provided by resident PSPs – POS terminals – Number per million inhabitants – Non-MFIs counterpart.* [Electronic] Available: http://sdw.ecb.europa.eu/quickview.do?SERIES_KEY=169.PSS.A.DK.S102.I00.I200.NC.X0.20.Z0Z.Z [Accessed: 10 May 2020]

European Central Bank – Statistical Data Warehouse. *Finland – Number of terminals – All types of payment services – Via customer terminals provided by resident PSPs – POS terminals – Number per million inhabitants – Non-MFIs counterpart.* [Electronic] Available: http://sdw.ecb.europa.eu/quickview.do?SERIES_KEY=169.PSS.A.FI.S102.I00.I200.NC.X0.20.Z0Z.Z [Accessed: 10 May 2020]

European Central Bank – Statistical Data Warehouse. *Sweden – Number of terminals – All types of payment services – Via customer terminals provided by resident PSPs – POS terminals – Number per million inhabitants – Non-MFIs counterpart.* [Electronic] Available: http://sdw.ecb.europa.eu/quickview.do?SERIES_KEY=169.PSS.A.SE.S102.I00.I200.NC.X0.20.Z0Z.Z [Accessed: 10 May 2020]

European Central Bank – Statistical Data Warehouse. *Denmark - Unemployment rate: total: -Member states: definition EUROSTAT – Percentage of population.* [Electronic] Available: https://sdw.ecb.europa.eu/quickview.do?SERIES_KEY=139.AME.A.DNK.1.0.0.0.ZUTN [Accessed: 5 June 2020]

European Central Bank – Statistical Data Warehouse. *Finland - Unemployment rate: total: -Member states: definition EUROSTAT – Percentage of population.* [Electronic] Available: https://sdw.ecb.europa.eu/quickview.do?SERIES_KEY=139.AME.A.FIN.1.0.0.0.ZUTN [Accessed: 5 June 2020]

European Central Bank – Statistical Data Warehouse. *Sweden - Unemployment rate: total: -Member states: definition EUROSTAT – Percentage of population.* [Electronic] Available:

https://sdw.ecb.europa.eu/quickview.do?SERIES_KEY=139.AME.A.SWE.1.0.0.0.ZUTN [Accessed: 5 June 2020]

European Commission, (2015). The VAT Gap: Questions and Answers. [Electronic] Available: https://ec.europa.eu/commission/presscorner/detail/en/MEMO_15_5593 [Accessed: 28 April 2020]

European Payments Council. (26 September 2019). *Sweden: Cashless society and digital transformation.* [Electronic] Available at: https://www.europeanpaymentscouncil.eu/news-insights/insight/sweden-cashless-society-and-digital-transformation. [Accessed: 10 April 2020]

Eurostat. (12 February 2020). *Corruption Perceptions index (source: Transparancy International).* [Electronic] Available: https://ec.europa.eu/eurostat/databrowser/view/sdg_16_50/default/table?lang=en [Accessed: 9 June 2020]

Eurostat. (17 August 2018). *Real GDP per capita.* [Electronic] Available: https://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&language=en&pcode=sdg_08_10&plugin=1 [Accessed: 10 May 2020]

FISCALIS Tax Gap Project Group. (2016). *The concept of tax gaps: Report on VAT Gap Estimation.* [Electronic] Available: https://ec.europa.eu/taxation_customs/sites/taxation/files/docs/body/tgpg_report_en.pdf [Accessed: 29 May 2020]

Hondroyiannis, G. and Papaoikonomou, D. (2017). *The effects of card payments on VAT revenue: New evidence from Greece.* Economic Letters: Volume 157 (August 2017) p.17-20.

Immordino, G. and Flaviano Russo, F. (2018). *Cashless payments and tax evasion.* European journal of Political Economy: issue 55 (2018) p.36-43.

Kagan, J., (17 May 2018). Tax avoidance. [Electronic] Available at: https://www.investopedia.com/terms/t/tax_avoidance.asp [Accessed 10 April 2020]

Keen, M; Smith, S. (2007) *VAT Fraud and Evasion: What do we know, and what can be done?* International Monetary Fund. [Electronic]. Available: https://www.imf.org/external/pubs/ft/wp/2007/wp0731.pdf. [Accessed: 25 May 2020]

Mitchell, K. and Scott, R. (2019). *Will that be cash or credit? Payment preferences and rising VAT in Argentina.* Journal of Post Keynesian Economics: Volume 42, issue 1 (2019) p.1-15.

Reckon LLP. (2009). *Study to quantify and analyze the VAT gap in the EU-25 Member States.* [Electronic] Available: https://ec.europa.eu/taxation_customs/sites/taxation/files/docs/body/reckon_report_sep2009.pdf [Accessed: 5 June 2020]

ResearchConsultation.com. (2007). *Identifying Multicollinearity in Multiple Regression Statistics Help for Dissertation Students & Researchers.* [Electronic] Available: http://www.researchconsultation.com/multicollinearity-regression-spss-collinearity-diagnostics-vif.asp [Accessed: 15 May 2020]

Sribney, B. *Problems with stepwise regression.* STATA. [Electronic] Available: https://www.stata.com/support/faqs/statistics/stepwise-regression-problems/ [Accessed: 10 May 2020]

UNIVERSITY WEST
School of Business, Economics and IT
Division of Law, Economics, Statistics and Politics
SE - 461 86 TROLLHÄTTAN
SWEDEN
Phone +46 (0) 520 22 30 00
www.hv.se