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The Economics of One Dollar

Should the $1 bill be replaced by a $1 coin? Dallas Fed economist Mark Wynne offers his own view.

AN INSIDIOUS CONSEQUENCE of the decline in the dollar's purchasing power over the past hundred years is the mismatch between the denominations of circulating currency and the transactions in which this currency is used. One subtle manifestation of this is the evolution of "penny trays" at many retail establishments, where customers are invited to "take or leave a penny." Another is the fact that many people rarely bother to stoop to pick up a penny lying on the ground. It has become increasingly difficult to carry enough coins to use pay phones for long-distance phone calls. And the New York City Transit Authority estimates that more than half of the riders on the express buses from Staten Island to Manhattan carry rolls of quarters to pay the $4 fare because the buses don't accept dollar bills.

It is not just in the form of greater inconvenience that this mismatch manifests itself. For example, the Southern California Transit District sells crumpled dollar bills for 97 cents to a subcontractor who unwrinkles them by hand.[1] The Chicago Transit Authority estimates that it costs $22 per thousand to sort notes, versus $1.64 per thousand to sort coins. The source of this dissonance is the low purchasing power of the lowest denomination circulating note in the United States (the $1 bill) and the highest denomination circulating coin (the quarter). Low-value transactions that were once the exclusive domain

Table 1
Paper currency outstanding by denomination, March 31, 1996

Denomination	Total	Percent of total volume	Percent of total value
$ 1	$ 5,897,666,092	34.0	1.5
2	917,235,364	3.0	.2
5	6,996,954,260	8.5	1.8
10	13,255,581,890	8.1	3.4
20	80,081,015,360	24.4	20.4
50	47,767,891,950	5.8	12.2
100	237,657,651,300	14.5	60.5
500	144,771,500	0	0
1,000	168,025,000	0	0
5,000	1,715,000	0	0
10,000	3,350,000	0	0
Total	$392,891,857,716	100	100

SOURCE: *Treasury Bulletin*, June 1996, Table USCC-2.

of the quarter now typically require the use of a $1 coin or note. In transactions for which only a coin can be used, the absence of a widely held $1 coin subjects the public to unnecessary costs and inconvenience. When a note can be used, the high volume of low-value transactions means that it is subject to a lot more wear and tear. It may be time to think about replacing the $1 bill with a $1 coin.

In recent years, there has been renewed interest on the part of the government in just such a move. For example, as part of a proposal for balancing the federal budget it has been suggested that the $1 bill be replaced by a $1 coin, on the grounds that such a switch could yield substantial savings.[2] According to some estimates, the switch could save taxpayers as much as $500 million annually. More recently, the Clinton administration has reportedly been considering the introduction of a new $1 coin as the existing stock of Susan B. Anthony dollars held by the Treasury and Federal Reserve Banks is issued into circulation.

However, the very existence of the large stock of Anthony dollars in the Fed's vaults serves as a reminder that, less than 20 years ago, a similar attempt to replace the $1 bill with a $1 coin failed miserably. The Susan B. Anthony coin was introduced in 1979, with the intention that it would ultimately replace the $1 bill. But the Anthony dollar was never widely accepted by the public, with the result that production of the coin ceased less than a year after its introduction. The public's unwillingness to use the Anthony dollar leads many commentators to argue that a renewed attempt to get Americans to accept $1 coins in place of $1 bills would also be doomed to failure. Opponents of the $1 coin contend that if the American public would benefit from the introduction of a $1 coin, it would have eagerly embraced the Anthony dollar.

Despite the failure of the Anthony dollar, there are substantial benefits to be had from replacing the $1 bill with a $1 coin. A properly managed plan to replace the $1 bill with a $1 coin could be just as successful as similar conversions in Canada, Australia and the U.K. over the past 15 years.

The Composition of the Stock of U.S. Currency

As of March 31, 1996, $416,280,682,432 of U.S. currency was in circulation outside of the Treasury and Federal Reserve Banks. That's $1,573.15 for every man, woman and child in the country, a surprisingly large number and one that raises questions about who holds the outstanding stock of dollars. About 95 percent of the total stock of currency outstanding (by value) consists of banknotes, almost all of which are Federal Reserve notes.

Table 1 gives a denominational breakdown of the outstanding stock of Federal Reserve notes, as well as each denomination's share in the total by value and by volume. Note that very high denomination notes (above $100) account for a trivial fraction of the stock of paper currency outstanding: very high denomination notes have not been printed since 1945 and have not been issued since 1969.[3] The table shows that the $1 bill looms large in the stock of U.S. currency: more than one-third of the bills outstanding are $1 bills, with the next most common denominations being the $20 bill and the $100 bill. But although $1 bills are important in terms of their sheer number, they account for a relatively small percentage of the value of the stock of currency outstanding. While high denomination notes ($50 and $100) account for just under one-fifth of the stock outstanding by volume, in value terms these denominations account for almost three-quarters of the outstanding stock.[4]

The need to maintain such a large stock of $1 bills in circulation makes the provision of currency unnecessarily costly to the monetary authority, and thus ultimately to taxpayers. The average lifetime of a $1 bill is about a year and a half: replacing worn-out $1 bills is a net drain on government revenue, and insofar as a $1 coin would have a longer lifetime (30 years is the standard estimate), the government (and thus the taxpayer) could realize significant savings from replacing the $1 bill with a $1 coin. The Bureau of Engraving and Printing (BEP), which produces all U.S. paper currency, devotes about 95 percent of its annual production capacity to replacing worn-out notes of various denominations. Most of this replacement production is devoted to replacing $1 bills, since they account for such a large fraction of the outstanding stock of bills and have by far the shortest lifetime of any of the bills. Specifically, about 45 percent of production time is devoted to the $1 bill, as opposed to 5 percent for the $50 and $100 bills.

The Coin—Note Boundary

Because coins are more expensive to produce, any decision to replace the $1 bill with a $1 coin would have to take these higher production costs into account. The fact that the $1 bill is the lowest denomination circulating note in the United States, while the quarter is the highest denomination circulating coin, reflects a decision by the issuers of U.S. currency about where to locate the *coin–note boundary* in the denominational structure of U.S. currency. Coins and notes have competing merits as currency. Typically, low denomination currency tends to be made of more durable materials than high denomination currency. The reason is that while it may cost more to produce a coin than a note (about 8 cents for a dollar coin versus 3.5 to 4 cents for a dollar bill), the greater frequency of use of low denomination currency means that it is subject to much more wear and tear, and so the greater durability of coins outweighs their higher cost of production.

The coin–note boundary is placed at the denomination where the greater durability of coins is less important than the lower cost of production of notes. At present, the coin–note boundary is at the $1 denomination. The existing coin–note boundary was essentially determined during the Civil War, when the U.S. government first got involved in the production of paper currency.[5] The $1 bill was first issued by the U.S. government during the Civil War; prior to the issuance of a $1 bill by the federal government, the demand for a currency token at the $1 denomination was met by the production of silver dollars and a plethora of privately issued bank notes. The optimal location of the coin–note boundary will shift over time as the value of the average transaction rises and low denomination notes are used more frequently. The $1 bill is used a lot more frequently and is subject to a lot more wear and tear in a world where the average cup of coffee costs a dollar and not a dime. The BEP has improved the durability of the $1 bill so that each bill now lasts an average of 18 months before deteriorating to the point of being unfit for circulation. But the need to replace a large and growing stock of $1 bills is now such that it may make more sense to replace the cheap to produce but short-lived $1 bill with a more expensive to produce but longer lived $1 coin.

Both the Government Accounting Office (GAO) and the Federal Reserve estimate that replacing the $1 bill with a $1 coin could save the federal government as much as $400 million to $500 million annually; some private estimates are even higher.[6] The exact magnitude of the savings depends on a variety of factors that are difficult to quantify precisely. One is the extent to which the outstanding stock of $1 bills is replaced by a larger stock of $1 coins: experience with note-to-coin conversions in other countries suggests that the public may demand a larger stock of coins than notes of the same denomination. Another is the extent to which there is a corresponding decline in the use of the quarter and an increase in the use of the $2 bill; again, based on the experience of other countries, both of these outcomes are likely.

What About the Users of Currency?

Missing from these estimates of savings are the direct costs and benefits to the private sector that the replacement of the $1 bill with a $1 coin would produce. The costs would primarily involve the conversion of existing vending machines, pay phones and so on to accept the new coin, but would also include increased transportation and handling costs associated with the use of a $1 coin. The savings would come from reduced processing costs for transit authorities, the banking industry and operators of coin-operated vending machines.

Would the savings to the government be offset by higher costs to the private-sector users of currency? George McCandless, Jr., (1991) estimates that adding a slot to accept a new $1 coin to an existing vending machine would cost only $25 in parts and $50 in labor. The costs of retrofitting existing parking meters and laundry machines are of a comparable order of magnitude. Coins are much more expensive to transport than are notes: $1,000 worth of Anthony dollars weighs about 17 pounds, versus three pounds for $1,000 worth of dollar bills. However, even when these costs are factored in, McCandless estimates that the replacement of the $1 bill with a $1 coin would yield about $600 million in net annual savings to the private sector, which he defines as including state and local government operators of mass transit systems.[7]

Why Did the Susan B. Anthony Dollar "Fail"?

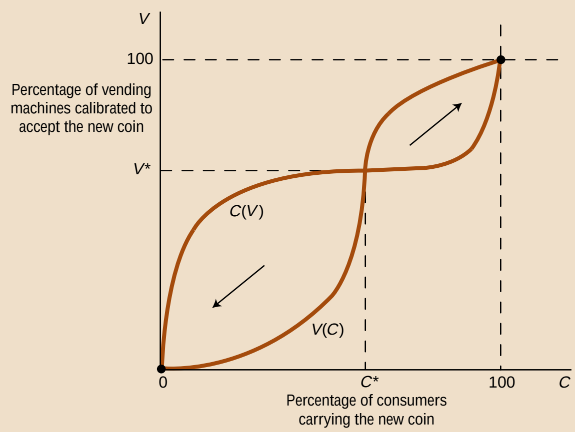
The Susan B. Anthony coin's failure to gain widespread acceptance raises the question of whether another attempt to replace the $1 bill with a $1 coin would meet the same fate. The reason usually given for the failure of the Anthony dollar is that it too closely resembled a quarter. It is difficult to know how much weight we should give to this argument: the Anthony dollar weighs about 43 percent more than the quarter (8.1 grams versus 5.67 grams) and bears almost the same size relationship to the quarter as the quarter bears to the nickel.[8] Furthermore, one never hears such complaints about U.S. paper currency, even though all denominations of U.S. paper currency are exactly the same size and color.[9]

While design features may have played some role in the Anthony dollar's failure to gain widespread acceptance, one suspects that something deeper was also at work. John Caskey and Simon St. Laurent (1994) argue that it was the government's failure to appreciate the important role of *network externalities* in a currency system that doomed the Anthony dollar. A network externality exists when the value of a product to a consumer changes as the number of users of the product changes. For example, a phone has little value if there's no one to call. Likewise, the usefulness of a computer increases when it can interact with a lot of other computers. Network externalities exist in currency systems also: the value of currency to a consumer is directly related to the number of other consumers using the same currency. In the presence of externalities, leaving individual consumers to pursue their own interests does not always generate the best outcome. Specifically, when individuals are given the choice between an existing $1 bill and a new $1 coin, there

A Theory of Why the Anthony Dollar Failed

Chart 1 illustrates why note-to-coin conversions generally fail if the public is given a choice between using a note or a coin for a particular denomination. The vertical axis measures the percentage of operators of the physical payments infrastructure (whom I refer to as vending machine operators), *V*, who recalibrate their equipment to accept a new coin. The horizontal axis measures the percentage of consumers who carry the new coin, *C*. The curve *V* = *V*(*C*) shows the percentage of vending machine operators who recalibrate their equipment to accept the new coin as a function of the percentage of the coin-carrying public that adopts the new coin. The curve *C* = *C*(*V*) shows the percentage of the coin-carrying public that adopts the new coin as a function of the fraction of the stock of vending machines they expect will have been recalibrated to accept the new coin. Both of these curves are upward sloping: as a larger fraction of the public chooses to use the new coin, a larger fraction of the vending machine operators will recalibrate their equipment to accept the new coin; as a larger fraction of vending machine operators recalibrate their equipment to accept the new coin, a larger fraction of the public will carry the new coin.

Chart 1



Both curves are also S-shaped. If vending machine operators expect only a small fraction of the public to adopt the new coin, it will not be in their interest to recalibrate their machines to accept it. As the fraction of the public that adopts the new coin grows, more vending machine operators will recalibrate, and the rate at which they do so will increase. Eventually, if everyone is carrying the new coin, all vending machine operators will have adjusted their machines to accept the new token. We can apply an analogous argument to motivate the shape of the *C*(*V*) curve.

There are two possible outcomes: either everyone adopts the new coin, or no one does. If not enough members of the public adopt the new coin initially, the no-use outcome is the eventual result. If a large enough fraction of the public adopts the new coin initially, it may be possible to get everyone to eventually do so. The critical percentages are *V** and *C**, respectively. If fewer than *V** of the vending machine operators adapt their machines to accept the new coin initially, and fewer than *C** of the public start carrying the new coin, the new coin will ultimately fail to circulate. Experience seems to suggest that when given a choice, most people adopt a wait-and-see attitude, with the result that the new coin never gets into wide circulation. This is what happened when the Anthony dollar was introduced. The only way to really encourage the public to adopt the new coin is to simultaneously withdraw the competing bill. This is what other major countries that have engineered note-to-coin conversions in recent years have done. Opinion polls in Canada following the introduction of the C$1 coin to replace the C$1 bill showed that the initial public dissatisfaction with the new coin dissipated relatively quickly.

is no guarantee that the coin will be adopted, even if adoption would make everyone better off.

Caskey and St. Laurent identify two sources of network externalities associated with a currency system. The first concerns the *physical payments infrastructure* that develops around the collection of bills and coins that circulate as currency. The second concerns the importance of *familiarity* with currency in facilitating transactions. Let's start with the physical payments infrastructure, by which we mean vending machines, cash registers, transit fare boxes, highway tollbooths, parking meters, subway fare machines, pay phones and so on. The various capital goods that make up the physical payments infrastructure are typically calibrated to accept a limited range of the circulating coins and notes. For example, today many of these machines will accept only nickels, dimes and quarters, even though the penny, Kennedy half-dollar, and Anthony and Eisenhower dollars are all legal tender. The operators of these machines have an incentive to recalibrate their machines to accept a new type of coin (or a new denomination of coin) only if they expect that a significant fraction of their customers are going to use the new coin. Likewise, customers who make purchases from machines (whether they be bus rides, phone calls or newspapers) are going to be willing to adopt a new coin only if they expect to be able to use the new coin in a significant fraction of these machines.

The second source of network externalities in a currency system arises from the familiarity of individuals with the most commonly encountered bills and coins. Transactions are faster when both parties are familiar with the bills and coins that are offered in payment and returned in change. Lest you doubt this, try buying something with an Anthony or Eisenhower dollar! When a new coin is introduced, shoppers are going to adopt it and familiarize themselves with it only if they expect to be able to use it easily in a wide range of transactions. This in turn requires that a large percentage of other shoppers and retailers also adopt the new coin. The existence of these network externalities means that the total benefit to the average individual of adopting a particular type of token for a particular currency denomination will increase the greater the fraction of the population that also adopts that token.

Caskey and St. Laurent argue that it was the failure of the U.S. government to take into account these network externalities that doomed the Anthony dollar. Specifically, by not removing the $1 bill from circulation at the same time that the Anthony coin was introduced, the government created uncertainty about how widely the new coin would be used. The public didn't want to carry a coin that they could only use in a limited number of retail transactions;

vending machine operators were unwilling to calibrate their machine to accept a coin that would rarely be offered in payment by their customers. By contrast, the other major countries that replaced low denomination notes with coins in recent years (Australia, Canada and the U.K.) always withdrew the note from circulation when the new coin was introduced. By doing so, the public was sure that they would be able to use the new coin in a large number of transactions, and vending machine operators calibrated their equipment to accept the new coin because they were sure that a significant fraction of the public would be carrying it.

Conclusions

There are sound economic reasons for replacing the $1 bill with a $1 coin. The most fundamental is the erosion in the purchasing power of the dollar that has occurred over the past 130 years. Low-value transactions that were once the exclusive province of the quarter now require either large numbers of quarters, inconveniencing the public, or $1 bills, which need to be replaced regularly, thus draining government revenues.

The unwillingness of the U.S. public to use the Anthony dollar makes the United States unique among developed countries in terms of the low purchasing power of its lowest denomination circulating note and highest denomination circulating coin. Many other countries have successfully replaced their lowest denomination note with a coin. Canada replaced the C$1 note with a coin in 1987 and the C$2 note with a coin in 1996. There is no good *economic* reason why the United States cannot also do the same. However, any decision to replace the $1 bill with a coin would necessarily take into account a broader range of considerations than those discussed here. Federal Reserve Board Gov. Edward W. Kelley, Jr., noted in testimony to Congress on this issue that "...the significance of the U.S. dollar goes beyond the purchasing power it represents or the utility it provides; for Americans, the dollar is a symbol of economic and political stability and a source of national pride; consequently, any change should be made only for the most compelling reasons."

—Mark A. Wynne

Notes

[1] *New York Times Magazine*, December 26, 1993, p. 9.

[2] See Georges (1995).

[3] Very high denomination notes were withdrawn from circulation to make it more difficult to evade income tax by conducting business transactions in cash.

[4] The discrepancy between these numbers is intriguing and raises the question of how much of the outstanding stock of paper currency is really held within the United States, given that one rarely encounters $50 or $100 bills in the course of legitimate everyday transactions. Porter and Judson (1996) consider a variety of possibilities and come down firmly in favor of the hypothesis that the bulk of the missing currency circulates overseas. They estimate that as of the end of 1991, about $200 billion (out of a total stock of currency in circulation of $375 billion) was circulating overseas.

[5] Before the Civil War, the only notes at the $1 denomination were privately produced, although the federal government did issue silver dollars.

[6] GAO (1990), Allison (1992), GAO (1993) and Kelley (1995).

[7] These savings are in addition to the estimated savings to the government or public sector, which McCandless puts at between $860 million and $890 million annually.

[8] The Susan B. Anthony dollar is 26.5 mm in diameter, the quarter is 24.26 mm in diameter, and the nickel is 21.21 mm in diameter.

[9] Few people claim to have any difficulty distinguishing a $1 note from a $10 note or a $100 note. Curiously, some have argued that one of the reasons that the $2 note never gained wide acceptance was that it was too easily confused with the $20 note! For some reason, nobody has this problem with $5 and $50 bills.

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