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The Cashless Society

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Gresham Professors write the abstracts for their lectures around 12 months ahead of the lecture. And when I wrote the abstract for this one, I thought that the societal issues around cashless were rather minor, and what was really of interest was the technology. But the more I looked, the more I found rational people objecting to the cashless society¹. So, I'd like to spend some time examining those objections because they are technological interesting, and they deserve a proper response. Of course, the objectors are keen to recruit 'fellow travellers' such as the Nobel laureate economist Amartya Sen to the cause of cash, but he was talking about *demonetisation* which is a completely different thing². This lecture is about the cashless society which is the replacement of coins and notes with digital alternatives. Even disallowing naysayers who were talking about something else, the defenders of cash do have some notable members. For example, Yves Mersch, who is member of the Board of the European Central BANK (ECB) speaks about the enthusiasts for a cashless society thus:

“The first camp, *the alchemists*, wants to overcome the restrictions that the zero lower bound (ZLB) imposes on monetary policy. The second, *the law and order camp*, wants to cancel the primary means of payment for illicit activities. And the third camp, *the fintech* (financial technology) *alliance*, anticipates major business opportunities arising from the elimination of the high storage, issuance, and handling costs of cash that the financial industry currently faces.”

The implication is that each group is self-interested and therefore cannot be trusted to give an impartial account. Given that implicit accusation, the speech is fascinating in that it quotes an ECB survey which claims that 79% of Europeans use cash to pay for things [4]. Mersch thus concludes that there is no desire for a cashless society among European citizens. The speech omitted the statistic in the adjacent sentence of [4] which shows that, when given a choice, only 32% of Europeans would choose cash. This survey took place before the widespread adoption of cash on public transport. A more impartial view is that, far from the public not wanting cashless, given the choice, they flee to it. This rapid change in habits has caught central banks on the hop so it is natural that they should write speeches decrying the cashless society since its rapid adoption is highly inconvenient and possibly risky. It is this last point which is the issue: does the very rapid swing towards cashless present any dangers?

The main objections to cashless can be summarised by four fears which I have called: *financial*, the fear that cashless will be either an inefficient financial instrument or that it is costly; *privacy*, the fear that cash confers certain privacy benefits which will be lost; *usability*, which is the fear that certain people will not be able to use cashless money and *security* which is the fear that fraud or financial disruption are more likely or more catastrophic for cashless societies.

I shall show that most of these fears are either groundless or manageable but, and this may be a big caveat, there does need to some design of the system. This is a theme we have encountered before, in the lecture on policing we saw that government commentators were tacitly admitting that it was impossible to digitise the criminal justice

¹ There is also a splendid collection of nutters and conspiracy theorists too of course!

² Sen was certainly talking about the Indian government's policy of *demonetisation* which was scheme to remove, overnight, all 500 and 1000 rupee notes. The theory was that middle-class Indians were avoiding tax by transacting using stashes of notes which had been garnered illegally. The policy was high disruptive, probably ineffective but it merely replaced one type of note with another newly minted kind so cannot be described as a move to a cashless society.



system because it was neither designed, nor indeed a system [2]. The financial system is also a bit of a hodge-podge but financial systems are nowhere near as chaotic as justice systems (probably because legislators give the topic little attention). However, before we tackle the four fears, it's important to recognise that cash, the current system is far from ideal.

The advocates for cash will often claim that cash is free to use. This is true. But so are electronic payment systems. The issue is who pays? And what do they pay? If it is desirable that the taxpayer pays, then cash is desirable. If on the other hand you think the retailer should pay, then cards are desirable and so on. As it happens, the costs of cash production vary wildly across the globe. Japan sinks an impressive \$500M per year into the production of cash whereas Slovenia spends around \$0.5M [5]. Curiously, the costs of printing cash, which are modelled in [5], appear to depend not on the number of security features but, principally, on the size of the banknote.

The second purported advantage of cash is that it confers anonymity. I'm completely mystified by this assertion. Coins do provide anonymity, but each banknote contains a unique number and as a harmless hobby many people track their banknotes across the planet (see [6] for example). Machine vision systems to read banknote numbers are considerably less complex than those required to scan QR-codes, so bill-scanning tills would be very easy to implement. In which case, cash is far from anonymous. Indeed, anyone who watches the movies will be aware of the usual trope of kidnappers asking for millions of dollars in used notes – used notes less easy to trace than new ones which have consecutive serial numbers and may also be “marked” in some way. So, in practice, cash is somewhat anonymous, but in principle cash is not anonymous at all.

The third stated advantage is that cash is secure. As the Swedish economy hurtles towards cashless, the protest group *Kontant Uppröret* (Cash Uprising) has caused enough of a stir that Swedish Civil Contingencies Agency has advised citizens to keep a pile of cash, in small denominations, at home, in case of emergencies⁴. It is not clear to me that advising your citizens to keep piles of cash at home is an improvement in national security but, as we shall later, Sweden is moving at great speed to cashless so maybe it is wise temporary contingency while their systems adapt.

Another feature of the cash-is-secure assertion, which has come to prominence recently, is whether cash is safe from the perspective of spreading disease. National banks have been keen to assure us that handling cash is OK, nevertheless would we kindly wash our hands after handling it. The World Health Organisation have found themselves caught in a similar trap [7] – not wishing to deny that viruses can be spread via cash but not wishing to cause panic. An interesting feature of modern banknotes is that they are made of polymers and the latest research on SARS-CoV2 shows the virus hangs-around for rather long time on plastics compared to say cardboard [8]. Needless to say, contactless payment spreads no disease.

A final feature of the security of cash is hyperinflation. Obviously, the business of printing and reprinting banknotes is an irritant which is rather secondary to the damages caused by hyperinflation itself. Nevertheless, electronic money does not have to be reprinted. In summary cash is not particularly cheap to produce and manage, it is relatively anonymous, but only because no-one has thought it worthwhile to track notes, it is rather easy to steal, particularly from Swedes who are instructed to keep piles of it around the place and it spreads disease.

Having established the dubious benefits of cash, I'd now like to turn to the criticisms of cashless. The financial criticisms are the ones that I am least qualified to discuss so let's skip quickly over those. There are three aspects to this: cards have expensive fees; cashless exposes consumers to negative interest rates and cashless systems encourage overspending. The final point relates to usability which we will discuss later. Credit card fees are certainly reviled by retailers but, as the founder of Gresham College, Sir Thomas Gresham, noted in his famous law that where two financial instruments offer the same utility the cheapest will win, which means that expensive

³ The British record of UK parliament, Hansard, recorded one “debate” of 28 minutes duration in 2019 when four people spoke, one of whom was the Minister who is obliged to respond.

⁴ Well according to the Daily Mail anyway – my Swedish is simply not good enough to find the original document on the msb.se website.

⁵ OK I admit that Gresham's law is bit more subtle than that and is really about debased coinage rather than a reformulation of a basic law of competition but I feel a mild duty to cite Sir Thomas!



cashless instruments, such as premium credit cards will eventually be replaced. So, fees will naturally be driven down by competition.

The final financial point relates to negative interest rates. Negative interest is when a bank instead of paying you interest for your deposit, charges you instead. So, your pile in the bank diminishes in front of your eyes and, under the cashless society, there is no cash alternative (which conventionally you could have kept under a mattress somewhere without any diminishment). For now, central bankers cannot charge too much negative interest because consumers will just withdraw cash. Needless to say, this situation is not favoured by central banks who need interest rates to control the economy [9]. However, it is very much favoured by the advocates of cash since it frees unwealthy citizens from yet more government-imposed costs. To me it seems something of a technicality. If we desired to help impoverished citizens avoid negative interest rates, then surely one would only apply negative interest to sums over a set amount? One does not require cash to do that – indeed cash is a hinderance to effective policy making as individuals now have piles of money which are relatively immune to monetary policy.

The second criticism relates to privacy. Here there are several issues. We have already challenged one which is the false assertion that cash provides anonymity. Cash provides some anonymity. Maybe it is a little more than a pre-paid credit card but it rather depends on the circumstances. If one turns up to a UK enterprise with £100k in cash, then cash provides no anonymity at all (due to money laundering regulations) but if one buys a pre-paid card in a shop with no CCTV and tops it via Tor and the darkweb using an anonymous Swiss email address – well that is pretty good anonymity. Privacy, however, is not the same as anonymity. Privacy is the right of everyday citizens to go about their lawful business without having everyone know about it. Countries that believe in privacy usually have laws to protect it. Those laws cover the unauthorised inspection or publication of one's spending data and one has a right to not have that data shared with other agencies. The great advantage of cashless is that the information is stored in an agreed format, a *schema*, it is therefore easier to judge what information an organisation holds on an individual. A more recent innovation, that is often mentioned, are distributed ledger systems as publicised in bitcoin and other blockchain currencies such as Ethereum. These systems do not confer anonymity, far from it, their attraction is that they provide a complete record of ownership of a currency item. The bitcoin block inspector allows anyone to work out the transaction amount and the address to which the payment was sent but both are anonymous. Where it becomes tricky is when bitcoin are converted into physical currency or visa versa – at that point anonymity is broken and hence there is now complete record of transactions across the currency. Even without this information, some effort in looking for similar patterns [11] allows one to cluster bitcoins belonging to a single user.

This then leads us to the two principal objections to a cashless society. The weakest of these is poor usability for some groups of people. The trite answer to poor usability is better design and this is what is needed here. The cashless society demands that everyone has a bank account. In the UK there, the Payments Accounts Regulations compel the nine largest banks to offer basic bank accounts. However, as noted in [11], since they offer no overdraft, and overdrafts make money, it can be tricky for consumers to open these accounts as the banks don't make any money on them. In the cashless society, a basic bank account is human right and clearly stronger methods are needed before we go cashless. Possibly the government could offer a bank account in the treasury which would provide the security associated with state investments to ordinary tax-payers, or the legislation compelling any bank to offer an account could be strengthened, or the requirement to prove one's identity could be relaxed⁷ for small accounts which, in turn would make it easier to open online bank accounts. Whatever the solution, a country needs to design a system that works for impoverished people and the need is urgent – consumers and retailers are fleeing from cash at a remarkable rates.

Another aspect of usability is that the cashless society implies some familiarity with computers. Again, there are multiple design solutions to this problem. Possibly we could issue mobile phones to all citizens who do not have

⁶ There is no schema for cash so the information held will vary from time-to-time and place-to-place.

⁷ India provides a state bank account as part of the social security system, the Aadhaar system, in which users are identified using biometrics – see Gresham lecture on biometrics.

⁸ Readers might wonder why I have not quantified the cashless numbers – only 2% of transactions in Sweden use cash and so – the reason is that the statistics are moving so quickly towards cashless that by the time you read this transcript the numbers will be wrong!



one. Or we could systematise the availability of terminals. Kazakhstan has public terminals that can be accessed by anyone with an identity card, France has the rather less intimidating Médiathèques which seem to be a sort of library, museum and public access point combined. One of the great advantages of IT equipment is that, unlike bank notes and coins, it can adapt to disability so potentially, the cashless society is far more inclusive than coins and notes.

The final aspect of usability is budgeting and overspending. It is a familiar experience, when provided with a credit card or an overdraft, to find that you need cardiac massage when the credit card bill comes in. But that situation is entirely of the credit card company's making – they need you to go into debt so they can charge you large interest fees. Basic bank accounts do not provide an overdraft so when it's gone, it's gone. So budgeting issues are not an essential feature of the cashless society at all – they are a feature of a system that encourages banks to make money out of borrowing. Modern banking apps, Monzo for example, also go some way towards budgeting: income can be distributed into “pots” each month and expenditure can be categorized. There is no doubt that the cashless society provides far more tools to allow people to not overspend – it's easy to build AI-powered assistants that can predict your end-of-month outcome; can help you save for emergencies; can route you to state assistance when necessary; can comply with Shariah finance and so on. Cash does none of that. There is clearly more work to be done on this problem and it is unhelpful when the user-interface to a bank account, the app, is controlled by the same bank that is trying to tempt you into debt. In the UK this conundrum was broken by the Competition and Markets Authority (CMA) who in 2016 ruled that banks had to make available data to the FinTech industry, so the consumer is not tied to the bank's app⁹. These initiatives have become known as “Open Banking”. Getting the banks and the Fintech industry to target impoverished citizens is a challenge but not beyond the wit of government¹⁰.

The final objection I have loosely termed “security” and, to my mind, it is the most serious. A large-scale hack of the cashless society can crash a country. A malign government can quickly track and control its citizens by the simple expedient of seizing control of their bank account. A benign government today, is not a guarantee of a benign government tomorrow. If we go cashless, then there has to be the strongest legal protections for citizens' bank accounts. Furthermore, it would be good practice for all citizens to have at least two bank accounts running on different architectures¹¹. Allowing redundancy to happen through competition, like the UK rail network, is not as desirable as building redundancy. What central banks call “Stress Testing” tests some of those linkages, but it is analogous to asking multiple people to build a railway bridge with whatever materials they have to hand, and then running a heavy locomotive across it to see if it works.

Security also concerns the ability of the system to remain robust to small and large-scale fraud. Cashless fraud in the UK is on the decline but to ordinary readers, such as myself, the numbers can appear quite staggering. The latest scam is the “Authorised Push Payment” fraud which in 2019 amounted to around £500M. The fraudster monitors emails and discarded correspondence¹². If something turns up from a high-value correspondent, maybe you are negotiating to buy a house and your lawyer¹³ is completing the deal, then the fraudster forges an email from your lawyer with instructions for you to pay several hundred thousand pounds into their escrow account. You pay into this bank account, minutes later the money is zooming around the world and you have lost your life savings. You authorised the payment so there is no recourse. Where was the security failure here? Certainly not the payment system. Here the issue is your lawyer, who chose to use insecure email to correspond with you – the ease of cashless payment exposed the insecurities of other systems.

⁹ The EU Payments Services Directive of 2015 is said to provide similar incentives.

¹⁰ British universities, if they are receiving money from the government for teaching, must provide evidence that they are accessible to full range of society. I cannot see why the Finance Industry cannot be asked to do the same especially when the interventions required for impoverished people would also benefit rich people.

¹¹ This is another annoying area. It requires some detective work to determine, for example, that Paypal payments are actually processed by JPMorgan.

¹² The UK and the whole of Europe is excited about paper recycling so consumers throw armfuls of correspondence and bills straight into the recycling bin without shredding.

¹³ In the UK they are called solicitors although “soliciting” is something quite different again!



One intriguing solution is programmable money. There are different definitions of what programmable money might be but, in the lecture, I consider a car sale between Bob and Alice¹⁴. Sales usually come with conditions ... will buy this car subject to a mechanical survey perhaps. At the start of the sale Bob reserves the money, which reassures Alice that the money is available, the money is programmed to be sent to Alice and Alice alone, or possibly it is programmed to be spent on companies of industry code 45111 or 45112 (sale of new cars and light motor vehicles). This immediately restricts the possibility for fraud. The sale is agreed, subject to a third-party, a mechanic perhaps, agreeing on the condition of the vehicle. The money, and program, is transferred to Alice but Alice cannot yet spend the money until the third-party agrees. The third-party agrees, the program explodes and Alice has the cash unfettered by the program. Of course, other deployments are quite feasible, the key idea of programmable money is that money has a function and can only be spent on that function¹⁵. Modern cryptography can bind programs to the objects they control so it sounds feasible.

In short, the cashless society has an exciting future; it need not exclude people; indeed it could be a very powerful tool for all citizens of whatever their wealth. But and this is a big but, like all IT systems it needs to be planned. Without design, planning, redundancy and security the future will look like Sweden where citizens are fleeing from cash without adequate protections, government agencies are responding by advising citizen to keep piles of cash at home for emergencies and there is worry that the simply is not enough contingency in the system. One response, like Yves Mersch [3] at the European Central Bank, is to write speeches pretending that consumers love cash and it would be a jolly god idea if things stayed as they were. Were he alive today then King Cnut would doubtless be to write speeches demonstrating that the tide is not incoming. Speaking as a citizen of one of those European countries, I'd rather not spend time debating whether it is a good thing if the tide is rising, I'd rather build a boat.

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¹⁴ Bob and Alice are the traditional correspondents in computer security examples.

¹⁵ This powerful idea is understood by parents the world over – pocket-money that can only be spent on noble things! With programmable money it could be enforced.