

Rösl, Gerhard; Seitz, Franz

Working Paper

Cash demand in times of crises

Weidener Diskussionspapiere, No. 83

Provided in Cooperation with:

University of Applied Sciences Amberg-Weiden (OTH)

Suggested Citation: Rösl, Gerhard; Seitz, Franz (2021) : Cash demand in times of crises, Weidener Diskussionspapiere, No. 83, ISBN 978-3-937804-86-6, Ostbayerische Technische Hochschule Amberg-Weiden (OTH), Weiden i.d.OPf.

This Version is available at:

<https://hdl.handle.net/10419/247918>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.

Die Hochschule im Dialog:

Cash demand in times of crises

Gerhard Rösl
Franz Seitz

Cash demand in times of crises^{*}

Gerhard Rösler[#] & Franz Seitz⁺

[#]) Technical University of Applied Sciences
(OTH) Regensburg
Seybothstrasse 2
D-93053 Regensburg
Germany
email: gerhard.roesl@oth-regensburg.de

⁺) Technical University of Applied Sciences
(OTH) Weiden
Hetzenrichter Weg 15
D-92637 Weiden
Germany
email: f.seitz@oth-aw.de

November 2021

Abstract:

In this paper, we focus on the role of different types of crises (technological crises, financial market crises, natural disasters) and their effects on the demand for cash in an international context. It becomes evident that over the past 30 years cash demand always increased in times of crises, independent of the nature of the crisis itself. However, the type of crises determines whether small or large banknote denominations are affected more. In case of payment uncertainties, we find a crisis-related increased demand for small denominations, probably reflecting an increased demand for transaction balances. In times of uncertainties regarding the financial and/or general economic development (also possibly driven by natural disasters), large banknote denominations were comparatively more in demand indicating that the crises-related need for non-transaction balances was the dominant driver.

JEL: E41, E51, E58

Keywords: Cash, banknotes, crises, Covid

^{*} We thank N. Bartzsch, L. Leahy, S. O'Brien and B. Segendorff for providing data. We are also indebted to N. Bartzsch, H. Fujiki, K.-H. Tödter, F. Schneider and J. Winchcombe as well as the participants of a seminar hosted by the Central Bank of Canada, the 5th international Cash conference of the Deutsche Bundesbank, the "Future of Cash" Conference Asia and the 10th Economics of Payments Conference of the Bank of Finland for their valuable comments.

Deutsche Zusammenfassung

Das vorliegende Papier analysiert die Rolle verschiedener Arten von Krisen (Technologiekrisen, Finanzmarktkrisen, Naturkatastrophen) für die Nachfrage nach Bargeld im internationalen Kontext. Es zeigt sich, dass in den letzten 30 Jahren die Bargeldnachfrage in Krisenzeiten immer gestiegen ist, unabhängig von der Art der Krise selbst. Die spezielle Natur der Krise entscheidet jedoch darüber, ob kleine oder große Banknotenstückelungen stärker betroffen sind. Im Falle von Zahlungsunsicherheiten stellen wir eine krisenbedingte erhöhte Nachfrage nach kleinen Stückelungen fest, die wahrscheinlich eine erhöhte Transaktionsnachfrage widerspiegelt. In Zeiten von Unsicherheiten hinsichtlich der finanziellen und/oder allgemeinen wirtschaftlichen Entwicklung (möglicherweise auch getrieben durch Naturkatastrophen) waren große Banknotendenominationen vergleichsweise stärker nachgefragt, was darauf hindeutet, dass der krisenbedingte Anstieg der Bargeldnachfrage vor allem durch Nicht-Transaktionsmotive getrieben war.

Cash demand in times of crises

1. Introduction

Over the past years, there was an intense discussion about restricting the use of or even abolishing cash (see, e. g., Rogoff, 1998, 2016, Agarwal & Kimball, 2015, Sands, 2016). The advocates of such drastic measures typically refer to the “fact” that cash will become obsolete anyway as electronic payments gain more and more importance. However, global cash in circulation increased enormously over the past 30 years (Jobst & Stix, 2017; Bech et al., 2018; Shirai & Sugandi, 2019; Arango-Arango & Suárez-Ariza, 2019, Ashworth & Goodhart, 2020, Rösl & Seitz, 2021). For the major currencies, growth in cash holdings even exceeded GDP growth in the last decades (Rösl & Seitz, 2021). On top, the Covid-19 pandemic led to an exceptional strong increase of cash demand all around the world (Ashworth & Goodhart, 2021; Goodhart & Ashworth, 2020; Heinonen, 2020) although in many countries cashless payments were more frequently used at the point of sale creating the so-called *cash paradox* (Ardizzi et al., 2020, Caswell et al., 2020, Mitchell, 2020, Zamora-Pérez, 2021). The present paper intends to provide a deeper insight into cash demand in times of crises more generally. For that purpose, we distinguish between three different types of crises and analyze large and small denominations of eight currencies over the last three decades.

2. Cash demand in times of crises

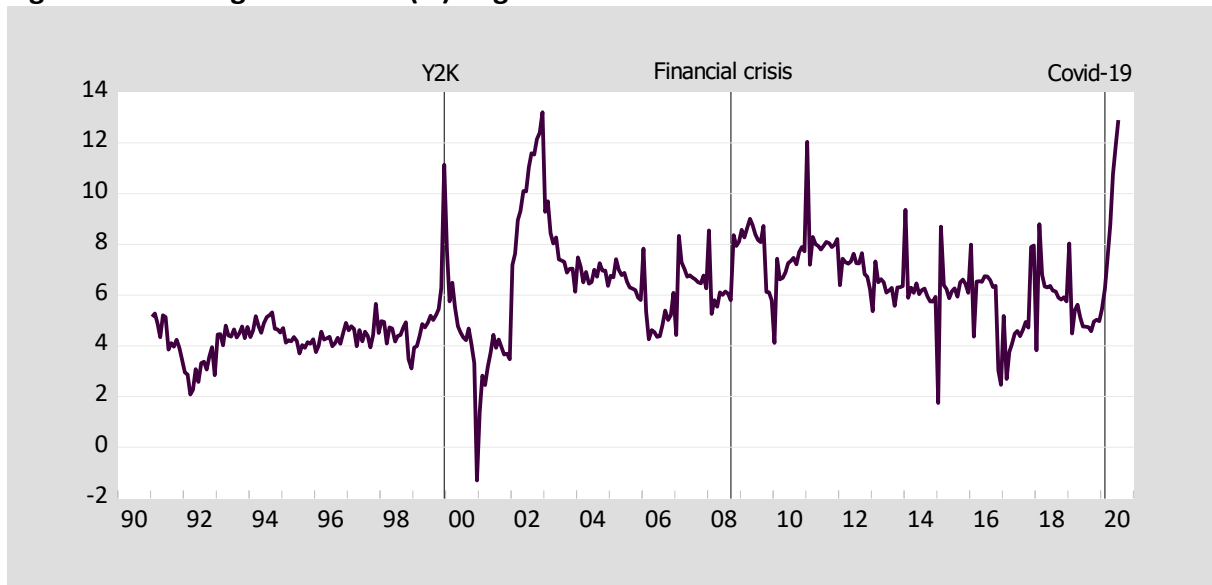
Since the early 1990s, worldwide inflation rates and opportunity costs for cash holders decreased quite considerably (Razin, 2005, Hakkio, 2009, Forbes, 2019). This should have contributed to the steep increase in global cash holdings (Deutsche Bundesbank, 1995; Fish & Whymark, 2015; Haas et al., 2018; Fujiki, 2019). In such an environment, it is not surprising that cash will be demanded more intensively especially once a crisis occurs since it provides a secure means of payment and it is at the same time the most liquid store of value. In order to identify crises-related cash demand over the past 30 years we distinguish three types of crises¹:

¹ In principle, other crises like the crises in the European Monetary System in 1992/93, the (geo-) political crisis after 9/11 in 2001 or the Euro crisis in 2010/11 could also be analysed. In their nature, however, these crises were effectively confidence crises and, hence, do not differ too much from the financial market crises in October 2008. For a more detailed analysis of cash demand for single currencies, see the econometric section in chapter 3.

1. Technological crisis (e. g., the Y2K crisis),
2. Financial market crisis (e. g., the Lehman Brothers insolvency in October 2008),
3. Natural disasters (e. g., the Covid-19 crisis).

The following figures show the annual growth rates of cash holdings at a global (figure 1) and individual currency scale (figure 2).

Figure 1: Annual growth rates (%) of global cash



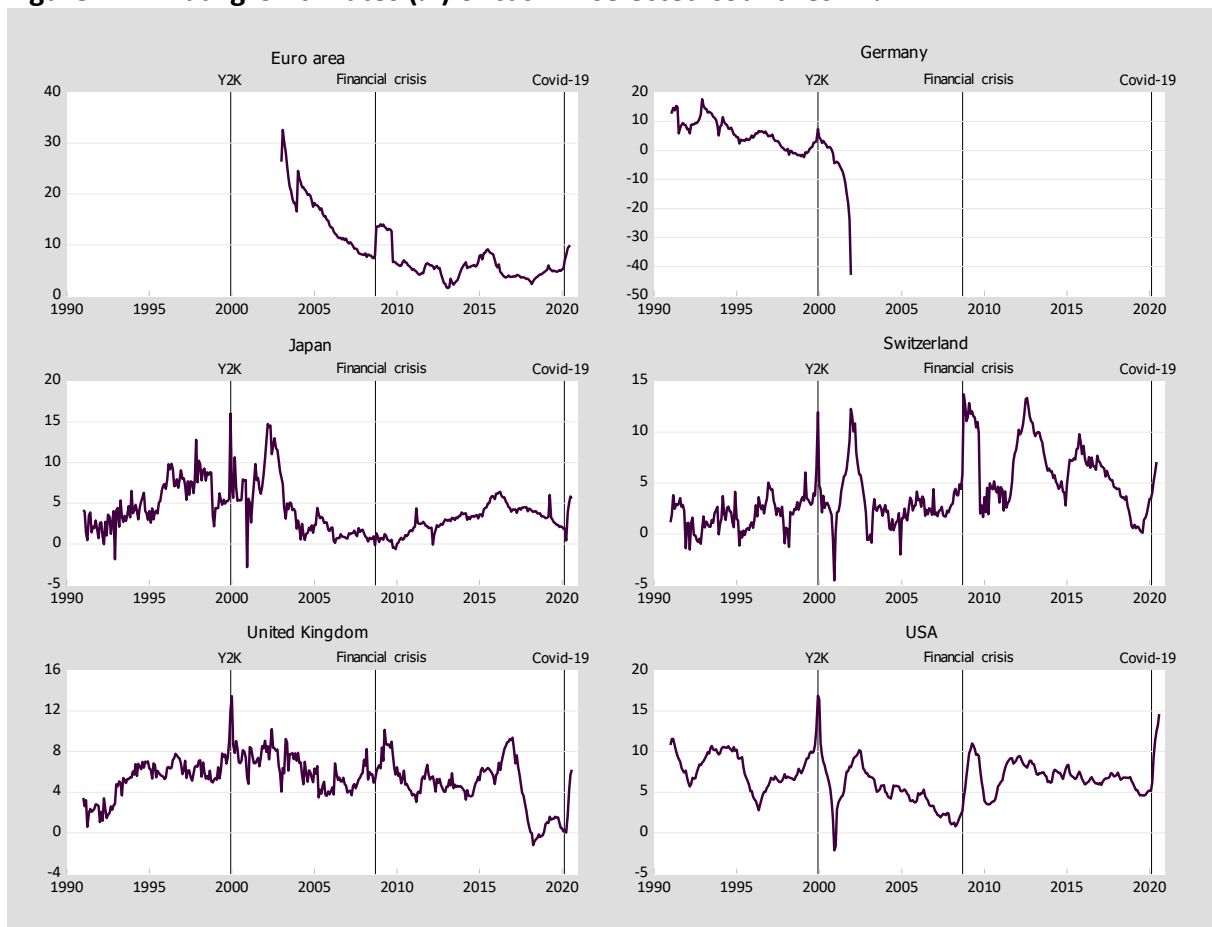
Notes: Data refer to cash or banknotes in circulation. Countries included are Australia, Brazil, Canada, China (since 2006), Denmark, Egypt, Euro area (since 2002), Germany (until end of 2001), India, Japan, Norway, Russia, South Africa, South Korea, Sweden, Switzerland, United Kingdom, USA; sample period: 1990.01-2020.07. National figures converted in US dollar by using the average exchange rate over the data period. The vertical lines highlight three crises (Y2K, financial crisis in October 2008, Covid-19 pandemic). The statistical breaks resulting from the inclusion of the Euro area 2002 and China 2006 are smoothed by means of simple linear interpolation.

Source: National central banks, IMF.

The huge increase in the global demand for cash during the technological crisis around the turn of the year 2000 (Y2K) was caused by heightened uncertainty. At that time, there were fears that the re-setting of computer program dates in order to adjust for the new millennium would have led to a shutdown of important institutions like public utilities, but also the smooth functioning of payment systems and cash withdrawals from ATMs were in question. After the insolvency of Lehman Brothers in October 2008, the resulting financial turmoil in the US quickly scaled up to a global financial crisis and led to a visible increase in cash demand worldwide (see figure 1). However, this increase was far behind that around Y2K mostly because cash demand only increased in those countries that were affected by the financial

crisis. In Japan, for instance, neither overall cash issuance nor single Yen denominations showed an unusual increase (see figure 2, tables 1 and 2, and Rösl & Seitz, 2021).

Figure 2: Annual growth rates (%) of cash in selected countries in %



Notes: Data refer to cash or banknotes in circulation.

Source: National central banks.

Obviously, there was a structural difference between the financial crisis 2008 and Y2K with respect to cash demand. Around the millennium, doubts of the public about the solidity of the digital infrastructure predominantly fostered the demand for cash. After the collapse of Lehman Brothers, however, the trust in banks and the financial system in some countries deteriorated and led to a flight into cash (crisis of confidence). In early 2020, a new type of crisis (natural disaster) affected the economy and cash demand on a global scale.² The outbreak of Covid-19 led into a deep recession worldwide in 2020 resulting in a stark decrease in turnover at the point of sale (see Auer et al., 2020; Chen et al., 2020) and due to fears of

² On a national level, it is not uncommon that natural disasters lead to a marked increase in cash demand. In the US, for instance, banks usually stockpile cash quite significantly if thunderstorms occur as observed for the Superstorm "Sandy" in October 2012 or prior to the anticipated landfall of hurricane "Irma" in September 2017.

virus contagion cash payments decreased (Cevik, 2020).³ At the same time, however, global cash in circulation increased exceptionally (see figures 1 and 2).⁴ Consequently, the main factor behind the increase in cash in circulation in 2020 is clearly non-transactional demand.

3. Cash demand for small and large banknote denominations in times of crises

Although the motivation for holding cash in times of crises will always remain somewhat opaque, the analysis of low-value and high-value banknote denominations may provide some insight into transaction versus non-transaction motives of cash users. In this section, we examine the long-term relationship between cash, its main determinants and crises. For that purpose, we augment standard long-run cash demand functions for small and large denominations with crisis-related dummy variables. In the classification of the two groups, we treat at least one denomination per country as a large one. As traditional potential determinants of cash holdings we include GDP (transactions variable), a short-term (money market) interest rate (opportunity costs variable) and an exchange rate argument (proxy for foreign demand) (see, e. g., Assenmacher et al., 2019).

Our sample consists of eight currencies: USD, JPY, DEM, EUR, CHF, GBP, SEK, and AUD. The sample is quarterly and ranges from the beginning of the 1990s until the third quarter of 2020. For the DEM, the sample ends in Q4/2000 due to the approaching cash changeover. From 2002 onwards, the EUR replaces the DEM. Our data is unadjusted; therefore, we include seasonal dummy variables. The general estimation equation reads as follows

$$(1) \quad bn_t = \beta_0 + \beta_1 y_t + \beta_2 i_t + \beta_3 e_t + \beta_4 ytk_t + \beta_5 fin_t + \beta_6 cov_t + \beta_7 x_t + \varepsilon_t,$$

where $bn \in \{\text{large, small}\}$ is (the log of) large and small banknotes in circulation, respectively, y is (the log of) nominal GDP, i is a 3-month money market interest rate, e is the (log of the) exchange rate, x stands for other deterministic variables like trends (trend),⁵ seasonal dummy ($s(i)$, $i=1,2,3,4$) or other dummy variables (dum) and ε is the error term. The main variables of interest on which we concentrate predominantly in what follows, are ytk , fin and cov . These represent impulse dummy variables for the Y2K crisis, the financial crisis and the covid-19

³ This happened despite the fact that banknotes do not carry viruses very well in contrast to authorization devices for electronic payments. If this had really been the case, the number of infections would have been much higher, see Auer et al. (2020), Caswell et al. (2020), Panetta (2020).

⁴ See also Heinonen (2020).

⁵ A significant deterministic trend in the case of the US is also present in Judson (2017), ch. V.

crisis. *Y2K* is one in Q4/1999, *fin* is one from Q4/2008 – Q1/2009 and *cov* is one from Q1/2020 – Q2(3)/2020, zero otherwise.

Tables 1 and 2 summarize the results.

Table 1: Estimation results for large denominations

	Euro area	US	Switzerland	Japan	UK	Sweden	Australia	Germany
GDP	-	-	***	***	**	***	**	-
Interest rate	-	**	-	***		-	**	***
Exchange rate	**	***	***	-	-	-	-	-
Y2K		0.05 (0.01)***	0.05 (0.02)***	0.05 (0.01)***	0.02 (0.01)*	0.04 (0.02)**	0.02 (0.01)*	0.00 (0.01)
Fin	0.05 (0.01)***	0.02 (0.01)***	0.04 (0.01)***	-0.00 (0.01)	0.04 (0.01)***	0.01 (0.01)	0.01 (0.01)*	
Cov	0.03 (0.01)***	0.02 (0.01)***	0.02 (0.01)*	0.02 (0.01)*	0.02 (0.01)*	0.04 (0.02)**	0.02 (0.01)***	
x	bn _{t-1} , bn _{t-4} , s(2), s(4)	bn _{t-1} , bn _{t-2} , s(1), s(4), dum_us, trend	bn _{t-1} , s(3), s(4)	bn _{t-1} , bn _{t-2} , s(1), s(4), dum_ja	bn _{t-1} , bn _{t-4} , s(1), s(3), s(4)	bn _{t-1} , bn _{t-2} , s(1), trend	bn _{t-1} , bn _{t-2} , bn _{t-4} , s(1), s(3), s(4)	bn _{t-1} , bn _{t-2} , s(4) dum_de
Sample	03.1-20.3	90.3-20.3	90.2-20.3	90.3-20.3	94.1-20.2	93.1-20.3	91.1-20.3	90.3-00.4
Adj. R ²	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
SE	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.01
LM(4)	0.83	0.67	0.01	0.00	0.02	0.04	0.00	0.07
Ramsey	0.83	0.85	0.07	0.15	0.21	0.17	0.33	0.08

Notes: Large denominations: USD 100; JPY 10,000; DEM 200, 500, 1,000; EUR 200, 500; CHF 200, 500, 1,000; GBP 50; SEK 10,000; 1,000; 500; AUD 100. GDP: nominal GDP; interest rate: 3-month money market interest rate; exchange rate: Euro-dollar exchange rate (US, Euro area), effective exchange rate (Switzerland); x: additional significant variables; dum_us: dummy variable for the extraordinary decrease in banknotes in 2000.1 in the US; dum_ja: dummy variable for positive outliers in 1997.4 and 2002.1-2002.2 in Japan; dum_de: dummy variable for an outlier during the EMS crisis in 1992.4 in Germany. Standard errors in brackets below coefficients; ***(**, *): 1 (5, 10) % level of significance; LM(4): p-value of Breusch-Godfrey serial correlation LM Test up to lag 4; Ramsey: p-value of Ramsey RESET misspecification test.

We get significant results in 31 of our total of 42 crisis cases (see tables 1 and 2). One denominational group per country is always positively affected by the crises. Obviously, the nature of the crisis influences which denominations are affected and how (see the explanations below). At least one of the economic determinants of cash holdings – GDP, interest rate, exchange rate – is significant in the equations. The statistical properties of the relationships are satisfactory: Taken together, the serial correlation LM test and the broader Ramsey mis-specification test do not reveal serious problems. The additional dummy variables

taken into account have economic significance: They are related to Y2K (decrease in cash demand in the US, after the potential problems of YTK have not materialized, see Judson, 2017, chs. II and V), the Asian and Russian crises (Japan and Switzerland), the introduction of Euro cash (Japan) and the EMS crisis (large denominations Germany).

Table 2: Estimation results for small denominations

	Euro area	US	Switzer- land	Japan	UK	Sweden	Australia	Germany
GDP	***	-	**	*	-	***	**	***
Interest rate	***	**	-	-	***	-	-	-
Exchange rate	-	-	-	-	-	-	-	-
Y2K		0.11 (0.01)***	0.03 (0.01)***	0.02 (0.01)*	0.06 (0.01)***	0.01 (0.01)	0.03 (0.02)	0.02 (0.01)**
Fin	0.03 (0.01)***	0.02 (0.01)	0.01 (0.01)	-0.00 (0.01)	0.02 (0.01)*	-0.02 (0.01)*	0.05 (0.02)**	
Cov	0.04 (0.01)***	0.09 (0.01)***	0.01 (0.01)**	0.01 (0.01)	0.01 (0.01)	-0.00 (0.01)	0.04 (0.02)**	
x	bn _{t-1} , bn _{t-2} , bn _{t-3} , s(3)	bn _{t-1} , bn _{t-2} , s(1), s(2), s(4), dum_us	bn _{t-1} , bn _{t-4} , s(1), s(4), dum_swi	bn _{t-1} , s(1), s(4), dum_ja	bn _{t-1} , bn _{t-4} , s(1), s(3), trend	bn _{t-1} , bn _{t-4} , s(1), s(4), trend	bn _{t-1} , bn _{t-2} , s(1), s(4)	bn _{t-1} , s(1), trend
Sample	02.4-20.3	90.3-20.3	91.1-20.3	90.2-20.3	94.1-20.2	93.1-20.3	90.3-20.3	91.1-00.4
Adj. R ²	0.99	0.99	0.99	0.99	0.99	0.90	0.99	0.99
SE	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.01
LM(4)	0.01	0.54	0.64	0.00	0.06	0.09	0.15	0.70
Ramsey	0.12	0.02	0.04	0.07	0.22	0.20	0.36	0.01

Notes: Small denominations: USD 1, 2, 5, 10, 20, 50; JPY 500, 1,000, 2,000, 5,000; DEM 5, 10, 20, 50, 100; EUR 5, 10, 20, 50, 100; CHF 5, 10, 20, 50, 100; GBP 5, 10, 20; SEK 5; 10; 20; 50; 100; AUD 5, 10, 20, 50. GDP: nominal GDP; interest rate: 3-month money market interest rate; exchange rate: Euro-dollar exchange rate; x: additional significant variables; dum_us: dummy variable for the extraordinary decrease in banknotes in 2000.1 in the US; dum_swi: dummy variable for outlier in 1997.4 in Switzerland; dum_ja: dummy variable for outliers in 1997.4 and 2002.1-2002.2 in Japan. Standard errors in brackets below coefficients; ***(**, *): 1 (5, 10) % level of significance.

With respect to the demand for large banknote denominations, all currencies analyzed show a crisis-related significant increase around the millennium except for the Deutsche Mark which was to be replaced by the Euro shortly afterwards. This general development seems to hold also roughly for the demand for small denominations at that time. In the case of the USD, CHF, GBP, JPY and DEM all estimates are significant whereas the results for the AUD and SEK are positive, but not significant. Hence, we can tentatively conclude that the drastic increase in global cash at end of the last century was caused by the desire to hold additional transaction

balances as well as non-transaction balances. Obviously, the public prefers physical money once confidence in the technological infrastructure deteriorates (technological crisis).⁶ Insofar, cash is by nature a stabilising factor in times of raising doubts about the robustness of the digital infrastructure.⁷

During the financial crisis in 2008/9 the overall picture of crises-related cash demand was somewhat different to the situation around the millennium. As already mentioned, overall cash demand only increased notably in those countries that were affected by the financial crisis. Hence, it is not surprising that cash demand was boosted quickly and promptly especially in the US, the Euro area, the UK, Switzerland, and to some extent also in Australia, but not in Japan and China.⁸ The second difference to the situation around Y2K is that this time stockpiling of non-transactional balances was clearly the main motive behind the demand for large denominations of USD, EUR, CHF and GBP which all show highly significant coefficients in table 1.⁹ By contrast, Japan – a country whose financial system was not affected by the financial turmoil around 2008/9 – had no significant increase in cash demand, neither for large nor small denominations. In general, the crisis-related demand for small denominations during the financial crisis was quite limited indicating that transactional motives should have played only a minor role at that time. This overall assessment seems to hold although the demand for small Euro denominations increased significantly during the financial crisis as shown in table 2. However, since 30% – 50% of all Euro banknotes issued circulate outside the Euro area (see European Central Bank, 2020, ch. 2.5 and Zamora-Pérez, 2021), non-transactional motives by foreign cash holders might still be the dominant factor.

Regarding the demand for cash during the Covid-19 pandemic, interesting international similarities show up. All countries analyzed were heavily hit by the SARS-CoV-2 virus in the first half of 2020 and the demand for high banknote denominations increased significantly, roughly between two and four percent (see table 1). Concerns of future tax increases might

⁶ For the advantages of "physical" money, see Ruberton et al. (2016).

⁷ Such considerations can also be conferred on instabilities of power grids. In the US, those problems quite often occur during the hurricane season and lead to an increase in the demand for cash even in regions that are not directly affected by the hurricane itself, see for instance Cheney & Rhine (2006) and Smith (2014).

⁸ The annual growth rate of total cash in China in Q4/2008 and Q1/2009 was 11% and 10%. This might look high by international standards but is in fact a continuation of an overall slowdown process since cash growth rates in the previous three quarters were even higher: 16% (Q1/2008), 12% (Q2/2008) and 11% (Q3/2008).

⁹ Such a development was observed already shortly after the terrorist attacks of 11 September 2001 when the demand for high value CHF banknotes increased massively, see figure 9 in Assenmacher et al., 2019, for the CHF and Judson, 2017, for the USD.

have played a role in this respect, but also precautionary motives and the crisis-induced flight to physical cash due to psychological reasons. By contrast and surprisingly, a notable significant crisis-related increase in the demand for small denominations at that time can also be detected for some currency areas, notably the USD, the EUR, and the AUD (see table 2). For the US dollar and the Euro, again, foreign non-transactional demand provides a partly explanation. In addition, in both currency areas banks increased their vault cash, which might reflect precautionary motives.¹⁰ Finlay et al. (2019) find that AUD are also in demand outside Australia for non-transactional purposes. Moreover, the results of the Reserve Bank of Australia's Consumer Payment Surveys reveal that the major reason why Australians hold cash outside their wallets is use in emergencies (see Caddy et al., 2020).¹¹

4. Summary and conclusions

In this paper, we analyzed the role of different types of crises (technological crises, financial market crises, natural disasters) and their effect on the demand for cash in an international perspective. We presented evidence that at least over the past 30 years cash demand always increased in times of crises, independent of the nature of the crisis itself. However, the type of crises determines which denominations – small or large banknotes – are affected more. In times of increased payment uncertainties, the crisis-related demand for small banknotes significantly increased, probably reflecting an increased demand for transaction balances. In times of uncertainties with respect to the financial and/or general economic situation (also possibly driven by natural disasters), large banknote denominations were comparatively more in demand indicating that the crises-related need for non-transaction balances increased since the 1990s. Since central banks provide cash in a perfectly elastic way, one can also conclude that cash seems to play an important role in successful crisis management.

¹⁰ See figure 7 in Rösl & Seitz (2021).

¹¹ One further explanation might be the accessibility of getting cash in rural areas.

References

- Agarwal, R & M Kimball (2015), Breaking through the Zero Lower Bound, IMF Working Paper WP/15/224, October.
- Arango-Arango, C A & N F Suárez-Ariza (2019), Digital Payments Adoption and the Demand for Cash: New International Evidence, Banco de la República de Colombia, Discussion Paper No. 1074.
- Ardizzi, G., A. Nobili & G. Rocco (2020), A Game Changer in Payment Habits: Evidence from daily data during a pandemic, Banca d'Italia, Occasional Paper Number 591, December.
- Ashworth, J & C A E Goodhart (2020), The Surprising Recovery of Currency Usage, International Journal of Central Banking 16, 239-277.
- Ashworth, J & C A E Goodhart (2021), The Great Covid Cash Surge – Digitalisation Hasn't Dented Cash's Safe Haven Role, CEPR Discussion Paper 16618, October.
- Goodhart, C A E & J. Ashworth, (2020), Coronavirus Panic Fuels a Surge in Cash Demand, CEPR Discussion Paper 14910, June.
- Assenmacher, K., F. Seitz & J. Tenhofen (2019), The Demand for Swiss Banknotes: Some new evidence, Swiss Journal of Economics and Statistics 155, article number 14.
- Auer, R., G. Cornelli & J. Frost (2020), Covid-19, Cash, and the Future of Payments, BIS Bulletin No. 3, April, 1-6.
- Bech, M, U Faruqi, F Ougaard & C Picillo (2018), Payments are a-changin', but Cash still Rules, BIS Quarterly Review, March, 67-80.
- Caddy, J., L. Delaney & C. Fisher (2020), Consumer Payment Behaviour in Australia: Evidence from the 2019 Consumer Payments Survey, Reserve Bank of Australia, Research Discussion Paper 2020-06, September.
- Caswell, E., M. Hewkin Smith, D. Learmonth & G Pearce (2020), Cash in the Time of Covid, Bank of England, Quarterly Bulletin 2020 Q4, 1-18.
- Cevik, S. (2020), Dirty Money: Does the Risk of Infectious Disease Lower Demand for Cash?, IMF Working Paper 2020/255, November.
- Cheney, J.S. & S.L.W. Rhine (2006), How Effective Were the Financial Safety Nets in the Aftermath of Katrina?, Discussion Paper, Payment Cards Center, Federal Reserve Bank of Philadelphia, January.
- Chen, H., W. Engert, K. P. Huynh, G. Nicholls, M. Nicholson & J. Zhu (2020), Cash and COVID-19: The impact of the pandemic on the demand for and use of cash, Bank of Canada, Staff Discussion Paper 2020-6, July.
- Deutsche Bundesbank (1995), The Circulation of Deutsche Mark Abroad, Deutsche Bundesbank, Monthly Report July, 65-71.
- European Central Bank (2020), The International Role of the Euro, June.
- Finlay, R., A. Staib & M. Wakefield (2019), Where's the Money? An Investigation into the Whereabouts and Uses of Australian Banknotes, The Australian Economic Review 53, 22–34.
- Fish T. & R. Whymark (2015), How has Cash Usage Evolved in Recent Decades? What might Drive Demand in the Future?, Bank of England, Quarterly Bulletin 2015 Q3, 216-227.

Forbes, K. J. (2019), Has Globalization Changed the Inflation Process?, BIS Working Papers No 791, June.

Fujiki, H. (2019), Cash Usage Trends in Japan: Evidence using aggregate and household survey data, TCER Working Paper E-131, March.

Haas, T., A. Paulson & S. Schulhofer-Wohl (2018), Understanding the Demand for Currency at Home and Abroad, Federal Reserve Bank of Chicago, Essays on Issues No. 396.

Hakkio, C. S. (2009), Global Inflation Dynamics, Federal Reserve Bank of Kansas City, Research Working Paper 09-01, January.

Heinonen, A. (2020), Banknote Developments at the Global Level – Before and after the outbreak of Covid-19, Currency News, Special Report 18(9), September, 10-12.

Jobst, C & H Stix (2017), Doomed to Disappear? The surprising return of cash across time and across countries, CEPR Discussion Paper No. 12327, September.

Judson, R (2017), The Future of Cash in Crisis and Calm: Demand for US dollar banknotes, in: Deutsche Bundesbank (Ed.), War on cash: Is there a future for cash?, conference volume "International Cash Conference 2017", Seitzers, Frankfurt am Main, 200-248.

Mitchell, T. (2020), COVID 19 – The Reaction of Some Central Banks, and Market Trends, Currency News, Special Supplement Issue 2, June, 2-3.

Panetta, F. (2020), Beyond Monetary Policy – Protecting the continuity and safety of payments during the coronavirus crisis, Blog post of 28. April 2020.

Razin, A. (2005), Globalization and Disinflation: A note, CEPR Discussion Paper No. 4826, January.

Rogoff, K. S. (1998), Blessing or Curse? Foreign and underground demand for euro notes, Economic Policy, 263-303.

Rogoff, K. S. (2016), The Curse of Cash, Princeton University Press, Princeton and Oxford.

Rösl, G. & F. Seitz (2021), Cash and Crises: No surprises by the virus, IMFS Working Papers, No 150, March.

Ruberton, P. M., J. Gladstone & S. Lyubomirsky (2016), How your Bank Balance Buys Happiness: The importance of “cash on hand” to life satisfaction, Emotion 16, 575–580.

Sands, P (2016), Making it Harder for the Bad Guys: the case for eliminating high denomination notes, M-RCBG Associate Working Paper Series No. 52, February.

Shirai, S & E A Sugandi (2019), What Explains the Growing Global Demand for Cash? ADBI Working Paper Series, No. 1006.

Smith, M (2014), Cash is Vital to Disaster Recovery: How IADs can help, ATM Marketplace.

Zamora-Pérez, Alejandro (2021), The Paradox of Banknotes: Understanding the demand for cash beyond transactional use, European Central Bank, Economic Bulletin 2/2021, 121-137.

Bisher erschienene Weidener Diskussionspapiere

- 1** „Warum gehen die Leute in die Fußballstadien? Eine empirische Analyse der Fußball-Bundesliga“
von Horst Rottmann und Franz Seitz
- 2** „Explaining the US Bond Yield Conundrum“
von Harm Bandholz, Jörg Clostermann und Franz Seitz
- 3** „Employment Effects of Innovation at the Firm Level“
von Horst Rottmann und Stefan Lachenmaier
- 4** „Financial Benefits of Business Process Management“
von Helmut Pirzer, Christian Forstner, Wolfgang Kotschenreuther und Wolfgang Renninger
- 5** „Die Performance Deutscher Aktienfonds“
von Horst Rottmann und Thomas Franz
- 6** „Bilanzzweck der öffentlichen Verwaltung im Kontext zu HGB, ISAS und IPSAS“
von Bärbel Stein
- 7** Fallstudie: „Pathologie der Organisation“ – Fehlentwicklungen in Organisationen, ihre Bedeutung und Ansätze zur Vermeidung
von Helmut Klein
- 8** „Kürzung der Vorsorgeaufwendungen nach dem Jahressteuergesetz 2008 bei betrieblicher Altersversorgung für den GGF.“
von Thomas Dommermuth
- 9** „Zur Entwicklung von E-Learning an bayerischen Fachhochschulen- Auf dem Weg zum nachhaltigen Einsatz?“
von Heribert Popp und Wolfgang Renninger
- 10** „Wie viele ausländische Euro-Münzen fließen nach Deutschland?“
von Dietrich Stoyan und Franz Seitz
- 11** Modell zur Losgrößenoptimierung am Beispiel der Blechteilindustrie für Automobilzulieferer
von Bärbel Stein und Christian Voith
- 12** Performancemessung
Theoretische Maße und empirische Umsetzung mit VBA
von Franz Seitz und Benjamin R. Auer
- 13** Sovereign Wealth Funds – Size, Economic Effects and Policy Reactions
von Thomas Jost
- 14** The Polish Investor Compensation System Versus EU – 15 Systems and Model Solutions
von Bogna Janik

- 15 Controlling in virtuellen Unternehmen -eine Studie-
Teil 1: State of the art
von Bärbel Stein, Alexander Herzner, Matthias Riedl**
- 16 Modell zur Ermittlung des Erhaltungsaufwandes von Kunst- und Kulturgütern in kommunalen
Bilanzen
von Bärbel Held**
- 17 Arbeitsmarktinstitutionen und die langfristige Entwicklung der Arbeitslosigkeit –
Empirische Ergebnisse für 19 OECD-Länder
von Horst Rottmann und Gebhard Flaig**
- 18 Controlling in virtuellen Unternehmen -eine Studie-
Teil 2: Auswertung
von Bärbel Held, Alexander Herzner, Matthias Riedl**
- 19 DIAKONIE und DRG's –antagonistisch oder vereinbar?
von Bärbel Held und Claus-Peter Held**
- 20 Traditionelle Budgetierung versus Beyond Budgeting-
Darstellung und Wertung anhand eines Praxisbeispiels
von Bärbel Held**
- 21 Ein Factor Augmented Stepwise Probit Prognosemodell
für den ifo-Geschäftserwartungsindex
von Jörg Clostermann, Alexander Koch, Andreas Rees und Franz Seitz**
- 22 Bewertungsmodell der musealen Kunstgegenstände von Kommunen
von Bärbel Held**
- 23 An Empirical Study on Paths of Creating Harmonious Corporate Culture
von Lianke Song und Bernt Mayer**
- 24 A Micro Data Approach to the Identification of Credit Crunches
von Timo Wollmershäuser und Horst Rottmann**
- 25 Strategies and possible directions to improve Technology
Scouting in China
von Wolfgang Renninger und Mirjam Rieseemann**
- 26 Wohn-Riester-Konstruktion, Effizienz und Reformbedarf
von Thomas Dommermuth**
- 27 Sorting on the Labour Market: A Literature Overview and Theoretical Framework
von Stephan O. Hornig, Horst Rottmann und Rüdiger Wapler**
- 28 Der Beitrag der Kirche zur Demokratisierungsgestaltung der Wirtschaft
von Bärbel Held**
- 29 Lebenslanges Lernen auf Basis Neurowissenschaftlicher Erkenntnisse
-Schlussfolgerungen für Didaktik und Personalentwicklung-
von Sarah Brückner und Bernt Mayer**
- 30 Currency Movements Within and Outside a Currency Union: The case of Germany**

and the euro area
von Franz Seitz, Gerhard Rösl und Nikolaus Bartsch

- 31 **Labour Market Institutions and Unemployment. An International Comparison**
von Horst Rottmann und Gebhard Flaig
- 32 **The Rule of the IMF in the European Debt Crisis**
von Franz Seitz und Thomas Jost
- 33 **Die Rolle monetärer Variablen für die Geldpolitik vor, während und nach der Krise:
Nicht nur für die EWU geltende Überlegungen**
von Franz Seitz
- 34 **Managementansätze sozialer, ökologischer und ökonomischer Nachhaltigkeit:
State of the Art**
von Alexander Herzner
- 35 **Is there a Friday the 13th effect in emerging Asian stock markets?**
von Benjamin R. Auer und Horst Rottmann
- 36 **Fiscal Policy During Business Cycles in Developing Countries: The Case of Africa**
von Willi Leibfritz und Horst Rottmann
- 37 **MONEY IN MODERN MACRO MODELS: A review of the arguments**
von Markus A. Schmidt und Franz Seitz
- 38 **Wie erzielen Unternehmen herausragende Serviceleistungen mit höheren Gewinnen?**
von Johann Strassl und Günter Schicker
- 39 **Let's Blame Germany for its Current Account Surplus!?**
von Thomas Jost
- 40 **Geldpolitik und Behavioural Finance**
von Franz Seitz
- 41 **Rechtliche Überlegungen zu den Euro-Rettungsschirmprogrammen und den
jüngsten geldpolitischen Maßnahmen der EZB**
von Ralph Hirdina
- 42 **DO UNEMPLOYMENT BENEFITS AND EMPLOYMENT PROTECTION INFLUENCE
SUICIDE MORTALITY? AN INTERNATIONAL PANEL DATA ANALYSIS**
von Horst Rottmann
- 43 **Die neuen europäischen Regeln zur Sanierung und Abwicklung von Kreditinstituten:
Ordnungspolitisch und rechtlich angreifbar?**
von Ralph Hirdina
- 44 **Vermögensumverteilung in der Eurozone durch die EZB ohne rechtliche Legitimation?**
von Ralph Hirdina
- 45 **Die Haftung des Steuerzahlers für etwaige Verluste der EZB auf dem rechtlichen Prüfstand**
von Ralph Hirdina

- 46 Die Frage nach dem Verhältnis von Nachhaltigkeit und Ökonomie
von Alexander Herzner**
- 47 Giving ideas a chance - systematic development of services in manufacturing industry
von Johann Strassl, Günter Schicker und Christian Grasser**
- 48 Risikoorientierte Kundenbewertung: Eine Fallstudie
von Thorsten Hock**
- 49 Rechtliche Überlegungen zur Position der Sparer und institutionellen Anleger mit Blick auf die
Niedrigzins- bzw. Negativzinspolitik der Europäischen Zentralbank
von Ralph Hirdina**
- 50 Determinanten des Studienerfolgs: Eine empirische Untersuchung für die Studiengänge
Maschinenbau, Medienproduktion und -technik sowie Umwelttechnik
von Bernd Rager und Horst Rottmann**
- 51 Cash Holdings in Germany and the Demand for "German" Banknotes:
What role for cashless payments
von Nikolaus Bartzsch und Franz Seitz**
- 52 Europäische Union und Euro – Wie geht es weiter? – Rechtliche Überlegungen
von Ralph Hirdina**
- 53 A Call for Action – Warum sich das professionelle Management des Service Portfolios in der
Industrie auszahlt
von Günter Schicker und Johann Strassl**
- 54 Der Studienerfolg an der OTH Amberg-Weiden – Eine empirische Analyse der Studiengänge
Maschinenbau, Medienproduktion und Medientechnik sowie Umwelttechnik
von Bernd Rager und Horst Rottmann**
- 55 Die Bewertung von Aktienanleihen mit Barriere – Eine Fallstudie für die Easy-Aktienanleihe der
Deutschen Bank
von Maurice Hofmann und Horst Rottmann**
- 56 Studie: Die Generation Y und deren organisatorische Implikationen
von Helmut Klein**
- 57 Die gesetzliche Einschränkung von Bargeldzahlungen und die Abschaffung von Bargeld auf dem
rechtlichen Prüfstand
von Ralph Hirdina**
- 58 Besser ohne Bargeld? Gesamtwirtschaftliche Wohlfahrtsverluste der Bargeldabschaffung
von Gerhard Rösl, Franz Seitz, Karl-Heinz Tödter**
- 59 Nowcasting des deutschen BIP
von Jens Doll, Beatrice Rosenthal, Jonas Volkenand, Sandra Hamella**
- 60 Herausforderungen und Erfolgsfaktoren bei der Einführung Cloud-basierter
Unternehmenssoftware – Erfahrungen aus der Praxis
von Thomas Dobat, Stefanie Hertel, Wolfgang Renninger**

- 61 Global Recessions and Booms: What do Probit models tell us?**
von Ursel Baumann, Ramón Gómez Salvador, Franz Seitz
- 62 Feste Zinsbindung versus kurzfristig variable Zinskonditionen in Deutschland**
von Jörg Clostermann und Franz Seitz
- 63 Deferred-Compensation-Modelle: Ersatz für eine konventionelle betriebliche Altersversorgung nach dem Betriebsrentengesetz?**
von Thomas Dommermuth und Thomas Schiller
- 64 Have capital market anomalies worldwide attenuated in the recent era of high liquidity and trading activity?**
von Benjamin R. Auer und Horst Rottmann
- 65 Vorschläge des französischen Staatspräsidenten Emmanuel Macron zur Reform der Europäischen Union**
von Ralph Hirdina
- 66 Von der Troika zu einem Europäischen Währungsfonds – Welche Aufgaben und Grenzen sollte ein Europäischer Währungsfonds nach den Erfahrungen mit der Troika haben?**
von Thomas Jost
- 67 Does Microfinance have an impact on borrower's consumption patterns and women's empowerment?**
von Charlotte H. Feldhoff, Yi Liu und Patricia R. Feldhoff
- 68 Uncertainty in the Black-Litterman Model - A Practical Note**
von Adrian Fuhrer und Thorsten Hock
- 69 Produktportfolio-Management im Zeitalter der Digitalisierung**
von Günter Schicker und Johann Strassl
- 70 Evaluation eines Inverted Classroom Konzepts in der makroökonomischen Lehre**
von Horst Rottmann und Christoph Voit
- 71 Immobilienkredite in Deutschland und der Schweiz: Die Rolle von Zinsen und Zinsbindung**
von Jörg Clostermann und Franz Seitz
- 72 Intelligente Verpackungen**
von Stephanie Abels-Schlosser
- 73 Digitale Strategien entwickeln – von der Idee zur Roadmap**
von Johann Strassl und Günter Schicker
- 74 Derivate im Zinsmanagement: Eine Analyse der Hedging-Qualität von Bund Future Kontrakten und deren Einsatzmöglichkeiten in Theorie und Praxis**
von Christoph Wontke und Franz Seitz
- 75 Steigerung der Kundenzufriedenheit durch Gestaltung von Artikeldetailseiten am Beispiel von WITT WEIDEN**
von Laura Graser und Marco Nirschl
- 76 Werkvertragsarbeitnehmerinnen und -arbeitnehmer in der Fleischindustrie**
von André Schulte und Ágnes Wörster

- 77 How to avoid fracture of the locking screw in modular revision arthroplasty of the hip using the MRP Titan Revision System
von Theresa Semmelmann, Alexander Schuh, Horst Rottmann, Reinhard Schröder, Christopher Fleischmann**
- 78 SARS-Cov-2 und Bargeld: Wie ein Virus die weltweite Bargeldnachfrage fördert
von Gerhard Rösl und Franz Seitz**
- 79 Monte-Carlo-Evaluation von Instrumentenvariablen-schätzern
von Benjamin R. Auer und Horst Rottmann**
- 80 Euro area house price fluctuations and unconventional monetary policy surprises
von Oliver Hülsewig und Horst Rottmann**
- 81 Euro Area Periphery Countries' Fiscal Policy and Monetary Policy Surprises
von Oliver Hülsewig und Horst Rottmann**
- 82 Überschätzen sich jüngere Personen mehr als ältere? Der Dunning-Kruger-Effekt im Altersvergleich
von V. Benesch, M. Godde, B. Hammami, U. Laufkötter, M. Seidel und B. Mayer**
- 83 Cash demand in times of crises
von Gerhard Rösl und Franz Seitz**



Ostbayerische Technische Hochschule
Amberg-Weiden

Die Weidener Diskussionspapiere erscheinen in unregelmäßigen Abständen und sollen Erkenntnisse aus Forschung und Wissenschaft an der Hochschule in Weiden insbesondere zu volks- und betriebswirtschaftlichen Themen an Wirtschaft und Gesellschaft vermitteln und den fachlichen Dialog fördern.

Herausgeber:

Ostbayerische Technische Hochschule (OTH) Amberg-Weiden
Prof. Dr. Horst Rottmann und Prof. Dr. Franz Seitz
Weiden Business School (Fakultät Betriebswirtschaft)

Presserechtliche Verantwortung:

Sonja Wiesel, Hochschulkommunikation und Öffentlichkeitsarbeit
Telefon +49 (9621) 482-3135
Fax +49 (9621) 482-4135
s.wiesel@oth-aw.de

Bestellungen schriftlich erbeten an:

Ostbayerische Technische Hochschule Amberg-Weiden
Abt. Weiden, Bibliothek
Hetzenrichter Weg 15,
D – 92637 Weiden i.d.Opf.

Die Diskussionsbeiträge können elektronisch abgerufen werden unter
http://www.oth-aw.de/aktuelles/veroeffentlichungen/weidener_diskussionspapiere/

Alle Rechte, insbesondere das Recht der Vervielfältigung und Verbreitung sowie Übersetzung vorbehalten.
Nachdruck nur mit Quellenangabe gestattet.

ISBN 978-3-937804-86-6

- **Abteilung Amberg:** Kaiser-Wilhelm-Ring 23, 92224 Amberg,
Tel.: (09621) 482-0, Fax: (09621) 482-4991
- **Abteilung Weiden:** Hetzenrichter Weg 15, 92637 Weiden i. d. OPf.,
Tel.: (0961) 382-0, Fax: (0961) 382-2991
- **E-Mail:** info@oth-aw.de | **Internet:** <http://www.oth-aw.de>