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Money demand and quality of institutions

-A Baumol-Tobin approach to money demand

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Preface

This thesis represents the conclusion of our two-year Master of Science program within Business Administration at the University of Stavanger (UiS) and its Business School (Handelshøgskolen ved UiS).

This has been an amazing journey with great success and major setbacks, but through hard work and dedication we have managed to bounce back every time we hit rock bottom.

A special thank you goes out to Amalie and Gry. We know our work has been time consuming, and we appreciate your understanding and support during this time. Now, with this work behind us, you have our full attention.

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Abstract

We study which variables can explain the demand for cash across countries. Our study is based on 11 years of data for 45 countries ranging from low income to high income. As expected, we find that GDP per capita is positively related to cash per capita, and interest rates are negatively related to cash per capita. Next, we explore whether various measures of country risk (or alternatively, various measures of country's institutional quality) are related to demand for cash. Our results indicate that the country risk variables do not impact the demand for money. However, we find some evidence that Democratic accountability has negative impact on cash holdings, while Government stability has positive impact.

Table of content

List of Tables

List of graphs

Introduction

The aim of this paper is to study the determinants of cash demand and with particular focus on how different country risk variables will affect the demand for cash.

In this paper, the Baumol-Tobin model will be used as a baseline for our regressions. The intent is to implement risk related variables into the regression-model to see whether these measures might influence the demand for cash in the countries observed. In addition, we have used data that has not previously been thoroughly examined in the light of the aforementioned risk related variables, partly due to unavailability of data. Our empirical findings suggest that none of the selected risk factors will affect the demand for cash.

In the paper, we will present the results from our regressions, these have been compiled using a panel data approach wherein we construct a dataset containing 45 countries over a timeframe of 11 years (2004 – 2014). In the regressions, we have utilized fixed effects for both country and time. Based on our preliminary research this seems to be the largest data sample in terms of participating countries. We also include variables that have not been accessible in previous studies. Such studies include the papers written by David B. Humphrey who has inspired much of our interest as well as laid the foundation of the field.

The work of Hancock & Humphrey (1998) takes a broad approach and tries to highlight the main drivers behind payment systems structure and their composition between cash and non-cash instruments. This includes, but are not limited to debit-, credit cards, checks, and giros. The result of this study will not be as applicable today since the data used is from the 80s and 90s. Alternative payment methods that might have had a major impact on the cash in circulation did not break through until the last two decades. Another aspect to consider is how much technological advances have progressed since this work was done in 1998. Hancock & Humphrey (1998) are presenting interesting findings of elasticity, particularly price elasticity, buy it does not give us any indicators as to how institutional quality affects cash and the availability of cash. Based on this research, we will try to reveal indicators that might tell us which direction different countries are headed regarding cash in circulation, and expanding the scope in terms of number of countries studied. However, there are several observations and findings that are worth noting in the work of Hancock

& Humphrey (1998). Hancock & Humphrey (1998) state a cost for payment systems, more specifically they found that the cost of running and maintaining a country's payment systems is about 3% of the country's GDP on average, and that electronic payments are substantially cheaper than its paper-based counterpart. This information leads us to expect that more developed countries with high GDP will have less cash as a percentage of GDP since cash is more expensive than other alternatives. As pointed out by Hancock & Humphreys (1998) earliest work in this field has gravitated towards general equilibrium issues including moral hazard, settlement failures, why cash is used, and tradeoffs between cash versus other means of payment. This was groundbreaking research when it was released, but none of it helps form a platform for our investigation, mostly because technological changes have altered the way our financial systems work. As a matter of fact, Hancock & Humphreys (1998) stated that:

> "although the popular press is full of references to the potential use of new types of payment arrangements – from the effect of ATMs and smart cards on cash use to the potential for electronic payments over the Internet to replace checks or credit cards for bill payments – little theoretical (and even less empirical) work has been done in this area" (Payment transactions, instruments, and systems: A survey, p.1574-1575)

The quote states that by 1998 there was not much empirical research conducted in the field.

One conundrum that we share with Hancock & Humphrey (1998) is that data on non-cash use is objective, and in many cases readily available. On the other hand, data on cash transactions is mostly educated guesses and estimates because it is near impossible to trace all cash transactions. While some data related to the use of debit/credit cards (or smartcards) are available, they are mostly limited to a small amount of countries and a narrow timespan. Substantial amounts of data have been collected within the European Union, but studying these countries in terms of quality of institutions will yield quite homogenous results and therefore does not align with our scope.

With Hancock & Humphrey's (1998) work in mind, we turn to Alessandra Guariglia and Yiing Jia Loke (2004). They published the article "What determines the value and volume of noncash transaction? Evidence from a panel of European and North American countries", which among other things looks at the use of noncash transactions. This paper contains relevant information for our case, but we still have some reservations towards it, mainly because we have access to more recent data compared to the data used by Guariglia and Loke (2004). We see this as an opportunity

to assess some of the findings of Guariglia and Loke (2004) while we are doing our own research. Also, only a selection of fifteen countries has been used in this study, something that imposes a limit on how broad the findings can be applied outside of this panel of European and North American countries. This further motivates us to expand upon the scale in terms of included countries as compared to previous studies. Guariglia and Loke (2004) set out to look at the determinants for noncash payments in developed countries. While Guariglia and Loke (2004) set out to look at the determinants for noncash payments in developed countries, we intend to build on some of these ideas and expand the analysis to a larger sample size. It is within reason to mention that Guariglia and Loke (2004) revealed some methodological issues with the regression done by Hancock and Humphrey (1998) and that they addressed them to improve the methodological approach to the research. In Guariglia and Loke's (2004) own words;

> "…updated estimation techniques compared to those in previous literature are used. Humphrey et *al*. (1996a) and Snellman et *al*. (2000, 2001) estimate in fact their panel regressions applying either Ordinary Least Squares (OLS) to their pooled panel data set or simple fixed effects techniques. Applying OLS to panel data is however likely to lead to biased and inconsistent estimates, as it does not take into account unobserved country heterogeneity." (What determines the value and volume of noncash transactions? Evidence from a panel of European and North American countries, p.292)

With this in mind we have utilized an approach consisting of country and time fixed effects with robust standard errors in order to avoid the pitfalls described in the above section. This will be thoroughly detailed in the methodology section. Although there is a limit to how much of this work we can base our research on, there are several findings that help set things into perspective. One of the more interesting findings they discovered from looking at ATMs and EFTPOS[1] terminals, is that the availability of these illustrate payment system development as well as general development across different countries. It was also proven by the authors that much of the increased frequency of card use stems from better and easier access to EFTPOS terminals. On the other hand, the positive correlation Guariglia and Loke (2004) found between card transactions and interest rates is as expected, as they themselves stated "the interest rate can be seen as the opportunity cost of

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[1] EFTPOS is shorthand for Electronic Funds Transfer at Point of Sale

holding money" (Guariglia and Loke, 2004, p. 296). A noteworthy observation was the fact that use of noncash payment instruments is highly driven by habits.

A working paper from 2005, "Will we pay in the same way? Empirical evidence of payment convergence on EMU panel data", written by Sandra Deungoue (2005) focuses on data from the European Monetary Union (EMU) from 1990 to 2001. As we have alluded to, we have aimed at including a more diverse combination of countries. Hence, the study by Deungoue (2005) focuses on a somewhat homogeneous set of countries thereby differing from our intended scope. Although a lot of emphasis has been put on European Union (EU) legislation, one finding sparked our interest, "in effect, payment instruments are culturally derived needs which are not considered in the choice of a bank account" (Deungoue, 2005, p. 28). This shows that an expanded panel data approach could possibly be of value to the field, by investigating on a larger scale to whether the observation holds outside EMU, although with a slightly altered model.

Humphrey, Kim & Vale (2001) published an article called "Realizing the Gains from Electronic Payments: Costs, Pricing, and Payment Choice", which covers highly relevant topics. First of all, they point out that countries such as Japan and Norway are amongst the few that have set up a pricing strategy that pushes customers towards electronic payments, while others like the United States has not made such a change (Humphrey, Kim & Vale, 2001). Furthermore, this article highlights that this is the first time data regarding the use of ATM cash withdrawal, check writing and debit cards used at POS[2] is available, and that these numbers can be generalized for other countries. The authors point out that Norway is the only known country that has collected data on the bank cost of payments and that analysis of the data collected in Norway show that electronic payments are cheaper than the non-electronic options (Humphrey, Kim & Vale, 2001). This is something that confirms the pricing strategy mentioned earlier where the banking industry "forces" customers over to electronic payments to keep their own costs low. From a consumer standpoint, it is worth mentioning that in the case of credit cards, most of the costs involved are taken on by the retailer through fees directly linked to the amount of each transaction and not the holder of the credit card. This contributes to favor this payment system in the eyes of the consumers

Bagnall et al. (2014) conducted a working paper on the topic of consumer cash usage. This cross-country comparison based on payment diaries from seven different countries managed to find

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[2] Point of Sale

several interesting points that earlier were out of reach due to missing data. They identify three universal factors as transaction size, consumer preference point of sale characteristics and correlation between use of cash and demographics. Further, they found that in all seven countries, cash still accounts for a large part of the economy even though other payment options are available, and that this extensive cash use is especially prevalent when examining low-value transactions (Bagnall et al., 2014). Another finding of interest is that the use of cash has a strong correlation with demographics in that people over the age of 36 use significantly more cash than those at the age of 35 and below. However, the most noteworthy part is their statement "Our finding that these results can be observed for all seven countries assures us that these are universal factors driving cash use" (Bagnall et al, 2014, p. 31). This statement strengthens our belief that an analysis of the risk related variables will be a useful contribution to this field of study, since our preliminary research indicated that no other studies have looked at the relationship between institutional risk and demand for cash.

The remainder of this paper consists of five sections, where we will present the history of money, methodology, data, results and discussion, and our conclusion. Some facts will be presented with some observations and comments from us. The second part gives a summary of the history of money before the third sections gives and in-depth explanation of the International Country Risk Guide variables and how they are scored by The PRS Group (2012), as well as financial variables employed in our analysis. The fourth section covers the methodology in our research. Further we will present our results and our discussion of our findings, before we finish with our conclusion where the relevant findings are put into perspective alongside comments and/or concerns. At the end, you will find appendices as well as references.

History of Money

Throughout history money has taken the form of stones, shells, cows, and many others before it took the form by which we know it today; notes, coins and electronic money. Money is a part of the highly complex payment system which in most cases are provided through banking institutions or the postal service. This system is subject to almost everything from technological advances to inflation, and there are differences in payment structure and payment platforms between countries. Consisting of different institutions, money transferring mechanisms and laws governed by central banks, the payment system moves funds from savings over to investments with the help of the tools offered by the financial markets. With various degrees of awareness about this complex system, consumers, businesses and basically all the subjects use it in everyday transactions. In other words, money is all around us.

At first trade was conducted through bartering, which is trading one commodity for another. This worked well if person A and person B had commodities the other party wanted at that point in time. However, issues arose when person A wanted the commodity held by person B, while person B had no interest in the commodity offered by person A. Working around this problem would be time consuming and involve several intermittent steps. Other problems related to this way of trade could be trade between persons who reaped their crops or got their resources at separate times. A farmer could not pay for a commodity with a future harvest, likewise a fisher had a limited window to trade fresh catch. The solution to this problem was a financial intermediary which was non-perishable and widely accepted so that it could be stored and reused at some future time.

In Asia knives were used as a means of exchange, while on the island of Yap major lime stones that never physically changed hands served as currency. Other examples are shells, cows and alcohol just to mention a few. In loose terms, currency moved to commodity money where the commodity itself provided an intrinsic value to back the money, such as gold and silver. While the scarcity of the commodity provided the value for the money it also served as a limit for the value, as it set a cap on how flexible the system was. Also commodities presented a logistical problem when the transactions were large as well as presenting security issues when high values were moved all at once.

In China, they started with coins that had a hole in the middle so that they could insert a string through them. A certain length of string would hence have a certain value, but this system

encountered the logistical issue mentioned above. To solve this, they started issuing "I-Owe-You"s (IOU) that represented a claim on a certain amount of gold at the capital. As people discovered that this was a safe way of accepting payments, they started trading them among themselves without cashing it in and thereby creating possibly one of the first equivalents to today's bank notes. In Italy, the predecessor to the modern banking system was created through the use of IOUs. A seller could accept an IOU (which was backed by a famous merchant) and would bring it to the local bank to exchange it for cash at a slight discount. The bank would then send these notes to the branch of their bank in the city where they were originally issued and use them to reclaim the cash from the buyer of the goods. If they did not have a branch in that area they would simply sell it to a bank that did.

Fast-forward 300 years; history shows that goldsmiths and merchants continued developing this idea. The goldsmiths had vaults with excess room while merchants had valuables they wanted to store somewhere safe. The merchants could rent a place in the goldsmith's vault and would receive a receipt for the amount deposited. These receipts, just like the IOUs in China, started changing hands without being cashed in from the goldsmiths. This led to receipts being written so that they could be redeemed by the holder, and they were written in smaller amounts that were more manageable in everyday transactions. The goldsmiths realized that they could write more receipts than they had gold to back up since one deposit could be used to cover a different claim if the holders kept exchanging receipts and refrained from collecting their claim on the gold all at once. This was in fact the birth of fractional reserve banking.

Several changes followed this development, and through "trying-and-failing" the central banks saw the light of day. They were originally created to fix issues with the paper money, but evolved over time to the institutions we know today; sound financial institutions which cannot fail unless the nation fails. The development of money went through several stages, and at one point they were once again backed by gold, but it finally reached the point where money was not equal to value, which effectively transformed money from a "thing" to an idea: the medium *by* which things are exchanged, not the value of which they are.

Data

The dataset used in this paper is a panel data set containing yearly data from 45 countries over a period from 2004 to 2014. We intended to include as many countries as possible, but due to limited data availability we had to narrow the sample down to 45. The final sample combines countries ranging from low income to high income. A full list of the countries included as well as a detailed explanation as to why we included these countries is provided in the appendix 1.1 to 1.7.

Currency in circulation[3], population[4] and the deposit interest rate[5] are all found in the international financial statistics (IFS) from the International Monetary Fund (IMF). Data concerning the number of Automated Teller Machines (ATM) per 100.000 adults[6] comes from the Financial access survey by the IMF. Likewise, both Bank lending-deposit[7] spread and Bank net interest margin (%)[8] comes from the same database. Lastly the nominal gross national product per capita[9] is found in the World Bank's World Development Indicators.

We also utilize some data from the PRS groups namely political risk ratings from the International Country Risk Guide (ICRG). This dataset includes scores for different variables on a country-level basis. The dataset is comprised of three main parts; political risk, economic risk and financial risk, which form an overall rating for each country included. Each rating consists of sub ratings, which again has subcategories. This enables us to extract the elements we want to study as opposed to using the broad overall rating.

The political risk consists of twelve subcategories with different scores depending on the category which, when summed up, reach the total score of 100. The key to understanding and interpreting these scores correctly, is to remember that a low score for a category indicates high risk, while a high score equates to a low risk for the given category. In other words, a score of 100 means that it has the lowest possible risk overall.

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[3] FASMBC_XDC
[4] LP_PE_NUM
[5] FR.INR.DPST
[6] FB.ATM.TOTL.P5
[7] GFDD.EI.02
[8] GFDD.EI.01
[9] NY.GDP.PCAP.CD

Table 1 Summary ICRG variables

Name	Range
Democratic accountability	0 – 6
External conflict	0 – 12
Internal conflict	0 – 12
Military in politics	0 – 6
Religious tensions	0 – 6
Socioeconomic conditions	0 – 12
Bureaucracy quality	0 – 4
Corruption	0 – 6
Government stability	0 – 12
Law and order	0 – 6
Investment profile	0 – 4

Democratic accountability is a complex element. The total of six points captures "how responsive government is to its people" (The PRS Group, 2012), with the assumption that with less responsiveness the risk for going out of office is higher. Also, it is assumed that the replacement of the government will be smooth in a democratic country and could possibly happen through bloodshed if the country is non-democratic. The reason for the complexity of this element is the definitions used for alternating democracies, dominated democracies, de facto one-party states, de jure one-party states, and autarchies, but these are outside of our scope[10] in this case so we will not address them further.

External conflict looks at the current government and the risk associated with outside, foreign actions ranging from trade restrictions to acts of war. Conflicts which this element is assessing can have a big impact on the business-society, especially for foreign companies and their operations in the area that is being assessed. Everything from trade restrictions to the risk of war, might in the most extreme cases lead to an all-out stop in ongoing operations or a barrier of entry keeping foreign business away from the market with all the implications this will have. This element has a total score of twelve which is equally distributed between the three subcategories; war, cross-border conflict, and foreign pressures (The PRS Group, 2012).

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[10] Readers that are interested in learning more about these definitions are encouraged to seek this information directly from The PRS Group

Internal conflict assesses the impact political disturbances/violence have or might have on the governance in the country (The PRS Group, 2012). Among the criteria for the risk rating is the unnecessary use of violence against citizens, if the opposition is armed or not, and the government's role in this situation. The tree subcategories here are: civil war/coup threat, terrorism/political violence, and civil disorder. Each of these accounts for four points towards the total of 12.

Military in politics. The PRS Group (2012) makes the statement that the military[11] is not elected by the people, and that any use of this "tool" for political purposes, no matter how small the degree of involvement is, lowers the democratic accountability in the country at hand. Another reason why this element is included is the economic side effects that may follow political use of armed forces, such as suboptimal allocation of resources[12]. In addition if the armed forces are loyal to an opposing political party, their threat of a military coupe can pressure the current government in office to change its policies in order to stay in office. Short term positive effects of a military regime on instability in countries are acknowledged, but in the long term such regimes are considered to be inherently negative. This does not have any subcategories and has a total score of 6 points.

Religious tensions. This element does not hold any subcategories and falls into the group of elements with six total points. The risk assessed here is one that stems from inexperienced individuals holding central roles in the government and/or in society based on religious beliefs and the risk of legislation being backed by religion rather than civil law. Such situations can lead to political and religious suppression, and even states of civil war (The PRS Group, 2012).

Socioeconomic conditions range from zero to 12 points. Here we find three subcategories; unemployment, consumer confidence, and poverty. What this element does is to assess "socioeconomic pressures at work in society that could constrain government action or fuel social dissatisfaction" (The PRS Group, 2012, p.3).

Bureaucracy quality has a total of four points. Countries with high scores in this element are characterized by "strength and expertise to govern without drastic changes in policy or interruptions in government services" (The PRS Group, 2012, p. 7) whenever there is a change of

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[11] In this case «military» refers to the armed forces backed by the government or by a political opposition in each country

[12] Use of armed forces for other reasons then their general tasks may often lead to reallocation of resources in a way that boosts military spending at the cost of other government programs.

government. On the other hand of the scale you have the countries that experience radical changes whenever there is a change of government.

Corruption is an element that assesses the political system. Corruption in the political system is of interest because such complications may cause issues for foreign business. Instability and powerful positions being abused can distort the market for foreign businesses and thus create unfavorable situations for both the businesses and the political system (The PRS Group, 2012). This element has no subcategories and a total score of six points.

Government stability consist of three subcategories; government unity, legislative strength and popular support. Each of these has a maximum score of four, hence a country can have a maximum score of twelve. The government stability element thus "measures" the capacity of the government to implement its program and how likely it is that they will stay in office (The PRS Group, 2012).

Law and order is an element with two self-explanatory subcategories; "law" which has a three-point maximum score assesses the robustness of the legal entities and overall system, while "order" on the other hand assesses "popular observance of the law" (The PRS Group, 2012), which likewise has a three-point maximum.

Investment profile has the following subcategories, all with a maximum score of four[13]; contract viability/expropriation, profits repatriation, and payment delays. These elements capture forces that might have an impact on the investment risk in the country, mainly forces that are not covered by other categories in the ICRG dataset.

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[13] With three subcategories, each worth four points, the total is twelve points for this element.

Data transformation

Some of the financial variables that were used were transformed for the sake of better statistical properties. None of the variables related to quality of institutions were transformed.

When it comes to the following variables some transformation was imposed namely; currency in circulation, GDP and ATM per 100.000 adults. Currency in circulation is adjusted by consumer price index then divided by population to create a proxy for the real demand for cash per capita. Due to the distribution of this variable we take the logarithm to gain better statistical properties. Similarly, we use the logarithm of both GDP per capita and ATMs per 100.000 adults, as their distributions are quite skewed. The impact of these transformations can be observed in figure 1.

Further we calculate the average of the Bank lending-deposit spread and Bank net interest margin (%). Both these variables are capturing similar underlying variables – the difference between the banks' lending and deposit rate. Therefore, the average of these two variables should be less noisy than either of these variables alone. We studied these variables also individually, and this is indeed what we found. Even though both of these variables are significant, the average of these variables is more significant than either variable alone.

Table 2 Summary statistics for data in levels.

	Min	Max	Median	Mean	St. Dev	Skewness	Kurtosis
Cash	0.29	9.74	4.09	4.66	2.18	0.54	-0.49
GDP	1.56	6.92	3.79	3.97	1.33	0.43	-0.63
Interest Rate	0.08	21.12	4.86	5.32	3.54	0.84	0.74
Lending Deposit Spread	0.82	23.53	5.79	6.35	3.61	1.58	3.94
ATM	-2.08	5.40	3.37	3.04	1.45	-0.83	0.26
Democratic Accountability	0.13	6.00	4.50	4.22	1.37	-0.67	-0.21
External Conflict	6.00	11.50	10.00	9.86	1.00	-0.83	0.71
Internal Conflict	4.96	12.00	9.50	9.19	1.54	-0.65	-0.32
Military in Politics	0.00	6.00	4.00	3.95	1.53	-0.47	-0.49
Religious Tensions	0.83	6.00	5.00	4.48	1.45	-0.92	-0.22
Socioeconomic Conditions	1.50	11.00	5.00	5.48	2.41	0.40	-0.78
Bureaucracy Quality	1.00	4.00	2.00	2.18	0.93	0.53	-0.56
Corruption	0.50	5.50	2.00	2.41	0.93	1.24	1.57
Government Stability	4.04	11.50	7.58	7.88	1.60	0.45	-0.45
Law and Order	1.00	6.00	3.00	3.38	1.31	0.30	-1.11
Investment Profile	3.00	12.00	8.50	8.69	1.83	-0.01	-0.60

Table 3 Summary statistics for data in first differences (Δ), where ΔX is calculated by subtracting by X_{t-1} from X_t

	Min	Max	Median	Mean	St. Dev	Skewness	Kurtosis
ΔCash	-0.31	0.47	0.04	0.04	0.09	0.61	3.64
ΔGDP	-0.57	0.62	0.02	0.02	0.12	-0.26	4.13
ΔInterest Rate	-7.27	5.94	-0.04	-0.14	1.51	-0.40	4.11
ΔLending Deposit Spread	-5.88	5.65	-0.12	-0.20	1.09	-0.52	6.89
ΔATM	-0.24	1.09	0.08	0.13	0.17	1.98	5.80
ΔDemocratic Accountability	-1.46	2.12	0.00	0.01	0.26	1.29	22.42
ΔExternal Conflict	-1.79	1.09	0.00	-0.03	0.27	-1.24	7.53
ΔInternal Conflict	-2.79	2.00	0.00	-0.06	0.40	-0.46	7.30
ΔMilitary in Politics	-1.29	1.71	0.00	-0.01	0.20	1.00	26.25
ΔReligious Tensions	-1.75	1.63	0.00	0.01	0.17	-0.21	50.57
ΔSocioeconomic Conditions	-2.12	1.96	0.00	0.00	0.37	-0.04	4.96
ΔBureaucracy Quality	-0.50	0.38	0.00	0.00	0.04	-1.91	74.82
ΔCorruption	-1.54	1.33	0.00	0.02	0.25	0.25	8.24
ΔGovernment Stability	-3.33	3.21	-0.04	-0.13	0.90	-0.20	0.94
ΔLaw and Order	-1.50	1.00	0.00	-0.01	0.19	-0.97	16.15
ΔInvestment Profile	-2.71	2.58	0.00	-0.06	0.48	-0.66	8.77

Table 4 Correlation matrix for variables in levels

	Cash	GDP	Interest Rate	Lending Deposit Spread	ATM	Democratic Accountability	External Conflict	Internal Conflict	Military in Politics	Religious Tensions	Socioeconomic Conditions	Bureaucracy Quality	Corruption	Government Stability	Law and Order	Investment Profile
Cash	1															
GDP	-0.04	1														
Interest Rate	-0.10	-0.52	1													
Lending Deposit Spread	-0.05	-0.44	0.46	1												
ATM	-0.03	0.79	-0.31	-0.25	1											
Democratic Accountability	0.06	0.24	-0.07	-0.11	0.40	1										
External Conflict	-0.14	0.25	-0.09	0.04	0.19	0.19	1									
Internal Conflict	-0.20	0.47	-0.20	-0.01	0.47	0.29	0.52	1								
Military in Politics	-0.16	0.54	-0.22	-0.19	0.50	0.42	0.54	0.76	1							
Religious Tensions	-0.13	0.34	-0.13	0.17	0.46	0.33	0.35	0.63	0.63	1						
Socioeconomic Conditions	0.01	0.84	-0.53	-0.47	0.65	0.13	0.24	0.40	0.48	0.16	1					
Bureaucracy Quality	0.07	0.69	-0.55	-0.47	0.53	0.34	0.19	0.25	0.43	0.23	0.68	1				
Corruption	-0.08	0.60	-0.29	-0.39	0.46	0.34	0.19	0.33	0.43	0.22	0.54	0.61	1			
Government Stability	-0.11	0.09	-0.04	-0.01	-0.16	-0.39	0.04	0.10	0.02	-0.05	0.15	-0.01	0.05	1		
Law and Order	-0.12	0.56	-0.29	-0.45	0.33	0.09	0.06	0.39	0.42	0.07	0.61	0.42	0.61	0.17	1	
Investment Profile	-0.01	0.74	-0.43	-0.39	0.53	0.23	0.25	0.46	0.53	0.27	0.68	0.60	0.54	0.15	0.49	1

Table 5 Correlation matrix for variables in first difference (Δ), where ΔX is calculated by subtracting by X_{t-1} from X_t.

	ΔCash	ΔGDP	ΔInterest Rate	ΔLending Deposit Spread	ΔATM	ΔDemocratic Accountability	ΔExternal Conflict	ΔInternal Conflict	ΔMilitary in Politics	ΔReligious Tensions	ΔSocioeconomic Conditions	ΔBureaucracy Quality	ΔCorruption	ΔGovernment Stability	ΔLaw and Order	ΔInvestment Profile
ΔCash	1															
ΔGDP	0.43	1														
ΔInterest Rate	-0.17	-0.11	1													
ΔLending Deposit Spread	-0.14	-0.02	-0.14	1												
ΔATM	0.22	0.13	0.09	-0.03	1											
ΔDemocratic Accountability	0.02	0.07	0.03	-0.04	0.15	1										
ΔExternal Conflict	0.02	0.02	-0.09	0.02	-0.07	0.06	1									
ΔInternal Conflict	0.04	0.04	-0.09	-0.01	0.03	0.08	0.14	1								
ΔMilitary in Politics	0.04	0.03	-0.03	0.004	0.10	0.13	0.05	0.11	1							
ΔReligious Tensions	0.06	0.08	-0.08	0.03	0.01	0.06	0.05	0.07	0.36	1						
ΔSocioeconomic Conditions	0.11	0.19	-0.04	-0.02	0.02	0.08	-0.01	0.16	0.09	0.11	1					
ΔBureaucracy Quality	-0.04	0.02	0.11	0.07	-0.01	0.01	0.07	-0.01	0.01	-0.01	0.05	1				
ΔCorruption	0.09	0.06	-0.05	0.02	0.16	0.04	0.07	0.03	-0.02	0.05	0.05	0.03	1			
ΔGovernment Stability	0.09	-0.02	-0.11	-0.03	-0.02	0.06	0.003	0.20	0.14	0.08	0.23	0.09	0.05	1		
ΔLaw and Order	-0.05	0.01	0.03	-0.00	0.04	0.13	0.02	0.06	0.13	0.12	0.02	0.03	-0.01	-0.00	1	
ΔInvestment Profile	0.11	0.19	0.001	-0.04	0.16	0.12	0.05	0.21	0.13	0.11	0.26	0.04	0.12	0.12	0.03	1

Figure 1 Scatter plot for selected pairs of variables
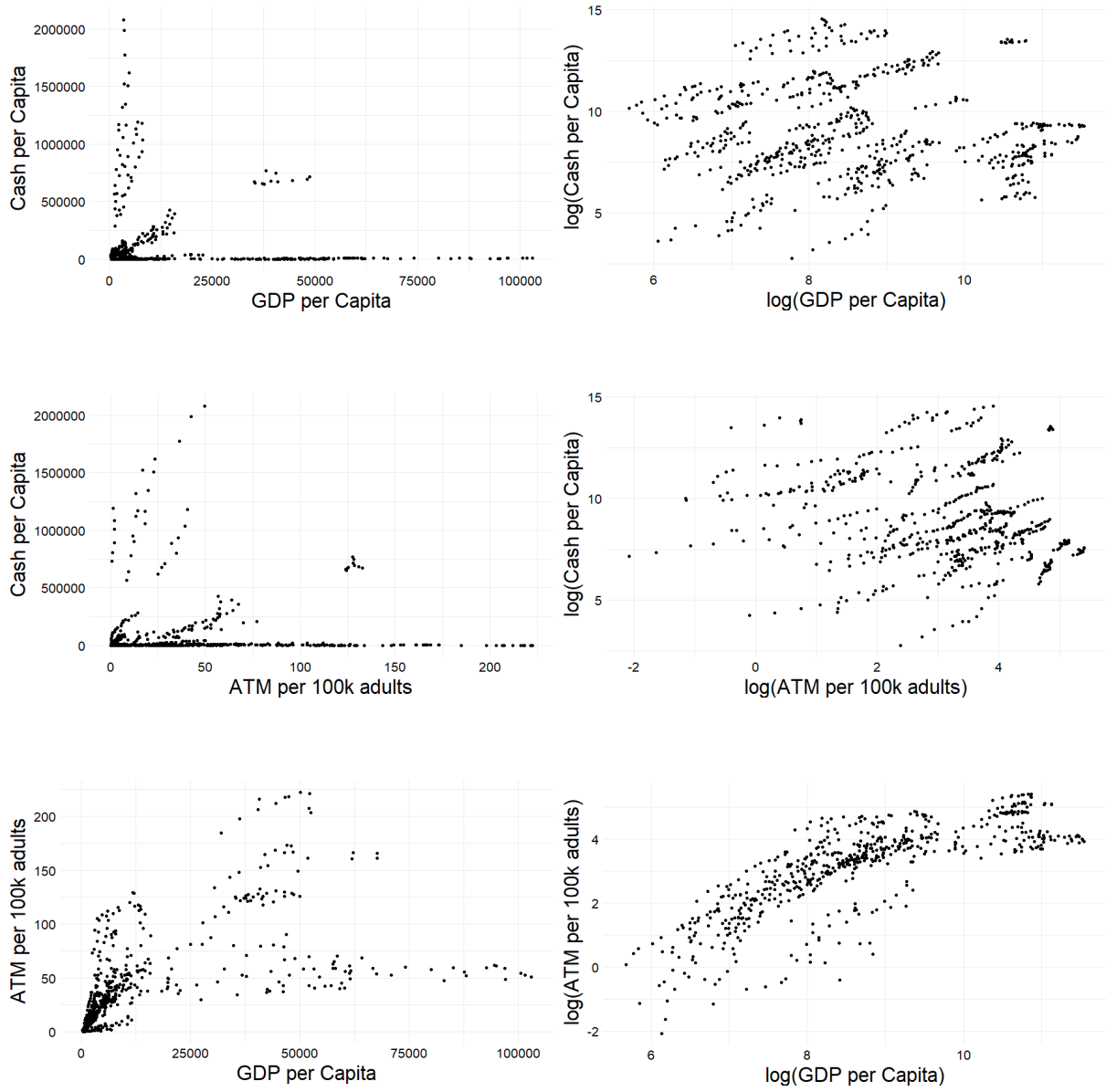
Methodology

We are using the Baumol-Tobin model in our work. This is a model that was individually developed by William Baumol (1952) and James Tobin (1956), but later got known as the Baumol-Tobin model upon the discovery that the two models were basically the same. We also want to point out that we are not testing the Baumol-Tobin model itself, but rather the commonly accepted relationships found by this model; which in our case is the positive relationship between GDP per capita and cash holdings, and the negative relationship between the deposit interest rate and cash holdings.

Baumol-Tobin Model

The base model used in this thesis draws on inspiration from the basic, yet well-established, Baumol-Tobin model. This model considers a person who at the beginning of a period receives a paycheck Y, withdraws the full amount, and spends the whole amount over the period (this assumes no savings). In this case the average money holding is equal to Y/2, Where Y is the total paycheck amount.

This can easily embrace several situations; if the individual first withdraws half of his/her income, spends it all and then at the middle of the period withdraws the rest. The average money holding will be Y/4, but in general the average money holding will be Y/(2N), where N is the number of withdrawals during the period.

Under the Baumol-Tobin model, the total cost of money management is estimated as NC+Yi/(2N), where C is the fixed transaction cost per transaction (independent of the amount withdrawn) and i is the nominal interest rate on money held at the bank and paid at the end of each period. From this model, optimal demand of money can be expressed as:

$$M = (\frac{CY}{2i})^{1/2} \qquad\qquad (1)$$

The predictions from this model are that the relationship between cash holdings and real amount of transactions is positive. The relationship between the deposit interest rate and cash holding is negative and the relation between money demand and the cost of taking out cash from the bank is positive.

As a measure of the real amount of transactions it is very natural to use real GDP per capita. Interest rate is available directly. However, obtaining cost of taking out cash from a bank is not easy. We are not aware of any such database providing historical data for various countries. The closest variable that we managed to obtain is the number of ATMs per 100.000 adults. Number of ATMs tells us how easy it is to take out cash, and it is therefore a proxy for non-monetary cost of taking out cash.

We are aware that there are possible endogeneity issues, not only is there a possibility of ATMs having an impact on the demand for cash, there is also the possibility that the demand for cash might have an impact on the number of ATMs. However, we did not find any other variable that could serve as a measure of cost of taking out cash. Moreover, we mitigate the endogeneity issues by considering also regression where we use lagged values of the number of ATMs.

Empirical Strategy

In order to test the generally accepted findings of the Baumol-Tobin model, we set up the following base model:[14]

$$Cash_{j,t} = \alpha + \beta_1 i_{j,t} + \beta_2 GDP_{j,t} + \beta_3 S_{j,t} + \beta_4 \text{ATM}_{j,t} + \delta_j + \gamma_t + \varepsilon_{j,t} \qquad (2)$$

where *Cash* is the logarithm of currency in circulation divided by population, i is the deposit interest rate, GDP is the log of GDP per capita, S is bank lending deposit spread which was constructed by taking the average of Bank lending-deposit spread and Bank net interest margin. ATM is the log of ATMs per 100.000 adults, j is the country index and t is the year index. Throughout the main body of this paper, we always include country fixed effects δ_j, and time fixed effects γ_t. We consider some alternative specifications in the appendix.

Next, we extend the base model with the different ICRG variables namely; Bureaucracy quality, corruption, government stability, law and order and investment profile, as specified by the following equation

$$Cash_{j,t} = \alpha_j + \beta_1 i_{j,t} + \beta_2 GDP_{j,t} + \beta_3 S_{j,t} + \beta_4 \text{ATM}_{j,t} + \beta_5 ICRG_{j,t} + \delta_j + \gamma_t + \varepsilon_{j,t} \qquad (3)$$

Where $ICRG_{j,t}$ describes different measures of institutional quality, mentioned in the above section.

To compare the strengths of the different variables we also constructed a multivariable model where we included all the aforementioned variables. To further test the strength of our model we ran three additional regressions. In these regressions, we estimate very similar models with lagged independent variables (4), variables specified in first differences (Δ) (5) and finally a model specified in first differences where independent variables are lagged (6).

$$Cash_{j,t} = \alpha_j + \beta_1 i_{j,t-1} + \beta_2 GDP_{j,t-1} + \beta_3 S_{j,t-1} + \beta_4 \text{ATM}_{j,t-1} + \beta_5 ICRG_{j,t-1} + \delta_j + \gamma_{t-1} + \varepsilon_{j,t-1} \quad (4)$$

$$\Delta Cash_{j,t} = \alpha_j + \beta_1 \Delta i_{j,t} + \beta_2 \Delta GDP_{j,t} + \beta_3 \Delta S_{j,t} + \beta_4 \Delta \text{ATM}_{j,t} + \beta_5 \Delta ICRG_{j,t} + \delta_j + \gamma_t + \varepsilon_{j,t} \qquad (5)$$

In this case the operator Δ describes the change in the independent variables, where $\Delta X_{j,t}$ would be constructed by subtraction of X_{t-1} from X_t.

$$\Delta Cash_{j,t} = \alpha_j + \beta_1 \Delta i_{j,t-1} + \beta_2 \Delta GDP_{j,t-1} + \beta_3 \Delta S_{j,t-1} + \beta_4 \Delta \text{ATM}_{j,t-1} + \beta_5 \Delta ICRG_{j,t-1} + \delta_j + \gamma_t + \varepsilon_{j,t} \quad (6)$$

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[14] All calculations and estimations where conducted in R.

Model (4) and (6) describe models where we impose lagged explanatory variables they will henceforth be referenced as the lagged and lagged change models accordingly.

We used robust standard errors specifically Huber-White robust standard errors clustered along countries. The models include fixed effects for both country and time, this was done in order to control for idiosyncratic shocks.

Results and Discussion

Table 5 to 8 describes the results from equation 2 to 6 with fixed effects imposed on the cross-sectional unit and time. In this output, real cash per capita was run as the dependent variable.

Our observation indicates that GDP per capita plays a key role in how much cash per capita is in the economy. Based on our regressions we can clearly see that countries with a higher GDP per capita have a proportionally higher amount of cash compared to a country with a lower GDP per capita. This relationship has also been consistent throughout all the regressions.

The deposit interest rate displays varied results. When we study the relationship in levels (table 5 and 6), the deposit interest rate did not consistently yield significant results. However, once we analyze the relationship as changes (table 7 and 8) we attained quite significant results. The likely reason for this result is that we have fixed effects in our panel data regression. Therefore, even though level of interest rates might have strong impact on cash holdings, as long as it is not time varying, it will be captured by country fixed effects. On the other hand, time (year) fixed effects capture only that part of time variation in cash holdings which is common in all countries, and this is probably the reason why panel data regression run for changes in variables yield significant results. The regression does however, consistently indicate that an increase in the deposit rate will negatively influence the demand for cash. This is in accordance with theory as holding cash will introduce a cost to the person, specifically the person will forgo any potential interest they could achieve if the cash had been kept in the bank.

The results related to the lending deposit spread consistently show a negative relationship between the lending deposit spread and the demand for cash, even though the significance varies across specifications. Given a greater deposit lending spread it would be more expensive to hold cash given that the person also had debt. A person would forgo the interest earned from keeping their money in the bank while also increasing the cost of their debt due to interest. In other words, this result is also consistent with the model predictions, because cost of holding cash consists of both deposit rate and deposit-lending spread if a person or company is indebted.

ATM per 100.000 adults variable exhibits a positive relationship with cash holdings. The results are consistent across specifications, being most significant in table 5, 7 and 8. Hancock and Humphreys (1998) highlighted that the relationship between ATMs and cash demand could be

twofold. It could be expected that better access to ATMs would lead to more frequent withdrawals for immediate need, or it could be the case that people will hold on to a larger amount of cash. Because we only have data on numbers of ATMs and not number of withdrawals we cannot draw a conclusion here. We can clearly see that all the regressions show a relationship between ATMs and demand for cash, however, we are not in a position to determine for certain the direction of the relationship. There might be an issue of endogeneity here, in that cash demand might rely on the number of ATMs or it may be the case that as demand for cash increases banks invest in more ATMs.

In general, the risk related variables did not yield significant results. We had some significance in the level and lagged model (table 5 and 6) that did not show up as significant in the change and lagged change models (table 7 and 8). The median and mean of the risk related variables are approximately zero, hence there are very minor changes to these variables. This could in part explain why there is little to none significance in the risk variables. Berggren, Bergh and Bjørnskov (2011) stated that the context surrounding the effects of institutional instability and change are more important and hence harder to interpret. One might argue that the change in itself could be meaningless, as it might depict an abrupt shock or some gradual expected improvement and one might expect that a gradual improvement would not really affect the demand for cash. Underlining this there might be a difference in expected and unexpected changes. If a country has a stable upwards trajectory, then changes in institutions might not matter as the changes are expected. So, whether change will have an effect or not might solely rely on whether it is expected or not, mirroring the concept of the efficient market.

In the level and lagged regression (table 5 and 6) we can observe a significant relationship between Democratic Accountability and the amount of cash holdings per capita. This variable indicates to an extent how democratic a country is and there seems to be a negative relationship between demand for cash and to the degree that a country is democratic. This relationship did not however, show any significance when we specify model in differences[15] and lagged differences (table 7 and 8).

In contrast, the difference and lagged differences (table 7 and 8) regression did yield significance for another variable namely Government stability. This variable captures the government unity,

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[15] By «differences» we refer to the Δ from one period to another

legislative strength and popular support. The regressions also demonstrate that in a more rigid country there will be a larger demand for cash.

Lastly Bureaucracy quality did show slight significance in the change and lagged change model. However, this relationship seems too weak for us to conclude anything based on the results in this study.

Robustness checks

We also ran regressions where we omitted ATM per 100.000 adults to verify that we did not have an issue with endogeneity. These tables are not included in the main paper as the conclusions remain the same whether we include or not include the ATM per 100.000 adults variable. The tables can be found in appendix 3.1 and 3.3.

We also ran regressions using only fixed effects for cross sectional unit, which are also included in the appendix. Generally, you get the same coefficients using any of these two approaches, although using fixed effects for both cross sectional unit and time will yield more robust results. These regressions can be reviewed in appendix 3.2 and 3.3.

Additional analysis

We also ran some alternative regressions with different dependent variables. The first one was using ATMs per 100.000 adults as the dependent variable, the thought behind this was the intuition that given a country with a large number of ATMs, likewise would have a large demand for cash. It would also possibly help illuminate the prevalence of smartcards[16] in the given country. These regressions can be found in appendix 4.0.

Lastly, we ran a few regressions using currency over differing money supply metrics[17].The thought here was to review the spread of cash compared to bank holding, and less liquid securities. These did not return any significant results and therefore were ultimately not included in the paper. We did however construct some scatter plots to describe the relationship, which can be reviewed in appendix 5.0.

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[16] Debit and credit card
[17] M1, M2 and M3

Panel data regression, with fixed effects for cross sectional unit (country) and time. Panel consists of the regressions done with 45 included countries. Following table returns the level model based on regression (3) $Cash_{j,t} = \alpha_j + \beta_1 i_{j,t} + \beta_2 GDP_{j,t} + \beta_3 S_{j,t} + \beta_4 \text{ATM}_{j,t} + \beta_4 ICRG_{j,t} + \delta_j + \gamma_t + \varepsilon_{j,t}$

	log (Currency in Circulation)												
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
GDP	0.364***	0.362***	0.363***	0.362***	0.364***	0.372***	0.376***	0.364***	0.364***	0.368***	0.355***	0.396***	0.388***
	(0.087)	(0.078)	(0.086)	(0.087)	(0.087)	(0.083)	(0.087)	(0.087)	(0.086)	(0.084)	(0.083)	(0.069)	(0.072)
Interest Rate	-0.011*	-0.007	-0.011*	-0.010*	-0.011*	-0.010*	-0.011**	-0.011*	-0.011*	-0.009	-0.010*	-0.015***	-0.006
	(0.006)	(0.005)	(0.006)	(0.006)	(0.006)	(0.006)	(0.005)	(0.006)	(0.006)	(0.006)	(0.005)	(0.006)	(0.005)
Lending Deposit Spread	-0.019***	-0.020***	-0.019***	-0.019***	-0.019***	-0.019***	-0.020***	-0.019***	-0.019***	-0.019***	-0.018***	-0.023***	-0.020***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
ATM	0.098***	0.101***	0.097***	0.095**	0.098***	0.099***	0.099***	0.098***	0.099**	0.098**	0.104***	0.144***	0.101***
	(0.038)	(0.037)	(0.037)	(0.038)	(0.037)	(0.037)	(0.037)	(0.038)	(0.038)	(0.038)	(0.036)	(0.028)	(0.035)
Democratic Accountability		-0.073**											-0.066**
		(0.029)											(0.029)
External Conflict			-0.013										-0.001
			(0.027)										(0.024)
Internal Conflict				0.008									0.015
				(0.018)									(0.015)
Military in Politics					0.003								0.003
					(0.020)								(0.026)
Religious Tensions						0.035							0.031
						(0.043)							(0.047)
Socioeconomic Conditions							-0.015						-0.024
							(0.018)						(0.019)
Bureaucracy Quality								-0.004					-0.060
								(0.123)					(0.097)
Corruption									-0.008				0.009
									(0.026)				(0.022)
Government Stability										0.011			0.010
										(0.008)			(0.007)
Law and Order											-0.064		-0.043
											(0.039)		(0.035)
Investment Profile												-0.017	0.0004
												(0.013)	(0.010)
Observations	442	442	442	442	442	442	442	442	442	442	442	442	442
R^2	0.317	0.362	0.318	0.318	0.317	0.322	0.320	0.317	0.318	0.327	0.333	0.626	0.388
Adjusted R^2	0.212	0.262	0.211	0.210	0.210	0.215	0.213	0.210	0.210	0.220	0.228	0.578	0.272

Fixed effects: Cross sectional unit and time

*p<0.1; **p<0.05; ***p<0.01

Table 7
Panel data regression, with fixed effects for cross sectional unit (country) and time. Panel consists of the regressions done with 45 included countries. Following table returns the lagged model based on regression (4) $Cash_{j,t} = \alpha_j + \beta_1 i_{j,t-1} + \beta_2 GDP_{j,t-1} + \beta_3 S_{j,t-1} + \beta_4 ATM_{j,t-1} + \beta_4 ICRG_{j,t-1} + \delta_j + \gamma_{t-1} + \varepsilon_{j,t-1}$

	log (Currency in Circulation)$_t$												
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
GDP$_{t-1}$	0.287***	0.286***	0.287***	0.286***	0.289***	0.293***	0.299***	0.281***	0.287***	0.288***	0.282***	0.302***	0.306***
	(0.078)	(0.070)	(0.078)	(0.079)	(0.078)	(0.076)	(0.078)	(0.080)	(0.079)	(0.077)	(0.076)	(0.066)	(0.070)
Interest Rate$_{t-1}$	-0.009	-0.005	-0.009	-0.009	-0.009	-0.009	-0.010	-0.009	-0.009	-0.009	-0.009	-0.015***	-0.006
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Lending Deposit Spread$_{t-1}$	-0.015*	-0.016**	-0.015*	-0.015*	-0.015*	-0.015*	-0.016**	-0.016**	-0.015*	-0.015*	-0.015*	-0.017**	-0.017**
	(0.008)	(0.007)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.007)
ATM$_{t-1}$	0.064*	0.068*	0.063*	0.061	0.063*	0.064*	0.065*	0.064*	0.063	0.064*	0.068*	0.117***	0.067**
	(0.038)	(0.038)	(0.038)	(0.038)	(0.038)	(0.038)	(0.038)	(0.038)	(0.038)	(0.039)	(0.036)	(0.028)	(0.034)
Democratic Accountability$_{t-1}$		-0.074***											-0.075***
		(0.026)											(0.027)
External Conflict$_{t-1}$		-0.008											-0.004
		(0.031)											(0.030)
Internal Conflict$_{t-1}$			0.009										0.013
			(0.017)										(0.014)
Military in Politics$_{t-1}$				0.006									0.012
				(0.026)									(0.027)
Religious Tensions$_{t-1}$					0.021								0.010
					(0.043)								(0.045)
Socioeconomic Conditions$_{t-1}$						-0.014							-0.017
						(0.018)							(0.017)
Bureaucracy Quality$_{t-1}$							0.130						0.133
							(0.115)						(0.092)
Corruption$_{t-1}$								0.006					0.021
								(0.027)					(0.025)
Government Stability$_{t-1}$									0.003				0.002
									(0.007)				(0.006)
Law and Order$_{t-1}$										-0.037			-0.015
										(0.039)			(0.034)
Investment Profile$_{t-1}$											-0.023*		-0.009
											(0.013)		(0.010)
Observations	409	409	409	409	409	409	409	409	409	409	409	409	409
R^2	0.221	0.277	0.222	0.222	0.222	0.224	0.225	0.225	0.222	0.222	0.228	0.508	0.295
Adjusted R^2	0.092	0.155	0.090	0.091	0.090	0.092	0.094	0.094	0.090	0.091	0.097	0.440	0.151

Fixed effects: Cross sectional unit and time $\quad$ *p<0.1; **p<0.05; ***p<0.01

Table 8
Panel data regression, with fixed effects for cross sectional unit (country) and time. Panel consists of the regressions done with 45 included countries. Following table returns the change (Δ) model based on regression (5) $\Delta Cash_{j,t} = \alpha_j + \beta_1 \Delta i_{j,t} + \beta_2 \Delta GDP_{j,t} + \beta_3 \Delta S_{j,t} + \beta_4 \Delta ATM_{j,t} + \beta_4 \Delta ICRG_{j,t} + \delta_j + \gamma_t + \varepsilon_{j,t}$ **Where operator Δ describes the change in the independent variables, where ΔXj,t would be constructed by subtraction of Xt-1 from Xt.**

	Δ*log (Currency in Circulation)*												
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
ΔGDP	0.256***	0.257***	0.253***	0.257***	0.256***	0.256***	0.257***	0.258***	0.256***	0.258***	0.255***	0.253***	0.258***
	(0.064)	(0.062)	(0.062)	(0.063)	(0.064)	(0.064)	(0.066)	(0.064)	(0.064)	(0.063)	(0.064)	(0.064)	(0.062)
ΔInterest Rate	-0.008***	-0.008***	-0.008***	-0.008***	-0.008***	-0.008***	-0.008***	-0.008***	-0.008***	-0.008***	-0.008***	-0.008***	-0.007***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
ΔLending Deposit Spread	-0.007*	-0.007*	-0.007*	-0.007*	-0.007*	-0.007*	-0.007*	-0.007*	-0.007*	-0.007*	-0.007*	-0.007*	-0.007*
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
ΔATM	0.096***	0.096***	0.098***	0.095***	0.096***	0.097***	0.096***	0.095***	0.091***	0.096***	0.095***	0.095***	0.092***
	(0.033)	(0.031)	(0.034)	(0.034)	(0.033)	(0.033)	(0.033)	(0.033)	(0.034)	(0.033)	(0.034)	(0.033)	(0.034)
ΔDemocratic Accountability		-0.003											-0.002
		(0.025)											(0.024)
ΔExternal Conflict			0.017										0.019
			(0.015)										(0.016)
ΔInternal Conflict				-0.003									-0.010
				(0.010)									(0.009)
ΔMilitary in Politics					-0.003								-0.005
					(0.020)								(0.019)
ΔReligious Tensions						0.006							0.005
						(0.034)							(0.034)
ΔSocioeconomic Conditions							-0.002						-0.006
							(0.008)						(0.007)
ΔBureaucracy Quality								-0.121*					-0.145**
								(0.073)					(0.070)
ΔCorruption									0.019				0.016
									(0.012)				(0.012)
ΔGovernment Stability										0.008**			0.009***
										(0.003)			(0.003)
ΔLaw and Order											-0.020		-0.016
											(0.020)		(0.019)
ΔInvestment Profile												0.004	0.003
												(0.006)	(0.005)
Observations	395	395	395	395	395	395	395	395	395	395	395	395	395
R^2	0.168	0.168	0.171	0.169	0.168	0.168	0.168	0.173	0.172	0.177	0.171	0.169	0.195
Adjusted R^2	0.025	0.022	0.026	0.022	0.022	0.022	0.022	0.027	0.026	0.032	0.024	0.022	0.024

Fixed effects: Cross sectional unit and time *p<0.1; **p<0.05; ***p<0.01

Table 9
Panel data regression, with fixed effects for cross sectional unit (country) and time. Panel consists of the regressions done with 45 included countries. Following table returns the lagged change (Δ) model based on regression (6) $Cash_{j,t} = \alpha_j + \beta_1 \Delta i_{j,t-1} + \beta_2 \Delta GDP_{j,t-1} + \beta_3 \Delta S_{j,t-1} + \beta_4 \Delta ATM_{j,t-1} + \beta_4 \Delta ICRG_{j,t-1} + \delta_j + \gamma_t + \varepsilon_{j,t}$ **Where operator Δ describes the change in the independent variables, where ΔXj,t would be constructed by subtraction of Xt-1 from Xt.**

	Δlog (Currency in Circulation)$_t$												
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
ΔGDP$_{t-1}$	0.253***	0.253***	0.249***	0.254***	0.253***	0.252***	0.253***	0.254***	0.253***	0.253***	0.251***	0.250***	0.255***
	(0.064)	(0.063)	(0.062)	(0.064)	(0.065)	(0.065)	(0.067)	(0.064)	(0.064)	(0.063)	(0.065)	(0.065)	(0.063)
ΔInterest Rate$_{t-1}$	-0.009***	-0.009***	-0.009***	-0.009***	-0.009***	-0.009***	-0.009***	-0.008***	-0.009***	-0.008***	-0.008***	-0.009***	-0.007***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
ΔLending Deposit Spread$_{t-1}$	-0.007*	-0.007*	-0.007*	-0.007*	-0.007*	-0.007*	-0.007*	-0.007	-0.007*	-0.007*	-0.007*	-0.007*	-0.007
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
ΔATM$_{t-1}$	0.091***	0.091***	0.093***	0.090***	0.091***	0.092***	0.091***	0.091***	0.086**	0.093***	0.090***	0.090***	0.090***
	(0.032)	(0.031)	(0.034)	(0.033)	(0.032)	(0.032)	(0.032)	(0.032)	(0.034)	(0.032)	(0.033)	(0.032)	(0.033)
ΔDemocratic Accountability$_{t-1}$		-0.001											-0.001
		(0.029)											(0.029)
ΔExternal Conflict$_{t-1}$			0.017										0.019
			(0.017)										(0.017)
ΔInternal Conflict$_{t-1}$				-0.006									-0.012
				(0.010)									(0.009)
ΔMilitary in Politics$_{t-1}$					-0.001								-0.004
					(0.020)								(0.019)
ΔReligious Tensions$_{t-1}$						0.007							0.007
						(0.034)							(0.034)
ΔSocioeconomic Conditions$_{t-1}$							-0.001						-0.005
							(0.009)						(0.007)
ΔBureaucracy Quality$_{t-1}$								-0.112					-0.138*
								(0.080)					(0.077)
ΔCorruption$_{t-1}$									0.017				0.013
									(0.012)				(0.012)
ΔGovernment Stability$_{t-1}$										0.009**			0.010***
										(0.003)			(0.003)
ΔLaw and Order$_{t-1}$											-0.022		-0.019
											(0.020)		(0.020)
ΔInvestment Profile$_{t-1}$												0.003	0.001
												(0.007)	(0.006)
Observations	363	363	363	363	363	363	363	363	363	363	363	363	363
R^2	0.170	0.170	0.173	0.171	0.170	0.170	0.170	0.174	0.173	0.180	0.173	0.170	0.197
Adjusted R^2	0.015	0.012	0.015	0.012	0.012	0.012	0.012	0.016	0.015	0.024	0.015	0.012	0.012

Fixed effects: Cross sectional unit and time   *p<0.1; **p<0.05; ***p<0.01

Conclusion

Our motivation for this thesis is rooted in our applied finance specialization, aided by the risk related variables (ICRG) and curiosity as to how these could reveal differences in the demand for cash in different countries. Our contribution comes from the fact that we explore a larger set of countries and look at them in the context of how different risk variables might affect money demand.

The underlying data consists of ICRG variables[18], currency in circulation, population, deposit interest rate[19], number of ATMs per 100.000 adults, bank lending-deposit spread, Bank interest margin (%)[20], and nominal gross national product per capita[21]. This data enabled us to analyze 45 countries over a time span of 11 years.

Our analysis consists of several regressions, where we imposed country and time fixed effects on the following models; level, lagged, change (Δ) and a lagged change. These were done to study whether the demand for cash was mostly reliant on the levels on the independent variables or if changes in these variables had more of an effect. These regressions are used to test if the quality of institutions have any effects on the generally accepted findings from the Baumol-Tobin model. From these regressions, we found that the relationship between GDP per capita and cash holding is positive, and that the relationship between the deposit interest rate and cash holding is negative.

On one hand, based on our regressions, we can see that GDP, Interest rate, Lending deposit spread and ATMs clearly are related to the demand for money. On the other hand, it is hard to argue that the risk variables reviewed in this paper have had much effect on the demand. Some have shown significance given a particular model i.e. level, lagged, change and lagged change, but no risk related variable has shown significance in all the considered model specifications. On a general basis, there are no indications that the selected risk factors will affect the demand for cash.

The relevant data for this study was limited by factors that were recently added to the relevant databases. Given a longer timeframe, further studies might be able to compile more data and

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[18] Collected from The PRS Group
[19] Data regarding currency in circulation, population, and deposit interest rate are collected from the International Monetary Fund
[20] Data regarding number of ATMs per 100.000 adults, bank lending-deposit spread, and bank net interest margin (5) is collected from the Financial Access Survey by the IMF
[21] Collected from the World Bank's World Development Indicators

structure the regression differently to gain interesting insight from a different viewpoint. It might be interesting to look at change in risk related variables in decades rather than on a yearly basis as changes might be too subtle to capture on a yearly basis.

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Appendices

Appendix 1.1 – Countries omitted due to missing deposit interest rate data (32)

Afghanistan, Angola, Anguilla, Netherlands Antilles, United Arab Emirates, Austria, Burundi, Belgium, Curacao, Germany, Finland, Eritrea, Spain, India, Greece, Italy, Ireland, Iceland, Malta, Kazakhstan, Luxembourg, Portland, Montserrat, Poland, El Salvador, Saudi Arabia, Sudan, Tunisia, South Sudan, Sint Maarten, Turkey and Zimbabwe.

Appendix 1.2 – Countries omitted due to missing currency in circulation data (39)

Aruba, Argentina, Bahrain, Bahamas, Switzerland, Democratic Republic of the Congo, Cyprus, Djibouti, Ecuador, Estonia, Ethiopia, France, Micronesia (Federal States of), Guinea, Hong Kong, Iran, Jordan, Lao People's Democratic Republic, Lebanon, Liberia, Libya, Lithuania, Latvia, Madagascar, Montenegro, Mauritania, Malawi, Netherlands, New Zealand, Peru, Palestine (State of), Romania, Singapore, San Marino, Slovakia, Slovenia, Timor-Leste, Vietnam, Yemen.

Appendix 1.3 – Countries omitted due to missing ATM data (3)

Haiti, Gambia and Guinea Bissau.

Appendix 1.4 – Countries omitted due to missing ICRG-values (19)

Antigua and Barbuda, Barbados, Belize, Benin, Bhutan, Bosnia and Herzegovina, Cabo Verde, Central African Republic, Comoros, Dominica, Equatorial Guinea, Fiji, Georgia, Grenada, Kyrgyzstan, Rwanda, Sao Tome and Principe, Serbia, Solomon Island and Tajikistan.

Appendix 1.5 – Countries omitted due to missing Consumer price index (5)

Azerbaijan, Belarus, Chile, China and Venezuela.

Appendix 1.6 – Countries omitted due to missing either Bank lending-deposit spread or Bank net interest margin (%) (10)

Denmark, Burkina Faso, Côte d'Ivoire, Gabon, Ghana, Iraq, Morocco, Sweden, United Kingdom and USA.

Appendix 1.7 – Included countries (45)

Albania, Algeria, Armenia, Australia, Bangladesh, Bolivia, Botswana, Brazil, Brunei Darussalam, Bulgaria, Burkina Faso, Cameroon, Canada, Colombia, Congo, Costa Rica, Croatia, Czech Republic, Denmark, Dominican Republic, Egypt, Guyana, Guatemala, Honduras, Hungary, Indonesia, Israel, Jamaica, Japan, Kenya, Kuwait, Republic of Moldova, Mexico, Malaysia, Nigeria, Nicaragua, Norway, Pakistan, Paraguay, Qatar, Serbia, South Africa, Ukraine, Uganda, United Republic of Tanzania, Zambia and Thailand.

Appendix 2.1 The selection of countries.

We started out with a spreadsheet containing 153 countries and their values for different elements (including, but not limited to; interest rate, M1, M2, M3, population, base-to-broad money, and several more) over the period from 2004 to 2014. Some of the elements came from the same data set (International Monetary Fund, 2017), while others are collected from different, but reliable, sources (FactSet 2017, Sveriges Riksbank 2017, Danmarks Nationalbank 2017) . These were all combined through the analysis program R, and it gave us our first list of countries. However, some countries had rather large holes in the data which meant we had to exclude them from our total list. The decisive variables will be discussed in turn.

i_rate – Deposit Rate

For our purpose, the deposit rate is of high importance when picking countries to examine through our analysis. Our reasoning behind this variable is that it is closely connected to the use of cash. If deposit rates are high, consumers would prefer to keep cash in their accounts in other to accumulate interest. If deposit rates are low, consumers would prefer to use the cash as they are not forgoing any noticeable interest revenue by not holding as much cash in their accounts. However, not all countries on our original list have a deposit rate available for us to use in our analysis, which means they will have to be omitted although we have found a solution for a few countries in order to utilize their data in our analysis. Two examples are the United States of America (USA) and United Kingdom (UK). These cases demanded a proxy for the deposit rate. The reason why a proxy is needed is that the deposit rate is near impossible to find, but we do not want to omit them due to their important role in the overall economy and the fact that they have, in our opinion, significant cultures with large volumes of cash use which is interesting to study. For USA, the Federal Funds Rate is used as a proxy for the deposit rate due to its close relationship to the deposit rates as well as the fact that this is one of the most important rate in the US economy. For the UK, the 3-month GBP London Interbank Offered Rate (LIBOR) since this is a known guide line, or base rate if you want, for a wide arrangement of financial products. Some of the omitted countries are left out due to extreme values, values that will distort the analysis and/or is caused by favorable tax legislation or situations that are not representative in relation to other variables and/or countries. We have defined extreme deposit rate values as values over 30%, and a country with three or more extreme values will be omitted. For a full list

of the 32 countries omitted because of missing and extreme values like Zimbabwe with a deposit rate close to 200 percent, see the comprehensive list in *Appendix 1.1*.

cur_cir – Currency in Circulation (M0)

Currency in circulation is another important variable for us. It shows how changes in the use of currency move from year to year and is also an indicator of alternative payment measures. Low amounts of currency in circulation can indicate that there are many alternatives to cash, while high amounts of currency in circulation can indicate that there are limited or no alternatives to cash. Just like the previous variable, this variable did not contain data for all countries in the original list, or even all countries after removing countries where the deposit rate was missing, which shortened or list further. For the full list of the 39 countries omitted due to missing or extreme currency in circulation data, see *Appendix 1.2*.

ICRG-Values

The last decisive factor is available International Country Risk Guide (ICRG) values. Since our analysis is tied up to these values, it is critical that the chosen countries have this data available. Only four countries were dismissed due to missing ICRG-values. For a list of these 19, see *Appendix 1.4*.

The final selection

After the previous stated selection-rounds, we have ended up with 45 countries. These are all countries with data available for analysis, and they are not confined to a single development-group (e.g. developed economies) or a single geographical area. It is simply all countries in which we could attain the desired data. One of the reasons for this approach is that we want to include more countries compared to previous studies as well as we want to look at countries from more than just one geographical or just one development category in order to be able to see connections and relationships that would be impossible to detect otherwise. For the full list of the 45 included countries, see *Appendix 1.6*.

Appendix 3 Omitted tables

Appendix 3.1 regressions without ATM

Table 10
Panel data regression, with fixed effects for cross sectional unit (country) and time. Panel consists of the regressions done with 45 included countries. Following table returns the level model based on regression $Cash_{j,t} = \alpha_j + \beta_1 i_{j,t} + \beta_2 GDP_{j,t} + \beta_3 S_{j,t} + \beta_4 ICRG_{j,t} + \delta_j + \gamma_t + \varepsilon_{j,t}$

	log (Currency in Circulation)												
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
GDP	0.413***	0.415***	0.413***	0.392***	0.417***	0.421***	0.432***	0.406***	0.413***	0.415***	0.413***	0.616***	0.444***
	(0.089)	(0.081)	(0.089)	(0.086)	(0.090)	(0.085)	(0.090)	(0.087)	(0.088)	(0.085)	(0.086)	(0.089)	(0.076)
Interest Rate	-0.007	-0.004	-0.007	-0.005	-0.007	-0.007	-0.008	-0.007	-0.007	-0.005	-0.006	-0.012	-0.002
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.007)	(0.006)	(0.007)	(0.006)	(0.007)	(0.006)
Lending Deposit Spread	-0.021***	-0.022***	-0.021***	-0.022***	-0.020***	-0.021***	-0.022***	-0.021***	-0.021***	-0.021***	-0.020***	-0.035***	-0.024***
	(0.008)	(0.007)	(0.008)	(0.007)	(0.008)	(0.008)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.006)
Democratic Accountability		-0.055*											-0.050*
		(0.031)											(0.030)
External Conflict			0.004										-0.013
			(0.029)										(0.025)
Internal Conflict				0.050*									0.059***
				(0.026)									(0.022)
Military in Politics					0.021								0.013
					(0.022)								(0.033)
Religious Tensions						0.027							0.018
						(0.050)							(0.052)
Socioeconomic Conditions							-0.022						-0.035**
							(0.020)						(0.017)
Bureaucracy Quality								0.127					0.025
								(0.171)					(0.111)
Corruption									-0.009				0.006
									(0.031)				(0.024)
Government Stability										0.015*			0.012
										(0.009)			(0.009)
Law and Order											-0.049		-0.042
											(0.039)		(0.035)
Investment Profile												-0.054***	-0.014
												(0.018)	(0.021)
Observations	462	462	462	462	462	462	462	462	462	462	462	462	462
R²	0.254	0.278	0.254	0.283	0.256	0.256	0.260	0.256	0.254	0.267	0.262	0.511	0.345
Adjusted R²	0.146	0.172	0.144	0.178	0.146	0.147	0.151	0.147	0.145	0.160	0.154	0.453	0.229

Fixed effects: Cross sectional unit and time   *p<0.1; **p<0.05; ***p<0.01

Table 11

Panel data regression, with fixed effects for cross sectional unit (country) and time. Panel consists of the regressions done with 45 included countries. Following table returns the lagged model based on regression $Cash_{j,t} = \alpha_j + \beta_1 i_{j,t-1} + \beta_2 GDP_{j,t-1} + \beta_3 S_{j,t-1} + \beta_4 ICRG_{j,t-1} + \delta_j + \gamma_{t-1} + \varepsilon_{j,t-1}$

	log (Currency in Circulation)$_t$												
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
GDP$_{t-1}$	0.326***	0.329***	0.326***	0.311***	0.330***	0.330***	0.341***	0.317***	0.326***	0.326***	0.325***	0.485***	0.358***
	(0.077)	(0.069)	(0.077)	(0.077)	(0.077)	(0.074)	(0.077)	(0.077)	(0.077)	(0.075)	(0.075)	(0.073)	(0.073)
Interest Rate$_{t-1}$	-0.007	-0.005	-0.007	-0.006	-0.007	-0.007	-0.008	-0.008	-0.007	-0.007	-0.007	-0.012*	-0.005
	(0.006)	(0.006)	(0.007)	(0.006)	(0.006)	(0.007)	(0.006)	(0.007)	(0.006)	(0.006)	(0.006)	(0.007)	(0.006)
Lending Deposit Spread$_{t-1}$	-0.016*	-0.016**	-0.016*	-0.016**	-0.016*	-0.016*	-0.017**	-0.017**	-0.016*	-0.015*	-0.015*	-0.024***	-0.018**
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.007)
Democratic Accountability$_{t-1}$		-0.049*											-0.053*
		(0.027)											(0.029)
External Conflict$_{t-1}$			0.008										-0.007
			(0.031)										(0.029)
Internal Conflict$_{t-1}$				0.037*									0.042**
				(0.021)									(0.018)
Military in Politics$_{t-1}$					0.018								0.022
					(0.026)								(0.033)
Religious Tensions$_{t-1}$						0.016							0.002
						(0.047)							(0.048)
Socioeconomic Conditions$_{t-1}$							-0.020						-0.023
							(0.019)						(0.015)
Bureaucracy Quality$_{t-1}$								0.178*					0.151**
								(0.105)					(0.067)
Corruption$_{t-1}$									0.004				0.019
									(0.028)				(0.025)
Government Stability$_{t-1}$										0.007			0.004
										(0.007)			(0.008)
Law and Order$_{t-1}$											-0.024		-0.012
											(0.037)		(0.034)
Investment Profile$_{t-1}$												-0.052***	-0.024
												(0.016)	(0.019)
Observations	427	427	427	427	427	427	427	427	427	427	427	427	427
R^2	0.203	0.228	0.203	0.222	0.205	0.204	0.209	0.209	0.203	0.206	0.206	0.436	0.282
Adjusted R^2	0.080	0.106	0.078	0.100	0.079	0.079	0.084	0.084	0.078	0.081	0.080	0.363	0.146

Fixed effects: Cross sectional unit and time   *p<0.1; **p<0.05; ***p<0.01

Table 12

Panel data regression, with fixed effects for cross sectional unit (country) and time. Panel consists of the regressions done with 45 included countries. Following table returns the change (Δ) model based on regression $Cash_{j,t} = \alpha_j + \beta_1 \Delta i_{j,t} + \beta_2 \Delta GDP_{j,t} + \beta_3 \Delta S_{j,t} + \beta_4 \Delta ICRG_{j,t} + \delta_j + \gamma_t + \varepsilon_{j,t}$ Where operator Δ describes the change in the independent variables, where ΔXj,t would be constructed by subtraction of Xt-1 from Xt.

	Δlog (Currency in Circulation)												
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
ΔGDP	0.238***	0.237***	0.236***	0.243***	0.238***	0.239***	0.241***	0.241***	0.238***	0.239***	0.238***	0.244***	0.251***
	(0.068)	(0.068)	(0.067)	(0.067)	(0.068)	(0.069)	(0.070)	(0.068)	(0.068)	(0.068)	(0.068)	(0.067)	(0.065)
ΔInterest Rate	-0.009***	-0.009***	-0.009***	-0.009***	-0.009***	-0.009***	-0.009***	-0.008***	-0.009***	-0.009***	-0.009***	-0.009***	-0.008***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
ΔLending Deposit Spread	-0.006*	-0.006	-0.007*	-0.007*	-0.006*	-0.006*	-0.006*	-0.006	-0.007*	-0.006*	-0.006*	-0.006*	-0.006
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
ΔDemocratic Accountability		0.016											0.015
		(0.017)											(0.018)
ΔExternal Conflict			0.013										0.015
			(0.015)										(0.016)
ΔInternal Conflict				-0.011									-0.016*
				(0.010)									(0.008)
ΔMilitary in Politics					0.001								0.003
					(0.021)								(0.018)
ΔReligious Tensions						-0.001							-0.003
						(0.035)							(0.035)
ΔSocioeconomic Conditions							-0.004						-0.006
							(0.008)						(0.007)
ΔBureaucracy Quality								-0.168**					-0.198**
								(0.082)					(0.079)
ΔCorruption									0.020*				0.019*
									(0.011)				(0.011)
ΔGovernment Stability										0.008**			0.010***
										(0.003)			(0.003)
ΔLaw and Order											-0.017		-0.013
											(0.016)		(0.016)
ΔInvestment Profile												-0.006	-0.004
												(0.011)	(0.008)
Observations	415	415	415	415	415	415	415	415	415	415	415	415	415
R²	0.127	0.129	0.128	0.129	0.127	0.127	0.127	0.135	0.131	0.135	0.128	0.128	0.162
Adjusted R²	-0.013	-0.013	-0.014	-0.013	-0.016	-0.016	-0.015	-0.006	-0.011	-0.005	-0.014	-0.014	-0.003

Fixed effects: Cross sectional unit and time   *p<0.1; **p<0.05; ***p<0.01

Table 13

Panel data regression, with fixed effects for cross sectional unit (country) and time. Panel consists of the regressions done with 45 included countries. Following table returns the lagged change (Δ) model based on regression $Cash_{j,t} = \alpha_j + \beta_1\Delta i_{j,t-1} + \beta_2\Delta GDP_{j,t-1} + \beta_3\Delta S_{j,t-1} + \beta_4\Delta ICRG_{j,t-1} + \delta_j + \gamma_t + \varepsilon_{j,t}$ **Where operator Δ describes the change in the independent variables, where ΔXj,t would be constructed by subtraction of Xt-1 from Xt.**

| | Δlog (Currency in Circulation)$_t$ | | | | | | | | | | | | |
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
ΔGDP$_{t-1}$	0.239***	0.237***	0.236***	0.244***	0.239***	0.239***	0.241***	0.241***	0.238***	0.239***	0.237***	0.246***	0.252***
	(0.069)	(0.069)	(0.068)	(0.068)	(0.069)	(0.070)	(0.071)	(0.069)	(0.069)	(0.068)	(0.069)	(0.069)	(0.066)
ΔInterest Rate$_{t-1}$	-0.009***	-0.009***	-0.009***	-0.010***	-0.009***	-0.010***	-0.009***	-0.009***	-0.009***	-0.009***	-0.009***	-0.009***	-0.008***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
ΔLending Deposit Spread$_{t-1}$	-0.007*	-0.006	-0.007*	-0.007*	-0.007*	-0.007*	-0.007*	-0.006	-0.007*	-0.006	-0.007*	-0.007*	-0.005
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
ΔDemocratic Accountability$_{t-1}$		0.018											0.015
		(0.018)											(0.020)
ΔExternal Conflict$_{t-1}$			0.013										0.017
			(0.016)										(0.017)
ΔInternal Conflict$_{t-1}$				-0.011									-0.015*
				(0.010)									(0.008)
ΔMilitary in Politics$_{t-1}$					0.002								0.003
					(0.021)								(0.018)
ΔReligious Tensions$_{t-1}$						-0.002							-0.003
						(0.035)							(0.036)
ΔSocioeconomic Conditions$_{t-1}$							-0.004						-0.005
							(0.009)						(0.008)
ΔBureaucracy Quality$_{t-1}$								-0.153*					-0.184**
								(0.086)					(0.082)
ΔCorruption$_{t-1}$									0.018				0.016
									(0.012)				(0.011)
ΔGovernment Stability$_{t-1}$										0.009***			0.010***
										(0.003)			(0.003)
ΔLaw and Order$_{t-1}$											-0.019		-0.016
											(0.017)		(0.017)
ΔInvestment Profile$_{t-1}$												-0.007	-0.006
												(0.011)	(0.008)
Observations	381	381	381	381	381	381	381	381	381	381	381	381	381
R^2	0.131	0.134	0.133	0.134	0.131	0.131	0.131	0.138	0.135	0.142	0.133	0.133	0.168
Adjusted R^2	-0.019	-0.018	-0.020	-0.019	-0.022	-0.022	-0.022	-0.014	-0.018	-0.010	-0.020	-0.020	-0.010

Fixed effects: Cross sectional unit and time *p<0.1; **p<0.05; ***p<0.01

Appendix 3.2 Regression with cross sectional fixed effects (with ATM)

Table 14

Panel data regression, with fixed effects for cross sectional unit (country). Panel consists of the regressions done with 45 included countries. Following table returns the level model based on regression $Cash_{j,t} = \alpha_j + \beta_1 i_{j,t} + \beta_2 GDP_{j,t} + \beta_3 S_{j,t} + \beta_4 ATM_{j,t} + \beta_5 ICRG_{j,t} + \delta_j + \varepsilon_{j,t}$

| | *log (Currency in Circulation)* | | | | | | | | | | | | |
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
GDP	0.379***	0.384***	0.376***	0.379***	0.377***	0.383***	0.395***	0.378***	0.380***	0.381***	0.368***	0.396***	0.408***
	(0.072)	(0.067)	(0.073)	(0.071)	(0.072)	(0.070)	(0.072)	(0.072)	(0.071)	(0.071)	(0.068)	(0.069)	(0.064)
Interest Rate	-0.016***	-0.012***	-0.016***	-0.016***	-0.016***	-0.016***	-0.017***	-0.016***	-0.016***	-0.016***	-0.015***	-0.015***	-0.011***
	(0.005)	(0.004)	(0.005)	(0.005)	(0.006)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.006)	(0.004)
Lending Deposit Spread	-0.024***	-0.024***	-0.023***	-0.023***	-0.024***	-0.024***	-0.025***	-0.024***	-0.024***	-0.024***	-0.022***	-0.023***	-0.024***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.006)	(0.007)	(0.006)
ATM	0.149***	0.150***	0.146***	0.148***	0.149***	0.148***	0.146***	0.149***	0.151***	0.152***	0.146***	0.144***	0.143***
	(0.028)	(0.026)	(0.027)	(0.028)	(0.028)	(0.027)	(0.028)	(0.028)	(0.030)	(0.030)	(0.027)	(0.028)	(0.027)
Democratic Accountability		-0.072**											-0.063**
		(0.031)											(0.032)
External Conflict			-0.021										-0.002
			(0.027)										(0.024)
Internal Conflict				-0.014									0.0004
				(0.018)									(0.015)
Military in Politics					-0.013								-0.005
					(0.018)								(0.024)
Religious Tensions						0.036							0.043
						(0.043)							(0.051)
Socioeconomic Conditions							-0.021						-0.017
							(0.021)						(0.021)
Bureaucracy Quality								0.016					-0.023
								(0.137)					(0.114)
Corruption									-0.008				0.008
									(0.028)				(0.023)
Government Stability										0.004			0.006
										(0.007)			(0.007)
Law and Order											-0.075*		-0.045
											(0.040)		(0.036)
Investment Profile												-0.017	-0.011
												(0.013)	(0.011)
Observations	442	442	442	442	442	442	442	442	442	442	442	442	442
R²	0.622	0.646	0.623	0.623	0.622	0.625	0.625	0.622	0.622	0.622	0.634	0.626	0.660
Adjusted R²	0.575	0.600	0.575	0.575	0.574	0.577	0.577	0.573	0.574	0.574	0.588	0.578	0.606

Note: *p<0.1; **p<0.05; ***p<0.01

Table 15
Panel data regression, with fixed effects for cross sectional unit (country). Panel consists of the regressions done with 45 included countries. Following table returns the lagged model based on regression $Cash_{j,t} = \alpha_j + \beta_1 i_{j,t-1} + \beta_2 GDP_{j,t-1} + \beta_3 S_{j,t-1} + \beta_4 ATM_{j,t-1} + \beta_4 ICRG_{j,t-1} + \delta_j + \varepsilon_{j,t-1}$

	log (Currency in Circulation)$_t$												
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
GDP$_{t-1}$	0.282***	0.286***	0.278***	0.281***	0.280***	0.285***	0.299***	0.277***	0.282***	0.279***	0.273***	0.302***	0.303***
	(0.070)	(0.066)	(0.071)	(0.069)	(0.069)	(0.069)	(0.069)	(0.070)	(0.071)	(0.069)	(0.067)	(0.066)	(0.063)
Interest Rate$_{t-1}$	-0.016***	-0.012**	-0.016***	-0.016***	-0.016***	-0.016***	-0.017***	-0.017***	-0.016***	-0.016***	-0.015***	-0.015***	-0.012**
	(0.006)	(0.005)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.005)
Lending Deposit Spread$_{t-1}$	-0.018**	-0.018**	-0.017**	-0.017**	-0.018**	-0.017**	-0.018**	-0.018**	-0.017**	-0.018**	-0.017**	-0.017**	-0.018**
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.007)
ATM$_{t-1}$	0.123***	0.125***	0.120***	0.122***	0.123***	0.122***	0.119***	0.123***	0.122***	0.119***	0.121***	0.117***	0.109***
	(0.029)	(0.027)	(0.028)	(0.029)	(0.028)	(0.028)	(0.028)	(0.028)	(0.030)	(0.030)	(0.028)	(0.028)	(0.028)
Democratic Accountability$_{t-1}$		-0.069**											-0.066**
		(0.029)											(0.031)
External Conflict$_{t-1}$			-0.019										-0.008
			(0.032)										(0.032)
Internal Conflict$_{t-1}$				-0.017									-0.0001
				(0.018)									(0.015)
Military in Politics$_{t-1}$					-0.007								0.010
					(0.026)								(0.027)
Religious Tensions$_{t-1}$						0.023							0.021
						(0.044)							(0.050)
Socioeconomic Conditions$_{t-1}$							-0.022						-0.013
							(0.021)						(0.019)
Bureaucracy Quality$_{t-1}$								0.130					0.137
								(0.129)					(0.101)
Corruption$_{t-1}$									0.005				0.018
									(0.027)				(0.025)
Government Stability$_{t-1}$										-0.006			-0.004
										(0.006)			(0.006)
Law and Order$_{t-1}$											-0.053		-0.018
											(0.042)		(0.038)
Investment Profile$_{t-1}$												-0.023*	-0.017*
												(0.013)	(0.010)
Observations	409	409	409	409	409	409	409	409	409	409	409	409	409
R^2	0.499	0.527	0.500	0.501	0.499	0.500	0.504	0.501	0.499	0.500	0.507	0.508	0.544
Adjusted R^2	0.430	0.461	0.430	0.431	0.429	0.430	0.434	0.431	0.429	0.430	0.438	0.440	0.465

Note: *p<0.1; **p<0.05; ***p<0.01

Table 16
Panel data regression, with fixed effects for cross sectional unit (country). Panel consists of the regressions done with 45 included countries. Following table returns the change (Δ) model based on regression $Cash_{j,t} = \alpha_j + \beta_1 \Delta i_{j,t} + \beta_2 \Delta GDP_{j,t} + \beta_3 \Delta S_{j,t} + \beta_4 \Delta ATM_{j,t} + \beta_4 \Delta ICRG_{j,t} + \delta_j + \varepsilon_{j,t}$ Where operator Δ describes the change in the independent variables, where $\Delta X_{j,t}$ would be constructed by subtraction of X_{t-1} from X_t.

	Δlog (Currency in Circulation)												
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
ΔGDP	0.264***	0.264***	0.263***	0.265***	0.264***	0.263***	0.261***	0.265***	0.263***	0.266***	0.265***	0.261***	0.263***
	(0.046)	(0.044)	(0.046)	(0.046)	(0.046)	(0.047)	(0.048)	(0.046)	(0.047)	(0.045)	(0.046)	(0.046)	(0.046)
ΔInterest Rate	-0.008***	-0.008***	-0.008***	-0.009***	-0.008***	-0.008***	-0.008***	-0.008***	-0.008***	-0.008***	-0.008***	-0.008***	-0.007***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
ΔLending Deposit Spread	-0.008**	-0.008**	-0.008**	-0.008**	-0.008**	-0.008**	-0.008**	-0.008*	-0.008**	-0.008**	-0.008**	-0.008**	-0.008*
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
ΔATM	0.100***	0.100***	0.102***	0.101***	0.101***	0.101***	0.100***	0.100***	0.096***	0.100***	0.100***	0.099***	0.098***
	(0.033)	(0.031)	(0.034)	(0.033)	(0.033)	(0.033)	(0.033)	(0.033)	(0.034)	(0.033)	(0.033)	(0.032)	(0.033)
ΔDemocratic Accountability		0.002											0.003
		(0.026)											(0.025)
ΔExternal Conflict			0.013										0.015
			(0.016)										(0.017)
ΔInternal Conflict				-0.007									-0.014
				(0.010)									(0.009)
ΔMilitary in Politics					-0.002								-0.007
					(0.021)								(0.020)
ΔReligious Tensions						0.010							0.008
						(0.031)							(0.029)
ΔSocioeconomic Conditions							0.004						0.001
							(0.008)						(0.007)
ΔBureaucracy Quality								-0.085					-0.116
								(0.072)					(0.071)
ΔCorruption									0.015				0.012
									(0.011)				(0.012)
ΔGovernment Stability										0.008**			0.009***
										(0.003)			(0.003)
ΔLaw and Order											-0.012		-0.010
											(0.019)		(0.018)
ΔInvestment Profile												0.005	0.003
												(0.006)	(0.005)
Observations	395	395	395	395	395	395	395	395	395	395	395	395	395
R^2	0.239	0.239	0.240	0.240	0.239	0.239	0.239	0.241	0.241	0.246	0.240	0.239	0.257
Adjusted R^2	0.131	0.128	0.130	0.129	0.128	0.129	0.129	0.130	0.130	0.137	0.129	0.129	0.124

Note: *p<0.1; **p<0.05; ***p<0.01

Table 17
Panel data regression, with fixed effects for cross sectional unit (country). Panel consists of the regressions done with 45 included countries. Following table returns the lagged change (Δ) model based on regression $Cash_{j,t} = \alpha_j + \beta_1 \Delta i_{j,t-1} + \beta_2 \Delta GDP_{j,t-1} + \beta_3 \Delta S_{j,t-1} + \beta_4 \Delta ATM_{j,t-1} + \beta_4 \Delta ICRG_{j,t-1} + \delta_j + \varepsilon_{j,t}$ **Where operator Δ describes the change in the independent variables, where ΔXj,t would be constructed by subtraction of Xt-1 from Xt.**

	Δlog (Currency in Circulation)$_t$												
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
ΔGDP_{t-1}	0.266***	0.266***	0.265***	0.267***	0.266***	0.265***	0.263***	0.266***	0.265***	0.267***	0.267***	0.264***	0.265***
	(0.047)	(0.045)	(0.046)	(0.046)	(0.047)	(0.047)	(0.049)	(0.047)	(0.047)	(0.046)	(0.046)	(0.047)	(0.046)
ΔInterest Rate$_{t-1}$	-0.009***	-0.009***	-0.009***	-0.009***	-0.009***	-0.009***	-0.009***	-0.009***	-0.009***	-0.008***	-0.009***	-0.009***	-0.008***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
ΔLending Deposit Spread$_{t-1}$	-0.008*	-0.008*	-0.008*	-0.008*	-0.008*	-0.008*	-0.008*	-0.008*	-0.008*	-0.008*	-0.008*	-0.008*	-0.008*
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
ΔATM_{t-1}	0.101***	0.100***	0.102***	0.101***	0.101***	0.101***	0.101***	0.100***	0.097***	0.101***	0.101***	0.100***	0.100***
	(0.032)	(0.030)	(0.033)	(0.032)	(0.032)	(0.032)	(0.032)	(0.032)	(0.034)	(0.032)	(0.033)	(0.032)	(0.032)
ΔDemocratic Accountability$_{t-1}$		0.004											0.005
		(0.029)											(0.030)
ΔExternal Conflict$_{t-1}$			0.012										0.015
			(0.018)										(0.018)
ΔInternal Conflict$_{t-1}$				-0.009									-0.016
				(0.010)									(0.010)
ΔMilitary in Politics$_{t-1}$					-0.001								-0.006
					(0.021)								(0.020)
ΔReligious Tensions$_{t-1}$						0.010							0.009
						(0.031)							(0.029)
ΔSocioeconomic Conditions$_{t-1}$							0.005						0.002
							(0.008)						(0.007)
ΔBureaucracy Quality$_{t-1}$								-0.076					-0.107
								(0.078)					(0.077)
ΔCorruption$_{t-1}$									0.012				0.009
									(0.012)				(0.012)
ΔGovernment Stability$_{t-1}$										0.008**			0.009***
										(0.004)			(0.003)
ΔLaw and Order$_{t-1}$											-0.014		-0.012
											(0.019)		(0.019)
ΔInvestment Profile$_{t-1}$												0.003	0.0003
												(0.006)	(0.005)
Observations	363	363	363	363	363	363	363	363	363	363	363	363	363
R^2	0.246	0.246	0.247	0.247	0.246	0.246	0.246	0.247	0.247	0.254	0.247	0.246	0.264
Adjusted R^2	0.127	0.125	0.126	0.126	0.125	0.125	0.125	0.127	0.126	0.134	0.126	0.125	0.118

Note: *p<0.1; **p<0.05; ***p<0.01

Appendix 3.3 Regression with cross sectional fixed effects (without ATM)

Table 18

Panel data regression, with fixed effects for cross sectional unit (country). Panel consists of the regressions done with 45 included countries. Following table returns the level model based on regression (3) $Cash_{j,t} = \alpha_j + \beta_1 i_{j,t} + \beta_2 GDP_{j,t} + \beta_3 S_{j,t} + \beta_4 ICRG_{j,t} + \delta_j + \varepsilon_{j,t}$

	log (Currency in Circulation)												
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
GDP	0.585***	0.590***	0.575***	0.585***	0.583***	0.590***	0.613***	0.578***	0.576***	0.571***	0.576***	0.616***	0.601***
	(0.092)	(0.088)	(0.094)	(0.091)	(0.092)	(0.091)	(0.092)	(0.087)	(0.094)	(0.091)	(0.090)	(0.089)	(0.079)
Interest Rate	-0.015*	-0.012*	-0.015*	-0.015*	-0.015*	-0.015*	-0.017**	-0.015*	-0.015*	-0.016**	-0.013*	-0.012	-0.010**
	(0.008)	(0.007)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.007)	(0.007)	(0.005)
Lending Deposit Spread	-0.038***	-0.038***	-0.036***	-0.038***	-0.038***	-0.037***	-0.039***	-0.038***	-0.037***	-0.036***	-0.036***	-0.035***	-0.036***
	(0.008)	(0.007)	(0.008)	(0.008)	(0.008)	(0.008)	(0.007)	(0.008)	(0.008)	(0.008)	(0.008)	(0.007)	(0.007)
Democratic Accountability		-0.062											-0.052
		(0.046)											(0.044)
External Conflict			-0.048										-0.043
			(0.030)										(0.030)
Internal Conflict				0.004									0.047
				(0.033)									(0.029)
Military in Politics					-0.010								0.012
					(0.035)								(0.044)
Religious Tensions						0.054							0.054
						(0.050)							(0.058)
Socioeconomic Conditions							-0.056**						-0.037
							(0.028)						(0.025)
Bureaucracy Quality								0.169					0.113
								(0.217)					(0.130)
Corruption									0.035				0.040
									(0.039)				(0.031)
Government Stability										-0.012			-0.007
										(0.010)			(0.009)
Law and Order											-0.095**		-0.056
											(0.045)		(0.035)
Investment Profile												-0.054***	-0.046**
												(0.018)	(0.021)
Observations	462	462	462	462	462	462	462	462	462	462	462	462	462
R^2	0.469	0.486	0.476	0.469	0.470	0.474	0.490	0.472	0.473	0.475	0.487	0.511	0.564
Adjusted R^2	0.408	0.425	0.414	0.406	0.406	0.412	0.429	0.409	0.411	0.412	0.426	0.453	0.500

Note: *p<0.1; **p<0.05; ***p<0.01

Table 19
Panel data regression, with fixed effects for cross sectional unit (country). Panel consists of the regressions done with 45 included countries. Following table returns the lagged model based on regression $Cash_{j,t} = \alpha_j + \beta_1 i_{j,t-1} + \beta_2 GDP_{j,t-1} + \beta_3 S_{j,t-1} + \beta_4 ICRG_{j,t-1} + \delta_j + \varepsilon_{j,t-1}$

	log (Currency in Circulation)$_t$												
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
GDP$_{t-1}$	0.461***	0.466***	0.452***	0.461***	0.461***	0.464***	0.485***	0.455***	0.450***	0.439***	0.454***	0.485***	0.462***
	(0.078)	(0.075)	(0.079)	(0.078)	(0.079)	(0.078)	(0.076)	(0.077)	(0.081)	(0.074)	(0.077)	(0.073)	(0.066)
Interest Rate$_{t-1}$	-0.015*	-0.013*	-0.015**	-0.015**	-0.015*	-0.015*	-0.017**	-0.015**	-0.015**	-0.016**	-0.014**	-0.012*	-0.012**
	(0.008)	(0.007)	(0.007)	(0.008)	(0.008)	(0.008)	(0.007)	(0.008)	(0.007)	(0.007)	(0.007)	(0.007)	(0.005)
Lending Deposit Spread$_{t-1}$	-0.026***	-0.027***	-0.025***	-0.026***	-0.026***	-0.026***	-0.027***	-0.027***	-0.025***	-0.025***	-0.025***	-0.024***	-0.024***
	(0.008)	(0.008)	(0.009)	(0.008)	(0.008)	(0.008)	(0.007)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.007)
Democratic Accountability$_{t-1}$		-0.047											-0.044
		(0.041)											(0.039)
External Conflict$_{t-1}$			-0.037										-0.034
			(0.032)										(0.034)
Internal Conflict$_{t-1}$				-0.004									0.031
				(0.027)									(0.024)
Military in Politics$_{t-1}$					0.002								0.030
					(0.039)								(0.041)
Religious Tensions$_{t-1}$						0.040							0.029
						(0.054)							(0.055)
Socioeconomic Conditions$_{t-1}$							-0.051**						-0.028
							(0.025)						(0.021)
Bureaucracy Quality$_{t-1}$								0.183					0.189**
								(0.165)					(0.087)
Corruption$_{t-1}$									0.042				0.044
									(0.033)				(0.029)
Government Stability$_{t-1}$										-0.018**			-0.012
										(0.007)			(0.008)
Law and Order$_{t-1}$											-0.062		-0.025
											(0.042)		(0.036)
Investment Profile$_{t-1}$												-0.052***	-0.045**
												(0.016)	(0.018)
Observations	427	427	427	427	427	427	427	427	427	427	427	427	427
R^2	0.386	0.399	0.391	0.386	0.386	0.390	0.408	0.389	0.394	0.401	0.396	0.436	0.487
Adjusted R^2	0.308	0.321	0.312	0.306	0.306	0.310	0.331	0.310	0.315	0.323	0.317	0.363	0.404

Note: *p<0.1; **p<0.05; ***p<0.01

Table 20
Panel data regression, with fixed effects for cross sectional unit (country). Panel consists of the regressions done with 45 included countries. Following table returns the change (Δ) model based on regression $Cash_{j,t} = \alpha_j + \beta_1 \Delta i_{j,t} + \beta_2 \Delta GDP_{j,t} + \beta_3 \Delta S_{j,t} + \beta_4 \Delta ICRG_{j,t} + \delta_j + \varepsilon_{j,t}$ **Where operator Δ describes the change in the independent variables, where ΔXj,t would be constructed by subtraction of Xt-1 from Xt.**

	Δlog (Currency in Circulation)												
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
ΔGDP	0.274***	0.270***	0.274***	0.276***	0.274***	0.273***	0.273***	0.274***	0.272***	0.276***	0.275***	0.278***	0.275***
	(0.050)	(0.048)	(0.050)	(0.050)	(0.050)	(0.051)	(0.052)	(0.050)	(0.051)	(0.049)	(0.050)	(0.050)	(0.050)
ΔInterest Rate	-0.009***	-0.008***	-0.009***	-0.009***	-0.009***	-0.009***	-0.009***	-0.008***	-0.008***	-0.008***	-0.009***	-0.009***	-0.007***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
ΔLending Deposit Spread	-0.008**	-0.007*	-0.008**	-0.008**	-0.008**	-0.008**	-0.008**	-0.007*	-0.008**	-0.008**	-0.008**	-0.008**	-0.007*
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
ΔDemocratic Accountability		0.025											0.023
		(0.019)											(0.019)
ΔExternal Conflict			0.007										0.010
			(0.016)										(0.017)
ΔInternal Conflict				-0.013									-0.019**
				(0.011)									(0.008)
ΔMilitary in Politics					0.007								0.003
					(0.020)								(0.018)
ΔReligious Tensions						0.008							0.003
						(0.029)							(0.028)
ΔSocioeconomic Conditions							0.002						0.00004
							(0.008)						(0.008)
ΔBureaucracy Quality								-0.142*					-0.171**
								(0.083)					(0.084)
ΔCorruption									0.019*				0.018*
									(0.011)				(0.011)
ΔGovernment Stability										0.008**			0.009***
										(0.003)			(0.003)
ΔLaw and Order											-0.007		-0.009
											(0.016)		(0.016)
ΔInvestment Profile												-0.006	-0.004
												(0.013)	(0.010)
Observations	415	415	415	415	415	415	415	415	415	415	415	415	415
R²	0.193	0.199	0.193	0.196	0.193	0.193	0.193	0.198	0.196	0.200	0.193	0.194	0.224
Adjusted R²	0.087	0.091	0.085	0.088	0.085	0.085	0.084	0.091	0.088	0.093	0.085	0.086	0.095

Note: *p<0.1; **p<0.05; ***p<0.01

Table 21
Panel data regression, with fixed effects for cross sectional unit (country). Panel consists of the regressions done with 45 included countries. Following table returns the lagged change (Δ) model based on regression $Cash_{j,t} = \alpha_j + \beta_1 \Delta i_{j,t-1} + \beta_2 \Delta GDP_{j,t-1} + \beta_3 \Delta S_{j,t-1} + \beta_4 \Delta ATM_{j,t-1} + \beta_4 \Delta ICRG_{j,t-1} + \delta_j + \varepsilon_{j,t}$ **Where operator Δ describes the change in the independent variables, where ΔXj,t would be constructed by subtraction of Xt-1 from Xt.**

	Δlog (Currency in Circulation)t												
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
ΔGDP$_{t-1}$	0.277***	0.272***	0.276***	0.279***	0.276***	0.276***	0.275***	0.277***	0.275***	0.277***	0.277***	0.282***	0.277***
	(0.051)	(0.049)	(0.050)	(0.050)	(0.051)	(0.051)	(0.053)	(0.051)	(0.051)	(0.050)	(0.051)	(0.052)	(0.050)
ΔInterest Rate$_{t-1}$	-0.009***	-0.009***	-0.009***	-0.009***	-0.009***	-0.009***	-0.009***	-0.009***	-0.009***	-0.009***	-0.009***	-0.009***	-0.008***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
ΔLending Deposit Spread$_{t-1}$	-0.008**	-0.008*	-0.008**	-0.008**	-0.008*	-0.008**	-0.008**	-0.008*	-0.008**	-0.008*	-0.008**	-0.008*	-0.007
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
ΔDemocratic Accountability$_{t-1}$		0.027											0.024
		(0.020)											(0.021)
ΔExternal Conflict$_{t-1}$			0.007										0.010
			(0.018)										(0.018)
ΔInternal Conflict$_{t-1}$				-0.014									-0.019**
				(0.011)									(0.009)
ΔMilitary in Politics$_{t-1}$					0.007								0.004
					(0.020)								(0.018)
ΔReligious Tensions$_{t-1}$						0.007							0.003
						(0.029)							(0.029)
ΔSocioeconomic Conditions$_{t-1}$							0.003						0.001
							(0.009)						(0.008)
ΔBureaucracy Quality$_{t-1}$								-0.126					-0.155*
								(0.086)					(0.087)
ΔCorruption$_{t-1}$									0.017				0.016
									(0.011)				(0.011)
ΔGovernment Stability$_{t-1}$										0.009***			0.010***
										(0.003)			(0.003)
ΔLaw and Order$_{t-1}$											-0.009		-0.011
											(0.017)		(0.017)
ΔInvestment Profile$_{t-1}$												-0.007	-0.006
												(0.013)	(0.010)
Observations	381	381	381	381	381	381	381	381	381	381	381	381	381
R^2	0.200	0.207	0.200	0.204	0.200	0.200	0.200	0.204	0.202	0.209	0.200	0.201	0.232
Adjusted R^2	0.084	0.089	0.082	0.086	0.082	0.081	0.081	0.086	0.084	0.091	0.082	0.083	0.091

Note: *p<0.1; **p<0.05; ***p<0.01

Appendices 4.0 Early editions of our regressions

Since our main question was what dictates the demand for cash we also ran some regressions with ATM per 100.000 adults as the dependent variable. The idea behind this was that ATMs are closely related to cash as it is one of the only ways to get it except for withdrawing directly from the bank. ATMs explicit purpose is to withdraw cash, although they require the use of smartcards. This could help illuminate the prevalence of smartcards which have the potential to replace cash.

It returned similar results in terms of GDP, however when it came to Interest rate it showed a positive relationship. This relationship was hard to explain it could be that people rather that keeping cash on their person would withdraw for specific uses i.e. before a shopping trip. These regressions also returned high significance for currency in circulation. Additionally, there seemed to be a strong positive relationship with Law and Order although we were hard for us to explain. To some extent it could be less of a perceived risk for banks to open more ATMs in a low risk country in terms of adherence to the law, as the likelihood of criminals interfering with the ATMs would be lesser.

Table 22
Panel data regression, with fixed effects for cross sectional unit (country). Panel consists of the regressions done with 60 included countries. Following table returns the level model based on a simplified regression $ATM_{j,t} = \alpha_j + \beta_1 i_{j,t} + \beta_2 GDP_{j,t} + \beta_3 Cash_{j,t} + \beta_4 ICRG_{j,t} + \delta_j + +\varepsilon_{j,t}$

	Dependent variable:						
	Log (ATM per 100k adults)						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Interest rate	0.031**	0.031*	0.032**	0.030*	0.030*	0.031**	0.031**
	(0.016)	(0.016)	(0.016)	(0.016)	(0.015)	(0.016)	(0.015)
GDP	0.746***	0.722***	0.714***	0.737***	0.757***	0.749***	0.712***
	(0.180)	(0.181)	(0.182)	(0.186)	(0.172)	(0.180)	(0.182)
Currency in circulation	0.612***	0.618***	0.613***	0.606***	0.679***	0.606***	0.665***
	(0.173)	(0.173)	(0.167)	(0.172)	(0.164)	(0.174)	(0.157)
Bureaucracy Quality		0.785**					0.768*
		(0.388)					(0.395)
Corruption			0.119				0.085
			(0.105)				(0.098)
Government Stability				-0.007			-0.009
				(0.018)			(0.018)
Law and Order					0.265***		0.255***
					(0.102)		(0.096)
Investment profile						-0.006	-0.019
						(0.024)	(0.025)
Observations	598	598	598	598	598	598	598
R^2	0.657	0.665	0.662	0.655	0.671	0.655	0.686
Adjusted R^2	0.617	0.625	0.621	0.614	0.631	0.613	0.645

Fixed effects for cross sectional unit   *$p<0.1$; **$p<0.05$; ***$p<0.01$

Table 23
Panel data regression, with fixed effects for cross sectional unit (country) and time. Panel consists of the regressions done with 60 included countries. Following table returns the level model based on a simplified regression $ATM_{j,t} = \alpha_j + \beta_1 i_{j,t} + \beta_2 GDP_{j,t} + \beta_3 Cash_{j,t} + \beta_4 ICRG_{j,t} + \delta_j + \gamma_t + \varepsilon_{j,t}$

	Dependent variable:						
	Log(ATM per 100k adults)						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Interest rate	0.040**	0.038**	0.040**	0.040***	0.039**	0.039**	0.038**
	(0.016)	(0.016)	(0.015)	(0.015)	(0.015)	(0.016)	(0.015)
GDP	0.558***	0.552***	0.553***	0.559***	0.589***	0.516***	0.569***
	(0.195)	(0.194)	(0.193)	(0.195)	(0.186)	(0.198)	(0.190)
Currency in circulation	0.412**	0.439**	0.417**	0.410**	0.477***	0.407**	0.502***
	(0.191)	(0.190)	(0.189)	(0.190)	(0.180)	(0.194)	(0.180)
Bureaucracy Quality		0.653*					0.613*
		(0.349)					(0.356)
Corruption			0.089				0.054
			(0.107)				(0.102)
Government Stability				0.007			0.002
				(0.018)			(0.018)
Law and Order					0.277***		0.260***
					(0.100)		(0.095)
Investment profile						0.030	0.007
						(0.028)	(0.027)
Observations	598	598	598	598	598	598	598
R^2	0.243	0.258	0.250	0.241	0.281	0.244	0.300
Adjusted R^2	0.137	0.153	0.143	0.134	0.179	0.137	0.195

Fixed effects for cross sectional unit and time *p<0.1; **p<0.05; ***p<0.01

Appendices 5.0 Additional graphs