

CHAPTER 7

A Plan for Phasing Out Most Paper Currency

Having laid out the serious drawbacks to paper currency, we are now ready to turn to the practical question of how it might be (mostly) phased out. This might seem premature, given that, except for seigniorage revenues, we have only cursorily discussed paper currency's many virtues: preserving privacy, dealing with black-outs and other emergencies, security from cybercrime, providing a medium of exchange for unbanked low-income individuals, and achieving what specialists call real-time clearing of transactions. On top of all that, there is inertia and custom; plenty of people would just rather not have to deal with any kind of change. The reason for deferring these issues until now is that they are much easier to put in perspective in the context of a concrete proposal.

The proposal here is driven by three guiding principles. First, the ultimate goal is to make it more difficult to engage in anonymous untraceable transactions repeatedly and on a large scale. Relatedly, it is intended to make it more difficult to secretly transport and store large quantities of cash. The idea is to reduce wholesale use of cash in tax evasion or illegal activities. For the most part, the use of cash in large legal transactions is becoming increasingly vestigial and unnecessary, at least in advanced economies.

Second, the speed of transition needs to be slow, stretching changes out over at least 10–15 years. Gradualism helps avoid excessive disruption and gives institutions and individuals time to adapt. It puts authorities in a position to make adjustments as issues arise and as new options become available. This is an important point; obviously, over any long course of transition, new technologies and new issues will arise, and any realistic plan has to acknowledge this possibility.

Third, it is essential that poor and unbanked individuals have access to free basic debit accounts (or the future equivalent), and possibly also basic smartphones, as several countries have already done or are contemplating. The cost is ideally borne directly by the government, though it can also be imposed on banks that will eventually pass the costs on to paying customers. Under the current system, financial exclusion imposes high costs on the poor (e.g., high fees for cashing checks or wiring money), and a strong case can be made for providing better access to financial services even under the current system. The costs are small compared to providing universal health care, and the potential benefits are large.

As for privacy, it is important to separate out protection from government snooping and protection from relatives, friends, employers, or other private entities. Of course, people will always want to keep some expenditures or income secret from spouses, parents, and friends. The government can perfectly well allow such transactions as long as they do not entail recurrent large expenditures and income to be completely hidden from the government. And there need to be ways to allow relatively small expenditures to be secret, even from the government, say, up to a few hundred dollars or equivalent, perhaps a bit more.

In principle, the ultimate objective is to find a balance between allowing for small completely anonymous transactions while forcing large completely anonymous payments through relatively illiquid and high-cost transaction vehicles other than cash. The current system fails miserably to strike that balance. Again, the proposal here illustrates general principles in a concrete fashion, but of course there is room for significant refinements and improvements. The goal here is not a quixotic attempt to stamp out all illegal activity and tax evasion but to make it more difficult and expensive to conduct these activities anonymously.

Later in this chapter, we consider myriad practical issues, such as “how do we survive blackouts?” or “wouldn’t phasing out paper currency make us more vulnerable to cybercrime?” One can think of endless objections to change, but most are quite superficial and can be easily dealt with, especially given a long transition period.

We will also defer discussion of the issues surrounding the policy of negative interest rates until part II of the book. For one thing, it is perfectly possible to phase out paper currency and at the same time prohibit the central bank from setting negative interest rates (though this would be a mistake). And although phasing out paper currency is certainly an elegant way of making negative rates feasible, there are other ideas for how this might be done, and we will take up these alternatives in due time. Importantly, a mix of approaches is possible, particularly along the transition path to phasing out paper currency. To the extent negative interest rates are a central goal, further transitions and adjustments need to be put in place to make negative interest rate policy fully effective.

Let's start with where countries might want to be in the long run. Again, the plan here is intended to illustrate ideas and can be adapted and tweaked in many directions.

A Long Run without Paper Currency

1. PHASING OUT PAPER CURRENCY: All paper currency is gradually phased out, beginning with all notes of \$50 and above (or foreign equivalent), then next the \$20 bill, leaving only \$1, \$5, and (perhaps) \$10 bills. These small bills would be left in circulation for an indefinite period. In the final phase, small bills would be replaced by equivalent-denomination coins of substantial weight.
2. UNIVERSAL FINANCIAL INCLUSION: The government provides all individuals the option of access to free basic-function debit card/smartphone accounts, either through banks or through a government option. This can be substantially implemented by making government transfer payments into the debit account after it is created.
3. PRIVACY: Regulatory and legal framework aims to discourage other means of making large-scale payments that can be completely hidden from the government.
4. REAL-TIME CLEARING: This is a technical point, but an important one. Government helps facilitate development of the “rails” of the payment infrastructure to achieve (near) real-time clearing for most transactions.

We discuss each item in turn.

PHASING OUT PAPER CURRENCY

The largest-denomination notes, which are by far the most problematic, should be phased out first. In the case of the United States, the largest bills are the \$50s and \$100s. The absolute simplest approach is to follow the blueprint of Canada, which began to phase out the 1,000–Canadian dollar note in 2000, or Singapore, which began to phase out the 10,000–Singapore dollar note in 2014. Sweden did the same in 2013 with its 1,000-krona note, as will be examined in more detail in Box 7.1. The United States could simply stop printing new \$100 and \$50 bills and instruct financial institutions to send any bills that come into the system back to the central bank for exchange and destruction. Over time, the large notes would gradually be reduced to a minor share of total currency. By the way, some clever reader might ask whether, during the transition period, large notes might actually sell at a premium, since they are now in scarce supply, and the central bank no longer stands ready to print more as needed to keep the prices of all notes in alignment with face value. In this case, the El Chapo Guzmáns of the criminal world might get a big capital gain on their cash holdings. Fortunately, this is pretty much a nonissue, because holders of existing large-denomination bills will also have to worry about the possibility that the government might start requiring a lot of information from anyone trying to turn them in at banks, or worse, simply declaring them null and void. Indeed, it is highly probable that large-denomination notes would trade at a discount rather than a premium.

A gradual phaseout of large notes could take a couple decades, but there are faster approaches. For example, the government could set a date after which large notes expire. Large note holders could tender their bills for exchange either at private banks or at regional government offices. Exchange at federal offices would be done for free up to a certain amount, then with a modest handling and processing charge thereafter. Private banks would be allowed to charge a fee to cover the costs of paperwork, ferreting out counterfeits, and security; maximum fees could be set by regulation.

Arrangements would be made with foreign central banks to cover individuals who wish to exchange money abroad. Foreigners could also bring currency to the United States for exchange, subject to the usual customs reporting requirements for amounts over \$10,000.

The time period of the exchange would need to be determined, but for the sake of concreteness, one idea would be for the process to give people 2 years to use private banks, and longer (say, 7 years) to use regional central bank offices. This approach follows the standard blueprint for currency reforms, which is to make things relatively easy early on, but then to force late adopters to travel farther, fill out more forms, and as time goes on, to reveal more information, particularly about large sums.

The process by which the Eurozone countries exchanged legacy national currencies (e.g., the deutsche mark, the French franc, the Italian lira) for euro notes and coins provides helpful elements of a blueprint. However, as already observed in chapter 6, the government in our case can afford to be somewhat more aggressive in requiring information and details from anyone bringing substantial sums of large-denomination notes either to trade for smaller ones or for electronic currency. Because the government is on a path to exiting the paper currency business, it is in a position to enforce laws more vigorously than in a typical currency exchange, where the government might be worried about reputational concerns and maintaining future demand.

Smaller notes would be allowed to circulate indefinitely, say, for at least the first two decades of the overall transition. A final stage, optional but recommended, is to eventually require that even the small bills be turned in, either for electronic money or for the newly minted \$5 and \$10 coins. These would be sufficiently substantial that it would be burdensome to carry around and conceal large amounts, say, \$10,000 or more.¹

The idea of shifting from small bills to coins is to discourage substitution. Eliminating the large bills is already helpful. A million dollars in \$100 bills weighs approximately 22 pounds (10 kilos), and, if stacked, rises to 43 inches (or 109 centimeters). It can fit comfortably into a large shopping bag. Obviously, with \$20 bills, all measures would be five times as much; with \$10 notes, \$1

million is suddenly 220 pounds (100 kilos) and 430 inches (1,090 centimeters). It is also proportionately costlier to count, verify, handle, and store. Of course, significant substitution is possible, but the weight, bulk, and storage space are costly. Ultimately, with coins, the weight and bulk can be made an order of magnitude greater than for paper bills. Properly designed, the weight of coins, though quite modest for ordinary day-to-day transactions, would make them awkward for transporting large amounts or conducting large anonymous transactions.

The inspiration for going back to the future on coinage comes from ancient China, where coins were made of iron and other heavier base metals, rather than gold and silver, arguably accelerating the transition to paper. In the case of a deep recession, where the central bank is forced to institute substantial negative interest rates for a presumably short period, the costs of counting and storage of large amounts would also be proportionately much larger than today and should be sufficient to allow central banks to institute negative interest rates to any degree realistically likely to be necessary without triggering a run to cash. My guess is that making the largest note \$10 would already be sufficient to allow significantly negative interest rates (say, -3%) for fairly long periods without a wholesale run from Treasury bills to cash, and even more negative rates would be possible for brief periods. If necessary, other measures can be taken to raise the cost of hoarding on a mass scale, for example, charging a fee to redeposit cash into the financial system, or (in the extreme) one of the more sophisticated mechanisms considered in chapter 10. Once paper currency has been sufficiently marginalized, more complex plans to marginalize it further would become easier for the public to digest.

It should be noted that mainstream private payment media already provide a mechanism for small-scale quasi-anonymous transactions, for example, prepaid cards. Indeed, as cash is phased out, it will be important to redouble efforts to discourage these as an alternative for moving large sums anonymously; the issue is already on the radar screen of major governments.

Finally, some might ask: what is to stop criminals from using \$100 bills for transactions among one another, long after the bills

are no longer accepted in the formal (legal) economy? Such a convention could arise, of course, but as noted in several places in this book, the value and liquidity of any candidate currency would be sharply diminished if there were no way to convert it into payments for ordinary goods and services, so this concern should be regarded as a minor issue. To be completely clear, \$100 bills would not simply trade at deep discount but otherwise be as useful in transactions for criminals as they were before. In fact, legacy \$100 bills would also be inconvenient and difficult to dispose of in perpetuity. If a market for \$100 bills did develop, in all likelihood, it would reasonably quickly become marginalized.

UNIVERSAL FINANCIAL INCLUSION

In principle, no new instruments are required to shift to a less-cash world; in particular, cryptocurrencies are not required. Transactions would likely continue shifting to debit cards, as is already happening now. Over time, transactions are likely to shift increasingly to smartphones.² The main issue is how to serve low-income individuals who are unbanked. Low-income households and individuals go without banks for various reasons, including the inability to meet minimum deposit requirements, monthly service fees, and lack of convenient access in lower-income neighborhoods.

In the United States, more than 8% of households were unbanked in 2013, according to an FDIC survey.³ Another 20% were underbanked, meaning they also used alternative financial services outside the banking system, including prepaid cards, payday loans, pawn shops, and check-cashing services. More than 25% of adult Americans do not have a credit card.

Unfortunately, the cost of not having bank access is high. Check-cashing services charge exorbitant fees; for immigrants and others who need to wire funds abroad and transfer money to relatives, the transaction costs can amount to 10–15% or more. Storing cash at home and carrying cash greatly increases the chance of theft.⁴ The risks of being subject to fraud are much higher outside the regulated financial sector. The poor may benefit from being able to use

paper currency, but overall, financial exclusion implies large costs for basic services. In sum, the status quo is extremely regressive.

A long-run solution is to provide government-subsidized access to financial services for the poor, giving them equal access to electronic currency and, at the same time, helping reduce some of the costs associated with financial exclusion. In principle, providing access can be done through a regulated banking sector, but there could also be a government provider of basic services. A basic account could, for example, allow up to a certain maximum number of transactions per month with no minimum balance requirements and only modest charges for transactions over the limit. The cost of providing subsidized electronic currency accounts for low-income individuals should be relatively modest, say, on the order of \$32 billion per year (for example, 80 million free basic accounts at \$400 per year).⁵ Again, it is possible to shift this cost to banks, forcing them to provide virtually free basic debit accounts, as some countries have done. Of course this is an implicit tax that is ultimately passed on to other depositors and borrowers.

If providing such basic services sounds spendthrift, remember, programs will be built in the context of a transition to electronic payment vehicles that would likely bring net revenue to the government overall, given higher tax receipts. Shifting away from cash will also help reduce crime-related expenditures. Increased financial inclusion will have numerous collateral benefits in fighting domestic inequality. A simple way to introduce universal debit cards is to pay benefits electronically in basic debit accounts, as some countries, including Denmark, are already doing.

In anticipation of the possibility of negative interest rates, the government might guarantee that deposits at the universal accounts up to a certain amount (say, \$1,000–\$2,000) would always receive a nonnegative interest rate. This should not interfere in any significant way with the basic functioning of monetary policy in a negative rate environment.

Now it must be acknowledged that some percentage of the unbanked want to be off the radar screen and out of the system for reasons having nothing to do with tax evasion or illegal activity. In the proposal here, such individuals could still employ a range

of other assets from small bills and coins, to jewelry and precious metals, to regulated cryptocurrencies. The need for a safety valve for citizens at the edge of society is a valid one, but it is a weak argument for maintaining a paper currency system that causes so much collateral damage.

With or without a shift to electronic currencies, mobile telephony and the Internet are already revolutionizing financial services in ways that help the poor. Mobile banking has made significant inroads in Africa, and Internet lending is challenging the standard banking model. One is almost tempted to make an analogy to ancient China, where inferior coinage precipitated the invention of a much better transaction technology—paper money. A thorough discussion of banking services goes far beyond the ambitions of this book. What should be understood is that the poor do not benefit from the status quo, often being hugely disadvantaged by obstacles that prevent them from enjoying the benefits of modern banking. Relatively modest subsidies can overcome this inequity. In addition, poor neighborhoods would experience many other advantages, particularly in terms of decreased crime, that would likely accompany a shift away from cash.

Naturally, the devil is in the details. Remember that the illustrative plan allows smaller bills to circulate for an extended period, so there would be plenty of time to iron out specifics. I tend to think there should be a government provider of subsidized debit cards, designed to catch those people that the private sector will not service, even with subsidies. There are also basic questions about how to design family accounts that need sorting out with appropriate government regulation, but the residual small bills or coinage system should be more than sufficient so that junior can go to the store to buy an apple.

PRIVACY

When phasing out paper currency, the most fundamental and difficult issue is how to balance an individual's privacy rights with the government's need to enforce laws, collect taxes, and combat terrorism. This is an important and subtle question that requires

considerable attention, and it goes far beyond the narrow confines of any debate on the role of paper currency.⁶ Whatever one thinks of American privacy activist and former National Security Agency contractor Edward Snowden, the revelations that have come out from the material he released show that the government already has eavesdropping capabilities once thought to be purely in the realm of science fiction. And it is only going to get worse. Extensive government monitoring of cell phones and emails has already exploded as an issue. GPS systems in telephones and autos allow tracking of these devices. In major cities like London, New York, and Beijing, security cameras are everywhere. Combined with high-powered computing and vast databases, governments already have the capacity to intrude on privacy that would have been unthinkable 20 years ago.

And it is not only government surveillance that is changing the privacy landscape. Taking advantage of the rapidly decreasing cost of information storage and sorting, behemoth tech and retail companies catalog your every click, cell phone companies trace your movement from cell tower to cell tower, and social networking sites record intimate details of your online person. In many cases, information is bought, sold, and exchanged. Late twentieth-century notions of privacy already seem quaint.⁷ There is a huge and ongoing battle over privacy across the technology spectrum about conditions under which private companies can be forced to share their proprietary databases with the government, and also over the sale of encrypted devices without a backdoor that would allow the government to unlock information for purposes of national security or criminal investigations. How this balance ultimately evolves will profoundly affect the landscape for alternative anonymous transaction technologies. It will certainly influence the future course of cryptocurrencies, which we take up in chapter 14; governments everywhere are facing the question of how to balance regulation with fostering innovation in this space. Nevertheless, one should have little doubt that governments have all the tools necessary to prevent any alternative transaction media from deeply infiltrating the legal economy on a sustained basis, thereby greatly undermining their value relative to the present-day status of cash.

In theory, a government could itself offer debit accounts that were guaranteed to be private. Unfortunately, that promise would not be worth the paper it was written on, so to speak. Given governments' past behavior, who could take such a promise seriously? A government is not going to create an encryption system itself without making sure it has the key. And if it has a key, it will eventually be used as the government sees fit. Governments already intensely monitor bank transactions for crime and terrorist activities; one can expect the same with any new type of debit account, and ultimately any transaction technology that interfaces with the financial system.

That said, one can imagine a government creating a system where transactions are anonymous for private citizens, and one that contains significant restrictions on government access as well. Tax information, for example, is already accorded heavily protected status in most countries. One could, in principle, extend that privilege much more broadly, perhaps on small individual accounts with strict limits on how much money can be in them. Such a system would have to be stress tested to see whether it is truly credible. For example, could the government be forced to reveal any private transactions information it knows in a child custody battle?

REAL-TIME CLEARING AND PERSON-TO-PERSON TRANSACTIONS

Paper currency is still superior in many person-to-person (P2P) transactions, allowing for real-time clearing in a way that, at present, electronic payment mechanisms cannot duplicate. Ordinary credit cards and debit cards take a day to clear, creating credit risk that can be mitigated but not eliminated through monitoring, since some merchants only process charges with delay. PIN-protected debit card charges do clear nearly instantaneously, though for the moment not all merchants in the United States have the resources to process these. If neither buyer nor seller has access to the growing number of credit and debit card readers (for example Square Cash, a plug-in for tablets that allows street vendors

to process credit cards), there is still no fully satisfactory substitute for cash. But unfolding electronic technologies are peeling away these limitations of digital payments. For example, apps like Venmo, Google Wallet, and Square Cash offer the possibility of allowing one individual to write a check to another individual with reasonably fast clearing. This is not to mention large players like WeChat and Facebook as they enter the game. P2P options are likely to proliferate and improve. Indeed, the range of transactions for which cash is still dominant is slowly dwindling. (Denmark is among several countries that have already developed widely used systems; see Box 7.1.)

Many of the changes that need to take place to promote real-time clearing can be sped up considerably through government action. The Automated Clearing House system in the United States, for example, is an anachronism by global standards, and so far the Federal Reserve has not invested the relatively modest sums necessary to replace it.⁸ Some of the resistance comes from incumbent banks, which realize that an upgraded electronic check clearing system could serve multiple purposes, potentially allowing new entrants to issue entirely new payment systems that compete with and even supplant existing technologies. Eventually all of this investment and change will take place. The issue of real-time clearing will take longer to resolve for small retail transactions, simply because it is harder to amortize the fixed costs, but this is another area where allowing the continued circulation of small bills (and later coins) should significantly mitigate transition problems.

FURTHER ISSUES

What about Foreign Currencies?

Would a shift to an electronic currency have to be coordinated internationally? Coordination would have significant advantages from a global social welfare point of view, as discussed in chapter 13, but it is not essential. From a domestic macroeconomic perspective, existing restrictions on cross-border movements of

international currencies, combined with reporting requirements for large currency deposits at financial institutions, already make laundering foreign currency difficult, as it is not easily spent domestically. Chapter 13 discusses in some detail why foreign currency cannot fill the void left by domestic currency, provided authorities exercise a modicum of vigilance.

Would Monetary Policy Be Affected?

Would eliminating paper currency make the conduct of monetary policy more difficult, even ignoring the possibility of negative rates? There is absolutely no reason to believe so. Indeed, most modern macroeconomic models either ignore paper currency or assign it an extremely minor role—it is almost superfluous.⁹ In such a world, money remains a unit of account but loses its status as a means for transactions. In fact, monetary policy could be conducted in much the same way as today, with the government setting the overnight interest rate on nominal debt with the aim of stabilizing output and inflation. Electronic money (at present, bank reserves held at the central bank) can perfectly well serve as the unit of account; there would not be a problem.

This is because in the limit of a cashless economy, the government—through its control of the size of bank reserves—would still be able to control the price level via the overnight nominal interest rate. The essence of the argument is that the government is a very large player and can use its size and massive taxation potential to credibly set the short-term rate. Assuming some level of price stickiness—so that some component of the price level cannot jump—then command of the short-term rate is enough to give the government enormous influence over the current and expected path of inflation, and complete power to achieve any desired average inflation rate over the long run. There are some qualifications to the preceding optimistic discussion, probably slight and easily dealt with, but worth mentioning. First, monetary economists have long suspected that the uniqueness of cash, as opposed to other forms of government IOUs (i.e., bonds), is more fragile than most people realize. Back in the 1980s, Neil Wallace, a monetary

theorist who was then at the University of Minnesota, made an extremely interesting and provocative conjecture. He argued that the only thing that makes cash special today is that the government chooses not to issue bonds in small denominations; otherwise, these bonds would compete with cash for transactions, and stabilizing prices would become extremely difficult. This might sound a bit far-fetched, but it is a bigger challenge than you think, and we explore the issue in a section of the appendix. Although Wallace did not necessarily envision electronic currency, his analysis raises real questions about what would happen if cash became electronic, with none of the other distinguishing features from bonds that we have today, which are already almost entirely electronic. The short answer is that the Wallace conjecture is probably not such a problem, given the success central banks have had in stabilizing the value of money even as transactions substitutes like debit cards have flourished. Besides, we are keeping small notes around. But the conjecture still merits consideration. An even more abstract but still potentially important issue is that “multiple equilibria” are endemic to modern monetary models. The use of money in transactions and as a unit of account is ultimately a social convention. Any large-scale change risks disturbing the status quo, potentially leading to unstable and unpredictable consequences. Again, in practice, this concern has not proved such a problem, as long as the government moves in slow measured steps, but theory suggests it cannot be entirely dismissed either.¹⁰

Effect on the Optimal Choice of Inflation Target

Central banks could retain their current inflation target (typically around 2%). In the very long run, this level is not necessary in a cashless world, because there is no reason to worry about retaining room for interest rate cuts in the event of a recession. The central bank could target a lower or higher inflation rate, though (as I stress in chapter 9) the transition costs of changing targets too quickly could be huge, and not having to ever worry about this is a major advantage of being able to use negative rates. In theory, a lower inflation rate would help reduce relative price distortions

that arise in a world of staggered price- and wage-setting, and it also would reduce the distortions created by the tax system.

Seigniorage and Central Bank Independence

This topic has been covered in chapter 6. After the transition, steps would need to be taken to ensure that central bank independence was not significantly compromised once the central bank was no longer viewed as a major profit center. This problem is handled easily enough. Indeed, if the global real interest rate rose sufficiently, the central bank might even pay interest on reserves that would be passed through to depositors, so that on average over time depositors earned a positive rate of return, even if rates were on occasion negative.

VARIANTS

The proposal of this chapter should be viewed as illustrative only and can clearly be tweaked and changed in many dimensions, depending on the objective. For example, restricting the maximum size of purchases in retail transactions and putting expiry dates on paper notes to force them to be traded in periodically are both steps that could make cash less attractive. Once only small bills or coins are in circulation, it should be possible to institute fairly large negative rates without causing a wholesale run into cash but, as noted earlier, further steps can be taken in the unlikely event that still proves a problem. Again, as the private sector innovates on methods for conducting undetectable transactions, the government will continue to need to take measures to raise the costs of these alternatives, as it already does today. And I do not claim here that phasing out cash would eliminate tax evasion and illegal activities, only that it would help reduce them at the margin from what they would have been otherwise. And finally, recall that these ideas are for the present directed only at advanced economies. As discussed in chapter 13, most developing countries are not yet in a position to provide the universal transaction alternatives required. Moreover, in countries with weak institutions, the informal (tax- and

regulation-evading) sector remains essential to a large segment of the population, given structural weaknesses in the formal sector (the legal economy).

As for whether phasing out cash is fantasy even for advanced countries, Box 7.1 looks at the cases of Sweden and Denmark, which have already taken some substantial steps toward reducing the use of cash.

Box 7.1. The Scandinavian Precedent

In the move to a cashless (or, to be precise, less-cash) society, the Scandinavian countries are attempting to lead the way. Through a mix of anti-crime and anti-terrorism measures, as well as a strong social predilection toward adopting new IT, Norway, Denmark, and Sweden have witnessed a dramatic drop in cash usage while not seeing the same sharp rise in cash holdings as in most other advanced countries. Sweden is particularly far along in the process.

Several factors have played a part. Like many governments in Europe, Sweden has cracked down on evasion of value-added taxes. Rather than hold a lottery as Portugal did, the Swedish government has required certified cash registers with a special control unit (black box) attached to the register. The black box downloads all sales, and the data can be read directly (only) by the Swedish tax agency.¹¹ At the same time, many Swedish bank branches no longer have cash or ATMs. This development was partly in response to strong demands for safety from the bank tellers' union, after a series of violent bank robberies. At the same time, payments technologies have advanced, for example, P2P real-time payments systems.

One important step the government has taken was phasing out the largest note in circulation;¹² the 1,000-krona note (about \$115) became invalid at the end of 2013. The combined effect of this broad range of changes has been remarkable, and the demand for notes and coins has fallen from 106 billion kronor in 2009 (yearly average) to 77 billion in 2015, as figure 7.1 illustrates.

(Continued)

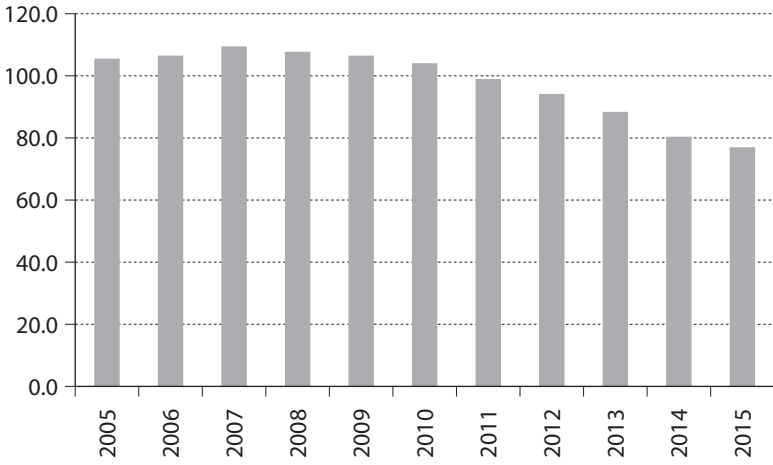


Figure 7.1: Sweden: Banknotes and coins in circulation (billion kronor). Source: Swedish Riksbank (data are averages for year).

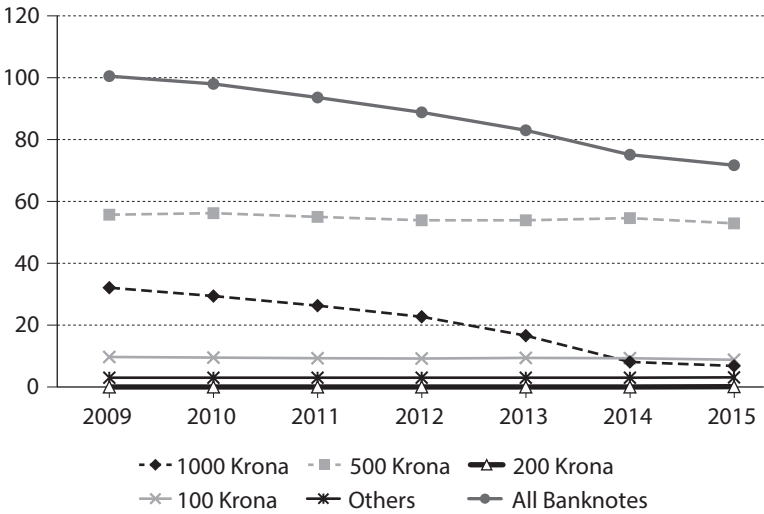


Figure 7.2: Declining total demand for large notes in Sweden (value in billion kronor). Source: Swedish Riksbank.

Interestingly, nearly all the drop in Swedish currency demand so far has come from the phaseout of the 1,000-krona note, as can be seen in figure 7.2. Demand for 500-krona notes has also fallen slightly over the same period.

The Swedes have been forced to address many issues along the way. For example, many churches have installed card-reading machines, so donations can be made by card instead of by cash. The government has given homeless people devices for accepting cash payments from cards also. Although the Riksbank is still printing paper currency, there are some who predict that Sweden will be effectively cashless by 2030. Cash use is still significant, accounting for about 20% of the number of transactions, though by value the number is far lower, perhaps 5–7%.¹³

It will certainly be ironic if Sweden, the first country in Europe to issue a paper currency connected to the government (see the discussion of Johan Palmstruch in chapter 2), became the first country to get rid of it.

Denmark has also made major progress toward moving away from cash. Of the country's 5 million citizens, 2.8 million have Mobile Pay, an app that allows one to make payments at a store or to another person. In contrast to earlier implementations of a similar idea, the Danish mobile payments system does not require participants to have accounts at the same financial institution, making it far more universally acceptable. Indeed, the Danish government has spoken about eliminating the need for cash registers. The Danish government has long made transfer payments electronically through free basic debit card accounts, effectively solving the problem of how to achieve financial inclusion for the unbanked.

The Swedish and Danish experiences cannot necessarily be generalized to a large heterogeneous country like the United States. Nevertheless, they show that, at a practical level, a transition of the sort discussed in this chapter is a very real possibility.

EMERGENCIES AND SECURITY

Emergencies

Certainly, a lot of the angst over electronic currency comes from deeply rooted fears of digital theft and paralysis after a major power outage. Although these fears are understandable, let's try to analyze them rationally. First, most people don't hold enough cash to provide a significant level of diversification against cybercrime. Per chapter 4, the average person in the United States is carrying around only \$50 or \$60, possibly with another couple hundred in the house or car. Even for the beleaguered middle class, cash holdings are only a small fraction of total wealth. Most people have far more in their bank accounts, pension funds, or other digital assets; if they are really worried about cybercrime, these should be the big concern. And, of course, physical cash itself is vulnerable to theft.

Power outages are a serious issue, and one of the more compelling reasons for allowing small notes and change to continue to circulate long after large notes have been withdrawn. Nevertheless, the average person does not carry large cash balances, and ATMs may not work during a power outage. The fact that you *could* have cash doesn't mean you *will* have cash. Indeed, arguably, the most important disaster preparedness today is a smartphone, and it will only become more so as payment systems migrate to mobile telephony. As already noted, smartphone apps for P2P payments continue to proliferate. One of the major lessons from Hurricane Katrina in 2005 was to push cell phone towers to have backup generators or batteries. As a result, when Hurricane Sandy hit the East Coast in 2012, most people retained at least spotty cell phone access. Supermarkets and pharmacies also typically have backup power and should be able to process payments. As cell phone apps grow, they will surely replace cash as the major transaction medium in power outages. Cell phones run out of power, of course, but it is far more cost effective for most people to have a couple inexpensive battery chargers around, or to charge their cell phone in their car, than to hide \$500 around the house.

Disaster relief planning websites also note that checks can be used in a disaster, assuming checks are still around in 20 years. In a sufficiently prolonged emergency when there is no longer any way to recharge cell phones and supplies of small bills are depleted, the government can air-drop currency for temporary use, redeemable for electronic currency after the crisis. Paper currency adds little to the mix if there are large-denomination coins and smartphones, and even today, cash arguably ranks much lower than many other emergency preparedness items.

Security

Many people pay cash for small purchases not so much because of convenience but to try to control their exposure to credit card theft. The odds of having your data ripped off on a small purchase are arguably pretty much the same as on a large purchase. This is, however, an especially American phenomenon, because the United States has been slow to adopt more secure payment systems, though this is at last changing. For example, the embedded chip-and-PIN technology that is common in Europe is a superior technology that makes the most common thefts today much more difficult. The United States has been slow to adopt the superior chip-and-PIN technology in part because retailers have lobbied not to be forced to upgrade their systems, but fortunately, it is gradually happening anyway.

Some might wonder about people who simply cannot remember their PINs, but these kinds of problems have already been addressed in Europe. One low-tech approach that has been applied, for example in Denmark, is to give people the option of getting an additional prepaid card that does not require a PIN and can be reloaded periodically at the bank. If lost, the money on the prepaid card will be lost (just like cash being stolen), but nothing more. A similar approach should work for people who like to put a fixed amount of cash in their wallet as a means of keeping track of their expenditures for the week.

Biometric identification methods, including fingerprint, voice, and retina are possible, and have already become prominent in

digital banking and government transfers in India, where over a billion people are now registered. Credit card companies already make use of neural networks to detect payment fraud. (A purchase coming from Russia for a designer handbag being shipped to the French Riviera might be regarded as suspect for a cardholder who lives in Boston.) Security is constantly evolving. Some Federal Reserve officials have talked about using a variant of the blockchain methodology pioneered by the cryptocurrency Bitcoin to create payment platforms that have built-in security due to its distributed public ledger verification process. We consider this technology in chapter 14.

There are certainly going to be other special cases where cash is still needed. An interesting example is the recent experience of marijuana shops in Colorado after the state legalized the drug in 2014. Two years on, some shops are still finding themselves with only limited access to the local banking system, because even though marijuana has become legal at the state level, it remains illegal at the federal level. And any bank under federal supervision is proscribed from doing business with an entity that is breaking federal law; Visa and MasterCard would not process payments for pot dispensaries for similar reasons. Hence the Federal Reserve has found itself having to send large cash shipments to help the shops operate.¹⁴

The list of possible problems that might arise in an electronic currency world is certainly daunting. Most of us have washed cash in the laundry; it generally comes out little worse for wear. (Given the germs that cash carries, who knows, maybe it is even good to literally launder it sometimes.) A smartphone or high-tech credit card might not survive so well. Again, though, this is a silly objection. Over the time frame of implementation, the technology will become cheaper and more durable. Probably you will be able to use any one of several vehicles to access your debit account. And fortunately—just as for such questions as “what if I drop my smartphone in the bathtub?” or “what if I accidentally put my smartphone in the washing machine?”—we can be reasonably sure that over the next 20 years, as people’s dependence on smartphones and similar devices continues to grow, more robust technologies will be developed.

A simple but important point is that, ironically, the end objective of many cybertheft schemes often involves cash, typically withdrawn from an ATM.¹⁵ This is sometimes how criminals ultimately remove the funds they have transferred to bank accounts they control, possibly withdrawing currency via a network of people to avoid being conspicuous.

Because the technology is evolving so rapidly, I am hesitant to go into much more detail, beyond saying that phasing out paper currency does not really move the needle much on society's vulnerability to cybercrime. Some of the present-day obstacles to improving security are really more political than economic. Some innovations in security, such as the potentially disruptive distributed-ledger technology embodied in cryptocurrencies like Bitcoin or Ethereum, may eventually lead to major improvements in financial security, at least at the core of the payment system, as discussed further in chapter 14.

It is particularly hard to see in any of these arguments why large-denomination notes are important. Probably they would be looked on askance after a power outage, earthquake, or other kind of catastrophe. I won't deny there are going to be residual issues that simply take time to sort out. Again, all these problems are good reasons to go slow and to leave some rump part of the paper currency system around for an extended period.

In any case, in a severe enough catastrophe, even cash might be difficult to use, leaving only barter. When I worked as a young economist at the Board of Governors of the Federal Reserve in the early 1980s, I remember being bemused one day when a few select top officials and governors participated in a mock nuclear attack evacuation. I believe the helicopters were whisking away the Fed's officials to deep caves in West Virginia, where, in principle, they could continue to keep the nation's currency system operating. Honestly, it was straight out of *Dr. Strangelove*. We lowly peons were supposed to follow the instructions in the back of our phone books, which, as I recall, said something along the lines of "hide under your desk and avert your eyes from flashes of bright light." With all due respect, in such a catastrophe, I sincerely doubt knowing that the head of the Federal Reserve is safe in a cave in

West Virginia will make me feel better about having the \$60 in my pocket, even if my desk protected me. This example may sound absurd, but certainly the possibility of having to deal with calamities and disasters is absolutely an important consideration, and another reason why cash needs to be phased out gradually.

Adjusting Regulations

Before cash is fully phased out, it will be important to reduce regulations in many areas that are not intended to be enforced strictly and that stay on the books only because cash allows them to be obeyed in the breach. For example, paying babysitters legally in Paris is much simpler and easier than in New York City, where reporting requirements are considerably more onerous. And while certainly part of the idea is to be able to tax individuals and businesses more equitably and fairly, making it more difficult to use cash might require lightening tax rates on small businesses, which are likely to bear the major brunt of a shift in regime.

CONCLUSION TO PART I

Paper currency has always facilitated tax evasion and crime; this phenomenon is hardly new. Over the years, however, the constant evolution of new transaction technologies has whittled down the role of cash in the legal economy until it remains important for small transactions but has become increasingly vestigial in medium-sized and large transactions. This point is brought into sharp relief by the ever rising and ever more dominant share of large-denomination notes in the currency supply of advanced countries. The \$100 bill and the 500-euro note, for example, are relatively unimportant in everyday retail transactions. Yet they dwarf small bills in their share of currency supplies in the United States and Europe. The evidence was already overwhelming two decades ago, when I first began to argue that retaining large-denomination notes was penny-wise and pound-foolish; the likely benefits from marginally increased tax receipts and marginal reductions in crime almost certainly outweigh the

lost seigniorage revenues from printing paper currency. This case appears to be even stronger today.

New technologies have now made even small-denomination notes increasingly less essential than they once were, a fact that is underscored by the progress that some countries (notably Sweden and Denmark) have already made toward reducing the use of cash. The change does not necessarily have to be wholesale; it seems likely that most of the benefits from phasing out paper currency can be achieved by slowly eliminating all but the smallest notes (say, up to \$5 or possibly \$10), and possibly in the end replacing even these with coins that while practical at a small scale, would be quite burdensome to store and transport in large numbers. This transition would address both the crime and tax evasion issues and would significantly raise the costs of hoarding that might otherwise undermine a shift to negative interest rates, as discussed in the next part of the book. If mass-scale hoarding of small notes or coins still proves to be a problem, it can easily be dealt with by putting restrictions on the maximum size of cash payments (as is already the case in much of Europe), and by introducing charges for very large deposits (or groups of deposits) of small bills, something banks would likely need to do anyway to offset costs. This kind of prohibition would discourage large-scale use of cash in crime as well as in hoarding. Of course, once the full transition to substantial-sized coins is made, large-scale cash transactions and hoarding should be expensive enough to make both nonissues.

By making the transition at a slow and deliberate pace, it should be possible to address various issues as they come up, much as the Swedes and Danes appear to be doing successfully. Technological limitations, such as how to make P2P payments electronically and how to achieve real-time clearing, are melting away with advances in telephony.

All in all, the case for going to a less-cash society if not quite yet a cashless society seems pretty compelling, with most of the various and sundry objections being easily handled, given enough lead time. Facilitating negative interest rate policy is not the main reason for phasing out paper currency, especially large-denomination notes. But it is an important collateral benefit that we turn to in part II.