

Staff Working Paper
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**Costs and Benefits of Replacing
the \$1 Federal Reserve Note
with a \$1 U.S. Coin**

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Preface

Public attention has focused recently on the possibility of replacing the \$1 Federal Reserve note with a \$1 coin. Indeed, Government Accountability Office (GAO) analyses indicate that replacing the \$1 note with a \$1 coin would yield savings to the U.S. government, and suggest that policymakers should consider such a payment system transition.

To promote increased awareness of the broader implications of such a transition, staff from the Federal Reserve Board conducted an assessment of

- the costs and benefits to the U.S. economy, the U.S. payment system, and its participants of such a payment system transition, and
- the sensitivity of previous analyses to various assumptions about future conditions.

The overarching goal of this study is to provide an analytical framework for the public to better understand the effects, risks, and benefits of withdrawing the \$1 Federal Reserve note from payment system circulation. This paper finds that under a broad range of assumptions the \$1 Federal Reserve note is currently the more efficient payment instrument compared with the \$1 coin.

Executive Summary

Recent analyses have examined the potential benefits of replacing the \$1 Federal Reserve note in the U.S. payment system with a \$1 coin.¹ These analyses typically focus on the cost savings and benefits accruing to the U.S. government, but they may overlook potential effects on participants in the payment system and the long-run changes that have been shaping the U.S. payment system.

This paper analyzes the potential broader effects of a currency-to-coin transition on the U.S. payment system and its participants, including but not limited to depository institutions, armored currency and coin carriers, the vending industry, retailers, and the Federal Reserve System and government agencies. Although “true” costs and benefits are difficult to measure, available data indicate that (1) the costs of using the \$1 coin are generally higher than using the \$1 note, and (2) these costs can be very high for businesses that accept cash in large volumes (for example, banks and large retail business operations).

We examined the broader impact of a currency-to-coin transition through consideration of two alternatives: (1) the status quo, or the co-circulation of \$1 notes and \$1 coins, where the public can choose between these instruments, and (2) the “all-\$1-coin” scenario, as a result of a mandated withdrawal of the \$1 note from circulation.² We projected the U.S. Department of Treasury (Treasury) and Federal Reserve production, distribution, and processing costs for each scenario, and also conducted a survey and focus groups to better understand the effects of each scenario on payment system participants. Finally, we conducted a sensitivity analysis of our results—in other words, we examined how changes in note life, replacement ratios, production costs, currency growth rates, and discount rates affected our conclusion about which payment instrument is most efficient.

¹ See the GAO website for its 2011 and 2012 reports (www.gao.gov/new.items/d11281.pdf, www.gao.gov/assets/590/588549.pdf).

² Because consumers infrequently use \$1 coins for transactional purposes, we consider the current environment where consumers choose between the \$1 note and the \$1 coin from a production and supply perspective to be equivalent to the all-\$1 note scenario. Based on current demand and Federal Reserve Banks inventory levels, we do not expect Reserve Banks to order any additional \$1 coins from the United States Mint during the 30-year period considered in this analysis.

Our analysis—including sensitivity analysis, a survey, and focus groups—resulted in several key findings about a complete currency-to-coin transition at the \$1 unit level.

- **Less payment system efficiency.** Using \$1 coins instead of \$1 notes for transactions is inherently inefficient, requiring a replacement of one \$1 note with more than one \$1 coin to make up for the difference in the way coins and notes are used by the public.
- **Less cost-effective.** Replacing \$1 notes with \$1 coins is also not cost-effective for the U.S. government and public more broadly, primarily because the higher cost to produce coins compared with notes is not offset by the longer life of the coin.
- **Higher costs under all projected scenarios.** Circulating only \$1 coins costs more under every scenario we considered (in net present value terms) than would continuing to provide \$1 notes to the public.
- **Increased costs to the private sector.** Circulating only \$1 coins could result in increased costs to the private sector, perhaps in the hundreds of millions of dollars per year, and would more than offset any “seigniorage revenue” to the government reported in earlier GAO studies.³

Background

U.S. Currency and Coin Issuance Practices

The Board of Governors of the Federal Reserve System (the Board) issues the nation’s currency (in the form of Federal Reserve notes), and the Treasury’s U.S. Mint produces and issues the nation’s coins. Twenty-eight Federal Reserve Bank offices provide currency and coin services (cash services) to approximately 9,000 banks, savings and loans, and credit unions (depository institutions) in the United States. The remaining depository institutions obtain currency and coin from correspondent banks rather than directly from the Federal Reserve. The depository institutions, in turn, provide cash services to the general public.

Federal Reserve Issues and Maintains the Quality and Authenticity of Federal Reserve Notes

Each year, the Board determines the number of new \$1 (and other) Federal Reserve notes needed to meet demand and submits a print order to the Treasury’s Bureau of Engraving and Printing (BEP). The Board reimburses the BEP for the cost of printing new notes (rather than face value), and pays the cost of transporting the currency from the BEP facilities in Washington, D.C., and Fort Worth, Texas, to Reserve Bank cash offices.

When a depository institution orders notes from a Reserve Bank, the Reserve Bank prepares the shipment and releases it to an armored carrier that is arranged for by the depository institution. When a depository institution deposits currency with a Reserve Bank, the Reserve Bank stores the currency in a secure vault until it is verified, note-by-note, on high-speed processing equipment using authentication and fitness sensors.

³ GAO studies have focused on costs and benefits to the U.S. government of replacing \$1 notes with \$1 coins and have found that all savings from a transition to the \$1 coin result from increased “seigniorage” revenue to the government. In a broader analysis, seigniorage is excluded from the calculation of net benefits because it is an inter-sector transfer of wealth from the private to the public sector.

During the “piece-verification” process, the deposited currency is counted, suspect counterfeit notes are identified and segregated, and unfit notes are destroyed. The suspect counterfeit notes are delivered to the United States Secret Service (USSS) for final adjudication. The fit currency is packaged and returned to the vault to be used to fill future orders. It is through this process and using this infrastructure that the Federal Reserve helps to maintain the quality and integrity of U.S. currency. This process, in turn, helps underpin public confidence in U.S. currency.

U.S. Mint Issues but Does Not Have a Means to Maintain the Quality or Authenticity of Coins

The Federal Reserve’s role in coin operations is more limited than its role in currency operations. As the producer and issuing authority for coins, the U.S. Mint determines annual coin production, based in large part on the Reserve Banks’ monthly coin orders. The U.S. Mint transports the coin from its circulating coin production facilities in Philadelphia and Denver to all of the Reserve Banks’ on-site and off-site locations.⁴

In performing a responsibility delegated by the Treasury, the Reserve Banks distribute new and circulated coin to depository institutions to meet public demand.⁵ Unlike the Federal Reserve’s infrastructure for currency, the U.S. Mint does not have the capability or infrastructure to ensure the authenticity or fitness of coins. The Federal Reserve also does not have any infrastructure to ensure coin authenticity or fitness.

Seigniorage Revenue and Its Offsets

Understanding the proper role of seigniorage is important to any cost-benefit analysis of transitioning from the \$1 note to a \$1 coin. Seigniorage is, generally, income a government derives from the difference in the face value of a monetary unit and the cost to produce it.

Seigniorage income derived from coins is the difference between the face value of the coin and the cost to produce the coin. Seigniorage income derived from Federal Reserve notes is interest payments on Treasury securities held to collateralize Federal Reserve notes.⁶

In an analysis of government costs and benefits, seigniorage is classified as income to the government and, therefore, is included in the benefit calculation. In a broader cost-benefit analysis, however, the seigniorage income to the government is directly offset by the seigniorage “tax” on the public. Seigniorage is an inter-sector transfer of wealth that nets to zero and should be excluded from a broad cost-benefit analysis. The Office of Management and Budget also considers seigniorage a wealth transfer from the private to the public sector, as indicated in its *Analytical Perspectives of the Budget of the U. S. Government*.⁷

Nonetheless, our analysis discussed later should be considered a partial-equilibrium analysis of the broad effects of replacing the \$1 note with a \$1 coin. If one considers seigniorage from notes and coins as a form of taxation on society intended to raise government revenue, a general equilibrium analysis might need to

⁴ Off-site facilities are coin terminals operated by armored carriers. As of December 31, 2012, Federal Reserve Banks had contracts with 167 coin terminals.

⁵ In 1920, the Congress directed the Secretary of the Treasury to discontinue both Subtreasuries and the exercise of all duties and functions by the Assistant Treasurers in charge of the offices. The provisions of the Appropriations Act of 1920 authorized the Secretary to delegate the currency and coin functions of the Subtreasuries to the Federal Reserve Banks.

⁶ Treasury securities are purchased with the proceeds on the sale of notes at face value to depository institutions, less the cost to produce the notes.

⁷ See the White House website for the 2014 report (www.whitehouse.gov/sites/default/files/omb/budget/fy2014/assets/spec.pdf).

consider alternative methods of taxation available to the government and what method or combination of methods is optimal.⁸

Factors that Affect the Success of Currency-to-Coin Transitions

Many other countries replaced low-value notes with coins in the 1980s. Current conditions in the United States, however, differ from those in other countries at the time of their transition efforts. For example, U.S. conditions in the 21st century include the proliferation of substitute payment instruments, low public acceptance of the \$1 coin, the longevity of the \$1 note, and the threat of counterfeiting.

Substitute U.S. Payment Instruments Readily Available

Many other countries made their decisions to replace low-denomination notes with coins when electronic and other card payment substitutes for cash were less mature than today. Canada replaced its lowest denomination note with a coin in 1987, Australia in 1984, and the United Kingdom in 1983. At that time, the number of electronic point-of-sale (POS) devices in those countries was virtually nonexistent.

In the U.S. today, there are an estimated 10 million POS devices. With more mature alternatives to cash, the United States may experience more substitution away from cash following a mandatory replacement of the \$1 note with a \$1 coin than indicated by historical experience.

\$1 Coins: Readily Available, Not Widely Used

There are two main theories about why \$1 coins are not used more heavily in the United States, despite the fact that they are readily available—network effects and physical attributes.

One theory centers on the concept of “network effects.” Historically, perceived barriers to circulation along with so-called network effects were thought to inhibit consumer and business demand (i.e., if there is no business demand, there is no consumer demand, and vice versa). The 2005 Presidential Dollar Coin Act (PDCA) was based on this theory.⁹ In an attempt to overcome barriers to circulation and network effects, the PDCA required the U.S. Mint and Federal Reserve to conduct a public awareness campaign and to remove barriers to circulation for \$1 coins, respectively. Although the U.S. Mint and Federal Reserve took numerous steps to raise awareness of the coin and to address perceived barriers to circulation, the effort failed to stimulate demand and left the Reserve Banks with an estimated 40-year supply of \$1 coin inventory.

A second theory about why \$1 coins do not circulate broadly in the United States assumes that because the physical attributes of the \$1 coin make it more cumbersome than the \$1 note for many consumers and businesses. A \$1 note weighs about one gram—one-eighth the weight of a \$1 coin—making it easier to carry several \$1 notes instead of \$1 coins. Network effects may further amplify the demand problems for the \$1 coin, but the root problem is seen as lack of demand.

The public has consistently demonstrated a strong preference for the \$1 note over the \$1 coin. In the event that a \$1 coin were to replace the \$1 note, there likely would be a reduction in the amount of transactions in

⁸ One must also consider fully issues of production and distribution efficiency on a large scale since monetary instruments must be circulated broadly to be effective.

⁹ In response to congressional action, the U.S. Mint introduced the Sacagawea \$1 Coin Program, the Presidential \$1 Coin Program, and the Native American \$1 Coin Program. It appears that these programs have not materially increased demand for \$1 coins for transactional use. A series of Board reports to Congress on the Presidential \$1 Coin Program can be found at <http://www.federalreserve.gov/publications/other-reports/default.htm>.

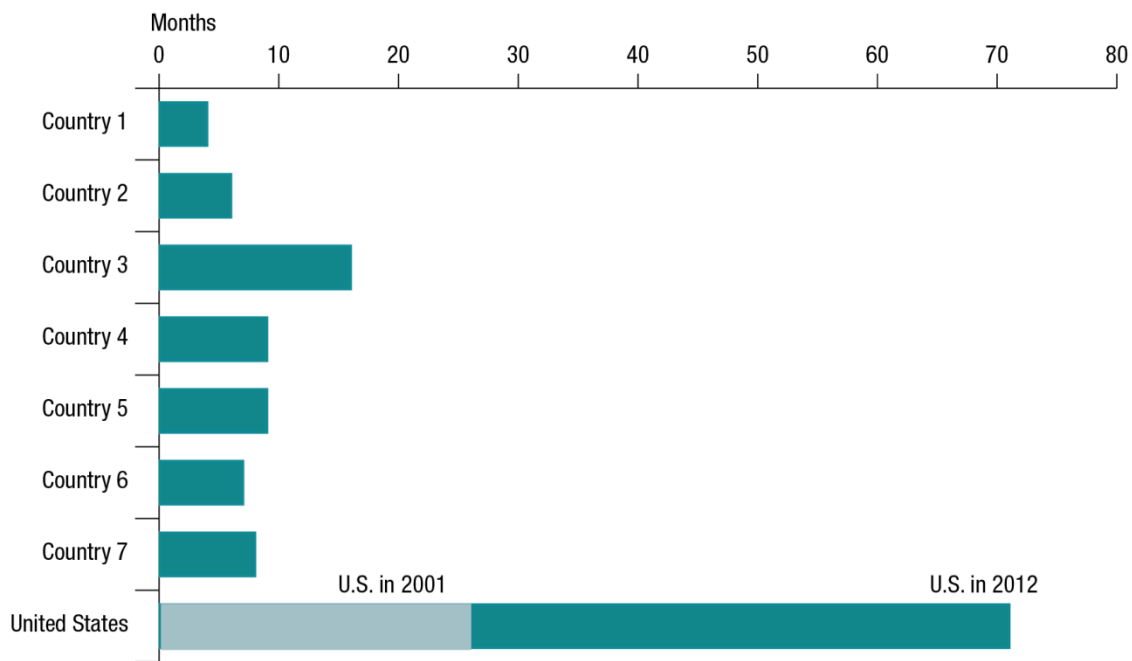
which \$1 payment instruments are used by the public given its strong preference for the \$1 note.¹⁰ The appetite for such a conversion or elimination is not likely to have changed in recent years, as polls on the subject indicate.¹¹

A transition to the \$1 coin has the potential to trigger a shift in consumer behavior away from the \$1 coin to alternative payment instruments. Credit, debit, and prepaid cards are more widely available and provide important substitutes for cash in many circumstances. If the limited circulation of the \$1 coin is inherently a consumer demand issue, it is unlikely that the \$1 coin will circulate widely in the United States unless withdrawal of the \$1 note is mandated by an act of Congress.

Longevity of the \$1 Note

As shown in figure 1, the low-denomination note life in many of the countries that replaced their equivalent note with a coin was less than 10 months, whereas current \$1 note life is greater than 70 months. A primary factor for the superior durability of the \$1 Federal Reserve note is its paper substrate. The paper for \$1 notes is a cotton and linen blend, as compared with the cotton substrate used in most other currencies. Although there may have been a cost justification to transition low-denomination notes to coins in other countries based on the lack of durability of the note, the long note life of the \$1 note makes it a more cost-effective payment unit for the United States.¹²

Figure 1. Low-denomination note life in various countries, 2001



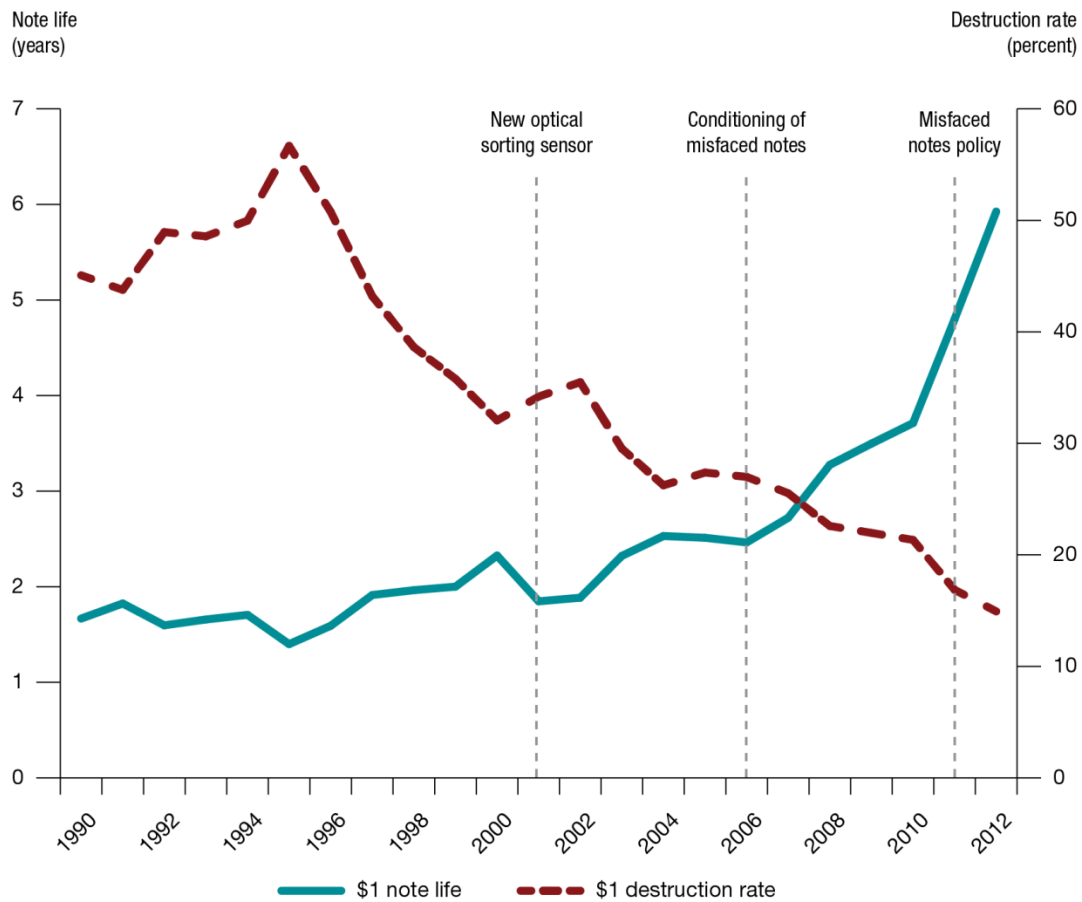
¹⁰ This preference is revealed by examining the Reserve Bank’s payments of notes and coins. In 2012, Reserve Banks paid roughly \$242 million in \$1 coins into circulation, while receiving roughly \$250 million \$1 coins from circulation. In contrast, during the same period, Reserve Banks paid out roughly \$12.7 billion in \$1 notes into circulation and received roughly \$12.4 billion \$1 notes from circulation. Presently, there are almost \$1.4 billion in \$1 coins stored in Reserve Bank vaults.

¹¹ “Americans Prefer Dollar Bill to Coin: Poll,” Reuters, (www.reuters.com/article/idUSN1435329120080414).

¹² Data for other countries (as reported in 2001 by the Reserve Bank of Australia); published data excluded the country names (www.polymernotes.org/resources/coventry9.pdf). U.S. note life is reported on the Federal Reserve Board website (www.federalreserve.gov/faqs/how-long-is-the-life-span-of-us-paper-money.htm).

In addition to the paper and design of the \$1 note, note-processing technologies and policies can have a significant effect on how long a note circulates in the economy. Improvements in note-sorting technology and policy changes from 1990 to 2012 reduced the number of notes the Reserve Banks prematurely destroy, and therefore increased note life significantly, from 18 months in 1990 to over 70 months in 2012. As shown in figure 2, both technology and policy changes have had dramatic and immediate changes in destruction rates for notes and consequently on average note life.

Figure 2. Evolution of the \$1 Federal Reserve note life



Between 2001 and 2003, Reserve Banks installed new optical-sorting sensors on note-processing equipment. These sensors use an image of the note to measure a variety of fitness characteristics to determine if a note should be destroyed or returned to circulation.

Because these sensors have been able relatively recently to distinguish dirt and tears from other blemishes, such as ink and folds, fewer notes are now being prematurely destroyed. Being able to differentiate folded from torn notes, for example, contributed to an increased note life from 1.8 to 2.5 years between 2001 and 2006.

These sensors also allow Reserve Banks to analyze the factors that cause a note to be destroyed. This analysis found that the leading cause of premature destruction was misfaced notes.¹³ When Reserve Banks

¹³ Misfaced notes are notes that are reverse-side up rather than portrait-side up.

became aware of the number of notes destroyed solely because they were misfaced, they undertook an effort to increase the percent of notes that were faced correctly before processing. This “conditioning” effort successfully reduced destruction rates from 26.8 to 22.5 percent from 2006 to 2010 and increased note life from 2.5 to 3.7 years.

In 2011, a new sensor was installed that allowed authentication regardless of facing, and the Reserve Banks updated their policy to allow misfaced notes in deposits from and payments to depository institutions. Because of the new sensor and the policy update, Reserve Banks stopped conditioning and destroying misfaced notes, which further reduced destruction rates to about 15 percent and increased note life to 5.9 years.

Potential Counterfeiting of Coin

Unlike the U.S. \$1 note, the \$1 coin does not have effective machine-readable or publicly usable counterfeit deterrent features and, without effective features, counterfeits can go undetected. The U.K., for example, experienced a substantial increase in counterfeiting of £1 coins in recent years. The Royal Mint estimates that as much as 2.8 percent of coins in circulation may be counterfeit.¹⁴ Currently, the \$1 note is counterfeited at a rate of less than one thousandth of 1 percent. If, however, the U.S. were to experience an increase in the counterfeit rate similar to that in the U.K. following the transition from the \$1 note to the \$1 coin, the value of counterfeit \$1 coins would be about \$540 million annually (based on a replacement ratio of 1.5 coins to 1 note), more than five times the level of *all* counterfeit activity in the United States today.¹⁵

The USSS indicated that it is not possible to predict with certainty whether a \$1 coin would be counterfeited if the U.S. were to adopt the \$1 coin as the sole \$1 denomination.¹⁶ The USSS has indicated, however, that if the U.S. were to face a counterfeiting problem similar to the one in the U.K., it would have to spend millions of dollars to provide specialized training for counterfeit specialists and field agents and purchase equipment specifically made for coins that is not currently present in USSS labs. The Federal Reserve would also likely need to invest tens of millions of dollars in additional processing equipment for coins. Significant counterfeiting of the \$1 coin could also adversely affect acceptance of U.S. coinage, which would directly affect not only U.S. residents but also residents of dollarized countries that use the \$1 coin extensively.¹⁷

Previous Studies: Benefits and Costs of Currency-to-Coin Transitions

GAO: Seigniorage Benefits Outweigh the Costs

Previous GAO reports have focused on the benefit to the U.S. government of an all-\$1-coin scenario narrowly. The GAO reported in 1990, 1993, 2000, 2011, and 2012 that a transition to a \$1 coin is beneficial to the government. The estimated benefits, however, have substantially declined in recent years. Changing assumptions for note life, replacement ratios, and discount rates have had dramatic effects on the

¹⁴ This level of counterfeiting has received broad media attention and has been sufficient to raise public issues of confidence in the coin (www.businessreport.co.uk/article/00762/43.5-million-fake-pound-coins-in-circulation and www.telegraph.co.uk/finance/personalfinance/consumertips/banking/7910602/Record-number-of-fake-1-coins-could-force-reissue.html).

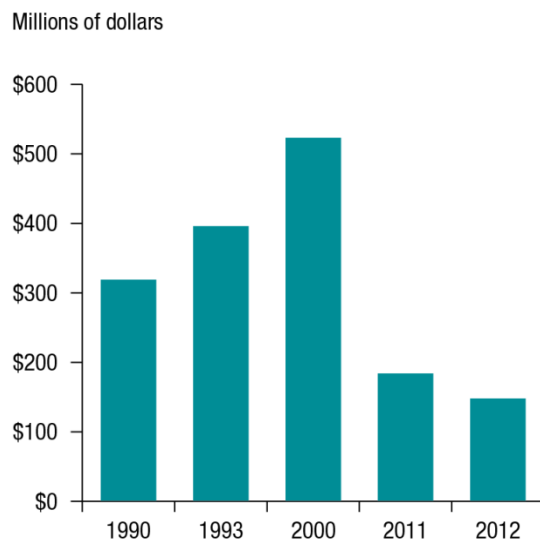
¹⁵ In 2012, total “passed” counterfeits reported by the Secret Service were about \$94 million, of which approximately \$19,000 were \$1 notes. There are currently about 10 billion \$1 notes in circulation.

¹⁶ Shortly following Ecuador’s conversion to the U.S. dollar in 2000, the U.S. Secret Service suppressed three counterfeit U.S. coin plants in Colombia, which were planning to manufacture counterfeit U.S. coins for distribution in Ecuador (www.secretservice.gov/press/pub0203.pdf).

¹⁷ Several Latin American countries use the \$1 coin, primarily Ecuador and El Salvador.

anticipated net outcome of a transition to the \$1 coin. Figure 3 illustrates these changes over time, reflecting GAO updates to its analysis.

Figure 3. GAO estimates of the annual net benefit to the U.S. government of replacing the \$1 note with a \$1 coin



From 1990 to 2000, the GAO’s estimate of savings to the government from replacing the \$1 note with a \$1 coin increased from \$318 million per year to \$522 million per year. This may have been due largely to assumptions about currency growth, the coin-to-note replacement ratio, and discount rates. More recently, however, from 2000 to 2012, the GAO’s estimate of savings has decreased significantly, to \$146 million per year, as it updated its assumptions.¹⁸ The GAO also noted in its 2012 report that its estimates of savings are subject to uncertainty.

GAO: Replacement Ratio and Other Assumptions Are Subject to Significant Uncertainty

The GAO’s recent analyses have recognized that all of the savings to the government result from increased seigniorage income due to the need to replace one \$1 note with more than one \$1 coin (a replacement ratio of 1.5 coins to 1 note).

The presumed replacement ratio reflects, however, the inefficiency of the \$1 coins as a payment instrument, as more than one \$1 coin is needed to replace one \$1 note. The public therefore pays the government a higher “tax” in the form of more seigniorage to undertake the same level of transactions. In a more complete cost-benefit analysis, seigniorage nets to zero because seigniorage is an inter-sector financial transfer. Excluding seigniorage, the GAO’s most recent analysis concludes that, under all scenarios, it is *more costly for the government to produce the number of \$1 coins than \$1 notes needed to supply the public with a \$1 cash instrument* over the 30-year period of its analysis.

¹⁸ The Congressional Budget Office (CBO) and Federal Reserve also previously estimated savings to the federal government from a transition to the \$1 coin. In 1995, the CBO estimated annual savings of at least \$200 million following a five-year transition period, and the Federal Reserve estimated annual savings of \$456 million; both of these scenarios were in line with GAO estimates at the time.

Although many of the costs to replace \$1 notes with \$1 coins occur in the near term, seigniorage income from \$1 coins that replace \$1 notes accumulates over a substantial period of time. Uncertainties such as future discount rates, replacement ratios, and substitution away from cash introduce significant downside risk as it relates to the premise that future seigniorage income will be sufficient to offset the upfront costs from producing sufficient stocks of \$1 coins to supply the public.

Given the public's preference for \$1 notes, it is also likely that the elimination of the \$1 note would accelerate a shift by consumers to card payments and other electronic payment alternatives. The U.S. Mint could face the need to produce large inventories of \$1 coins to prepare for the transition, but over time the inventories would likely flow back to the Reserve Banks as the public increasingly uses substitutes. The flow back of coin would result in large inventories of \$1 coins and very little benefit to the government. In essence, the high costs associated with the initial production may never be fully offset by seigniorage income, yielding no net benefit to the public or the government.

Our Cost-Benefit Analysis and Results

Given the variance in GAO estimates over time, the sensitivity of the results to changes in the underlying assumptions, and the exclusion of private-sector costs and benefits from previous studies, we analyzed the more complete costs and benefits of replacing the \$1 note with a \$1 coin. We updated the assumptions used by the GAO, analyzed the sensitivity of the results to changing assumptions, and surveyed depository institutions, armored carriers, and retailers to assess the potential effects on the private sector of a replacement of the \$1 note with a \$1 coin.

We concluded that a transition to the \$1 coin has significant downside risks and would likely cost the U.S. government and payment system participants more than in the current environment, where the public can readily choose between the two \$1 payment instruments. Table 1 lists the assumptions used throughout the analysis.

Scenarios Considered

Status Quo: Continued Choice between the \$1 Coin and the \$1 Note

In a status-quo scenario, we assumed the vast majority of \$1-denomination cash transactions will be made with \$1 notes over the next 30 years. A small fraction of transactions will be completed using the \$1 coin, similar to today. Because the Treasury directed the U.S. Mint to suspend production of the \$1 coin for transactional use in December 2011, and the Reserve Banks have enough \$1 coins to meet demand for over 30 years, there are no incremental costs to the U.S. Mint under this scenario. Federal Reserve costs related to notes include BEP production, transportation (from the BEP to the Reserve Banks and transfers between the Reserve Banks), and Reserve Bank note processing. No significant changes in the BEP's unit costs were assumed for \$1 note production for the purposes of this analysis.

All-Coin Scenario: Replacement of the \$1 Note with the \$1 Coin

The all-coin scenario assumes that all \$1-denomination cash transactions will be made with \$1 coins over the next 30 years, except for a four-year transition period. The transition period would allow the U.S. Mint to produce enough \$1 coins to replace the \$1 notes in circulation. The U.S. Mint would need to produce about 15 billion \$1 coins over the first four years of this scenario to enable a successful transition from the \$1 note to the \$1 coin (based on the number of \$1 notes in circulation and a replacement ratio of 1.5 coins to 1 note during the initial transition). During those four years, the BEP would continue to produce \$1 notes and the Reserve Banks would continue to pay \$1 notes to depository institutions to meet transactional

demand. After the initial four years, the BEP would discontinue producing \$1 notes and the Reserve Banks would begin destroying all \$1 notes it receives and would provide only \$1 coins to depository institutions.

Table 1. A comparison of GAO and Federal Reserve Board staff assumptions

	GAO's assumptions	Staff's assumptions
Replacement ratio (coins:notes)	1.5:1	Varies; begins at 1.5:1 and decreases to 1:1 based on experiences of other countries
Discount rate	3.4 percent	3.4 percent based on the GAO's analysis (2.0 percent inflation and 5.4 percent government borrowing rate)
Annual growth of \$1 notes	3.3 percent	1.25 percent based on the annual growth of \$1 notes in circulation over the past 10 years
\$1 note costs ¹	\$0.027 variable	\$0.052 total (variable plus fixed) based on actual 2013 \$1 note costs
\$1 coin costs ¹	\$0.15 variable	\$0.33 total (variable plus fixed) estimated based on estimates provided by the U.S. Mint
\$1 note life	56 months	70 months based on 2012 Reserve Bank processing data
\$1 coin life	34 years	30 years based on GAO 2012 testimony
Substitution effect	Not considered	Small decrease in \$1 coin use after increase in \$2 note use

1. The GAO used variable production costs and excluded short-term fixed costs from its analysis. Board staff used total (fixed plus variable) production costs because all short-term fixed costs become variable over 30 years, especially given the infrastructure changes in the all \$1 coin scenario. Staff's sensitivity analysis includes a scenario that uses only variable costs, and the results were largely unaffected.

To determine the number of \$1 coins needed to meet Reserve Bank payment requirements on the date of transition, current Reserve Bank \$1-note inventories (amounts currently held to meet anticipated demand) were added to the total \$1 notes currently in circulation. After the four-year transition period, the Reserve Banks would only require coins sufficient to meet demand growth, plus enough to meet demand from the heightened replacement ratio.

Based on the experiences of other countries, the analysis assumes that the public generally requires 50 percent more coins to replace the lowest-denomination note during the initial transition period, with a slow return to a 1-coin-to-1-note replacement rate years after the initial introduction.¹⁹ These assumptions yield an aggregate 30-year production volume of about 30 billion \$1 coins.

¹⁹ The replacement ratio of the Canadian \$1 coin to a \$1 note for the first 10 years after issuance was about 2 to 1, but declined to 1.25 to 1 in subsequent years (following the introduction of the \$2 coin and the maturation of electronic payments). Moreover,

Once all the \$1 notes are removed from circulation in the United States, the Reserve Banks’ processing costs could decline as much as \$900 million over the 30-year estimate. Some of these savings would be offset by the cost of construction for additional vault space at Reserve Banks to house the \$1 coins. Today, Reserve Banks are only responsible for distributing coin. If, however, they were required to fitness-sort and authenticate coin, the \$900 million reduction would likely be completely offset by increased spending to establish and operate an appropriate infrastructure. The aggregate 30-year production, processing, and distribution expenses associated with 30 billion \$1 coins have an estimated net present-value cost of \$10.0 billion.

Governmental Costs and Benefits

U.S. Government “Incremental Resource Cost” to Switch to a \$1 Coin: \$6.9 Billion over 30 Years

Table 2 compares the production volumes and governmental costs of the two scenarios discussed above, maintaining the status quo and transitioning to the all-\$1-coin environment. Although the number of \$1 notes produced over 30 years is twice as large as the number of \$1 coins produced, the total costs to produce \$1 coins exceed the costs to produce \$1 notes by \$6.9 billion because the costs to produce a \$1 coin (\$0.33) is about six times larger than the cost to produce a \$1 note (\$0.052).

Table 2. Comparison of cumulative 30-year volumes and costs

	Scenario 1: status quo	Scenario 2: all-\$1 coin
\$1 notes produced	57 billion	6.5 billion
\$1 coins produced	0	30 billion
Governmental costs ¹	\$3.1 billion	\$10.0 billion

1. Includes costs in 2013 dollars to the Treasury and the Federal Reserve.

\$1 Note: Currently a More Efficient U.S. Payment Instrument

Given the current production costs in the United States, if note life is less than 4.75 years then the \$1 coin would be the more efficient payment instrument. If \$1 note life is greater than 4.75 years, the \$1 note would be the more efficient payment instrument. Because the current life of the \$1 note is 5.9 years, it is the more efficient instrument to produce (see figure 4 for a representation of the efficiency breakeven point).

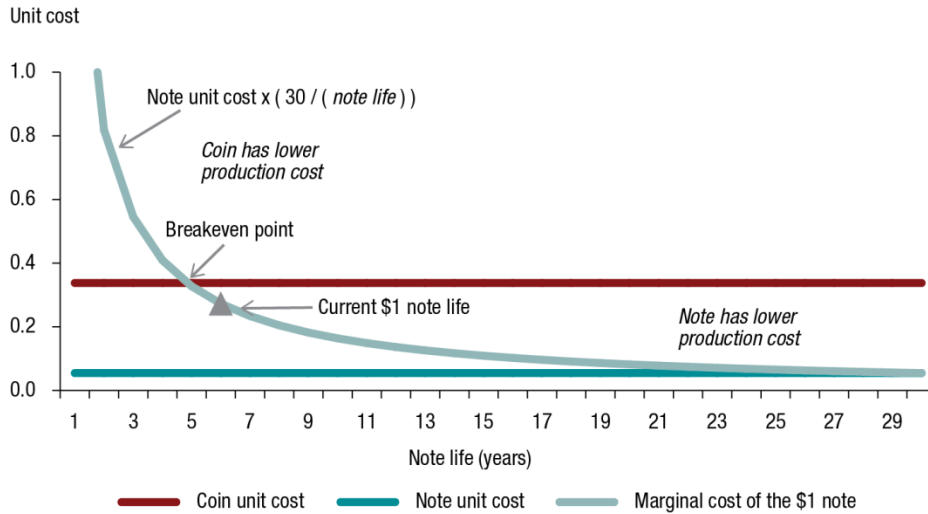
Figure 4, which demonstrates an efficiency breakeven point, shows a curve that represents the unit cost of maintaining the \$1 note for 30 years in a scenario assuming a varying note life. The solid line in the figure represents the unit cost of maintaining the \$1 coin for 30 years. (It does not vary because coin life is assumed to be 30 years, so only one unit needs to be provided).²⁰ To the right of the breakeven point (where note life exceeds 4.75 years) the note is more efficient, and to the left of the breakeven point the coin is the more efficient instrument. This analysis shows that depending on note life and production costs,

the \$2 note’s initial replacement ratio was only 1.25 coins to 1 note, potentially reflecting an immediate substitution away from coin to electronic payments by some of the public.

²⁰If the analysis considered a longer time horizon (e.g., 35 years), the cost of coin would be significantly higher, given the need to replace the coin initially produced during the first four years of the transition.

replacement of notes with coins could be more efficient. In the United States, however, given current production costs and note life, the \$1 note is more efficient.

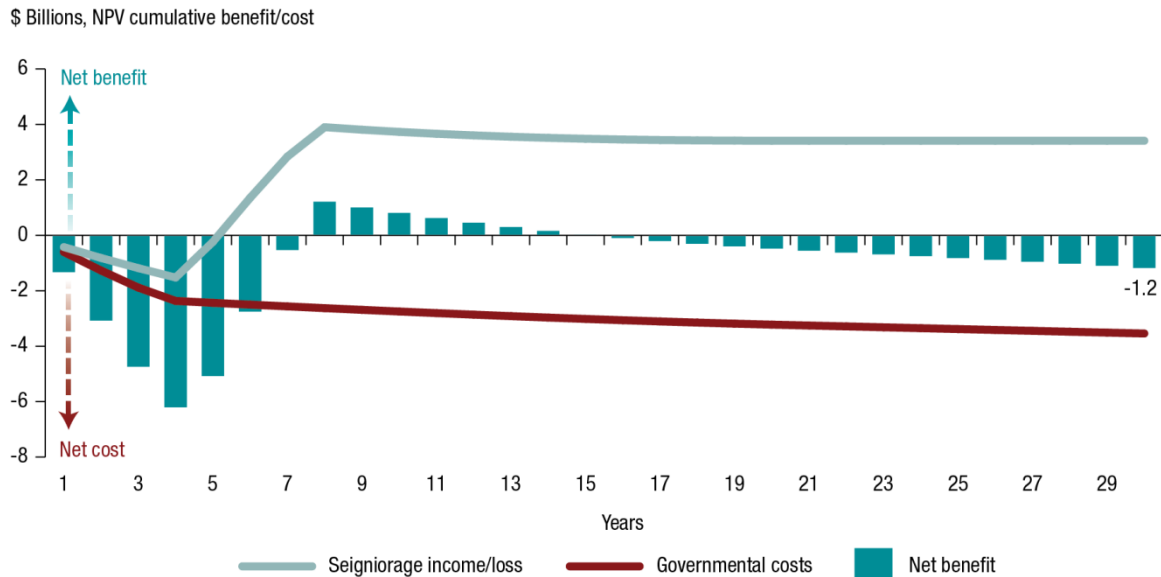
Figure 4. Breakeven efficiency analysis of the \$1 note and the \$1 coin



Replacing the \$1 Note with a Coin: No Net Incremental Benefits to U.S. Government

When determining potential estimated net benefits to the U.S. government, the estimated costs to produce \$1 notes and \$1 coins are subtracted from the estimated seigniorage benefits. We estimate that replacing \$1 notes with \$1 coins could cost the government about \$1.2 billion over 30 years. Figure 5 illustrates the estimated cumulative costs and benefits to the government of a transition from the \$1 note to the \$1 coin.

Figure 5. Cumulative benefit/cost to the U.S. government of replacing the \$1 note with a \$1 coin



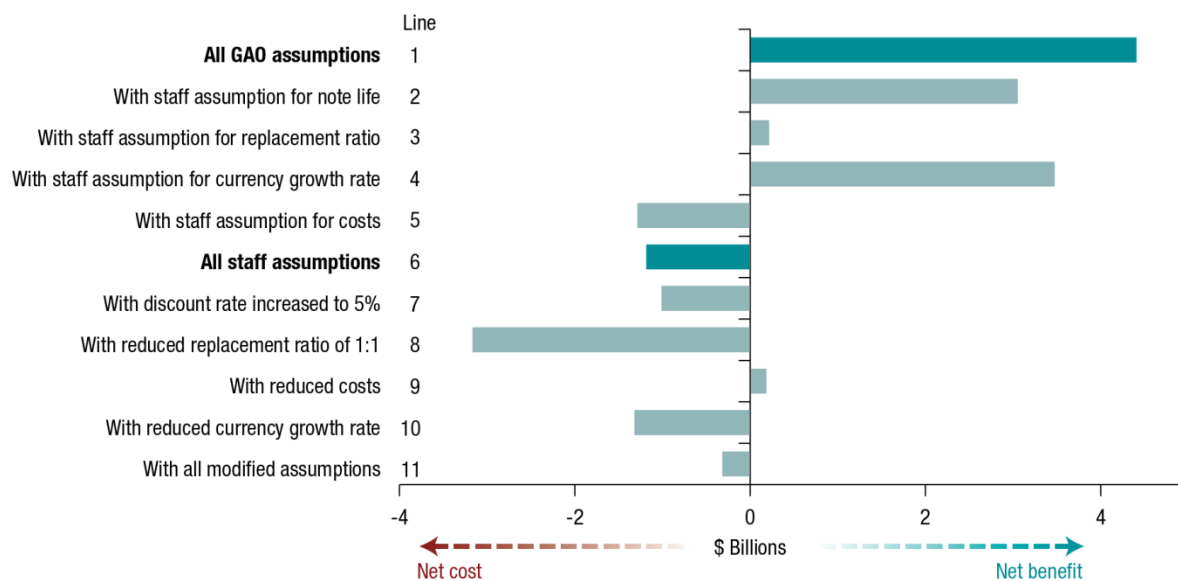
The figure 5 bars show the cumulative net benefit to the government (seigniorage less production costs) of a transition to \$1 coins. There are no net benefits in the large majority of the 30 years included in the analysis. Any benefit is derived solely from seigniorage resulting from the inefficient increase in \$1 coins needed to meet transactional demand. Over 30 years, the net loss to the government from a transition to all \$1 coins is about \$1.2 billion.

Figure 5 illustrates that the majority of the costs associated with transitioning to a \$1 coin would be incurred over the first five years. These near-term costs relate to producing sufficient initial inventories and are relatively certain. The magnitude of longer-term projected benefits is subject to much greater uncertainty. If the number of \$1 coins in circulation falls below estimates, due to the accelerated transition to cash substitutes, losses could far exceed the projected \$1.2 billion.

Sensitivity Analysis: Significant Downside Risks in an All-\$1-Coin Scenario

The analysis of costs and benefits is highly sensitive to any underlying assumptions. To determine the level of sensitivity, assumptions were varied, one by one, from those used by the GAO to ones that we believe more accurately reflect the current environment. Using assumptions that are based on historical patterns and our expectations for the future (such as a lower replacement ratio and currency growth rate, fully loaded note-and-coin costs, an inflation rate that represents historical averages, and the higher note life that has been observed in 2013) seigniorage income is not enough to offset the higher production costs associated with \$1 coins. The effect of varying these assumptions is shown in lines 1 through 6 in figure 6.

Figure 6. Net 30-year benefit to the U.S. government in replacing the \$1 note



Assumptions that represent a range of potential future scenarios were also used to estimate the resulting change in cost to the government of the all-\$1-coin scenario. These assumptions are illustrated in lines 7 through 11 in figure 6. The discount rate was increased to rates observed in the past, the replacement ratio was reduced to an efficient 1-note-to-1-coin ratio, costs were reduced to the midpoint between the variable costs used by the GAO and the fully loaded costs we used, and the currency growth rate was reduced to 2 percent. This sensitivity analysis highlights the significant downside risk to any estimate of net savings to the government.

Other Payment System Participant Costs and Benefits

Estimates of Benefits Have Declined over Time

In 2008, the National Automatic Merchandising Association stated that the \$1 coin could save the vending industry as much as \$600 million annually. In 2013, the Dollar Coin Alliance reported that the benefits to the vending industry, small retailers, and transit agencies of using \$1 coins might exceed \$109 million annually. Recent vending and transit company trends reflect a shift from cash to electronic payments, and none of the 26 respondents to a survey we conducted noted any savings from an all-\$1-coin scenario.

Our Survey: How Would the All-\$1-Coin Environment Affect Other Payment System Participants?

Given the variation in estimated savings from a transition to an all-\$1-coin environment to the private sector from 2008 to 2013, we surveyed retailers, medium and large (in terms of cash volume) depository institutions, armored carriers, and equipment manufacturers to gain insight into the effects of a change from the status quo to an all-\$1-coin environment. Twenty depository institutions, three armored carriers, two large retailers, and one equipment manufacturer responded to the survey. Staff also conducted focus groups with 12 small depository institutions.

Although the depository institution survey respondents and the focus group participants represent a small fraction of the depository institutions in the United States, they account for more than 80 percent of the Federal Reserve's currency-volume business. The results provide valuable insight into how private-sector organizations would likely be affected by the change. The participating entities provided their best estimates of the incremental costs their organizations would incur if \$1 coins were to replace \$1 notes. They also provided anecdotal information about how they believe their customers would react to a change.

Private-Sector Costs May Be Significant

Responses from survey and focus group participants indicated that society would likely bear costs in the hundreds of millions of dollars per year, a total beyond the incremental governmental costs to produce the \$1 coins in the all-\$1-coin scenario.

As table 3 indicates, the depository institutions indicated that switching to an all-\$1-coin environment could require them to incur one-time costs ranging from as little as an estimated \$10,000 for a medium-size institution to almost \$28 million for a large institution, to obtain the infrastructure (vault storage and coin handling equipment) needed for the new environment. These respondents also indicated they would likely incur ongoing costs ranging from \$40,000 to \$6.3 million per year, as a result of increased workers' compensation costs, manual labor costs, equipment costs, and increased costs related to armor-carrier services.

Small depository institutions indicated they would expect increased costs for their organizations as well. A few representatives of small institutions indicated that some long-time employees might be physically unable to perform the manual labor required to handle the much heavier \$1 coins.

Armored carriers that handle the largest volumes of currency and coin estimated they would each face one-time costs of up to \$3 million to make infrastructure changes and would face ongoing costs of more than \$2 million annually for fuel, labor, and equipment related to an all-\$1-coin environment. Staff believes that these costs would likely be passed on to their depository institution and retailer customers.

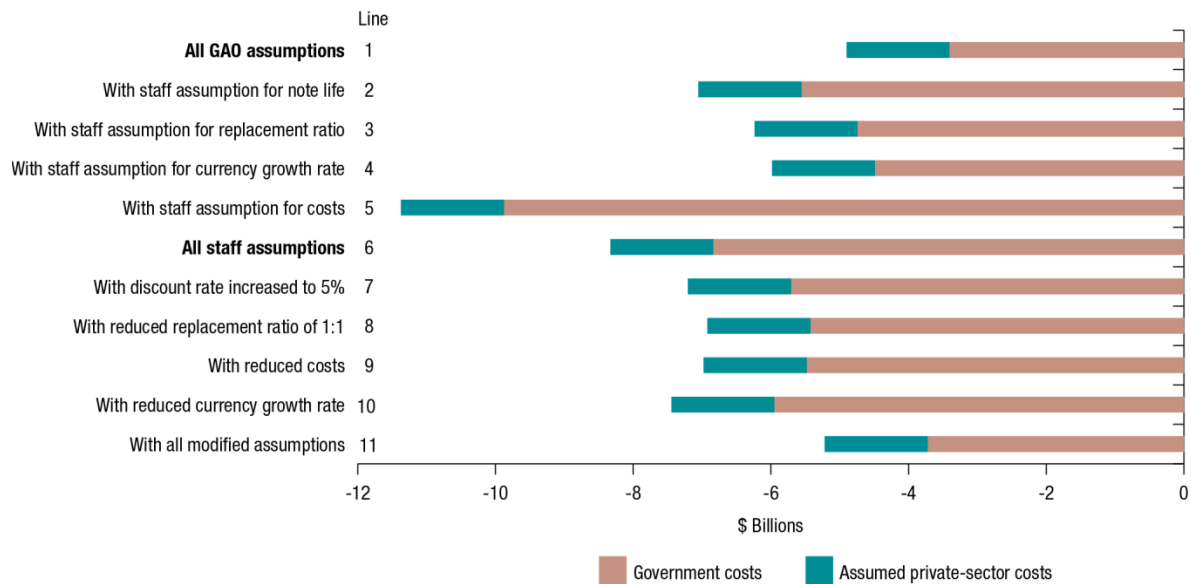
Table 3. Survey responses

Type of institution	One-time transition costs			Annual cost increases after transition		
	Lowest cost estimate	Average cost estimate	Highest cost estimate	Lowest cost estimate	Average cost estimate	Highest cost estimate
Large depository institution (n=10)	\$120,000	\$9,596,500	\$27,900,000	\$74,000	\$4,356,000	\$6,308,000
Medium depository institution (n=9)	\$10,000	\$65,000	\$1,200,000	\$40,000	\$186,500	\$333,000
Armored carrier (n=3)	\$1,500,000	\$2,250,000	\$3,000,000	\$800,000	\$1,100,000	\$1,400,000

Broader Payment System Costs Add to U.S. Governmental Costs under All-\$1-Coin Scenario

When private-sector costs are added to government costs the net societal cost of an all-\$1-coin scenario increases. Figure 7 illustrates the sensitivity analysis of government costs, excluding seigniorage and including some private-sector costs (although the exact amount of private-sector costs is uncertain, for graphical purposes staff assumed \$1.5 billion). Under all scenarios, the all-\$1-coin scenario costs society more than maintaining a status quo where the public can choose between the two payment instruments.

Figure 7. Difference in cost between the status quo and the all-\$1-coin scenario over 30 years



Conclusion

Based on our analysis of the benefits and costs of a currency-to-coin transition, we believe that the \$1 Federal Reserve note should remain in circulation and not be replaced with a \$1 coin.²¹

We find that, in general, requiring the use of \$1 coins instead of \$1 notes for transactions is inherently inefficient, as the public would have to replace one \$1 note with more than one \$1 coin. Replacing \$1 notes with \$1 coins is also not cost-effective for the government and other payment system participants, primarily because the higher cost to produce coins compared with notes is not offset by the longer life of the coin.

Our sensitivity analysis finds, furthermore, that circulating only \$1 coins costs more in every scenario (in net present value terms) than continuing to provide \$1 notes to the public. Additionally, information from surveys and focus group interviews indicates that increased costs to the private sector could be hundreds of millions of dollars per year and could offset any seigniorage revenue to the government. The real resource costs to produce \$1 coins and private-sector costs to handle \$1 coins exceed the costs to produce and handle \$1 notes over 30 years, resulting in the all-\$1-coin environment costing payment system participants significantly more than the current co-circulation environment.

²¹ Continuing to provide the public with a choice of using the \$1 note or \$1 coin would continue to serve the needs of potential coin users, but would not subject the government or payment system participants to the costs and downside risks of replacing the note with a coin.