

**THE FUTURE OF MONEY:
COINS AND BANKNOTES**

HEARING
BEFORE THE
SUBCOMMITTEE ON MONETARY
POLICY AND TRADE
OF THE
COMMITTEE ON FINANCIAL SERVICES
U.S. HOUSE OF REPRESENTATIVES
ONE HUNDRED FIFTEENTH CONGRESS
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CONTENTS

	Page
Hearing held on:	
September 5, 2018	1
Appendix:	
September 5, 2018	33

WITNESSES

WEDNESDAY, SEPTEMBER 5, 2018

Olijar, Leonard R., Director, Bureau of Engraving and Printing	5
Ryder, David J., Director, United States Mint	7

APPENDIX

Prepared statements:	
Olijar, Leonard R.	34
Ryder, David J.	84

ADDITIONAL MATERIAL SUBMITTED FOR THE RECORD

Barr, Hon. Andy:	
Written statement from Sonecon	92

THE FUTURE OF MONEY: COINS AND BANKNOTES

Wednesday, September 5, 2018

U.S. HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON MONETARY
POLICY AND TRADE,
COMMITTEE ON FINANCIAL SERVICES,
Washington, D.C.

The subcommittee met, pursuant to notice, at 10:06 a.m., in room 2128, Rayburn House Office Building, Hon. Andy Barr [chairman of the subcommittee] presiding.

Present: Representatives Barr, Williams, Lucas, Huizenga, Pittenger, Love, Hill, Emmer, Mooney, Davidson, Tenney, Hollingsworth, Moore, Foster, Sherman, Green, Kildee, and Vargas.

Chairman BARR. The subcommittee will come to order. Without objection the Chair is authorized to declare a recess of the Committee at any time. All members will have 5 legislative days within which to submit extraneous materials to the Chair for inclusion in the record.

This hearing is entitled, “The Future of Money: Coins and Banknotes.” I now recognize myself for 4 minutes to give an opening statement.

Despite all the focus on innovative ways to exchange value or settle transactions, Bitcoin, Apple Pay, Venmo, and dozens more and with the increasing use of credit and debit cards, coins and currency still are a major factor in our retail economy.

Cash may not be king anymore but it is still royalty and many Americans have a little of it in their pocket or purse right now. Even so, there is a really large amount of United States coins and banknotes circulating, all \$1.7 trillion or so of it produced by one of two bureaus of the Treasury Department: The Bureau of Engraving and Printing, which prints Federal Reserve notes and the United States Mint, which makes our circulating coins as well as some investor and collector coins.

The nearly 4,000 people who work at those bureaus do a terrific job. That being said, it is up to Congress to ensure that the Mint and the Bureau of Engraving and Printing remain effective and efficient and have adequate plans for the future, a future where innovative payment options are likely to multiply and usage likely to grow.

To that end, today the Monetary Policy Subcommittee welcomes the directors of the two bureaus to continue that discussion. There are real issues, real issues that have real impacts on both the econ-

omy and the Treasury's General Fund in the near-term and, particularly, in the long-term.

One of those issues, that Congress has been prodding the Mint on for a decade, is the cost to produce circulating coins. The penny and the nickel both cost considerably more than their face value to produce.

Thirty years ago, Canada and the United Kingdom changed to steel coins plated to look and function like their previous coins which in turn saved a lot of money and now these countries contract manufacture coins for a number of other countries.

Why hasn't the United States been the leader? Why didn't we emulate them when their move turned out to be successful? Have we just wasted tens or hundreds of millions of dollars for no good reason?

There are other coin-related issues, Congressman Mooney has been a leader in pointing out that there is an increasing problem of counterfeit copies of the Mint's American Eagle investment coins, a problem that defrauds both investors and dealers. Again, other Mints around the world have inserted anti-counterfeiting technology into their bullion but the U.S. Mint hasn't, why not? To be sure in our discussions with the Secret Service, there are anti-counterfeiting measures that have been put into place but we want to explore improvements in that area.

Additionally, the Bureau of Engraving and Printing would like a new printing plant to replace its well-known one just down the street. That is potentially a reasonable request but more work probably needs to be done on cost controls and on pinpointing future banknote demand. Right now, spending close to \$1.5 billion dollars to save \$40 million a year makes sense if demand for banknotes stays the same until maybe 2050 but not everyone imagines that demand will hold up.

Finally, I hope that we will hear that the bureaus have contingency plans for the possibility that the demand for all cash and coins could dry up fairly quickly. It is unknown whether we are moving that rapidly to a cashless society but it is worthy of exploration.

If that were to happen over just a few years, we would have about 4,000 employees and four major factories to think about repurposing. Additionally, the ability of the U.S. Mint to collect seigniorage from coins could be greatly reduced, ultimately increasing the Federal Government's deficit by hundreds of millions of dollars annually and there may be logistical difficulties with converting paper and coin money into another currency medium.

I don't see that happening anytime soon, if at all, but someone needs to be thinking about it and I hope the directors can give us a hint about such plans.

The Chair now recognizes the Ranking Member of the subcommittee, the gentlelady from Wisconsin, Gwen Moore for 5 minutes for an opening statement.

Ms. MOORE. Let me join the Chairman in welcoming our esteemed witnesses for the day.

As I was cleaning my bedroom and picking up all the pennies on the floor, this is a very appropriate time to talk about this matter, finding a little jar to put them in.

I would yield the balance of my time to Mr. Sherman from California.

Mr. SHERMAN. Thank you.

Most transactions are through an electronic payment system. We have to make sure that remains in U.S. control. If we push Europe too hard they will invent a system to close major oil and other major transactions without touching U.S. soil or perhaps U.S. currency.

“Future of Money” is not cyber and as the Chairman points out the seigniorage is very valuable to the United States, we should not lose it nor should we create a method of payment that, while it can be used and is often used for legitimate transactions, is particularly well designed for tax evasion and the evasion of sanctions legislation.

As to the currency we can actually touch, as long as we have a paper dollar people will not use a dollar coin. We would save an awful lot of money at the Federal level if people would use a dollar coin because it costs so much to make a paper dollar, it doesn’t last that long or doesn’t last nearly as long as a coin, after all we have coins from the Roman Empire; coins last a long time.

But the real savings of having a society in which people carry dollar coins will be its use by transit systems and vending machines, although gradually our technology is taking us beyond the need for a coin in either of those cases.

We ought to abolish the penny. It is not inflationary. If a merchant is going to charge you 23 cents for an orange and round it up to 25, then buy two oranges for 46 cents and round it down to 45 cents.

Every transaction we engage in is actually a rounded transaction because when you apply State and local sales tax to a transaction, you never bought anything at a store that was exactly \$6.92, there was tax, it was six dollars ninety-two point three cents and the merchant rounded it to the nearest penny. If we can round to a penny, we can round to a nickel.

I know the Illinois delegation has historically favored retaining the penny because it has Abraham Lincoln on it. Back when a penny was worth something, as it was in Lincoln’s day, it was an honor to be on the penny. Today if you were to scatter pennies around the room you would not be enriching those who walk by, a penny on the ground is litter.

So if we abolish the penny there is room in the cash register for a dollar coin, we save a lot of zinc, a little bit of copper, or a fair amount of money and we do not make transactions at the store more difficult nor do I think that any merchant will calculate the price of an orange on the theory that you will buy just one and that you will owe 23 cents and it will get rounded up to 25 cents which you can always buy two oranges, they are delicious and they come from California.

I will yield back the balance of my time back to the Ranking Member.

Ms. MOORE. I am excited to hear your testimony and I yield back.

Chairman BARR. The Ranking Member yields back the balance of her time.

The Chair now recognizes the gentleman from West Virginia, Mr. Mooney for 1 minute for an opening statement.

Mr. MOONEY. Thank you very much Mr. Chairman.

Welcome Director Olijar and Director Ryder, I really appreciate you being here, look forward to working with you in the future, getting a better understanding of how the Bureau of Engraving and Printing and the U.S. Mint view the future of the U.S. currency.

I thank the Chairman for his comments.

I have taken a special interest in coins and fraudulent attempts from other countries. I have been concerned about what has been without question a lack of attention to address the growing problem of high-quality counterfeits coming from China and elsewhere but especially China. They seem to want to hack, steal our intellectual property, counterfeit, they seem to be very, extra, extra good at coming to this country and causing problems.

It is important that we secure U.S. coins, minted of gold, silver, platinum, and palladium which happens to be the only sound money currency minted in the United States.

I did recently meet with the Secret Service to discuss their role in combating counterfeit currency flooding our market. During our meeting they reported they have been working on at least 15 major cases over the past 2 years.

The Secret Service did voice some frustration about obtaining support from the U.S. Mint when it comes to investigating and curtailing the growing counterfeiting problem.

Since that meeting and sharing information with the U.S. Mint, I have really not seen evidence that the U.S. Mint intends to meet the standards set by several foreign mints who have adopted various anti-counterfeiting technologies that are in existence and in use very effectively.

In addition to discussing the anti-counterfeiting measures, I hope to hear from both of you, both directors, regarding the stability of the U.S. currency, how we can ensure a strong and stable currency for the American public, through sound Monetary Policy which may also include a discussion of returning to the gold standard; I have a bill that does that, "and not relying solely on the full faith and credit of the U.S. Government," quote/unquote.

Again, I appreciate the opportunity to hear from Director Olijar and Director Ryder on this important issue.

Chairman BARR. The gentleman's time has expired.

Today we welcome the testimony of Director Olijar, who became the Director of the Bureau of Engraving and Printing in May 2015, after serving as the BEP's Deputy Director, from 2012 to 2014.

Mr. Olijar began his career at the BEP 30 years ago in 1988 as a Systems Accountant and rapidly advanced. In 2006 Mr. Olijar was appointed the Chief Financial Officer of the Bureau of Engraving and Printing. Mr. Olijar graduated magna cum laude from the University of Colorado in 1987. He received the Gold Medal Award for the highest score in Virginia on the Certified Public Accountant Exam and scored in the top 1 percent in the Nation. Mr. Olijar resides in Northern Virginia with his wife and two daughters.

We also welcome Director Ryder, who is the 39th United States Mint Director. Mr. Ryder also led the Mint as its 34th Director

from September 1992 to November 1993, during the Administrations of President George H. W. Bush and President Bill Clinton.

Most recently Ryder was the Global Business Development Manager and Managing Director of Currency for Honeywell Authentication Technologies. Previously, Ryder served as the CEO of Secure Products Corporation which was acquired by Honeywell in 2007.

In addition to the United States Mint, Ryder's prior government service included Deputy Treasurer of the United States; Deputy Chief of Staff to Vice President Dan Quayle; and Assistant to Vice President George H. W. Bush. Mr. Ryder attended Boise State University and is married with two children.

Each of you will be recognized for 5 minutes to give an oral presentation of your testimony. Without objection each of your written statements will be made part of the record.

Director Olijar you are now recognized for 5 minutes.

STATEMENT OF LEONARD OLIJAR

Mr. OLIJAR. Thank you. Good morning Chairman Barr, Ranking Member Moore, and distinguished members of the Subcommittee. Thank you for inviting me here today to testify about the many improvements underway at the Bureau of Engraving and Printing.

The BEP produces United States currency notes in Fort Worth, Texas, and downtown Washington, D.C. I am honored to lead BEP. I am proud to say we continue to be very successful at meeting the Nation's and the world's demand for currency.

Demand for U.S. currency remains strong. There are now more than 42 billion notes in circulation with a value of more than \$1.7 trillion and cash in circulation continues to grow almost 5 percent per year. Approximately 7 billion notes have been ordered annually for the past decade.

Up to two-thirds of the value of U.S. currency is held overseas where our currency is the world's currency. It is the most trusted international store value and serves as a hedge against uncertainties, natural disasters, and political turmoil.

In the U.S. the use of cash has been resilient. While several small countries set a goal of going cashless, they have recently recognized that a cashless society presents a significant economic risk and neglects to serve those who do not have access to smartphones, computers, banks, and credit.

I believe the 21st century warfare has a significant cyber component and these countries are now recognizing the risks. If your enemy is able to take down your electronic infrastructure or a natural disaster hits, there will be no way to conduct commerce in a cashless environment, crippling the economy.

The FDIC estimates that 7 percent of U.S. households are unbanked and almost 20 percent are under-banked, as a result over 45 million U.S. households do not have access to the payment systems that are most often used in lieu of cash.

In my 30 years at BEP, the composition of our currency has changed significantly with the addition of complex, covert, and overt security features to address domestic and international counterfeiting threats. It is the development of these security features that drives the timeline for introduction of a new currency series.

I am happy to say that less than one one-hundredth of 1 percent of notes in circulation are counterfeit.

BEP works collaboratively through the Advanced Counterfeit Deterrent Steering Committee, with the Board of Governors of the Federal Reserve System, the Secret Service, and the Treasury Department to develop counterfeit deterrent features for U.S. currency.

Potential features are subject to adversarial analysis at our national labs. The ACD Committee recommends security features and designs to the Secretary of the Treasury, who has final authority.

BEP continues to implement more efficient, cost-effective, manufacturing processes. We develop custom machines that combine four manufacturing steps into one and, now, transition printing \$1 notes from 32-subject sheets to 50-subject sheets and ultimately every denomination will be printed on a larger sheet size.

Other strategic investments include robotic palletizers and new equipment that allows BEP to reclaim good notes from defective sheets. Together these efficiencies have saved us over \$100 million.

Currency production equipment has grown dramatically in complexity and size over the past 20 years. Moreover, the next family of currency will have new overt and covert security features which will require new production equipment to apply.

We are expanding the Fort Worth facility to accommodate this equipment, it will not fit inside the current Washington, D.C. facilities, two obsolete, six-story, multi-wing buildings that have no security perimeters.

We are seeking statutory authority to use the BEP revolving fund to construct a smaller, more efficient, and more secure production facility to replace our existing Washington facilities. Our legislative proposal has strong support from OMB. Director Mulvaney has listed it as a critical priority for the Administration and of course it is budget neutral. A new facility will cost almost \$600 million less than renovating the existing space. It will shrink our Federal footprint by 27 percent and lower operating costs by at least \$38 million annually.

The GAO (Government Accountability Office) looked at the Bureau's most recent facility study and, in a report released this year, GAO's own review and analysis strongly supports the Bureau's recommendation to construct a new facility, in lieu of renovating existing space.

No action has been taken on facility studies over the past 25 years and doing nothing is no longer an option without jeopardizing BEP's mission and the U.S. currency program. Our currency program returns more than \$50 billion a year to the Treasury and is a cornerstone of the global economy.

It is our hope that this committee will support the need for a smaller, more efficient facility.

Mr. Chairman, this concludes my remarks about some of the initiatives of BEP and I will be happy to take questions from you or the committee members.

Thank you for your time this morning.

[The prepared statement of Mr. Olijar can be found on page 34 of the appendix.]

Chairman BARR. Thank you, Mr. Olijar.

Mr. Ryder you are now recognized for 5 minutes for an opening statement.

STATEMENT OF DAVID RYDER

Mr. RYDER. Thank you, Chairman Barr, and Ranking Member Moore. It is a privilege for me to be here today address your concerns.

The Mint performs three primary missions. We produce coins at sufficient levels to meet daily needs of Commerce. We also manufacture numismatic and bullion products as well as safeguard our national assets.

I visited and held town hall meetings in all four production facilities since being appointed Director about 5 months ago.

This workforce is well-equipped, enthusiastic, engaged, and committed. At any one of these facilities you will find safety statistics and a level of morale that rivals the very best in private industry.

Our employees make use of cutting-edge technology in three key production phases: Design, manufacturing, and packaging. Robotic technology has improved production in die manufacturing. While a series of robotic arms boosted proof-coin packaging from 600 to 1,800 units per hour.

By the end of this year we should expect to produce 13.9 billion circulating coins and more than 2.8 million numismatic items. The Federal Reserve demand for currency coins will continue to fluctuate due to economic cycles.

To manage market uncertainty, the Mint has identified and executed state-of-the-art manufacturing processes. Although the unit cost for pennies and nickels is above face value, lean practices have put the Mint on track to return \$250 million to the Treasury General Fund in Fiscal Year 2018.

The Mint is collaborating with the Federal Reserve to explore cost-reduction strategies for the penny. We are also evaluating potential savings from alternative metals with the 5-, 10-, and 25-cent denominations.

Since 1982, Congress has authorized 71 commemorative programs that have generated more than \$522 million in surcharges. In order to continue the success of these programs, I feel that it is necessary for the Mint to work closely with Congress during the legislative development process to identify Commemorative Coin programs that actually work better for our customers.

We are also eager to start a dialog for a successor of the circulating Commemorative Quarter program before the current America the Beautiful Quarters program ends in 2021. Over the past 10 years, the Mint's numismatic customer base has declined from 1.2 million customers to approximately 500,000 today.

The Mint is developing and marketing a sales strategy aimed at increasing awareness and promoting our products much more broadly to our depleting customer base that we need to take care of.

The United States Mint is the world's largest manufacturer of gold and silver bullion coins. Beginning in 2017, demand for both gold and silver bullion coins worldwide slumped dramatically as investors apparently focused on other investments. In the last couple

of months, demand has shown signs of stabilizing. We have adjusted our production levels to be in line with market demand.

I believe that for the foreseeable future, coins will remain important instruments for settling financial transactions. However, with expanded cryptocurrency options on the horizon the importance of their seriousness, studies cannot be underestimated.

The Mint is developing anti-counterfeiting measures for our bullion products. I have assembled a team within the Mint who will develop a multilevel approach including customer awareness, new secure product-packaging features, as well as product integration protections.

As part of the alternative metals research and development, the Mint is actively seeking feedback from industry stakeholders who may be impacted in areas such as vending, parking meters, coin-operated laundry, amusement, public transportation, banking, and supermarkets.

Helping our youth understand the role of coins can be a gateway for financial awareness. The Mint has developed a first-class website at www.usmint.gov. The site contains lesson plans and interactive activities that help kids understand the importance of saving their hard-earned money and enable them to take control of their own economics.

The Mint is privileged to connect America through coins and medals which reflect the remarkable history, values, culture, and natural beauty of our Nation.

Mr. Chairman, I thank you for your interest in the mission of the United States Mint. I will be happy to answer any questions you have. Thank you.

[The prepared statement of Mr. Ryder can be found on page 84 of the appendix.]

Chairman BARR. Thank you, Mr. Ryder for your testimony.

The Chair now recognizes himself for 5 minutes for questioning. Let me start with you Mr. Ryder.

Congress has been prodding the Mint for a decade or more to find a less expensive way to produce circulating coins that could and would co-circulate with existing ones.

Many other countries notably Canada, and the United Kingdom, as I pointed out in my opening statement, figured out how to do this seamlessly and effectively as much as 30 years ago. What is the current status of this effort at the Mint and how much taxpayer money could be saved if the Mint were to move to steel or some other less expensive formulation?

Mr. RYDER. Yes, sir. Thank you for the question.

The Mint is actively and has actively been researching alternate metals. We have identified one particular metal that we call our 80-20 composition, that it is 77 percent copper, 20 percent nickel, and 3 percent zinc. The cost savings of that program would be about \$4.1 million if we introduced that program with the nickel, dime, and the quarter.

Another alternative metal that we are looking at is more of a 50-50 blend. We are in the initial stages of trying to run that product through its courses with the vending machine industry and other stakeholders.

That particular program we believe would save over \$16 million a year in cost savings. It is probably 1-1/2 to 2 years away from being realized but we are endeavoring to undertake those two issues and try to move them out to the general public.

Chairman BARR. Can you take those actions administratively on your own initiative without Congressional action?

Mr. RYDER. It has to be Congressional action. We have submitted through our budget process legislative language that will allow the Secretary to make that decision. I have briefed the Secretary on both of these alternatives and I believe he is supportive.

Chairman BARR. OK. Thank you very much.

Mr. Olijar, the Bureau of Engraving and Printing is on record as seeing constant and improving demand for banknotes at least the next decade, and your testimony talked about the risks associated with electronic transactions.

But others, including the Chicago Fed, believe that externalities including the improving economy and new technologies may work against that particularly in out-years. What is your projection for banknote demand in the near and longer-term, 2-years, 10-years, 20-years, will people still be using as much cash say in 2040?

Mr. OLIJAR. Our projection is that cash is going to continue to remain a viable mechanism for payment and store value.

The challenges that come with payment mechanisms are if there are a significant amount of them, but it really hasn't impacted currency demand to date.

People have a preference for using cash. As I mentioned there is a large, under-banked population in this country, that has a significant preference and has no access to alternative payment mechanisms.

Chairman BARR. Let me move on to the proposal for a new plant. I have looked at the GAO report and they do compliment you in some regards for following good practices and then they have some constructive suggestions for you all as you pursue this idea.

When the plant in Fort Worth was opened, the land, the infrastructure, and the building were donated with the understanding that a large number of good jobs would arrive with the new facility.

My question on this most recent proposal on a new facility is whether or not the Bureau has pursued a similar model for its plans to replace the D.C. facility, specifically whether or not you are looking at States that may be willing to save the Bureau money by donating the lands with the expectation that jobs would be located there and what is the status of that and if you are not pursuing that, a donation concept, why not?

Mr. OLIJAR. To date we have not pursued a donation concept. We are open to pursuing that. The initial look we did with respect to the facility location was existing Federal facilities in the Washington, D.C. area, when we were going to use GSA's (General Services Administration) Exchange Authority.

When GSA put a stop to using the Exchange Authority because they didn't feel that they were receiving value, we decided to pursue a different option.

We are open to looking at pursuing an option like we did with Washington or Fort Worth facility and getting a donated land and facility. Key requirements for us is that we do want to remain on

the East Coast. Primary shipments for us go to the East Rutherford, Federal Reserve Center. We need to be near an airport. But we can put our requirements out and work with GSA to identify anybody that would be interested in donating land and facility.

Chairman BARR. Thank you. I look forward to working with you on ways in which we can make this work for everyone in a cost-effective manner.

My time has expired and so I now yield 5 minutes to the Ranking Member, the gentlelady from Wisconsin, Ms. Moore.

Ms. MOORE. Thank you so much Mr. Chairman.

Thank you, and I appreciate your comments about just the impracticality of going to a totally cashless society because people are unbanked, under-banked, children, and certainly merchants that maybe have pop-up vending products that really would not be able to handle a cashless enterprise.

That being said, I want to just ask a little bit. I noticed from your testimony that you have costed out the price of pennies and nickels and it is one eighty-second of a cent to produce the penny and 6.6 cents for the nickel.

I just want to know with what economists or marketing people, do you consult, with regard to the practicality of getting rid of either the penny and particularly the nickel?

It is one thing to round up or down with a penny but you start rounding out nickels and it will add costs, so to whom do you interface in order to evaluate whether or not it is possible to get rid of a nickel in particular or a penny?

Mr. RYDER. Sure. My primary interface is the Federal Reserve Bank so we have been meeting regularly on this issue, the penny and the nickel. We have had quite a number of meetings. It is my goal, I should say, our goal, to reach a conclusion on what to do with the penny before the end of the year.

It might take quite a bit longer than that to implement whatever plan we do, but in regards to the penny I believe there are quite a number of pennies out in circulation that are not circulating.

One of our goals is to try to get the general public to circulate more of those pennies. The banks that hold them along with the armored carriers that hold them, need to start circulating some of those pennies and not depend on brand new pennies that are coming out of our facilities.

If we can really improve the circulation and get them back into circulation, the cost to produce pennies is going to go down because I would hope to see it go from 7 billion currently to somewhere in a manageable number of the 2 to 3 billion pennies a year to satisfy the Federal Reserve requirements.

Ms. MOORE. The nickel?

Mr. RYDER. The nickel as you said, is correct. It costs more than a nickel to make a nickel. I don't have the authority to disregard the nickel. But again, we will work with the Federal Reserve on measures to reduce cost. Circulation is not as much of an issue with the nickel.

With our alternative metals, I believe we can introduce new metals in the coming years that will reduce that cost significantly and bring it down in line with the cost to produce.

Ms. MOORE. The topic of the need for a new facility, obviously this has been costed out and the current or projected use of coins is factored into that so we can afford a new facility in your estimation?

Mr. OLIJAR. Yes. I believe that we can afford.

One of the criteria driving the need for a new facility is the constraints that exist in the existing facility aren't going to enable us to add the new security features that are going to be coming with the redesigned currency and maintaining the confidence of the currency is the essence of—

Ms. MOORE. But this is with program revenue, not any appropriation from Congress, you can build the facility?

Mr. OLIJAR. That is correct. There would be no appropriation from Congress. We would include it in the billing rates for the Federal Reserve for our currency.

Ms. MOORE. OK. Thank you.

Mr. Chairman, I will yield back my time.

Chairman BARR. The gentlelady yields back.

The Chair now recognizes the Vice Chairman of the subcommittee, the gentleman from Texas, Mr. Williams for 5 minutes.

Mr. WILLIAMS. Thank you, Mr. Chairman for holding this important hearing on the Future of Money in the United States.

Our economy is booming and thankfully Americans are consuming, spending, and saving more than ever before. While we encourage and work to foster this historic growth we must also scrutinize our current systems, keep what is working, reform what is not.

This subcommittee has focused on issues that are important to the American people and most importantly paid close attention to how the Federal Government spends the taxpayer's money. It is my hope that this morning we can have a discussion on the U.S. Mint and Bureau of Engraving and Printing, how they are doing, what are the good things they are doing, and how we can improve upon what they are doing and how we can establish and support best practices for the foreseeable future.

I look forward to this hearing and I appreciate our witnesses being here and in full disclosure, I am from Fort Worth, Texas.

First question, Director Olijar, I am sure many people followed the proposal, removing Andrew Jackson or Alexander Hamilton from Federal Reserve notes. Where does this issue stand?

Mr. OLIJAR. The Secretary of the Treasury has final design authority with respect to United States currency.

At this time, we are focused on the next denominations to be redesigned, which are the 10 and the 50.

Mr. WILLIAMS. OK. It seems though any decision on this subject would be controversial but a decision probably has to be made as part of the banknote redesign schedule so what is the decision or what is the timeline, that you think we will have?

Mr. OLIJAR. Our estimate is that we need a decision with respect to the \$20 note in 2021 to enable us to be in production and introduce a redesigned currency by 2026.

Mr. WILLIAMS. OK. Another question, the United States dollar is particularly strong right now and two-thirds of U.S. \$100 notes are

thought to be circulating overseas, so what is the state of counterfeiting of Federal Reserve notes these days?

Mr. OLIJAR. As I mentioned, counterfeiting today is less than one one-hundredth of a percent of the notes that are in circulation. That said, the significant threat that we face in counterfeiting is the casual counterfeiter has emerged as the primary focus. Those are the folks that are using their personal computer and inkjet printer to scan and print a note.

That is why we are redesigning the currency and coming up with state-of-the-art security features to thwart that.

Mr. WILLIAMS. Will you say is that problem increasing, decreasing, stable?

Mr. OLIJAR. Overall counterfeiting remains relatively stable. But it used to be, that it was large printing shops, it has now become the small individual and a lot more of them are doing it.

Mr. WILLIAMS. You just touched on what I was going to ask you, so is counterfeit produced in specific places or passed more in specific places?

Mr. OLIJAR. Counterfeiters typically target the larger retailers that don't have automated equipment; individual cashiers; small businesses where people aren't as knowledgeable about the currency and don't know the security features to look for in what is there today.

Mr. WILLIAMS. OK. Finally, is the Secret Service still emphasizing an anti-counterfeiting mission the way it once did?

Mr. OLIJAR. The Secret Service, BEP, the Department of Treasury, all work very collaboratively to keep the Nation's currency secure.

Yes, they are aggressively helping us fight counterfeiting, especially in the international markets where you do see the larger counterfeiters.

Mr. WILLIAMS. And also, I will just make a statement because we have touched on the Fort Worth model, if that is what you want to call it, for future expansion, is certainly the way to go. It works does it not?

Mr. OLIJAR. Yes, it works very well. I would love to follow that model and we could actually make some improvements on that model. That was a facility opened—

Mr. WILLIAMS. Maybe bringing more business to Fort Worth?

Mr. OLIJAR. Yes.

Mr. WILLIAMS. Might be an improvement.

Mr. OLIJAR. We are doing a significant expansion in Fort Worth already to accommodate the new equipment.

Mr. WILLIAMS. OK.

And just in closing, Director Ryder, I want to thank you for the experience you bring with the Mint and your views and so forth.

Tell me one more time, before my time is up, what does it cost to make a penny?

Mr. RYDER. Right now, it is about two pennies.

Mr. WILLIAMS. But the nickel?

Mr. RYDER. About 6.3.

Mr. WILLIAMS. Yes. Sounds like you are in the car business.

I want to thank you all for being here, appreciate your involvement.

I yield my time back, Mr. Chairman.

Chairman BARR. The gentleman yields back.

The Chair now recognizes the gentleman from California, Mr. Sherman.

Mr. SHERMAN. Mr. Olijar, impressive results on the Virginia CPA exam.

Mr. OLIJAR. Thank you.

Mr. SHERMAN. We have other countries in the same business, countries like ours, like Japan, the E.U., Canada, Great Britain, what is their smallest unit of paper money in those countries?

Mr. OLIJAR. I am not sure but it is generally above a dollar.

Mr. SHERMAN. I am used to \$2 to \$5 because they have discovered that if you don't have a dollar bill, people will use the dollar coin and they will save a lot of the money that we are talking about here.

Mr. Ryder, I know you are going to be coming up with a report on the penny by the end of the year, my guess is that you won't do it but I am going to suggest that you simply abolish the penny.

It is not currency, it is litter. Literally if a police officer saw me throw pennies on the ground, I would get a ticket for littering and if I tried to pay that ticket in pennies, the judge would be very upset.

There will be the issue that somehow when transactions are rounded, that that would be inflationary or somehow the merchant would benefit.

If you buy something for \$1.98 in a State with a 7 percent sales tax, you are already rounding to the nearest penny, you actually owe the merchant \$2.1186 and it gets rounded to \$2.12 so you are rounding up. If you buy four of those items instead then with sales tax you round down.

The penny has been our lowest unit of currency since 1857, since Lincoln, now he would not throw pennies on the ground and call it litter because back then a penny was worth more than a dollar is today, I believe, certainly well more than 50 cents.

Are you considering abolishing the penny?

Mr. RYDER. No, sir.

Mr. SHERMAN. Would you? Even after that impassioned rhetoric from the gentleman from California?

Mr. RYDER. I actually just this morning off the Metro, picked up a penny. I always seem to pick pennies up wherever I go but it is not my decision to abolish the penny.

I will comply with regulations if and when, but right now it doesn't seem that the American population wants to get rid of the penny. If we had to round, the inclination will be to round up.

Mr. SHERMAN. No. The rules—we round every transaction, in every State with a sales tax, and the computers and before that, little paper charts that the agency I used to run distributed.

We round up or we round down based upon whether it is over 0.5 or under 0.5.

We can certainly mandate by law that if it was exactly half a penny you round down.

Mr. RYDER. My personal opinion I think rounding affects the people that least can afford it and—

Mr. SHERMAN. But every person who can least afford it has their transactions rounded, every time they buy anything, in any State with a sales tax.

Mr. RYDER. True.

Mr. SHERMAN. OK.

Let us see. I will ask your colleague there, what steps you are taking in designing the currency particularly the \$5 bill, the \$1 bill but all currency to make sure that the changes you make are consistent with vending machines that read currency?

Mr. OLIJAR. We are prohibited by statute from redesigning the \$1 note so at this point in time we have no plans for a redesign on that.

With respect to the \$5 note, we have a very active interaction with the BEM, the Banknote Equipment Manufacturing community. We share proposed designs with them. We give them at least 18 months to modify their equipment. We seek their feedback on security features that we add specifically for the Banknote Equipment Manufacturers to use because—

Mr. SHERMAN. This is the same equipment that is used in the vending machines as well?

Mr. OLIJAR. Correct.

Mr. SHERMAN. OK. I would point out that in your testimony you folks are talking about saving \$4 million, saving \$16 million and a million dollars is a lot of money, it sounds like a lot of money but compared to the cost in this economy of having people carry money and coins, of having machines count money, of having vending machines either work or not work, just the psychological cost of having to hire a psychiatrist to talk to you about the incredible anger that you have when the machines won't give you your potato chips. Those costs dwarf the \$4 million and the \$16 million, I would hope.

Is it your mandate to come up with the best decisions for society or just whatever cost your agency the least money?

Mr. OLIJAR. We focus on society. The cost of the electronic transaction and electronic fraud is much more significant than the cost of counterfeiting or the cost borne by businesses of today.

Mr. SHERMAN. Well, yes.

Chairman BARR. The gentleman's time has expired.

The Chair now recognizes the Chairman of the Capital Markets Subcommittee, Mr. Huizenga.

Mr. HUIZENGA. Thank you, Mr. Chairman. I appreciate the opportunity to welcome you here.

Just while we are on this subject that Mr. Sherman was just talking about, how much of a consideration is really given to the equipment manufacturers, vendors, and the folks that utilize these, whether it is coins or paper money, on a daily basis? How much weight is given to their opinions on content as they need to go in and maybe change how a machine would read a coin or read a dollar?

Talk a little bit about that process if you would?

Mr. OLIJAR. With respect to currency, there are a significant number of conferences where we have an opportunity to sit down with the equipment vendors. One of the things that they share with us is the particular version of counterfeit notes that they see

and how their machines are being reverse-engineered so that we can work collaboratively with them to enhance the security of our designs.

We have a very significant outreach to them. They are one of the front line of defenses in fighting counterfeit so we want to work collaboratively.

Mr. HUIZENGA. Mr. Ryder?

Mr. RYDER. With regard to the Mint, we rely heavily on our vendors and machine manufacturers. Behind me there are two gentlemen from Coinstar that have about 17,000 machines in the industry today that count coins and whatnot, in supermarkets.

We also work with many of our other vendors when we are doing metal evaluation of our different products to ensure that the machines work well with our products, they cohabitate well. We depend heavily on those vendors.

Mr. HUIZENGA. That is a pretty dynamic relationship?

Mr. RYDER. Yes.

Mr. HUIZENGA. I know that has been cited, however, in the past, reluctance to move from a paper dollar or \$5 banknote to those coins, changing those systems, but it sounds like those systems are continually reviewed and in demand from the manufacturing side.

I am going to move on to a letter, this is a theme, it is not particularly new, but this is a letter that I had sent in September 2016 to a Comptroller generally, a U.S. GAO and when I had the privilege of chairing this particular subcommittee, talking about the building and the desire at the time to move the Mint.

One of the things I was really quite curious about though was the BEP had foregone at least \$200 million in maintenance on its current D.C. facility and it seems quite a big number and I believe it begs the question of how well all BEP facilities or any new one would be cared for. If you could address that issue?

Then I am curious how did it occur? How did we get \$200 million behind? Was BEP underpricing their services, their printing fee, charges to the Federal Reserve or was the Federal Reserve refusing some of those charges? How did we get \$200 million behind in maintenance?

Mr. OLIJAR. A significant amount of that maintenance actually goes back to being deferred into the late 1990's when I was the CFO of the Bureau of Engraving and Printing.

As I have mentioned we have done three facility studies and prior to making, I will say, significant infrastructure investments we had the hope that we would be able to move forward on a replacement facility rather than continuing to put money into a facility that would not provide us with the operational efficiencies that a new one would give us so we deferred maintenance.

We have done three facility studies in the past 25 years. Our hope is that we can get a smaller more efficient manufacturing facility. The deferred maintenance that we are talking about exists primarily in Washington, D.C. We have not deferred maintenance in the Fort Worth modern facility that we have today.

Mr. HUIZENGA. Yes. Real quickly, my time is running out.

Are we really going to need two factories for banknotes in 25 years?

Mr. OLIJAR. I believe it is in the Nation's interest, as does the Federal Reserve and the Department of Treasury to have two manufacturing facilities for what is the world's currency today. Putting all of our eggs in one basket, presents a significant security risk.

Mr. HUIZENGA. Do you have some third-party studies or anything that could demonstrate that?

Mr. OLIJAR. With respect to security?

Mr. HUIZENGA. Has anybody looked at what that means outside of just internally, both the need for the sheets, the security situation, the entire package of why a second facility would be necessary?

Mr. OLIJAR. GAO did a comprehensive review of our most recent study that was done and they support the need for a more efficient manufacturing facility, in lieu of—

Mr. HUIZENGA. With real indulgence are people going to be able to go tour it?

That is one of the things that we hear from constituents all the times. They want to go and see their money being made and I am curious if that is part of that plan?

Mr. OLIJAR. We haven't gotten that far. There is a great interest in our citizens to see the printing of the Nation's currency and I would hope to entertain them there as well.

Chairman BARR. The gentleman's time has expired.

The Chairman now recognizes the gentleman from Texas, Mr. Green.

Mr. GREEN. Thank you, Mr. Chairman. I thank the Ranking Member and the witnesses for appearing.

I am curious about digital currency and I am curious about it not in the sense of Bitcoin but in the sense of dollars as we know them and coins as we know them. It seems to me that there is a future wherein hard currency and coins won't find as much prevalence as we see today.

Russia is currently looking at a bit currency of a sort, they are calling it the CryptoRuble, I believe. China is doing a similar thing. There seems to be some advantages in digital currency. You have better efficiency. You have immutability. You have transparency. You have portability.

Where are we in terms of looking at the future of currency in the sense of whether there will be a need for the type of tangible currency that we currently have a lot of need for it seems?

Mr. OLIJAR. People have a preference to a tangible currency.

I do not believe that there is going to be a world in which we won't have something that we can hold, touch, and transact.

The challenge that faces a digital currency as I mentioned is that there is a lot of electronic-related fraud going on and that the loss that accumulates related to that type of fraud is much more significant than that encountered from counterfeiting.

Mr. RYDER. My opinion is there is probably a place for it but there is a larger place in society for actual currency that you hold and transact with.

Crypto-type currencies are much more speculative and risky but you are talking to somebody whose parents raised a pretty conservative investor so I am going to stick with currency.

Mr. GREEN. You do understand that I am not talking about Bitcoin. I am talking about a crypto dollar. I am talking about persons who are going to metamorphose from going to the vending machine and utilizing a credit card to make a purchase as opposed to a coin. I am talking about people who want to traverse the country and they want to take \$10,000 with them but they don't want to take it in dollars for fear of many things that can happen along the way.

Why would we not see a world where these people are going to at some point, not everybody will have \$10,000 but everybody will have the opportunity to go to a vending machine and there are other types of machines now that have been converted such that they can use credit cards.

I know that there will be fraud, in anything that we do we have fraud. It is just a fact of life, let us try to minimize it.

Are you saying that there will be more fraud with the electronic currency than we have with tangible currency?

Mr. OLIJAR. I believe that there already is more fraud with the electronic payment mechanisms than there is with currency today, so I would think that would be likely to continue in digital currency.

In addition, there is a very large part of the population that likes the anonymity that comes from using currency in their transactions. There is a government fear. When you take Russia issuing a currency, do you really want to hold that as a stored value?

Mr. GREEN. No. I don't.

As a matter of fact, nor do I want to hold China but what I do want to do is look to the future and sometimes others can get to the future ahead of us. We ought not to conclude that because we have other things that we find that we don't like about Russia, that they may not be ahead of us on some other things. I can think of a few things that they have done ahead of us that we try to catch up with.

But let me just leave you with this. I am just concerned about our not staking out at least a vision, at least start to look at where this may be going without us. I don't care to have people know what I have in my bank account. There probably would be an easier way to find out but I do want to make sure that we don't find ourselves at the tail end of a future that is going to envelop currency.

Thank you. I yield back.

Chairman BARR. The gentleman yields back.

The Chair now recognizes the gentleman from North Carolina, Mr. Pittenger.

Mr. PITTENGER. Thank you, Mr. Chairman. Thank each of you for being with us today.

According to a report by the Federal Reserve of San Francisco, cash purchases amount to only 14 percent of the total value of consumer transactions with the average transaction being only \$21. With this in mind I just want to ask you, is it necessary to continue to produce cash at the rates we have seen over the past decade or so?

Mr. OLIJAR. We have seen no decrease in demand for cash. As I mentioned, it has two uses—

Mr. PITTENGER. Let us say and excuse me but maybe 50, 60 years ago it was close to 100 percent and then we began utilizing more credit cards. Now it is only down to 14 percent.

Mr. OLIJAR. At the same time the overall number of transactions has increased significantly and overall cash demand as I have mentioned, over the past 10 years, has remained relatively stable at 7 billion notes. We don't perceive that other payment mechanisms are going to drive that down at this point in time.

The Apple Pay, the Bitcoin have taken share from checks. Checks have been the primary payment mechanisms that as has suffered a significant decrease in volume.

Mr. PITTENGER. OK.

Some scholars propose eliminating higher value notes because they are heavy-use in tax evasion, corruption, and even terror financing. With this in mind the Europeans had a \$500 note they call the "bin Laden note" because of it's ease of use by terror groups.

I would say that no other transaction provides the same level of anonymity. Understanding this, will it be worth studying a gradual phase-out of our large denominations?

Mr. OLIJAR. The largest denomination that we produce today is the \$100 bill.

Mr. PITTENGER. I understand that.

Mr. OLIJAR. We do have the authority to print 500-, 1,000- or 10,000-notes. I don't think that we could look at doing that. It would have a very adverse impact on Commerce, the \$100 note is increasingly used in transactions.

The higher denomination notes when we stopped printing them in 1969, the \$100 note today is worth \$17 compared to the hundred it was in 1969.

As the level of prices have gone up, the demand and usage of the \$100 note has increased significantly in Commerce and it serves as a stored value internationally.

Mr. PITTENGER. Mr. Ryder, you wish to comment on that?

Mr. RYDER. The Mint, in 2016, produced a little over 16 billion coins. It reduced in 2017 to about 14 billion and we are on track to produce over 13 billion coins this year so it is hovering in that area. The Federal Reserve has been ordering that for the last 10 years.

Mr. PITTENGER. Does the Secret Service and Customs have the tools necessary to identify counterfeit coins and then prosecute those counter-felons?

Mr. RYDER. Yes. The U.S. Mint is taking that issue very seriously.

When I joined the Mint, I created a taskforce of some of the brightest men and women in our facility where we are addressing that issue on a weekly basis.

The Gold bullion coming out of China that is counterfeit is a unique problem from a technology point of view as they are replacing the gold with tungsten. Tungsten has about the same weight as gold, the density and trying to detect that can be difficult but we are looking at technologies to address that issue both from a coining point of view within the metal itself or on the metal as well as packaging.

Recently we have undertaken a new effort with consumer awareness on educating our consumers about what to look for.

Mr. PITTENGER. Thank you. Let me ask you one other question, if I could.

I am told that some countries including China may have truckloads of perhaps counterfeit coins that they maybe would engage us with a mint buyback program.

Are we prepared to ensure that this buyback program that we have is secure?

Mr. RYDER. Yes, sir. We are working diligently with the Office of Inspector General and the Secret Service, to address those issues. I believe we are on top of it and can take care of that issue when it comes up.

Mr. PITTENGER. Thank you very much. My time has expired.

Chairman BARR. The gentleman's time has expired.

The Chair now recognizes the gentleman from Illinois, Mr. Foster.

Mr. FOSTER. Thank you, Mr. Chairman.

I guess I should start out by saying that, as I guess the most senior representative from Illinois, if we are looking at a future where you are thinking about issuing digital currencies, I think I can speak for the entire delegation from Illinois, that that currency must be named for Abraham Lincoln. Just wanted to get on the record on that.

Second, as I guess the only PhD physicists in Congress, if you are looking at methods for distinguishing tungsten from gold, you could look at low-frequency or medium-range gammas and x-rays which have a very, very strong dependence on atomic number and then well, probably with a pretty simple method, generate even a hand-held way of telling the difference there.

Now back to digital currencies. I was wondering what you can learn, or maybe you already studied this, if you look at countries where they have made the transition to having most of the consumer payments be it cashless, payment by cellphone. That I presume is accompanied by a drop in low denomination bills and coins and perhaps a persistence of the higher denominations as they are used for other purposes.

Have you looked at the adoption curves in those countries that have made this rapid transition and factored that into your planning?

Mr. OLIJAR. We have. We are in constant contact with other countries and the mechanisms that they are using to drive efficiencies in the economy. They have not seen a significant increase in demand for the higher denomination notes as a result of that.

The countries that have done the dollarization are very small, homogeneous countries, mostly Scandinavian countries going toward cashless but as I mentioned they are actually moving backward now and trying to make sure that they are serving the population.

Mr. FOSTER. The total demand, particularly low denominations, is not affected when the consumer economy goes cashless, is that what they observe?

Mr. OLIJAR. The demand for—it is the demand for all notes.

Mr. FOSTER. I was talking about the shift. You may actually see a shift, my guess is that the low denominations would become just stored on your cellphone and it is the higher denominations where you want something you can hold in your hand and stuff under the mattress or whatever, do you see anything, have you looked at the difference in the distribution of value that consumers are asking for?

Mr. OLIJAR. It is fairly much across the board when you are going cashless.

Mr. FOSTER. That is interesting. OK.

Is there a general report? If you could, as a response for the record, if there is some review article of what the response is in different countries I would be very interested? Don't do a big internal study on this but if you can pretty quickly come up with some report of what the experiences in countries that are ahead of the curve of the U.S. on cashless economies, it would do everyone some good to see what is coming and look around the corner here a little bit.

Mr. OLIJAR. Absolutely. We can get you that.

Mr. FOSTER. Thank you. I appreciate it. I will yield back.

Chairman BARR. The gentleman yield's back. The Chair now recognizes the gentleman from Minnesota, Mr. Emmer.

Mr. EMMER. I thank the Chair and the gentlemen for being here today.

The United States dollar is particularly strong right now and two-thirds of U.S. \$100 notes are thought to be circulating overseas. What is the state of counterfeiting of Federal Reserve notes these days?

Mr. OLIJAR. The level of counterfeiting remains relatively stable. It is less than one one-hundredth of 1 percent.

In 2011, we unveiled a redesigned \$100 note with a Blue 3-D Security Ribbon. It has been extremely successful in the marketplace. To date, it has not been successfully replicated by the counterfeiters. They are continuing to counterfeit older designs.

Mr. EMMER. I am sorry, they are, I missed it?

Mr. OLIJAR. The counterfeiting is focused on older design notes and we are gradually taking those out of circulation as quickly as we can.

Mr. EMMER. In general, has the counterfeiting been stable since 2011 or just stable on \$100 notes?

Mr. OLIJAR. Overall counterfeiting has been stable. \$100 notes have gone down. Counterfeiters have shifted towards the 50, which is why it is now the second note to be redesigned.

Mr. EMMER. Is counterfeit currency produced in specific places or passed more in certain locations?

Mr. OLIJAR. In the United States, 85 percent of the counterfeits are done with a PC or an inkjet printer and a scanner so there are literally thousands of them and unfortunately across the country where people are generating very small volumes of counterfeit.

Outside the country there are some locations that are hot-beds of counterfeiting.

Mr. EMMER. For instance?

Mr. OLIJAR. For instance, Peru. The Secret Service has opened an office there and they are working very closely with the Peruvian government to combat that.

Mr. EMMER. Are there others or is Peru the outright winner?

Mr. OLIJAR. There are some others that I could share with you. I would prefer not to do it publicly.

Mr. EMMER. OK.

Is the Secret Service still emphasizing the anti-counterfeiting mission the way it once did?

Mr. OLIJAR. As I mentioned, yes. We are working very collaboratively with the Secret Service and the Federal Reserve to keep the Nation's currency secure.

Mr. EMMER. All right.

Mr. Ryder, following a similar line of questioning, in an August 14 interview you are quoted as saying that you have, "set up an internal steering committee at the Mint," which is what you referred to a little bit earlier, that is addressing counterfeiting issues.

Can you give us some more information about the specific mission of this steering committee, who sits on the committee, who runs it and what do you expect the committee to accomplish within the next year? Earlier you were referencing gold bullion and other things but just counterfeiting in general?

Mr. RYDER. Yes, sir. As I said we take counterfeiting pretty seriously.

I spent 25 years in that industry both in the currency as well as the coinage side of the business. Our team at the Mint is mostly operational-type individuals who have knowledge of the makeup of our products.

We meet twice a week or twice a month usually in Philadelphia but we have a pretty good handle on the problem. We are addressing those problems properly with the Secret Service, the Office of Inspector General, on the bullion side as well as the circulating side.

Mr. EMMER. Who sits on it?

Mr. RYDER. I am sorry?

Mr. EMMER. Who sits, so how many people do you have on this committee?

Mr. RYDER. About 12 members on our steering committee, mostly members of the Mint.

We are getting ready to have a Vendor Day at the Mint where any vendor who has an anti-counterfeiting technology can come to the Mint, present to us and it is our hope to select the best of the best that particularly pertain to both our packaging and our certificates of authenticity, as well as entertaining some pretty smart people with regard to the physics of what we might be able to do within the metal itself.

Mr. EMMER. Do you run this committee personally or you have somebody else running it?

Mr. RYDER. I run it.

Mr. EMMER. In the last few seconds I have left for both of you, are there additional authorities that Congress should provide to aid your efforts to combat counterfeiting?

Mr. RYDER. You are doing a great job as it—

Mr. EMMER. We don't hear that every day.

Mr. RYDER. No. But as I have had several letters in this regard, it keeps us on our toes. If you find a problem out there in your districts, any of you, it is good that you let us know either verbally or in writing and we will address it.

Mr. OLIJAR. Currency is a counterfeiting game and we greatly appreciate your support in the anti-counterfeiting mission we have.

Mr. EMMER. Thank you both.

I see my time has expired.

Chairman BARR. The gentleman's time has expired.

The Chair now recognizes the gentleman from West Virginia, Mr. Mooney.

Mr. MOONEY. Thank you, Mr. Chairman.

It is good follow up to my colleague's comments about counterfeiting.

Your predecessors have not incorporated anti-counterfeiting technologies into U.S. coins, minted of precious metals. My efforts to press your agency on this inaction has been met with responses suggesting, you have not had that many complaints or see a large problem.

But in my meetings with law enforcement, I know the Secret Service and U.S. Customs and Border Enforcement have been dealing with many cases and would certainly like more assistance from the U.S. Mint.

Other than providing ongoing cooperation with investigations, one thing the Mint can do is adopt the types of anti-counterfeiting technologies that other sovereign mints have adopted long ago.

I have had a demonstration of one of these in my office. This technology is called a "PAMP VeriScan" and it seems to work great, so when will the U.S. begin to address these problems and implement these types of security standards?

Mr. RYDER. I believe we are adjusting to them now, I am very active in this area.

Finding a solution for the bullion problem is an interesting problem. I have talked recently to a very bright physicist who has some very interesting ideas about how to resolve that at a relatively inexpensive cost but from a technology point of view, it is very robust.

Our team at the Mint is addressing many of the issues that you are speaking about and we will continue to do so.

Mr. MOONEY. OK. I look forward to working with you. I appreciate your comments earlier that if we hear problems we pass it on to you and so that is what I am doing.

It is important we do that. It is in the Constitution that we have the right to do that, the duty to do that.

Mr. RYDER. Yes.

Mr. MOONEY. Unlike a lot of things government does, that is actually in the Constitution and I would just comment as an aside to my colleagues on the other side of the aisle, who are complaining about the value of the penny, it is the inflationary practices of the Fed that we should stand up to because those inflation costs have devalued the penny greatly over the years.

The Fed's goal is 2 percent. It is been higher than that many years so, yes, the penny is worth a lot less and my constituents, many of whom save and are the ones that you mentioned, Director

Olijar, about folks that are not highly banked and I are just saving their pennies and their dollars, they are the ones who were hurt by those inflationary prices so maybe we should keep that in mind as we complain about the value of the penny, to my colleagues on their side of the aisle.

Another question however is, the IRS currently classifies these precious metals and coins as collectibles like Beanie Babies and baseball cards and then requires taxpayers to report capital gains, which are taxed at a discriminatory high collectibles rate of 28 percent.

My view, which is backed up by language in the U.S. Constitution, is that gold and silver coins are money and indeed these American Eagle coins are legal tender.

If they are indeed U.S. money, it seems there should be no taxes on them at all so why are we taxing these coins as collectibles?

Mr. RYDER. That is a very good question. It would help our investor community, collector community if it weren't taxed.

Obviously, it is not my decision, but it is something that we deal with, but again there is not much I can do about it.

Mr. MOONEY. OK. I see my colleague Frank Lucas is here so we have been working on this issue and appreciate seeing you and I am glad you are here to ask some questions.

I will ask you one more before I finish here. I understand from my meetings with law enforcement that one hurdle in getting counterfeit prosecutions pursued is the statutory threshold of the \$10,000 in value.

Gold Eagles have a face value of \$50; however, as a direct result of the Federal Reserve's inflationary policies over many decades, the market value of the gold contained in a single one-ounce Gold Eagle is now worth about \$1,200 so \$10,000 in face value of these coins is worth about \$240,000 at current gold prices.

Shouldn't the statutory threshold be modified so that prosecutors can look at actual values involved in these frauds and therefore pursue more cases and leads?

Mr. RYDER. It is something probably they should take a look at.

Mr. MOONEY. OK. Thank you.

Mr. Chairman I will go ahead and yield back the balance of my time.

Chairman BARR. The gentleman yields back.

The Chair now recognizes the gentleman from Arkansas, Mr. Hill.

Mr. HILL. I thank the Chairman. Thank you for conducting this hearing. It is good to have our leaders from the Mint, the Bureau of Engraving with us today.

First of all, I know you have addressed this but I was not in the room, I would like to talk a little bit about the proposed facility you are considering in the Bureau of Engraving here in the Beltway.

Is there no way to expand the facility in Fort Worth to increase capacity and thereby not build another facility here? That is question one.

Question two is, are you using the same approach which is donated land and treating it in the same manner you did when you built the facility in Fort Worth back in 1986?

Then, third I would say, what cost-benefit analysis it requires?

I understand the part about expensive property here in Washington, D.C., higher and better use, old facility but I am real interested in this issue of could you just do it by expanding in Fort Worth or are you required from a safety point of view to have two production facilities?

Thank you very much.

Mr. OLIJAR. That is the primary driver for two facilities, it is in the Nation's and the world's interest that we have two manufacturing facilities. Putting all of our eggs in one basket presents a significantly high risk. That is one of the reasons that the Fort Worth facility was constructed so that we had two manufacturing facilities.

When the facility in Washington, D.C. faced a threat from the airliner that went down on the 14th Street Bridge, we had to look at that as a very significant economic threat to the country. I want to make sure that we can meet the Nation's and the world's demand for our currency.

Mr. HILL. Who supervises construction on a Treasury project like that?

Mr. OLIJAR. We don't have the expertise internally to do that type of a construction. We would work with either GSA or the Army Corps of Engineers to supervise the production. It is well beyond our capabilities.

Mr. HILL. Thank you.

For the facility location here, are you going to use the same approach you did in Texas on considering an economic advantage to Maryland or Virginia and ask for donated land and State support for that construction?

Mr. OLIJAR. We are considering going out and asking to see what type of land and facility would be provided to us.

Mr. HILL. Thank you. I appreciate that.

I noted in the preparation for the hearing, there was some interest that the Bureau might propose conducting your high-quality engraving, printing for non-Federal customers. Can you tell me about that?

Mr. OLIJAR. Yes, yes. A coalition of the States has approached us to get secure documents, I think birth certificates done. There is no capacity and capability to do that in the United States today. The States have reached out to Canada to get their secure documents printed. We have the capability. We could do it without having any impact on our core mission and would incorporate the necessary security features that they are looking for.

Mr. HILL. I presume that is because as the bond and stock market has gone electronic, we have no private engraver, printers left in the United States?

Mr. OLIJAR. That is correct. No large scale.

Mr. HILL. Thank you very much.

Mr. Chairman I appreciate the time and I yield back the balance.

Chairman BARR. The Chair now recognizes the gentleman from Ohio, Mr. Davidson.

Mr. DAVIDSON. Thank you, Chairman. Thank you both for your time here today and the work you do on behalf of our country.

I am curious if we look at the problem Director Ryder, with the counterfeit bullion coins coming into the country, do Secret Service

and Customs have adequate tools to detect the counterfeits? Do they have adequate legal authorities? Are there changes that need to be made and if so what might we do to address that?

Mr. RYDER. I don't think that Customs, based on the problem that we have, has the right tools because I don't think the tools exist to easily authenticate the difference between an authentic bullion coin or one that has been incorporated with tungsten particularly.

If it is simply a counterfeit coin that is made of gold, they have the capabilities of addressing that issue but the tungsten issue is an interesting problem and it is difficult to manufacture an inexpensive detector, when I say inexpensive, something less than say \$5,000 that can do the job.

We currently have quite a number of those types of devices in our facilities and they do not detect the tungsten without destructive testing.

Mr. DAVIDSON. Have you put out an RFI? DARPA, for example, funds defense projects when, gee, I wish there was a technology solution to this and they solicit proposals. Have you solicited proposals from the commercial sector for innovators whether they are PhD candidates or existing companies to try to solve this problem?

Mr. RYDER. We have. I have sat down with a number of companies to talk to them. As I said earlier, we are going to have a Vendor Day to allow anybody who might have something, come and talk to us.

I have talked to NASA particularly with some of their scientists about some of the things they might be doing but it is something that is ongoing, is something that we have to address.

Mr. DAVIDSON. Thank you. And, one of the other challenges of course, when you have cash or coins, is they do store value, they are the legal tender of the United States of America but sometimes people lose them. When you lose them they are gone or cash and coins, are they used for illicit finance?

Mr. RYDER. In a number of cases, yes, they are.

Mr. DAVIDSON. Do people launder money—

Mr. RYDER. Absolutely.

Mr. DAVIDSON. With cash? OK.

Many of these same objections are raised about cryptocurrencies or crypto assets of various types and as we speak about those, how much cash could you store inside this phone case?

Mr. RYDER. Quite a bit.

Mr. DAVIDSON. If it were digitized, you could store quite a lot but in a similar package, you really would not be able to carry much value. If you had gold coins or melted this and turned it into a piece of gold but that is not what we print in the Mint, we print currency and coins, paper currency.

There is a demand in the future for crypto out there and the question is, will there be intermediaries like currently, Visa and MasterCard, or cryptocurrencies, whether it is Bitcoin or one of the numerous other coins that are out there, seeking to become currencies?

Recent reports have cited that demand for investor-grade bullion coins has decreased and perhaps some of that decrease is accounted for due to demand for Bitcoin or Ether or XRP because they are

an emerging asset class and present opportunities for investor to store values.

Do you see a correlation between the rise in demand for these cryptocurrencies and decline for bullion?

Mr. RYDER. There are two different customer bases, two different people who have two different agendas.

The bullion products have been selling quite a bit in reduced numbers in the last couple of years mostly because investors have taken on different types of investments.

We have seen a rise in the last 2 or 3 months where we have seen a slight increase from an investment point of view.

But as I said, I believe the crypto-type investments are built for specific investors who have specific investment goals.

Mr. DAVIDSON. OK. My time has expired.

I look forward to following up with you on additional items.

I yield Chairman.

Chairman BARR. Thank you.

The gentleman yields back.

The Chair recognizes the gentlelady from New York, Ms. Tenney.

Ms. TENNEY. Thank you, Chairman Barr.

I really appreciate the panel for being here today.

Obviously the jurisdiction of this committee is to give oversight over the institutions that produce our currency and aid in facilitating our everyday commerce.

I have a question, just jump right to it, is, according to the bipartisan study from the Dollar Coin Alliance in Canada, approximately 10 percent of our population saved \$450 million over the first 5 years of moving to a coin-base as opposed to the dollar bill.

Can you tell me what your opinion is on that happening, Mr. Olijar, first and then Mr. Ryder either way? I would like to hear from both you, what is your opinion on that, particularly referring to the Currency Optimization, Innovation, and National Savings Act. Let me just clarify, a study on the penny and then moving to the coin similar to Europe and Canada, if you could tell me what is your opinion, it says there is going to be a cost savings, is that true? Can you give me a little quick pro and con just for a few seconds there?

Mr. OLIJAR. The American public obviously loves the dollar bill and prefers to use that in commerce. Treasury's policy is that the note and the bill co-circulate and given a choice, people significantly prefer the paper note.

The analysis that GAO did of the conversion shows that after 10 years it would be a net cost to the U.S. Government of over \$500 million of making that conversion.

Ms. TENNEY. How about giving, Mr. Ryder, do have an opinion?

Mr. RYDER. Yes. As the chairman mentioned in his opening statement, one of the issues that has constantly plagued the dollar coin is reluctance to remove the dollar bill.

Ms. TENNEY. Yes.

Mr. RYDER. The two just haven't co-circulated. Currently there are 1.1 billion-dollar coins in the Federal Reserve storage vault and in our storage vaults, and that equates to about a 14-year supply, if we use 80 million coins a year.

The program as designed hasn't worked.

Ms. TENNEY. Yes. It is interesting because the GAO says that savings would be about \$4.5 billion over 30 years. That is pretty significant when you realize the paper version lasts about 5.8 years and the coin lasts longer.

I know when I was in Europe and you get the coin, as an American citizen we are so used to having the dollar bill but actually you find the coin is pretty convenient.

Maybe your point is right, maybe if the Americans didn't have the choice maybe they would actually decide they liked the dollar coin better. That is up for debate at this point.

But I am thinking as you are advocating for, and I am looking at the GAO on renovating the new site, that you are proposing, would be \$2 billion but then a new site, which would be higher technology, as you advocate, would be \$1.4 billion so there would be a savings.

If we did move to the dollar coin, wouldn't that actually take care of some of the savings on building the building that you want to build? Technically we could save money that way if we are looking at a fiscally conservative message.

Mr. OLIJAR. I don't think it would have a significant impact overall, if you eliminated the dollar bill, the demand for the \$2 note would most certainly go up and as it exists today the \$1 note is only about 14 percent of our volume.

Ms. TENNEY. OK. I know you have answered this before but I missed it, could you just tell me again what your opinion is on eliminating the penny, is that something you would advocate for or not Mr. Olijar first?

Mr. OLIJAR. I am agnostic.

Ms. TENNEY. OK.

Mr. OLIJAR. I am a coin collector so—

Ms. TENNEY. Oh, there you go.

How do you feel about challenge coins, they are out there—

Mr. OLIJAR. Love them.

Ms. TENNEY. We could be making those.

Mr. Ryder, what do you think?

Mr. RYDER. No. It is not the intention of the Treasury Department to eliminate the penny, our intention is to try to create programs to increase circulation of pennies that are currently out there.

Ms. TENNEY. Yes.

Mr. RYDER. If we can do that effectively with the Federal Reserve's assistance, I believe we can reduce the penny production by approximately 2 to 3 billion per year.

Ms. TENNEY. The savings?

Mr. RYDER. 2 to 3 billion demand for—

Ms. TENNEY. Demand? OK.

How much in savings would that be to the taxpayer?

Mr. RYDER. Probably in the neighborhood of \$20 million, \$25 million.

Ms. TENNEY. Twenty-five million annually?

Mr. RYDER. Potentially.

Ms. TENNEY. OK. That is better than nothing.

Mr. RYDER. Yes ma'am.

Ms. TENNEY. Thank you. I appreciate your comments.

Thank you. I yield back.

Chairman BARR. The gentlelady yields back.

The Chairman recognizes the gentleman from Oklahoma, Mr. Lucas.

Mr. LUCAS. Thank you, Mr. Chairman. I apologize for being late. This is also Farm Bill Conference morning, so kicking off with the esteemed other body to start the process to address that.

To both directors, I apologize for being late and have arrived way into the discussion so just for the sake of conversation, you mentioned that 14 percent of the paper currency printing is the \$1 bill.

Of the volume of Mint production what percentage in dollar value or tonnage, however you want to describe it, Mr. Ryder, what percentage is the one-cent piece?

Mr. RYDER. Currently the one-cent is about 8.4 billion compared to the five-cent which is 1.3; the dime is 2.4 billion; the quarter-dollar is at 1.9, for a total of about 14 billion coins produced.

Mr. LUCAS. More than slightly half of the production of the Mint at current levels would be one-cent pieces?

Mr. RYDER. Correct.

Mr. LUCAS. OK. Fair enough.

As my colleagues discuss these issues of course, I think back to the historic beginning of both your institutions. Mint, 1790's, Bureau of Engraving and Printing, 1860's so to speak, and the goal of both institutions reflected the time. And for the benefit of some of my colleagues here, the original Mint Act of 1792, the goal was to make sure that the coins produced at the Mint, the material in that coin reflected the value of the coin at the time.

A one-cent piece was a big old chunk of copper. From 1793 to 1857 we made half cents, we did all sorts of stuff like that and with time and commerce and the focus, things change. We went from big old giant one-cent piece to the present coin that we all think of, of course. Just as on the paper side, we went from those rather large banknotes prior to 1929, to the size we use now. Nothing has ever set in stone and the goal is to reflect the needs of commerce and of the industry.

It would seem to me that, even though as some of my cohorts discussed, Bitcoin and the other electronic types of currency or even the more traditional use of debit and credit cards and that sort of stuff, obviously from the production levels that both of your institutions are engaged in, there is still a need for the physical commodity, the consumer still wants the physical commodity so it is important that we maintain that.

I would suggest that at some point, I believe we need to assess in both currency and in coins what we have. We don't make half-cent pieces anymore. We don't make half-dimes anymore. We went off the Gold Standard. We don't stamp out gold coins anymore.

We released into general circulation the last standard silver dollars in 1960, to 1963, somewhere along that period of time so, at some point, we need to have a piece of legislation, I believe, that addresses the denominations, the makeup, and the size, a comprehensive review and our neighbors around the world have done that. But that is a different day.

A number of my colleagues have stressed the importance of the bullion coin programs and counterfeiting and that is an issue not

just with the bullion coin programs but as the value of the historic coin issues for say the Mint have gone up, the tendency and the focus on counterfeiting those two are there also.

Can you explain, each of you from your own perspective, what you believe is the greatest challenge you face, is it production volumes, is it your old facilities, is it maintaining the integrity of the products you produce, that is an open-ended question?

Mr. OLIJAR. For me at the Bureau of Engraving and Printing, the greatest challenge that we face is keeping the Nation's currency secure.

As I have said, there are counterfeiting threats that we face around the world today and our paper currency is really a confidence-game and we need to maintain people's confidence in our currency in order to continue its usage as a store value and in commerce.

Mr. LUCAS. This is not an appropriate question for you but my understanding is more a Federal Reserve question, don't we have more \$100 bills outside of the United States physically than we have inside the United States?

Mr. OLIJAR. Yes. It is estimated two-thirds of them circulate outside this country, yes.

Mr. LUCAS. That says something about the store value that our paper currency represents and am I fair to say too that we are one of the few countries, if maybe not the only country, in the world where if I go to a bank with a product that you printed and the Treasury issued in 1863, it cashes just the same as if I pull out a brand-new \$1 bill that came from D.C. or from Fort Worth, unlike most of the world that recalls currency and cancels currency?

Mr. OLIJAR. That is correct. We have never devalued and or dis-denominated our currency. I would say good today, good tomorrow, good forever, that is what the United States say.

Mr. LUCAS. Everybody on the planet wants it under their pillow, if they want a nest egg.

From the Mint perspective, again the products that you have issued, your institutions issued since 1793, 1792, all still legal tender, all still spendable, tell me about the challenges you face?

Mr. RYDER. I agree with Len, counterfeiting is an issue that we have to address. That is something we take very seriously.

On the numismatic side of our business, our customer base has dwindled. When I was Mint Director in 1992, we had a customer base of around 2.7 million, today it is around 500,000.

Working with Congress to create some new innovative projects from both the bullion and the numismatic side would be of great interest to me.

Mr. LUCAS. Would the Chairman indulge me for 1 more minute?

One of the comments that I get direct from the general public, on the occasions that these topics come in, they point out how from basically the mid-1960's until the early 1980's there were very few products available to the consumer out there from the Mint, other than just the standard-issue products, the proof sets, the Mint sets, and the things that went through commerce.

Since the 1980's the number of products, the number of metals, the number of different pieces, I occasionally get comments about

how deep one's pocket would have to be if you wanted a complete set.

Do you think that is a fair observation from the public?

Mr. RYDER. Yes. I believe that over the years, there have been quite a number of products legislated that we have had to manufacture, that haven't been that successful.

Mr. LUCAS. It is a fair observation, you only make what we authorized or insist you make?

Mr. RYDER. Correct.

Mr. LUCAS. That issue is shared by this side of the table?

Mr. RYDER. With the exception of some of our bullion products that sell quite nicely, a new 9999 bullion product, the Buffalo program, a Palladium program that was authorized by Congress. The Secretary of Treasury has certain authorities to be able to do certain things. The majority of the products are legislated but I would really look forward to working with the Congress when we are drafting that type of legislation to work together to create legislation that makes a bit more sense from the consumers' point of view creating more of a rarity, creating different programs.

I would love to see the next Quarter programs to be more of a sports-related type of product to follow the America the Beautiful program which generated almost 72 million.

Changing that in 2021 with the help of Congress would be a very interesting challenge but very rewarding for our customer base.

Mr. LUCAS. Mr. Chairman, there is not enough time left in this session of Congress to address these issues, but this is perhaps something we need to, as an institution, look at in the coming year or 2, the overall process completely.

Chairman BARR. I thank the gentleman for his suggestion.

Mr. LUCAS. I yield back.

Chairman BARR. Thank you. The gentleman yields back.

I appreciate the gentleman's suggestion and I will be happy to work with him to pursue that.

If the witnesses would indulge me for one final round of questions, I just wanted to follow up on a few points and since we were on the subject of the declining numismatic customer base, I did want to ask why that is the case to Mr. Ryder.

Why do you think that is the case especially given the success of the America the Beautiful Quarters program and do you count the Commemorative Coin programs or the America the Beautiful Quarters program as part of that new numismatic customer issue?

Mr. RYDER. It is the primary reason in my opinion. In the last 10 years, the Mint was not given authority to spend any money on marketing our products globally.

I am trying to change that around to get more allocation of funds from the Treasury Department to spend on important advertising of these programs which is another one of my priorities.

Chairman BARR. You may have already answered this question, but from the start to the projected finish of the America the Beautiful Quarters program, what is the total seigniorage that will be produced as a result of that program as a result of coin collectors pulling those quarters out of circulation for keep-sake?

Mr. RYDER. That is a good question and I don't know the specific answer.

The total revenue that we generated on that program after cost and whatnot was about \$72 million.

A new program that is coming up now, the American Innovators program which is a Dollar-Coin program, we are hoping to generate total revenue in this neighborhood of \$350 million.

But that is going to be a brand-new program but I would stress that the America the Beautiful Quarters program expires in 2021, and I would really like to work with the Congress to create a new program going forward after 2021 that would inspire young collectors and whatnot with the right theme to get back into the coin collecting community and raise our revenues that much more.

Chairman BARR. Some numismatists in my district came to me with an idea that ultimately manifested itself in legislation I introduced a couple of Congress' ago, we called it the "American Liberty Coinage and Deficit Reduction Act," and that bill proposed to direct the Mint to, on every other year, instead of having the head-side of the coin reflect Statesmen from the past, not pulling those off of the coins, but keeping them in every other year, but in every other year going forward putting a symbol of liberty on the coin.

The idea was that this could create additional collectors. It could attract more seigniorage.

Is that an idea that would appeal to you or that you would consider going forward?

Mr. RYDER. Absolutely.

We are going to introduce another Liberty product in 2020 or 2019 I believe it is, but I like the theme that you have on that piece of legislation, Liberty.

In my opinion, Liberty comes in a lot of different forms, that encompasses the United States of America and it could be anything from the Statue of Liberty to a starburst of fireworks, there are a lot of things that, from a design point of view, we could put in that program that would generate interest going forward for the collector community.

Chairman BARR. Yes. The legislation specifically referenced celebrations of American Liberty; the Union; American values; attributes of freedom; independence; civil governance; enlightenment; peace; strength; equality; democracy; justice; those concepts could be used to generate additional interest and maybe help increase the numismatic customer base to address that issue that you mentioned.

Mr. RYDER. Absolutely.

Chairman BARR. I would love to work with you Mr. Ryder on that issue.

Our time has expired today but, would the gentleman like to ask another question, in my remaining time?

Mr. LUCAS. No Mr. Chairman. Just to offer and an observation there.

Chairman BARR. Sure.

Mr. LUCAS. One of the important things about our coinage, which sometimes we forget in the day-to-day commerce, this is something that as societies, as countries that we took up on this planet 2,500 years ago, and in many ways there are images of leaders, images of concepts from the ancient times, that only exist because they were incorporated as a coinage theme, so we should always be ar-

tistically mindful about the legacy that we leave when we produce things.

We are not just stamping out pieces of metal, we are leaving a statement for all time, about who we were and what we are, so the artistic element always must be factored into our coinage and engraving programs.

Thank you, Mr. Chairman.

Chairman BARR. Well said. I couldn't agree with you more. I appreciate your passion and interest in the issue. It is very important.

We appreciate the service of Mr. Olijar and Mr. Ryder and for the work of the thousands of public servants who work for your Bureaus, we appreciate every single one of them for their work and for their service to our country.

The Chair notes that some Members may have additional questions for this panel, which they may wish to submit in writing. Without objection, the hearing record will remain open for 5 legislative days for Members to submit written questions to these witnesses and to place their responses in the record. Also, without objection, Members will have 5 legislative days to submit extraneous materials to the Chair for inclusion in the record.

Once again, I want to thank our witnesses for their testimony today.

This hearing is now adjourned.

[Whereupon, at 11:48 a.m., the subcommittee was adjourned.]

A P P E N D I X

September 5, 2018

STATEMENT OF LEONARD R. OLIJAR

Director

Bureau of Engraving and Printing

United States Department of the Treasury

before the

Financial Services Committee

Subcommittee on Monetary Policy and Trade

United States House of Representatives

September 5, 2018

Good morning Chairman Barr, Ranking Member Moore, and distinguished members of the subcommittee. Thank you for inviting me to testify before you today about transformative initiatives underway at the Bureau of Engraving and Printing (BEP).

As you know, the mission of the BEP is to develop and produce United States currency notes that are trusted worldwide. BEP's vision is to maintain its position as a world-class securities printer, providing our customers and the public superior products through excellence in manufacturing and technological innovation.

Cash Demand

The demand for United States currency remains strong. There are now more than 42 billion notes in circulation, with a value of more than \$1.7 trillion – more than ever before, and cash in circulation continues to grow almost 5% per year. Approximately 7 billion notes have been ordered annually for the past decade. According to the Government Accountability Office, “the volume of U.S. currency notes in circulation increased by 43 percent from 2008 to 2016.” Up to two-thirds of the value of U.S. currency is held overseas, where United States' currency remains the world's currency. It is the most trusted international store of value, and serves as a hedge against uncertainties, natural disasters, and political turmoil. Any time there is political instability, the rush is on for United States currency. Over the past several years, the frequency of cash use remained unchanged; approximately 32% of all transactions, and more than 50% of all transactions under \$25 are done in cash, in spite of the availability of other forms of payment.

In the past five years, several small countries have set a goal of going cashless. However, more recently, they have recognized that a cashless society presents a significant economic risk and neglects to account for those who do not have access to smart phones, computers, banks and credit. I believe that 21st century warfare has a significant cyber component, and these countries

are now recognizing the risk – if your enemy is able to take down your electronic infrastructure, or if a natural disaster hits, there will be no way to conduct commerce in a cashless environment, and the economy will be crippled. With respect to access to financial institutions, seven percent of U.S. households are unbanked, and almost twenty percent are underbanked. As a result, over 45 million U.S. households do not have access to the payment systems that are used in lieu of cash. Like other nations, our duty to serve this portion of the population is a factor in slowing any move to a cashless economy.

Overview

The BEP was established and began producing currency in 1862 through statutory authority conferred upon the Secretary of the Treasury. 31 U.S.C. §§ 321(a) (4) and 5114 authorize the Secretary of the Treasury to engrave and print currency and security documents for the United States Government, and this authority has been delegated to BEP. In addition to printing Federal Reserve notes for the Federal Reserve System, the BEP also produces miscellaneous products and security documents at the request of other federal agencies. As the security printer for the United States Government, we also provide technical assistance and advice to other federal agencies in the design and production of security documents, which because of their inherent value or other characteristics, require counterfeit deterrence. The BEP reviews cash destruction and unfit currency operations at Federal Reserve Banks. The BEP has authority to produce currency, postage stamps, and other security documents for foreign governments as well, per the Intelligence Reform and Terrorism Prevention Act of 2004, (Pub. L. No. 108-458, Title VI, Subtitle D, § 6301(a); 118 Stat. 3638, 3748 (Dec. 17, 2004)). BEP is also seeking authority to provide these secure documents for state and local governments. As a free service to the public, the BEP also processes claims for the redemption of mutilated paper currency (31 CFR, §§ 100.5 – 100.9). In FY 2017, the BEP redeemed 20,602 mutilated currency cases valued at \$40,449,496.00. Other BEP activities include manufacturing inks and engraving plates and dies.

BEP operations are financed by means of a revolving fund, which was established in 1950 in accordance with Public Law 81-656. This fund is reimbursed through product sales for direct and indirect costs of operations, including administrative expenses. In 1977, Public Law 95-81 authorized the BEP to include an amount sufficient to fund capital investments and to meet working capital requirements in the prices charged for products, which eliminated the need for annual appropriations.

The BEP has a diverse workforce of approximately 2,000 employees and contractors and two facilities, one operating in Washington, D.C. (DCF) and the other in Fort Worth, Texas (WCF). Both facilities are capable of producing all banknote denominations. As this nation's sole currency manufacturer, the BEP produces Federal Reserve notes based on an annual currency order received from the Board of Governors of the Federal Reserve System. On average, the

BEP has produced seven billion notes per year for the past five years. The Fort Worth facility typically produces about 60 percent of the annual production order, while the Washington facility produces the other 40 percent and conducts the majority of research and development associated with currency production and security features.

Currency Redesign Program

The primary reason Federal Reserve notes are redesigned is for security. As the world's currency, we face domestic and international threats, thereby focusing our redesign on addressing and combatting current and emerging counterfeiting threats, not aesthetics. The currency redesign timeline is driven by security feature development; and the redesign sequence for the denominations is driven by the security threats.

Securing U.S. currency requires strong designs, aggressive law enforcement, and an educated public. The BEP works collaboratively through the Advanced Counterfeit Deterrence Steering (ACD) Committee with the Board of Governors of the Federal Reserve System, the United States Secret Service (USSS), and the Department of the Treasury to improve the counterfeit deterrent features in Federal Reserve notes.

When deliberating the various options for the next denomination to be redesigned, the ACD Committee engages in a detailed analysis consisting of a counterfeit threat assessment, the state of security feature development to counter such threats, production capabilities and complexities, societal issues, relative use of various notes in transactional commerce, and impact on consumers and banknote equipment manufacturers. The ACD Committee recommends new Federal Reserve note designs to the Secretary of the Treasury, who then makes final design decisions.

Currency notes contain an array of counterfeit deterrent security features, some of which are visible and easily recognizable to the public (micro-printing, raised printing, watermarks, security thread and color shifting ink) and some of which are covert or machine-readable only. Notes also include a digital counterfeit deterrent system that was developed under the auspices of the Central Bank Counterfeit Deterrence Group (CBCDG) to thwart digital counterfeiting. The CBCDG digital counterfeit deterrent system, which is being used in a number of countries, relies on a hidden marker embedded in the note's design that can be read or detected by software deployed in digital printers. Due to these cutting-edge features, the overall level of counterfeiting remains low; less than one one-hundredth of one percent of notes in circulation are counterfeit.

To stay ahead of the threats to our currency from increasingly sophisticated reprographic technology, the U.S. Government must continuously develop new currency designs with state-of-the-art security features. While the level of counterfeiting is low, BEP must continually develop

new security features and currency designs to be ready to respond to current and emerging counterfeiting threats.

The most recent redesign series or next generation (NXG) notes, were marked by the reintroduction of color, and introduced into circulation beginning in 2003. On April 21, 2010, the U.S. Government unveiled the last banknote in that series, the NXG \$100 note, which included innovative, new public security features, including the 3-D Security Ribbon which has been very successful in deterring counterfeiting of that denomination.

Today, the BEP is developing security features for a new series to continue to deter counterfeiting threats. In 2013, the ACD Steering Committee decided that the \$10 note would be the next note to be redesigned (expected completion in 2026), followed by the \$5 (2028), \$20 (2030), \$50 (2032-2035), and \$100 (2034-2038) notes pending any new developments in counterfeiting threats or technology issues. The success of the redesigned NXG \$100 in thwarting counterfeiting, and the increased use of the \$50 note in ATMs, has made the \$50 note a more frequent target of counterfeiters. As a result, the ACD Committee has recommended that the \$50 note be redesigned sooner than originally planned. The BEP and the Federal Reserve Board are working together to accelerate its redesign, with a focus on security feature development.

Once production is underway, the Board of Governors of the Federal Reserve System, as the issuing authority, will determine the actual issue dates for the redesigned notes.

Innovations

BEP is officially registered to the ISO 9001:2015 standard for Quality Management Systems for the development and production of US Currency and the ISO 14001:2015 Environmental Management System standard, which means that BEP's processes and manufacturing operations conform to and/or exceed international quality standards. BEP is consistently thinking outside the box to develop more efficient, cost-effective, and environmentally sustainable solutions for currency manufacturing.

In 2014, BEP successfully moved from printing 32-subject sheets to 50-subject sheets for \$1 notes through the installation of custom Large Examining Printing Equipment (LEPE). There is currently one LEPE press in Washington, D.C. and two at the Fort Worth Facility. The LEPE presses significantly increased our efficiency by consolidating four production processes into a single process. This, combined with being able to print a larger number of notes per currency sheet, has resulted in considerable cost savings. The \$5 note is currently undergoing validation testing for 50-subject production. Ultimately, additional specialized equipment will be incorporated into the process at BEP and every denomination will be printed on a larger sheet.

Currency production equipment is very unique and takes years to purchase, build, test, and install. Recognizing this, we have increased efficiency by 13% at the DCF by refurbishing, extending the life, and relocating a 30-year-old currency production press from the WCF. The press is now the most productive press of its kind at DCF. Installation of Single Note Inspection (SNI) equipment in 2015 allows BEP to reclaim good notes from defective sheets. This reclamation process has reduced overall spoilage by two-thirds. These efficiencies have saved us more than \$100 million since their introduction. In addition, the reduced spoilage eliminated more than 300 tons of non-hazardous waste.

New Facility

The BEP currently operates, without a security perimeter, out of two, six-story, multi-wing buildings across the street from each other in downtown Washington, D.C. While ultramodern 100 years ago, the structure and age of the existing buildings does not allow for efficient production of the technologically-sophisticated, secure currency notes of today. In order to stay ahead of worldwide counterfeiting trends and threats amplified by ever-improving commercial and non-commercial printing capabilities, the BEP must replace the production equipment in the Washington, D.C. facility to support the next generation of currency scheduled for release over the coming decade.

The President's FY2019 Budget proposes statutory authority to use BEP's revolving fund to construct a smaller, more efficient, and more secure manufacturing plant, to replace our existing Washington, D.C. facility. Without this authority, BEP would be required to renovate its current facility, which is not well suited for modern manufacturing.

The next generation of currency will include additional overt and covert security features, which will require additional production equipment that will not fit inside the current Washington, D.C. facility as constructed. This will require extensive and expensive renovations if production is not moved to a modern facility. In fact, the need for additional production equipment has forced the BEP to initiate a 260,000 square-foot addition to our more modern production facility located in Fort Worth, Texas.

The BEP has conducted multiple facility feasibility studies over the past 25 years to determine the best approach to recapitalize the aging Washington, DC production facilities. As reviewed and supported by a recent GAO engagement, the BEP's recommended facility approach is to reduce our federal footprint, and construct a smaller, more efficient, more secure, single-floor manufacturing facility (akin to a warehouse). Construction of a modern facility would cost an estimated \$579 million less than the alternative option of a risky, large, whole-sale renovation of BEP's existing Washington, D.C. facilities that would not produce operational efficiencies. Moreover, BEP would reduce its real estate portfolio by 28 percent and save \$38 million dollars

annually due primarily to staff reductions from increased automation and more efficient operations associated with a new, modern, single-floor production facility.

As noted in the GAO report, the antiquated Washington, D.C. buildings must contend with a number of safety and physical security vulnerabilities currently exacerbated by their location in a congested, urban city center and inflexible structures such as a lack of building setback, blast resistance shortfalls, and minimal vehicle screening capabilities. While certain security improvements, such as blast resistant windows or vehicle barriers, could be installed if the facility is renovated, other standards could only be addressed with a new facility, such as an adequate set-back security perimeter to provide a point of separation between the facility and where an unscreened vehicle can travel or park. Moreover, the current facility's historic nature also limits BEP's ability to make changes to meet the necessary level of protection a facility of its security level should have. A new facility, by design, would modernize and enhance BEP's security profile and limit BEP's vulnerability and high risk to threats and explosive devices.

No action has been taken on the three facility studies done over the past 25 years, and doing nothing is no longer an option without jeopardizing BEP's mission and the U.S. Currency Program. It is our hope this Committee will support legislation facilitating the construction of a smaller, more efficient production facility.

Meaningful Access

In May 2011, then Secretary of the Treasury Timothy F. Geithner approved the pursuit of a three-pronged strategy to provide meaningful access to U.S. Federal Reserve notes for the blind and visually-impaired community in assisting them to denominate currency notes: 1) continued use of large, high contrast numerals and different colors on each denomination it is permitted by law to alter; 2) a raised tactile feature unique to each U.S. currency note it may lawfully alter; and 3) a Currency Reader Program.

The BEP has been actively engaged in meaningful access solutions, while also giving appropriate consideration to the interests of domestic and international users of currency, U.S. businesses, and cash handling and cash-intensive industries.

Large numerals have appeared on the back of U.S. currency notes since 1997 to assist the visually impaired. This feature provides meaningful access to the largest segment of the visually-impaired community. Since the issuance of the NXG notes, the BEP has increased the contrast and color on the large numerals based upon feedback from the visually-impaired community, who have also indicated that it is a preferred method of denominating currency. BEP intends to continue the practice of placing large, high-contrast numerals on future currency notes.

Currency Reader Program

BEP continues to provide meaningful access to U.S. currency for a large proportion of blind and visually-impaired persons through the U.S. Currency Reader distribution program operated in conjunction with the National Library Service. The distribution program officially launched in 2015 and is the one method that provides virtually all blind and visually-impaired U.S. citizens and legal residents with a means to identify different Federal Reserve notes. Furthermore, it provides virtually 100% accuracy in identifying the denomination of currency. To leverage existing expertise and a pre-existing national distribution system, the BEP contracted for currency reader program support from the Library of Congress National Library Services for the Blind and Physically Handicapped (LOC/NLS). NLS administers a Talking Book Program, a free library program where Braille and audio materials are made available to U.S. residents and citizens living abroad, whose low vision, blindness, or physical handicap makes it difficult to read a standard printed page.

As of August 20, 2018, the BEP has distributed more than 64,000 electronic currency readers at no cost to patrons through NLS and at conferences that cater to the blind and visually-impaired community, such as the American Council of the Blind, the National Federation of the Blind and the Blind Veterans Association.

If patrons are unable to attend a live distribution event, the currency reader application form is also available for download through BEP's website in both English and Spanish; interested persons may also request via email or by calling BEP's dedicated call center that a currency reader application be mailed to them.

As part of its ongoing efforts to promote the distribution of currency readers, the BEP also works with third-party organizations that work with blind and visually-impaired persons, to distribute currency readers directly to their patrons, such as the Association of Assistive Technology Act Programs (ATAP) and the Lighthouse for the Blind.

Meaningful Access (Mobile Applications)

Technology has continued to advance dramatically in terms of mobile devices, Artificial Intelligence, and accessibility. As such, BEP continues to provide meaningful access for a large segment of the blind and visually-impaired community through free mobile device applications, which allow smartphones and similar devices to function as currency readers. The number of downloads of these applications continues to increase. The EyeNote® app for Apple devices, which BEP developed in 2010, has been downloaded nearly 55,000 times. The IDEAL Currency Identifier app, developed in collaboration with the Department of Education in 2012 for the Android operating system, has been downloaded approximately 15,700 times. These applications are providing an immediate accommodation for a segment of the blind and visually

impaired population, and may ultimately result in lower demand for currency readers over time. Furthermore, they denominate currency with near-perfect accuracy.

Tactile Feature Technology

BEP continues to pursue the creation of a durable, usable, and manufacturable tactile feature. The BEP has now settled on a four-position rectangle shape for the feature as offering the best possibility of success, but has not yet chosen between the two remaining potential methods of application (Intaglio and Coated-embossed). Any tactile feature must satisfy several criteria, each of which is required: it must enable blind and other visually impaired persons to denominate currency effectively; it must be able to function in commerce without interfering with security features; it must be sufficiently durable to remain usable through the extensive handling of currency; and, BEP's machinery must be able to produce the feature consistently in the large volumes required. Finding a tactile feature that is both durable and allows for accurate denomination remains a great challenge. BEP established a testing schedule to evaluate all of these factors using the rectangle shape and the two remaining potential application methods. Under that schedule, BEP began conducting durability testing early in the year.

As part of longstanding practices by BEP to ensure quality and acceptance of the nation's currency in commerce, all U.S. currency must survive a series of durability tests designed to simulate the actual use of currency in circulation. These tests include a Crumble test which crushes currency a number of times, a Laundering test which simulates accidental washing of currency, and Chemical Resistance tests which saturate the bills with chemical substances, all to verify that the Raised Tactile Feature (RTF) remains virtually intact and adheres to the bill. All features of a bill, such as security features and an RTF, must be able to survive these same tests. Additionally, the RTF will be subject to new durability tests to assess functionality, namely a Scrape test simulating abrasion, and a Humidity test with long exposure to hot and humid conditions, both to ensure that the RTF remains intact. It is currently unknown whether any RTF will successfully pass all of these tests. After RTF down-selection and optimization, the feature will also go through the process of integration with the security features into the currency design, which may require additional testing as an integrated currency note. BEP must verify that any potential RTF does not interfere with any security features that are selected for incorporation into the next generation of notes.

BEP continues to conduct end-user, focus group testing to determine feature effectiveness and the preferences of blind and visually-impaired persons. Banknote equipment testing has also begun in order to determine whether the tactile feature will function in high-speed currency processing and handling, and critical manufacturing testing is scheduled later this year to verify manufacturability. Further large-scale testing with blind and visually-impaired persons is scheduled for later this year, and final analysis of the resulting data is expected in late 2018. In 2019, BEP plans to begin a Technology Integration Phase during which it will determine how

any potential tactile feature will interact with the rest of the note, including most critically, the security features. By late 2019, BEP intends to make a final decision as to which, if any, potential tactile feature option is able to meet all of the criteria described above.

At the same time the BEP is developing tactile features, it is working closely with the ACD to identify counterfeiting threats and determine appropriate measures to respond to them. Due to the interrelated nature of the various processes, the overall creation of any one Federal Reserve note design is a lengthy and complex endeavor, requiring appropriate progress on several fronts, including changes to the Washington, D.C. facility.

Strategic Human Capital Initiative

The BEP is only as strong as its unique and highly specialized workforce, and I am extremely proud of the over 150-year legacy we have established through craftsmanship, creativity, and ingenuity. In recognizing BEP's ongoing need to incorporate more sophisticated systems and equipment to produce an increasingly technologically advanced product to combat security threats such as counterfeiting, we established a well-defined, multi-year, strategic Human Capital Plan consisting of five goals and related initiatives targeted to address challenges affecting BEP's workforce, as a whole, and to guide organizational activities as we work to continuously improve in a number of critical, human capital areas such as hiring, training, engagement, and leadership and skills development.

Workforce Planning helps the BEP make sure the right people are in the right positions at the right time. We are using data to align staffing needs and strategic goals to fiscal resources, which positions us to better create formidable banknotes well into the future.

BEP employees take pride in the fulfillment of BEP's mission and show great loyalty – we are proud that the average tenure of our employees is 20 years. Employees have indicated that they enjoy job stability, a sense of tangible accomplishment, and work-life flexibilities in progress at the agency. However, with very little turnover and most of our employees retiring through attrition, this also means BEP has an increasingly aging workforce. Therefore, a Knowledge Management Program was developed to stabilize succession planning and facilitate knowledge sharing across the Bureau as we look to capture the unique skills and historical knowledge that many of our long-time employees possess.

In maintaining and building a world-class workforce of the future, it was important to gain buy-in and commitment from all levels of the workforce, from front-line employees to senior leadership. The human capital goals and initiatives in this plan were designed as a proactive measure to improve and foster a positive and engaging work environment that results in high levels of job satisfaction and productivity as well as provide a strong foundation for the retention and recruitment of future talent as we become more automated and science driven.

As we can all attest, the world is becoming increasingly technical. Whether building rockets using 3D printers, finding cures for diseases, or developing mechanisms to meet everyday activities like ordering groceries through mobile apps, there is an overwhelming need for people with strong science, computer, and mathematics skills in almost every industry around the globe. This can also be said of the Banknote industry as technology capable of capturing and reproducing accurate currency images, such as printers and scanners, continue to advance technologically, become more portable, and accessible, financially, to the would-be, everyday counterfeiter. Recruiting in the Science, Technology, Engineering, and Mathematics (STEM) fields is challenging. Competition from the private sector, long lead times to bring people onboard, backlogs for background clearances, a complex hiring process, and a general unawareness of the benefits of careers in public service, etc. all contribute to difficulties in attracting and retaining viable candidates. To keep pace with rapid, technology changes, changes in materials availability, and environmental requirements, the BEP is constantly looking for ways to broaden its own Research and Development and production programs, and acquire appropriate technology and qualified staff capable of taking the agency and its products well into the next century. As part of this initiative, we have developed a separate (STEM) strategic program (anticipated to launch in 2020) to address the specific development and training needs of/for STEM positions at BEP.

In response to a recent call from the Office of Personnel Management, Treasury directly supported BEP's STEM recruitment efforts by requesting inclusion of Engineers and Physical Scientists in a government-wide Direct Hire Authority for STEM occupations that is currently under consideration. Significant investments have also been made in apprenticeships, trainee programs, and career development to address skill/knowledge gaps, including the formalized development of leadership at BEP.

All of these initiatives make an important impact as BEP continues to focus on being an excellent place to work and deliver a world-class product to our customers.

Conclusion

Mr. Chairman, this concludes my remarks about initiatives at the BEP. I will be happy to respond to any questions you or other members of the Committee may wish to ask. Thank you.

United States Government Accountability Office



Report to the Chairman, Subcommittee
on Capital Markets, Securities, and
Investment, Committee on Financial
Services, House of Representatives

April 2018

BUREAU OF ENGRAVING AND PRINTING

Options for and Costs of a Future Currency Production Facility

ATTACHMENT A

GAO Highlights

Highlights of GAO-18-338, a report to the Chairman, Subcommittee on Capital Markets, Securities, and Investment, Committee on Financial Services, House of Representatives

Why GAO Did This Study

BEP, within Treasury, designs and produces U.S. currency notes at BEP's facilities in Washington, D.C., and Fort Worth, Texas. The Federal Reserve pays for BEP's operational expenses, including currency production. BEP is requesting legal authority to purchase land and construct a new production facility in the D.C. area. BEP officials told GAO that, if it does not receive the necessary legal authority for a new production facility, it will renovate the D.C. facility.

GAO was asked to review BEP's facility planning process. This report (1) describes the results of facility studies that BEP has funded and factors that led BEP to propose a new production facility, (2) examines the extent to which BEP's actions align with leading capital planning and cost estimating practices, and (3) describes other factors that could affect total federal costs of BEP's actions.

GAO analyzed BEP documents and data from 2010-2017 on currency note production, visited both BEP production facilities, assessed BEP's actions against leading capital planning and cost estimating practices, and interviewed officials from BEP, GSA, the Federal Reserve, and Treasury.

GAO provided the draft report to BEP, GSA, the Federal Reserve, and Treasury for review. BEP coordinated with Treasury in its comments. In the comments, reproduced in Appendix I, BEP emphasized the factors that led BEP to determine that a new facility is the preferred alternative. BEP and the Federal Reserve also provided technical comments, which we incorporated as appropriate. GSA did not provide comments.

View GAO-18-338. For more information, contact Lori Rectanus at (202) 512-2834 or rectanusl@gao.gov.

April 2018

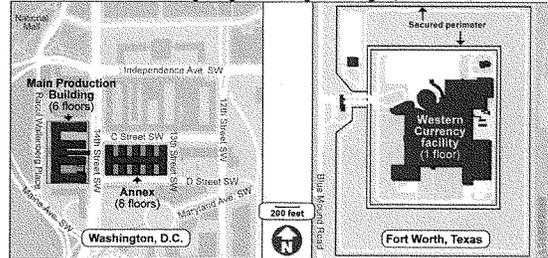
BUREAU OF ENGRAVING AND PRINTING

Options for and Costs of a Future Currency Production Facility

What GAO Found

The Bureau of Engraving and Printing's (BEP) studies and research determined that a new production facility would be less expensive and better address BEP's need for secure, efficient, and flexible currency production than a renovation of its Washington, D.C. facility. According to 2017 cost estimates, BEP's preferred option—a new production facility in the Washington, D.C., area and some renovated administrative space in its current D.C. facility—would cost approximately \$1.4 billion, while a renovation of its current facility for both production and administrative functions would cost approximately \$2.0 billion. A new facility similar to BEP's Texas facility could have a secure perimeter that meets federal building security standards. Such a perimeter is not possible with the current facility. A new facility could also house production on a single production floor to allow for a more efficient production process.

Aerial View of the Bureau of Engraving and Printing's Washington, D.C. and Texas Facilities



Sources: National Park Service and GAO. | GAO-18-338

BEP generally followed leading capital-planning practices, and its 2017 cost estimate of a new production facility partially met the characteristics of a reliable cost estimate. BEP's capital planning followed leading practices, for example, by including a needs assessment, a link to BEP's strategic plan, and a long-term capital plan. BEP's cost estimate partially followed leading practices, for example, by including most life-cycle cost components and documentation of the data used for the estimate. However, it did not include sufficient sensitivity analyses, which identify a range of costs-based on varying assumptions. BEP officials stated that they plan to follow the updated GSA guidance that includes GAO's cost-estimating leading practices when updating this early stage estimate.

The ability to sell or repurpose any part of the current D.C. facility could affect the total federal costs of BEP's actions. According to officials from the Department of the Treasury (Treasury) and the General Services Administration (GSA), there could be savings if Treasury could consolidate staff or operations into the vacated facility. There could also be savings if the unneeded facility could be sold to a private buyer. However there would be costs to prepare the facility for use by other entities or if the unneeded facility does not sell. Agency officials said that it is too early to determine specific costs and savings.

United States Government Accountability Office

Contents

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Letter	1
Background	4
BEP's Proposal for a New Production Facility Considered Project Costs and Feasibility, Security, Efficiency, Safety, and Future Flexibility	7
BEP Generally Followed Leading Capital-Planning Practices, and Its 2017 Cost Estimate Partially Met the Characteristics of a Reliable Cost Estimate	15
Ability to Sell or Repurpose Potentially Vacant Space Could Affect the Total Cost to the Federal Government	22
Agency Comments	27
<hr/>	
Appendix I	29
<hr/>	
Appendix II	31
<hr/>	
Tables	
Table 1: Studies Related to a New Production Facility Commissioned by the Bureau of Engraving and Printing (BEP) Since 2010	8
Table 2: Current and Proposed Use of Bureau of Engraving and Printing's (BEP) Buildings in the D.C. Area under the Hybrid Alternative	9
Table 3: Fiscal Year 2016 Production Reported by the Bureau of Engraving and Printing (BEP) at Washington, D.C., and Fort Worth, Texas, Facilities	12
Table 4: GAO's Assessment of the Bureau of Engraving and Printing's Adherence to Leading Capital-Planning Practices for Its Proposed New Currency Production Facility	16
Table 5: Alternative Methods BEP Considered to Fund and Obtain Land and a Building for a New Production Facility	18
Table 6: GAO'S Assessment of the Extent to Which the Bureau of Engraving and Printing's (BEP) 2017 Cost Estimate Meets the Characteristics of a High-Quality, Reliable Cost Estimate.	19

Figures

Figure 1: Aerial Views of the Bureau of Engraving and Printing's Washington, D.C., and Fort Worth, Texas, Facilities	6
Figure 2: Potential Disposition and Funding of BEP's Washington, D.C., Facility and Related Potential Costs or Savings	23

Abbreviations

BEP Bureau of Engraving and Printing
D.C. Washington, D.C.
GSA General Services Administration
ISC Interagency Security Committee

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April 5, 2018

The Honorable Bill Huizenga
Chairman
Subcommittee on Capital Markets, Securities, and Investment
Committee on Financial Services
House of Representatives

Dear Mr. Chairman:

For over 150 years, the Bureau of Engraving and Printing (BEP) within the U.S. Department of the Treasury (Treasury) has been responsible for designing and producing U.S. currency notes. BEP prints the notes for the Federal Reserve System (Federal Reserve), which is BEP's primary client.¹ BEP reported that in fiscal year 2018, it plans to produce 7.4 billion notes worth about \$233 billion at its facilities in Washington, D.C., and Fort Worth, Texas. The D.C. facility is over 100 years old, and currency production primarily takes place on different floors in one of its two multi-wing, multi-level buildings. The Fort Worth facility is less than 30 years old and includes a large, one-level open space for producing currency.

BEP has explored renovating the D.C. facility or replacing it with a new facility in the D.C. area to bring its currency production up to 21st-century production standards. BEP has proposed building a new currency production facility in the D.C. area and repurposing one of its current D.C. buildings for administrative functions. According to Treasury officials, while BEP has the legal authority to use its revolving fund to renovate an existing facility, it does not have legal authority to purchase land and construct a new facility, nor the authority to use the revolving fund to pay for such a project. As a result, BEP is seeking the necessary legal authority to purchase land and construct a new building in the D.C. area, as part of the fiscal year 2018 President's budget proposal. BEP officials have stated that if BEP does not receive this legal authority and funding, it will begin a renovation of the current D.C. facility. According to BEP, it would be designed to address the facility's deficiencies and to accommodate new, larger printing equipment that BEP anticipates

¹According to BEP officials, almost 100 percent of BEP's production consists of producing bank notes for the Federal Reserve. On occasion, BEP receives orders from other agencies to print certificates and other documents.

needing over the next few years for security features being developed for new currency notes.

You asked us to review BEP's proposal to build a new production facility in the Washington, D.C., area. This report:

- describes the results of the facility studies that BEP has funded and factors that led BEP to propose a new production building;
- examines the extent to which BEP's actions align with leading capital-planning and cost-estimating practices; and
- describes other factors that could affect total federal costs if BEP were to construct a new production facility or renovate its existing D.C. facility.

To describe the results of the facility studies that BEP has funded and the factors BEP considered in proposing a new currency production facility, we reviewed studies and cost estimates BEP undertook between 2010 and 2017, its strategic plans, and pertinent BEP operations and production data. Specifically, we reviewed workers' compensation claims and manufacturing costs from fiscal years 2013 through 2016. We also reviewed employee staffing levels as of September 2017. While we did not independently assess the validity of these data, we reviewed the data for outliers and obvious errors. We found the data to be sufficiently reliable for our purposes. We conducted a literature review of research on currency demand. We reviewed the President's 2017 and 2018 budget proposals as well as relevant statutes and regulations. We visited BEP's facilities in Washington, D.C., and Fort Worth, Texas, to examine the production process at both facilities. We interviewed officials from BEP, the Federal Reserve, and Treasury. We also interviewed officials from the General Services Administration (GSA), which is responsible for helping federal agencies acquire and dispose of office space, among other things.

To determine the extent to which BEP's actions aligned with leading capital-planning and cost-estimating practices, we first identified leading capital-planning and cost-estimating practices from a variety of federal sources. In particular, we reviewed the leading capital investment decision-making practices identified by GAO and OMB in their respective

guides,² as well as leading cost-estimating practices identified in GAO's Cost Estimating and Assessment Guide.³ We focused on the capital-planning processes that would be most applicable to BEP, which has limited real property. The applicable processes include:

- conducting an assessment of current and future needs;
- evaluating alternatives to determine how to best bridge performance gaps;
- strategically linking capital investments to a strategic-planning process; and
- documenting the agency's goals and objectives, among other things, in a long-term capital plan.⁴

We compared these leading practices against actions BEP took since 2010 that led BEP to conclude that the agency would be best served by a new production facility. Specifically, we reviewed BEP's 2010 and 2013 feasibility studies, BEP and Treasury strategic and long-term capital plans, and other relevant documents. Regarding cost estimating, we focused on four broad characteristics of high quality, reliable cost estimates identified in the Cost Estimating and Assessment Guide. These characteristics include that the estimates are comprehensive, well-documented, accurate, and credible. We compared BEP's 2017 estimate for the cost of BEP's proposal for a new facility to these practices because it was BEP's most recent cost estimate for constructing a new facility. As part of our work, we reviewed the cost information that BEP used to develop its 2017 cost estimate and interviewed senior BEP officials on the estimates.

To describe other factors that could affect the overall cost to the federal government if BEP were to construct a new production facility or renovate

²GAO, *Executive Guide: Leading Practices in Capital Decision-Making*. GAO/AIMD-99-32 (Washington, D.C.: December 1998); and OMB, *Capital Programming Guide, Supplement to Office of Management and Budget Circular A-11: Planning, Budgeting, and Acquisition of Capital Assets* (2017).

³GAO, *GAO Cost Estimating and Assessment Guide: Best Practices for Developing and Managing Capital Program Costs*. GAO-09-2SP (Washington, D.C.: March 2009).

⁴We found that not all leading capital-planning practices were applicable to BEP, such as a review and approval of a framework with established criteria for selecting capital investments and project prioritization. BEP's proposal for a new D.C. facility is not contingent on capital decisions made for its Fort Worth facility.

its existing D.C. facility, we reviewed BEP studies and discussed potential uses of BEP's current buildings with BEP, Treasury, and GSA officials. We reviewed GSA documentation and previous GAO work on the building disposal process, and interviewed officials at BEP, Treasury, and GSA on their plans for the use of each BEP building depending on the selected alternative.

We conducted this performance audit from April 2017 to April 2018 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Background

BEP produces notes at the request of the Federal Reserve. Each year, the Federal Reserve determines how many currency notes are needed to meet the demand for currency. Federal Reserve and BEP officials then agree on a payment amount for note production, including costs associated with maintaining BEP's facilities. The Federal Reserve's payments are deposited into BEP's revolving fund; the revolving fund is used for BEP's operational expenses, including note production.⁵ According to Treasury officials, the revolving fund can pay for renovations and retrofitting of a production facility, but not for land purchase or new building construction.⁶ In 2016, the Federal Reserve paid around \$660 million for note production.

In order to cover all expenses associated with the Federal Reserve's needs, including currency production, the Federal Reserve generates income primarily from the interest on their holdings of U.S. government securities, agency mortgage-backed securities, and agency debt acquired through open market operations. The Federal Reserve is required to transfer any surplus funds over \$7.5 billion to the General Fund of the

⁵See 12 U.S.C. § 420; 31 U.S.C. § 5142.

⁶Treasury officials based this interpretation, in part, on a 1951 Comptroller General decision, which determined that BEP's revolving fund could be used for the cost of replacements and additions of such equipment and installations as elevators, air conditioning, water cooling, electrical, plumbing and heating equipment, permanent and semi-permanent partitions, and flooring. See B-104492, Oct. 4, 1951.

U.S. Treasury.⁷ Increases or decreases in operating costs or BEP's currency production could affect these surpluses and subsequent transfers to the General Fund. Historically, the Federal Reserve has had significant surpluses. In 2016, the Federal Reserve transferred \$92 billion to the General Fund.

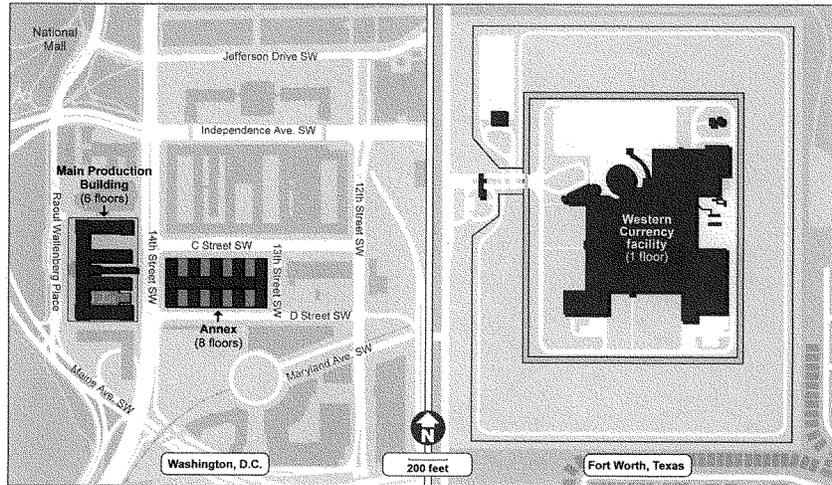
BEP's Washington, D.C., facility consists of a 104-year old, multi-story, multi-wing Main Building and an 80-year old multi-story, multi-wing Annex Building (see fig. 1). The Main Building is the primary production building, and the Annex Building is used primarily for administrative functions. Both buildings qualify for historic designation and thus any alterations would be subject to certain requirements under the National Historic Preservation Act of 1966, as amended.⁸ In addition to these buildings, BEP leases a warehouse in Landover, Maryland, to store production supplies in part because the two Washington, D.C., buildings do not have the necessary infrastructure to accommodate shipments carried by large commercial trucks.⁹

⁷12 U.S.C. § 289 (a)(3).

⁸See Pub. L. No. 89-665, 80 Stat. 915 (Oct 15, 1966) (codified as amended at 54 U.S.C. §§ 300101-307108).

⁹In March 2012, BEP renewed a 10-year lease with GSA to continue use of the warehouse. BEP rents the building through GSA from a private owner, and makes part of the building available for use by other Treasury components through interagency agreements. According to GSA officials, the cost to BEP is approximately \$2.9 million per year after payments from other Treasury components.

Figure 1: Aerial Views of the Bureau of Engraving and Printing's Washington, D.C., and Fort Worth, Texas, Facilities



Sources: National Park Service and GAO. | GAO-18-338

Note: The figure does not include the warehouse in Landover, Maryland

BEP's Fort Worth facility was built in order to ensure reliable currency production in the event of any disruption of operations at the D.C. facility. BEP was able to obtain donated land and a building in Fort Worth and therefore did not need to purchase land or construct a new facility.¹⁰ Specifically, in 1986, BEP accepted a proposal from the City of Fort Worth that included 100 acres of donated land and a donated building shell to be built to BEP's specifications. BEP then used its revolving fund to pay for the building's interior retrofitting, including a central energy plant and installation of currency presses. The Fort Worth facility began

¹⁰The Department of the Treasury has the authority to accept gifts of real and personal property for the purpose of aiding or facilitating the work of the Department of the Treasury. 31 U.S.C. § 321(d)(1).

producing notes in December 1990 and was intended to produce around 25 percent of U.S. notes. According to BEP officials, as a result of increased demand for U.S. notes and production limitations associated with the D.C. facility, the Fort Worth facility has produced an increasingly large share of notes. In fiscal year 2016 the Fort Worth facility produced nearly 60 percent of notes, while the D.C. facility produced the remaining 40 percent.

BEP's Proposal for a New Production Facility Considered Project Costs and Feasibility, Security, Efficiency, Safety, and Future Flexibility

BEP Studies from 2010 to 2017 Determined the Cost and Feasibility of Multiple Alternatives

From 2010 through 2017, BEP contracted for various studies to investigate alternatives, costs, potential sites, and program requirements to ensure future currency production in the D.C. area (see table 1 for details of the studies).¹¹ In BEP's 2013 study and since then, the agency has focused on three alternatives:

- "Renovation"—a major renovation of the current facility
- "New build"—a new building in a different location that would house currency production and all administrative functions
- "Hybrid"—a new building in a different location that would house currency production, but having administrative functions in one of its current buildings

According to BEP officials, the cost estimates in the 2013 study were an important factor in their preference for a new facility instead of a renovation.

¹¹Bureau of Engraving and Printing, *Feasibility Study for Renovation and/or Relocation of the Washington, DC Facility* (Dec. 15, 2010); Bureau of Engraving and Printing, *Facility Strategic Alternatives Study* (Jan. 23, 2013); *Federal Agency Initial Site Investigation and Screening* (Sept. 30, 2015); Bureau of Engraving and Printing, *Future Workplace Recommendations Report* (Aug. 17, 2017)

Table 1: Studies Related to a New Production Facility Commissioned by the Bureau of Engraving and Printing (BEP) Since 2010

Date Completed	December 2010	January 2013	September 2015	August 2017
Purpose	Identify and rank nine alternative solutions for future BEP operations	Review and rank three alternatives (new build, renovation, and hybrid) to continue production in the Washington, D.C. area	Identify and rate potential sites for a new BEP production facility within 30 miles of the Washington Monument	Identify program requirements and cost estimates for (1) the hybrid and (2) renovation alternatives.
Conclusion	Ranked the new build option highest	Ranked the new build option highest	Identified 31 federal and non-federal sites	Estimated the cost for (1) the hybrid option at \$1.389 billion and (2) renovation at \$1.957 billion ^a

Source: GAO analysis of BEP data. | GAO-18-338

^aThe cost estimate includes additional project costs determined by BEP.

The 2013 study concluded that BEP should pursue the new build alternative because it was estimated to be the least costly option, could be completed in the shortest time frame, and promised the greatest efficiencies. The study found that the renovation alternative would be the most costly option and take the longest time to complete because it would require BEP to produce currency at its current location while it was being renovated. BEP officials told us this would require moving production equipment from the Main Building to the Annex during the renovation and back to the Main Building once it was renovated.¹² According to GSA officials, renovations are often more costly than new construction. According to Federal Reserve officials, moving large, complex printing presses and machines from one building to another and then back again significantly expands the renovation’s timeframe, as time would be needed to test the machines to get them back into specification. The Federal Reserve further noted that some modern presses will not fit into the Main Building without significant structural alterations, which would add cost and time to a renovation.

Following the release of the 2013 study, BEP proposed to the Secretary of Treasury, with the support of Treasury officials, that Treasury and BEP pursue the hybrid alternative as their first choice (see table 2 for details on BEP’s proposal). BEP officials told us that they, along with Treasury,

¹²Federal Reserve officials noted that equipment past its useful life would most likely be replaced with new equipment and thus not be moved back into the Main Building. However, some equipment could be moved back into renovated space.

selected the hybrid alternative even though the hybrid was more expensive than the new build alternative. According to BEP officials, the cost difference between the hybrid and new build was outweighed by the value of maintaining administrative functions in Washington, D.C., to facilitate the day-to-day decision-making process among BEP, Treasury, and Federal Reserve officials. According to Treasury officials, the ability for other Treasury employees to co-locate in the Main Building after the repurposing is completed would also provide long-term cost benefits to Treasury because Treasury could save on expensive lease agreements in downtown Washington, D.C. Further, Treasury officials noted that it is important that the Treasury Department maintain the Main Building as an asset because of its location and history, and Treasury officials prefer that BEP maintain some functions in the building. The 2017 study provided cost estimates of BEP's and Treasury's preferred hybrid option, as well as the renovation option that BEP officials said they would pursue if BEP does not receive the necessary legal authority to construct a new facility. The study estimated that the hybrid option would cost approximately \$1.389 billion and that the renovation option would cost approximately \$1.957 billion.¹³

Table 2: Current and Proposed Use of Bureau of Engraving and Printing's (BEP) Buildings in the D.C. Area under the Hybrid Alternative

Building	Use	
	Current	Proposed
Main Building	Houses most production functions, some administrative functions, and public tour	Would house primary BEP administrative functions and visitor center; remaining two-thirds of space could house other Treasury bureaus and offices
Annex Building	Houses most administrative functions and some production functions	Would be declared excess and enter GSA's disposal process
Warehouse	Stores production materials	GSA lease would not be renewed once new facility is complete
New construction	Not applicable	Would house all production functions, some administrative functions, a gift shop, and space for a public tour

Source: GAO analysis of BEP data. | GAO-18-338

Federal Reserve officials told us they concur with the 2013 study that a new facility is warranted, that a renovation of the existing facility would be more costly than a new facility, and a renovation would not provide the same degree of efficiency. Federal Reserve officials said that they prefer the new build alternative because the 2013 study identified this alternative

¹³The cost estimates include additional project costs determined by BEP.

as the least expensive option, and would provide a modern, efficient manufacturing process. These officials also told us that, whatever alternative BEP pursues, the Federal Reserve will be financially responsible—whether it is for a new building,¹⁴ a renovated building, or the continuation of the currency production process in the D.C. facility.

BEP officials stated that they support a new building over a renovation because the new build would both be less expensive and have greater benefits than a renovation. Furthermore, BEP officials told us that while they prefer to remain in the D.C. area, they would approve of the construction of a new facility in a different location if necessary. However, BEP officials also told us that if BEP does not get the legal authority necessary to use its revolving fund to purchase land and build a new facility in 2018, BEP will pursue a renovation of the existing D.C. facility beginning at the end of 2018.

BEP Considered Other Factors in Deciding to Propose a New Production Facility

Security

As a federal facility, BEP must meet physical security standards established by the Interagency Security Committee (ISC).¹⁵ According to an assessment conducted by BEP's Office of Security¹⁶, the D.C. facility does not meet many of the necessary requirements for a facility of its security level. While certain security improvements, such as blast resistant windows or vehicle barriers, could be installed if the facility is renovated, other standards could only be addressed with a new facility. Specifically, the current buildings are located in an urban center

¹⁴According to Federal Reserve officials, it is not clear if the Board currently has the authority to acquire land and pay for the construction of the building "shell" for a new BEP facility.

¹⁵The ISC, housed within the Department of Homeland Security, defines the criteria and process used to determine a facility's risk level and the applicable physical security standards for each risk level. Exec. Order No. 12977, 60 Fed. Reg. 54411 (Oct. 24, 1995). Each executive agency and department must cooperate and comply with the policies and recommendations of the ISC except where the Director of Central Intelligence determines that compliance would jeopardize intelligence sources and methods.

¹⁶Bureau of Engraving and Printing, *Facility Risk Assessment* (July 25, 2015).

surrounded by buildings (see fig. 1 above). As a result, according to the assessment, the facility does not have a secure perimeter because it lacks the required setback between the building and any point where an unscreened vehicle can travel or park. BEP officials said that even after a renovation, the facility would continue to have inadequate setback distance. According to the assessment, the facility's designation as a historic building also limits BEP's ability to make changes to the current facility to meet the necessary level of protection. For example, the facility's placement on the historic registry limits BEP's ability to make certain structural changes that could mitigate the building's chances of progressively collapsing in the event of certain types of destructive attacks or actions. BEP's Office of Security attributed certain security deficiencies to the facility's limited setback distance and the buildings' structure, and determined that the D.C. facility is at relatively high risk to threats such as an externally-placed portable explosive device.

Efficiency

BEP aims to provide quality banknotes in an efficient, cost effective manner.¹⁷ However, BEP officials concluded that the layout of the D.C. facility makes production less efficient than the Fort Worth facility. According to BEP production data, from 2013 to 2016, manufacturing costs were higher at the D.C. facility for all comparable denominations. For example, in 2016, production costs of \$1 and \$20 notes were 23 percent and 7 percent higher, respectively, at the D.C. facility compared to the Fort Worth facility.¹⁸ Additionally, the D.C. facility employs more manufacturing personnel than Fort Worth, even though it produces fewer notes (see table 3). BEP officials attributed the difference in the costs to the D.C. facility's multi-floor, multi-wing production layout. Specifically, in D.C., after notes are printed on one side, they are moved to another floor to dry for at least 72 hours, brought back to the original floor to be printed on the opposite side, and again moved to the other floor to dry. In Fort Worth, because the production occurs in one large room on one floor, these processes occur in adjacent spaces on the same floor. As a result, according to BEP, notes travel more than twice as far during production in the D.C. facility.

¹⁷Bureau of Engraving and Printing, *2014-2018 Strategic Plan*.

¹⁸Manufacturing cost includes depreciation costs. Each note costs a different amount because of variations in processes and materials used. Note production is divided between the two facilities, but each facility does not produce every denomination. Therefore, only the \$1 and \$20 programs are comparable between the two facilities.

Table 3: Fiscal Year 2016 Production Reported by the Bureau of Engraving and Printing (BEP) at Washington, D.C., and Fort Worth, Texas, Facilities

	D.C. facility	Fort Worth facility
Percentage of notes produced	42%	58%
Distance travelled by currency paper	5,615 feet	2,230 feet
Manufacturing cost per 1,000 \$1 notes ^a	\$29.62	\$24.07
Manufacturing cost per 1,000 \$20 notes ^b	\$47.59	\$44.61
Number of manufacturing employees ^c	464	422

Source: GAO analysis of BEP data | GAO-18-338

Note: We did not independently validate the accuracy of these figures.

^aManufacturing cost includes depreciation costs.

^bEach note costs a different amount because of variations in processes and materials used. Note production is divided between the two facilities, but each facility does not produce every denomination. Therefore, only the \$1 and \$20 programs are comparable between the two facilities.

^cNumber of employees is as of September 2017

According to BEP, Treasury, and Federal Reserve officials, a new production facility would offer greater efficiency gains than a renovated facility. According to BEP officials, maintaining production on one floor in an open space improves production efficiency. They added that a renovation of the D.C. facility could include tearing down some walls and raising ceilings, steps that could improve some production processes. However, they also noted that because the D.C. facility qualifies for a historic designation, according to BEP officials, a renovation could not alter the building's shape. As a result, production would still occur on multiple levels and in separate wings if the facility were renovated. We have reported in the past that agencies faced challenges in rehabilitating and modernizing historic buildings for contemporary use because of their age, specific design characteristics, and their particular historical features.¹⁹

Safety

According to its Strategic Plan, BEP is committed to providing a safe and positive work environment for its employees. However, BEP officials said that manufacturing employees at the D.C. facility face greater injury risk than at the Fort Worth facility. According to BEP workers' compensation claim data, approved workers' compensation claims at the D.C. facility accounted for approximately 67 percent of BEP's approved claims from

¹⁹GAO, *Federal Real Property: Improved Data Needed to Strategically Manage Historic Buildings, Address Multiple Challenges*, GAO-13-35 (Washington, D.C.: Dec. 11, 2012).

fiscal year 2013 through fiscal year 2016, or 200 of 297 approved claims. BEP officials attributed the higher number of workers' compensation claims in the D.C. facility to the relatively high number of employees needed to produce fewer notes (see table 3) and the increased opportunity for employee injury because production material must be transported farther and between floors. BEP officials estimated that approximately 65 to 70 percent of all worker injuries are related to materials handling.

BEP officials noted that there is an estimated \$196-million deferred-maintenance backlog at the D.C. facility. This backlog includes maintenance to the facility's electrical and architectural systems. Even if BEP had taken care of these maintenance issues in the past, it would not negate the need for a renovation or a new facility. BEP officials noted that a renovation would reduce some safety concerns, such as upgrading the facility's electrical systems and adding more fire-rated exits as required by Occupational Safety and Health Administration regulations;²⁰ however, a renovation would not be able to address the multi-floor production process that BEP officials attributed to employee injuries.

Flexibility

According to BEP officials, it is important for BEP to maintain flexible currency production to respond to production needs that may change over time. Specifically, BEP officials said that a production facility should have the ability to adapt to changes in production equipment. Both BEP and Federal Reserve officials told us that the new equipment likely will be larger than current machinery. According to a representative from a leading currency printing equipment manufacturer from which BEP buys its printing equipment, future equipment is unlikely to decrease in size. BEP officials said that, while the D.C. facility could be renovated to accommodate larger equipment, it would not be possible to replicate the large, open production floor of the Fort Worth facility, which allows for simple installation of equipment. BEP officials told us that, unlike the current D.C. facility, a new production facility would be able to easily

²⁰29 C.F.R. § 1910.36. The Occupational Safety and Health Administration (OSHA) within the Department of Labor sets and enforces workplace standards to assure safe and healthful working conditions.

accommodate the printing equipment necessary for security features that BEP is currently developing for the next currency redesign.²¹

Flexibility is also an important factor when considering the future demand for currency. The demand for currency fluctuates, and recent changes in how the public makes purchases could affect the demand for currency. Some observers have noted that the increased use of new payment technologies—such as online banking and phone applications—as well as the rise in online purchases may lead to a substantially reduced demand for currency. In a few countries, such as Sweden, noncash transactions have become common and the demand for currency has fallen substantially.

In the United States, there are several indications that currency demand will not substantially decline within the next decade. For example, the yearly number of U.S. currency notes in circulation increased by 43 percent from 2008 to 2016. In addition, the number of ATMs in the United States continues to grow, and a 2016 Federal Reserve study of consumer payment choice found that cash still accounted for 32 percent of all transactions, and more than 50 percent of transactions under \$25.²² This continued strength in the demand of cash has several sources.²³ Cash can be seen as a hedge against uncertainties, such as natural disasters or political or economic turmoil, and also has advantages related to privacy, anonymity, and personal data security. Moreover, according to the Federal Deposit Insurance Corporation, approximately 25 percent of U.S. households have limited access to the products and services of the banking industry, and therefore, these “unbanked” and “underbanked”

²¹Additionally, a court order requires Treasury to “take such steps as may be required to provide meaningful access to United States currency for blind and other visually impaired persons...not later than the date when a redesign of that denomination is next approved by the Secretary of the Treasury.” *Am. Council of the Blind v. Paulson*, 581 F. Supp. 2d 1 (D.D.C. 2008). BEP recommended pursuing a tactile feature as a potential means of identifying each denomination by way of touch. See 75 Fed. Reg. 28331 (May 20, 2010). As we previously reported, the Secretary of the Treasury approved BEP’s approach on May 31, 2011. See GAO, *U.S. Currency: Reader Program Should Be Evaluated While Other Accessibility Features for Visually Impaired Persons Are Developed*, GAO-14-823 (Washington, D.C.: Sept. 26, 2014).

²²*The State of Cash*, Cash Produce Office Federal Reserve System, November 2016.

²³One source of U.S. currency demand is from people in other countries. About half of the outstanding value of U.S. currency is held outside the United States, largely in the form of \$100 denominated notes. Foreign demand for U.S. currency derives from its role as a global reserve currency and reliable store of value.

populations, who may not have many alternative means of payment, rely largely on cash.

Federal Reserve and Treasury officials we spoke with do not believe that the use of cash in the U.S. will decline in any significant way over the next decade. In particular, the Federal Reserve predicts a continued rise in demand for cash over the next 10 years, despite the increased availability of noncash payment options, indicating that a new or renovated facility will still be required for currency production. According to BEP officials, a new production facility would better manage the ebbs and flows in the future demand for currency than a renovation of the current facility. Specifically, should production demand increase, a new production facility could be designed to easily scale to meet new production requirements. Conversely, should the demand for currency decline in the coming years or substantially decline in the future, unused space in a new facility could be partitioned off and be used for other purposes or by another Treasury agency.

BEP Generally Followed Leading Capital-Planning Practices, and Its 2017 Cost Estimate Partially Met the Characteristics of a Reliable Cost Estimate

BEP Generally Followed Applicable Leading Capital-Planning Practices

Capital investments in infrastructure can require significant resources to construct, operate, and maintain over the course of their life-cycle. Leading capital-planning practices can help agencies determine the resources needed to meet their mission, goals, and objectives and how to efficiently and effectively satisfy those needs throughout the capital decision-making process. As shown in table 4, we found that BEP's capital investment decision-making process that resulted in its decision to pursue a new currency-production facility (as part of the previously

described hybrid option) followed three applicable capital-planning leading practices and substantially followed the fourth.²⁴

Table 4: GAO's Assessment of the Bureau of Engraving and Printing's Adherence to Leading Capital-Planning Practices for its Proposed New Currency Production Facility

Leading practice	Key Activities	Assessment
Needs assessment	<ul style="list-style-type: none"> Considers the capability of existing resources as well as current information on asset condition. Using this information, an organization can make decisions about where to invest in facilities. Identifies the resources needed to fulfill both immediate requirements and anticipated future needs. 	Followed ^a
Alternatives evaluation	<ul style="list-style-type: none"> Determine how best to bridge performance gaps by identifying and evaluating alternative approaches. Before choosing to purchase or construct a capital asset or facility, leading organizations carefully consider a wide range of alternatives and funding options, such as using existing assets, leasing, or privatizing the activity 	Substantially followed ^b
Strategic linkage	<ul style="list-style-type: none"> Provide a long-range plan for the capital asset portfolio in order to meet the goals and objectives in the agency's strategic plans. Agency strategic plans should identify capital assets and define how they will help the agency achieve its goals and objectives. 	Followed ^a
Long-term capital plan	<ul style="list-style-type: none"> The long-term capital plan should be the final and principal product resulting from the agency's capital-planning process. The capital plan should cover 5 years or more, updated annually or biennially, and should reflect decision makers' priorities for the future. Capital plans should include a statement of the agency mission, strategic goals and objectives; and a description of the agency's planning process. 	Followed ^a

Source: GAO analysis of Bureau of Engraving and Printing's capital planning process | GAO-18-338

^aFollowed: BEP provided evidence that it fully followed the activities associated with the practice.
^bSubstantially followed: BEP provided evidence that it followed most of the activities associated with the practice.

Needs assessment: BEP followed this leading practice, which calls for comprehensively assessing the resources needed as a basis for investment decisions. BEP conducted a facility condition assessment in 2004 that contributed to BEP's effort to seek a new production facility, resulting in the studies from 2010-2017 discussed above. The assessment identified the current condition of the facility and the facility's capabilities, including production inefficiencies that led BEP to begin a multi-year effort to determine its immediate and future infrastructure

²⁴GAO, *Executive Guide: Leading Practices in Capital Decision-Making*, GAO/AIMD-99-32 (Washington, D.C.: December 1998); and OMB, *Capital Programming Guide, Supplement to Office of Management and Budget Circular A-11: Planning, Budgeting, and Acquisition of Capital Assets* (2017).

needs. BEP also determined in 2004 that the agency had almost \$200 million in deferred maintenance needs. BEP officials told us that they consulted with Federal Reserve officials²⁵ and concluded that it would not be prudent to spend substantial funds to address this deferred maintenance. For example, officials determined that it would not be prudent to replace the heating and plumbing systems while pursuing a new production facility. As a result, BEP deferred some maintenance items, such as replacing heating systems, which would not compromise safety and production. However, BEP officials said that they prioritized and maintained critical items, such as its cleaning and recycling systems, and implemented energy conservation initiatives to help reduce costs. As of October 2017, BEP's deferred maintenance backlog was about \$196 million.

Alternatives evaluation: BEP substantially followed this leading practice, which calls for a determination of how best to bridge performance gaps by identifying and evaluating alternative approaches. As noted above, BEP first considered multiple alternatives on how to achieve its mission to efficiently produce banknotes. Further, BEP considered different methods to fund and obtain land and a shell for a new production facility (see table 5). To evaluate alternatives for the location of a new facility, a contractor identified, in 2015, potential construction sites in the D.C. area and compared each site to a set of criteria. However, BEP officials told us that they discounted locations outside the metropolitan D.C. area because they believed it would be costly to relocate employees or hire and train new manufacturing personnel to replace employees who do not relocate. BEP officials said that the few employees who relocated from the D.C. facility to the Fort Worth facility when it first opened were paid \$50,000 each for their move. Based on these factors, BEP focused on a D.C.-area location and did not conduct an analysis of the financial implications of building a new facility outside the D.C. area, where construction or other costs could be less expensive.

²⁵The Federal Reserve is required to pay all costs incurred by BEP for the production of currency notes. 12 U.S.C. § 420. According to Federal Reserve officials, for expenses greater than \$1 million, BEP notifies the Federal Reserve in accordance with an agreement codified in a Memorandum of Understanding between Treasury and the Federal Reserve. Federal Reserve officials told us this is not approval authority, but it gives the Federal Reserve the ability to ask questions before such large purchases are made. Federal Reserve officials told us that they have no document related to the maintenance needs and deferral of key maintenance activities; however, BEP may have informed Federal Reserve staff of its decision to defer such costs in light of Treasury's pursuit of a new facility.

Table 5: Alternative Methods BEP Considered to Fund and Obtain Land and a Building for a New Production Facility

Method considered	Justification given for not selecting an alternative
Donated land and building shell	According to BEP officials, given the high value of land in the D.C. area, it is unlikely that a private entity or municipal government would donate land and a building shell.
Swap-construct exchange	BEP officials explored the idea of entering into a "swap-construct" exchange in which a private developer would build a new facility for BEP in exchange for title to BEP's current building(s). However, GSA determined that a "swap-construct" exchange would not be feasible in this case because of the long timeline required to migrate the existing production equipment to a new production facility. In addition, GSA has limited experiences with swap-construct projects and recent attempts have been cancelled. ⁸
Congressional appropriations	BEP officials inquired about receiving congressional appropriations to fund the land purchase and construction, but Treasury, OMB, and GSA officials said that since the purpose of a new production facility would be to produce currency notes, the funds should originate from the Federal Reserve.
Federal Buildings Fund	BEP and GSA officials discussed using funds appropriated from the Federal Buildings Fund to purchase land and construct a building; however officials believed that Congress would be unlikely to appropriate such funds since BEP does not pay rent into the Federal Buildings Fund.

Source: GAO analysis | GAO-18-338

⁸GAO, Federal Real Property: Observations on GSA's Canceled Swap Exchange Involving Buildings in the Federal Triangle South Area, GAO-16-571R (Washington, D.C.: June 16, 2016)

Strategic linkage: BEP followed this leading practice, which stresses the importance of linking plans for capital asset investments both to an organization's overall mission and to its strategic goals. In the 2014-2018 Strategic Plan, BEP noted that it would seek approval to proceed with the 2013 study's recommendation to construct a new production facility. According to the strategic plan, a new production facility would help achieve BEP's long-articulated strategic goal of being a printer of world-class currency notes, providing its customers and the public with superior products through excellence in manufacturing and technological innovation. Furthermore, Treasury concurred with BEP's assessment and added its request for legal authority to purchase land and build a new facility in the fiscal year 2018 President's Budget proposal.

Long-term capital plan: BEP followed this leading practice, which calls for a capital plan that documents an agency's decisions and describes its mission, planning process, and risk management, among other things. BEP completed all of the key activities associated with this practice. For example, in its fiscal year 2018 capital investment plan, BEP lays out the purpose, goals, and benefits of a new currency production facility. It also notes the implications of exposing currency production to vulnerabilities relating to potential facility systems failures and inefficiencies.

BEP's 2017 Cost Estimate Partially Met the Four Characteristics of a High-Quality, Reliable Estimate

A reliable cost estimate—a summation of individual cost elements—is critical to support the capital planning process by providing the basis for informed investment decision-making, realistic budget formulation and program resourcing, and accountability for results. BEP's 2017 cost estimate includes a contractor-developed estimate of the cost for the construction of a new production plant and the repurposing of the Main Building for BEP's administrative offices (the hybrid alternative) and a BEP-developed estimate of additional project costs, such as additional production equipment and real estate acquisition. We found this estimate partially met the four characteristics of a high-quality, reliable cost estimate (see table 6). In developing this estimate, BEP relied on GSA guidance that was available at the time.²⁶ That guidance did not refer to leading practices for cost estimates that are identified in GAO's Cost Guide. GSA has recently updated its guidance to refer to the leading practices in GAO's Cost Guide, and BEP officials told us that they will follow this updated GSA guidance when developing any future cost estimates.

Table 6: GAO'S Assessment of the Extent to Which the Bureau of Engraving and Printing's (BEP) 2017 Cost Estimate Meets the Characteristics of a High-Quality, Reliable Cost Estimate.

Characteristic	Leading practice	Overall assessment
Comprehensive	<ul style="list-style-type: none"> The cost estimate includes all life-cycle costs. The cost estimate completely defines the program, reflects the current schedule, and is technically reasonable. The cost estimate work breakdown structure is product-oriented, traceable to the statement of work/objective, and at an appropriate level of detail to ensure that cost elements are neither omitted nor double-counted. The cost estimate documents all cost-influencing ground rules and assumptions. 	Substantially met ⁶

²⁶The guidance is GSA, P-120: *Project Estimating Requirements for the Public Buildings Service*. GSA Office of the Chief Architect (Washington, D.C.: January 2007). According to GSA officials, GSA updated its guidance to include GAO's best practices in August 2016, after BEP had begun the cost estimating process.

Characteristic	Leading practice	Overall assessment
Well-documented	<ul style="list-style-type: none"> The documentation should capture the source data used, the reliability of the data, and how the data were normalized. The documentation describes in sufficient detail the calculations performed and the estimating methodology used to derive each element's cost. The documentation describes step-by-step how the estimate was developed so that a cost analyst unfamiliar with the program could understand what was done and replicate it. The documentation discusses the technical baseline description and the data in the baseline is consistent with the estimate. The documentation provides evidence that the cost estimate was reviewed and accepted by management. 	Partially met ^b
Accurate	<ul style="list-style-type: none"> The cost estimate results are unbiased, not overly conservative or optimistic, and based on an assessment of most likely costs. The estimate has been adjusted properly for inflation. The estimate contains few, if any, minor mistakes. The cost estimate is regularly updated to reflect significant changes in the program so that it is always reflecting current status. Variances between planned and actual costs are documented, explained, and reviewed. The estimate is based on a historical record of cost estimating and actual experiences from other comparable programs. The estimating technique for each cost element was used appropriately. 	Partially met ^b
Credible	<ul style="list-style-type: none"> The cost estimate includes a sensitivity analysis that identifies a range of possible costs based on varying major assumptions, parameters, and data input. A risk and uncertainty analysis was conducted that quantified the imperfectly understood risks and identified the effects of changing key cost driver assumptions and factors. Major cost elements were cross-checked to see whether results were similar. An independent cost estimate was conducted by a group outside the acquiring organization to determine whether other estimating methods produce similar results. 	Partially met ^b

Source: GAO analysis of Bureau of Engraving and Printing's cost estimates. | GAO-18-338

^aSubstantially met: BEP provided evidence that it followed most of the practices associated with the characteristic.

^bPartially met: BEP provided evidence that it followed about half of the practices associated with the characteristic.

Comprehensive: BEP's 2017 cost estimate substantially met the comprehensive characteristic. For example, the estimate included most life-cycle cost components, defined the program and its current schedule and included a consistent work breakdown structure. However, the estimate did not include operating and sustainment costs or information regarding the ground rules and assumptions used to develop the costs.

Well documented: BEP's 2017 cost estimate partially met the well-documented characteristic. For example, the estimate documented the source data and the technical assumptions used for the construction

costs, which were reviewed by GSA and BEP personnel. However, documentation for the contractor's estimate and its sources for the factors used in the estimate did not include details to enable an outside cost analyst to replicate the work. According to BEP officials, the cost data are the contractor's proprietary data. BEP officials also told us that sources for the factors used were based on subject matter expert opinion.

Accurate: BEP's cost estimate partially met the accurate characteristic. While we found minor rounding errors and no errors in the model build-up calculations and did not find any calculation or adjustment errors in the estimate, the estimate nonetheless did not provide information regarding the bias of the costs and the appropriateness of the estimating technique used. However, BEP did follow industry standards to develop contingency costs for a pre-design estimate for a program that has not yet been authorized. We also found that \$515 million of the internal estimate (37 percent of the program's total cost estimate) was based on undocumented subject matter opinion or escalated incorrectly from the 2013 study estimate. Further, BEP's estimate did not use the same construction year mid-point as its contractor for the inflation assumptions. According to BEP officials, that lack is because BEP's costs were projected based upon the contractor's estimate of fiscal year 2022, while the production equipment was escalated to fiscal year 2021 because this is the projected year for purchasing equipment. The officials also acknowledged that this rationale, however, was not documented in the cost estimate. BEP clarified that the estimates did not explicitly state a confidence level because the estimate is in the pre-planning stage. They added that it is common in the design and construction industry that contingencies are applied to the estimate based on the completeness of design, and as the design progresses, these contingencies are reduced as more becomes known about the project. As there have not been actual costs yet, variances between planned and actual costs have not been documented, explained, and reviewed.

Credible: BEP's 2017 cost estimate partially met the credible characteristic. For example, BEP provided documentation showing that both BEP and GSA reviewed the contractor's construction estimate and its technical assumptions. However, the estimate did not include a sensitivity analysis for the construction costs, a risk and uncertainty analysis, or cross-checks to see whether similar results could be obtained. A cross-check could include an independent cost estimate conducted by an outside group to determine whether other estimating methods would produce similar results, but BEP officials told us that no independent cost estimate was developed because this was too early in

the project to do such a comparison and that the construction estimate was developed in response to a government contract statement of work to prepare a preliminary budget forecast for BEP. Rather, BEP relied on what it characterized as an extensive review by BEP management and GSA officials.

Ability to Sell or Repurpose Potentially Vacant Space Could Affect the Total Cost to the Federal Government

The alternative that BEP pursues could have a financial effect on the federal government and ultimately taxpayers. Below, we discuss potential costs and potential savings associated with the disposition of the three buildings under the different scenarios based on our review of BEP documents and interviews with Treasury and GSA officials (see fig. 2). For example, Treasury, which has custody and control over the Main Building and the Annex, could experience costs if it needs to spend money to upgrade these buildings, but could also experience savings if it can repurpose the buildings or consolidate its employees into fewer buildings. GSA, which serves as the federal government's primary real property and disposal agent, could incur costs for the marketing and disposal process, but could create savings for the government if it could repurpose or sell any vacated buildings. Proceeds from sales of Treasury-controlled facilities would benefit the federal government.

Figure 2: Potential Disposition and Funding of BEP's Washington, D.C., Facility and Related Potential Costs or Savings

Building	Potential action	Additional costs or savings, if any	
Main Building	Renovation	<ul style="list-style-type: none"> The Bureau of Engraving and Printing (BEP) renovates entire building using payments deposited by Federal Reserve into BEP's revolving fund BEP occupies renovated Main Building 	No additional costs or savings to the federal government
	Hybrid	<ul style="list-style-type: none"> BEP renovates 1/3 of the Main Building for its use for administrative purposes and partially repurposes the remaining space to a warm-lit shell^a using payments deposited by Federal Reserve into BEP's revolving fund The Department of the Treasury (Treasury) pays to repurpose the remaining 2/3 of the Main Building for occupancy by another Treasury agency 	<ul style="list-style-type: none"> Cost to Treasury to repurpose 2/3 of the Main Building for its use Savings to Treasury from consolidating leased space
	New build	<ul style="list-style-type: none"> Treasury pays to repurpose the entire Main Building for use by a Treasury agency BEP no longer occupies the Main Building 	<ul style="list-style-type: none"> Cost to Treasury to repurpose the entire Main Building for its use Savings to Treasury from consolidating leased space
Annex Building	Renovation	<ul style="list-style-type: none"> BEP renovates 1/2 of the Annex for its use and partially repurposes the remaining space to a warm-lit shell using payments deposited by Federal Reserve into BEP's revolving fund Treasury pays to repurpose the remaining half of the Annex for its use 	<ul style="list-style-type: none"> Cost to Treasury to repurpose 1/2 of the Annex for its use Savings to Treasury from consolidating leased space
	Hybrid or new build	<p>BEP is responsible for any needed environmental cleanup of the Annex before transferring the building to the General Services Administration (GSA) to carry out the disposal or sales process</p> <p>If the Annex sells</p> <p>If the Annex does not sell</p> <p>If the Annex is transferred to a local government for public services, such as sheltering the homeless</p>	<ul style="list-style-type: none"> Cost to BEP for environmental cleanup, if necessary, before transferring the Annex to GSA for the disposal process Cost to GSA to conduct the sale of the Annex Proceeds from sale of the Annex would benefit the federal government Cost to BEP and Treasury to annually maintain the Annex (in general) Cost to GSA to market the Annex
Warehouse	Renovation	BEP continues to lease the warehouse and allow other Treasury components to use a portion of the building as outlined in interagency agreements	Cost to BEP to lease the warehouse
	Hybrid or new build	<p>BEP does not renew its lease for the warehouse with GSA</p> <p>GSA finds new tenants for the term of the lease with the private entity that owns the warehouse. At the end of the lease, GSA could terminate the lease with the private owner</p>	<ul style="list-style-type: none"> Savings to BEP from ending the lease of the warehouse Cost to GSA if it is not able to find another federal tenant

Source: GAO analysis of BEP, Treasury, and GSA data. | GAO-18-338

^aA "warm lit shell" is a commercial or residential building with a minimally finished interior, usually with ceilings, lighting, plumbing, heating and cooling (HVAC), interior walls (painted or unpainted), electrical outlets, elevators, rest rooms, and a concrete floor. A warm lit shell is considered ready to lease and ready for tenant improvements.

Note: The Federal Reserve deposits payments for currency production, including BEP's operational expenses, into BEP's revolving fund. BEP uses its revolving fund to pay for all of its operational costs.

While it is possible to identify some potential costs and benefits, it is too early to determine which costs or benefits may be realized or to attempt to quantify them. GSA and Treasury officials told us that the actions of other agencies or interested third parties (e.g., those potentially interested in purchasing the Annex) would affect the costs and cost-savings of any alternative. In addition, there are factors outside of the government's control, such as timing and market conditions, that could affect costs and cost-savings. For example, changes in the Washington, D.C., real estate market could affect the opportunity to sell the Annex. Based on interviews with officials at GSA, Treasury, the Federal Reserve, and BEP, we have identified the following potential costs and savings for each building.

Potential costs and savings associated with the Main Building: Both BEP and Treasury officials told us that the Main Building will remain under Treasury's custody and control, regardless of which alternative BEP undertakes.

- **Renovation:** BEP would use its revolving fund to replace existing heating/cooling systems and windows in the Main Building with higher efficiency ones. Ideally, there would be some long-term cost savings because the new systems would be less costly to operate. However, BEP officials told us that a renovation may be more expensive than currently estimated because the Main Building is over 100 years old and there could be unforeseen expenses depending on what is found once walls and ceilings are removed.
- **New build:** Treasury would likely pay to renovate the Main Building once BEP vacates it because the Main building would remain under Treasury's custody and control. The cost of this renovation could be partially offset by savings associated with co-locating other Treasury offices in the Main Building after the renovation is complete. For example, Treasury bureaus currently have 15 leased facilities with about 1.9-million square feet in the downtown D.C. area. The annual cost of these facilities is \$91.7 million. While, not all of the employees currently in leased space could move into a renovated Main Building, the Main Building's 530,000 square feet could provide opportunities to reduce leasing costs. However, because these potential renovations and staff moves are not likely to occur for several years, Treasury officials told us that they are not able to determine either the costs or benefits of moving Treasury staff to the Main Building.

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- **Hybrid:** BEP's revolving fund would pay for the renovation of one-third of the Main Building that would serve as BEP's administrative office and a future visitors' center. This step would leave the remaining two-thirds to be renovated to a "warm lit shell"²⁷ to allow others to occupy the building. At this time, Treasury does not know what entity or account would pay for the renovation of the remaining two-thirds because, according to Treasury officials, they have not determined what the use of the balance of the Main Building would be, including what entity would fund any modifications needed for new occupants. If Treasury decided to use the Main Building for its own staff, then Treasury could fund the cost to convert to offices for other Treasury agencies. Under this scenario, there is both a cost to Treasury to renovate the space it plans to use as well as a savings in having Treasury staff vacate other leased space and move to a Treasury-controlled building.

Potential costs and savings associated with Treasury's Annex: The Annex could either remain for BEP's administrative offices or could be declared excess and transferred to GSA for disposal.

- **Renovation:** BEP's revolving fund would cover the cost of renovating the entire Annex as a "warm lit shell" and a more extensive renovation of the portion of the Annex that BEP would use first as temporary space for its currency printing equipment and then permanently for its administrative office. According to BEP officials, the Annex would be renovated to accommodate currency-printing lines that would be relocated from the Main Building in order for the Main Building to be renovated. Once the Main Building is renovated, the Annex would then be renovated to become administrative space for BEP. This process could be quite costly and take more time as the Annex would be renovated twice for different purposes. However, if the unused part of the Annex could be used by Treasury for other Treasury offices, there could be some cost savings to Treasury. According to BEP officials, while BEP would use its revolving fund to renovate the Annex to a "warm lit shell," the agency that ultimately occupies the unused space would be responsible for the costs associated with repurposing that space for its own purposes.

²⁷A "warm lit shell" is a commercial or residential building with a minimally finished interior, usually with ceilings, lighting, plumbing, heating and cooling (HVAC), interior walls (painted or unpainted), electrical outlets, elevators, rest rooms, and a concrete floor. A warm lit shell is considered ready to lease and ready for tenant improvements.

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- **New build and Hybrid:** BEP's revolving fund would pay for any necessary environmental clean-up needed in order for the Annex to be declared as excess and transferred to GSA for disposal. GSA, as part of its mission, would incur costs such as marketing, conducting the disposition process, and concluding the property transfer. GSA's disposal process can result in the building being transferred for use by another Federal agency, being sold to a local or state government via a negotiated sale, being conveyed to a public entity or eligible non-profit for public uses (e.g. homeless use), or being sold to a private party via a public sale. As the Annex is centrally located in Washington, D.C., the building could be attractive to potential developers.²⁸ GSA recently sold another federal building near the Annex for over \$30 million. GSA officials believe that there would be significant market interest in the Annex due to the Annex's location and recent private development in the area. Treasury and GSA officials stated that proceeds from the sale of the Annex would be deposited into the Land and Water Conservation Fund to benefit the federal government.²⁹

On the other hand, there is no guarantee that GSA would be able to sell the Annex: our previous work found that the most frequent method of disposal for federal buildings from fiscal years 2011 through 2015 was demolition (57 percent) rather than sale (14 percent). Federal buildings identified for disposal may not be suitable for sale for reasons such as their age, location, and condition, factors that often make demolition the preferred disposal method. The unique configuration of the Annex with its five wings, its age and condition, and historic-designation eligibility could deter some potential buyers. The future demand for the building, interest from private-sector buyers, and the general economic and real estate market are

²⁸Part of the Annex is a small building known as the "Railroad Siding Building." The building sits on a larger tract of land owned by a private developer. According to BEP officials, the land was transferred by the District of Columbia Redevelopment Land Agency to the developer subject to an easement that preserves BEP's property interest in the building. BEP officials are uncertain as to what would happen to this property interest if Treasury declares the Annex as excess.

²⁹According to Treasury officials, Treasury does not have the authority to retain proceeds from sales of its buildings. According to Treasury and GSA officials, the proceeds from the sale of the Annex would be deposited into the Land and Water Conservation Fund. See 54 U.S.C. § 200302. Amounts in the fund must be appropriated before they can be used. Once appropriated, amounts in the fund are generally available for purposes related to land and water acquisitions for national parks, national forests, and national wildlife refuges, or as otherwise permitted in the appropriation act making them available.

uncertain and can change quickly. If the Annex is not sold and remains on the government's real property inventory, generally BEP or Treasury would be responsible for any annual maintenance costs for the building.³⁰ Alternatively, the unsold Annex could be donated to a state or local government that would then be responsible for maintenance costs.

Potential costs and savings associated with the leased warehouse: The warehouse is a GSA-leased property.

- **Renovation:** BEP would continue its annual leasing of the warehouse, which would still be needed to accommodate large trucks that cannot access the D.C. facility. The current lease costs approximately \$3.4 million each year, and BEP recovers about \$500,000 per year of these costs by permitting other Treasury components to use the building through interagency agreements.
- **New build and Hybrid:** If BEP discontinued its lease after a new facility is completed, it would save approximately \$2.9 million per year. If BEP ended its lease prior to the end of the lease term, GSA would need to find another entity to occupy the warehouse for the remainder of the lease term.

Agency Comments

We provided copies of the draft report to the BEP, GSA, the Federal Reserve, and Treasury for review and comment. BEP coordinated with Treasury in providing comments. In these comments, reproduced in Appendix I, BEP emphasized the factors that led BEP to determine that a new facility is the preferred alternative for its currency production process and acknowledged our findings on those factors. BEP and the Federal Reserve also provided technical comments, which we incorporated as appropriate. GSA did not provide comments.

As agreed with your office, unless you publicly announce the contents of this report earlier, we plan no further distribution until 30 days from the report date. At that time, we will send copies to the Director of the Bureau of Engraving and Printing, the Secretary of the Treasury, the Chair of the Federal Reserve Board, and the Administrator of the General Services

³⁰Generally, the landholding agency is responsible for the cost of protection and maintenance of excess or surplus property until the property is transferred or disposed, but generally not for more than 15 months. 41 C.F.R. § 102-75.970.

Administration. In addition, the report will be available at no charge on the GAO website at <http://www.gao.gov>.

If you or your staff have any questions about this report, please contact me at (202) 512-2834 or RectanusL@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. GAO staff who made major contributions to this report are listed in appendix II.

Sincerely yours,

A handwritten signature in cursive script that reads "Lori Rectanus".

Lori Rectanus
Director, Physical Infrastructure Issues

Appendix I: Comments from the Department of the Treasury

 <small>DIRECTOR</small>	<small>DEPARTMENT OF THE TREASURY BUREAU OF ENGRAVING AND PRINTING WASHINGTON, D. C. 20228</small>
<p>March 9, 2018</p>	
<p>MEMORANDUM FOR:</p>	<p>Lori Rectanus, Director – Physical Infrastructure Team U.S. Government Accountability Office</p>
<p>FROM:</p>	<p><i>L.R. Olin</i> Leonard R. Olin, Director Bureau of Engraving and Printing Department of the Treasury</p>
<p>SUBJECT:</p>	<p>Bureau of Engraving and Printing Facility Planning Draft Report Agency Comments GAO Engagement Code: 101990/GAO-18-338</p>
<p>The Bureau of Engraving and Printing (BEP) thanks the members of the U.S. Government Accountability Office (GAO) review team for their professionalism while reviewing the options for and federal costs of a future production facility to manufacture United States Federal Reserve notes (FRNs). The BEP preferred option – to build a new production facility in the Washington, D.C. area and renovate some administrative space in its current DC facility – would: (1) save federal costs; (2) allow for a secure perimeter that meets federal building security standards; and (3), improve production efficiencies by enabling the BEP to manufacture FRNs on a single production floor utilizing modern processes and equipment.</p> <p>The GAO found the BEP generally followed leading capital planning practices relevant at the time, and its 2017 cost estimate of a new production facility partially met the characteristics of a reliable cost estimate. As acknowledged in the GAO report, the BEP relied on the General Service Administration guidance that was available at the time, which did not refer to the leading practices for cost estimates identified by GAO in its cost guide. In addition, GAO verified the reliability of the BEP data gathered from multiple facility studies conducted over the past three decades that all concluded the agency would be best served by construction of a new production facility.</p> <p>In order to stay ahead of worldwide counterfeiting trends and threats amplified by ever-improving commercial and non-commercial printing capabilities, the BEP must recapitalize its production equipment and Washington, DC facility. The current production environment in the facility is inadequate to meet the challenges of counterfeit deterrence and complete the robust annual currency order from the Board of Governors of the Federal Reserve System (Board), all while maintaining or surpassing world-class quality currency note standards. For this reason, the Department of the Treasury, the Office of Management and Budget, and the White House included a legislative proposal in both the Fiscal Year (FY) 2018 and 2019 Presidential Budget Submissions to Congress that would enable the BEP to lower federal costs by building a new facility in the Washington, DC area.</p>	

Appendix I: Comments from the Department of
the Treasury

The BEP agrees with GAO's analysis that a new production facility and some renovated administrative space in its current Washington, DC facility would accommodate modern, more efficient equipment, and based upon the FY 2019 Presidential Budget Submission to Congress would save the federal government \$579 million dollars in comparison to the alternative of renovating the BEP's 100-year-old, multi-story buildings in downtown Washington, D.C. As a result of this notable savings, the Congressional Budget Office scored the legislation requested by the BEP to authorize construction of a new production facility as a cost-neutral proposal. Of course, all construction program estimates are a snapshot in time and are subject to change with the passage of time due to inflationary pressures.

During its review, GAO also heard from Board officials who concur a new facility is warranted, because multiple studies have indicated renovation of the existing facility would be more costly and would not provide the same degree of production efficiency. Board officials indicated they prefer the new building alternative because it is the least expensive option. These officials also told GAO the Board will be financially responsible for funding a new facility.

The BEP would be able to continue its manufacturing operations, but will not gain any significant production efficiencies by renovating its antiquated, multi-floor facilities in Washington, DC. In addition, high operating costs that would be eliminated in a modern, warehouse-like production facility would continue, as would the exorbitant maintenance costs that result from force-fitting manufacturing operations in a downtown office building. While U.S. currency dates back to the 1800s, it must be considered a contemporary product requiring a twenty-first century production facility. If not, the Government of the United States will continue to bear unnecessary costs, as well as unnecessary risks associated with process inefficiencies.

To satisfy the manufacturing needs of the next generation of state-of-the-art currency note design, as well as the BEP's commitment to quality, the agency will need to initiate large-scale renovations of its existing facilities if it does not obtain the requisite statutory authority to construct a new production facility in the Washington, DC area in a timely manner. Renovating existing facilities, which can be done without congressional action, would forgo the manufacturing efficiencies that would be realized by creating a new, streamlined facility. It also would eliminate the anticipated reduction of approximately 25 percent of the BEP's real estate portfolio, and the estimated \$579 million in cost savings that would result from constructing a new facility.

The BEP is not an ordinary government agency requiring an ordinary government building. The BEP is a manufacturing facility – a printing plant – which produces an iconic commodity trusted worldwide. GAO is aware the BEP has studied the issue of recapitalizing its DC-based equipment and facilities for decades. The studies show clear and justified reasoning for a new production facility.

The BEP's mission requires a near-term decision: to proceed with a new facility; or embark on costly renovations of the existing Washington, DC facility. It is the BEP's hope that GAO's thorough review of the BEP facility recapitalization program will provide Congress the necessary data to consider and approve the legislation the BEP needs to construct a new facility.

Appendix II: GAO Contact and Staff Acknowledgments

GAO Contact

Lori Rectanus, (202) 512-2834 or RectanusL@gao.gov

Staff Acknowledgments

In addition to the individual named above, John W. Shumann (Assistant Director); Martha Chow (Analyst in Charge); Amy Abramowitz; Lacey Coppage; Delwen Jones; Jennifer Leotta; Josh Ormond; and Tomas Wind made key contributions to this report.

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EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF MANAGEMENT AND BUDGET
WASHINGTON, D.C. 20503

ATTACHMENT B

July 9, 2018

The Honorable Richard Shelby
Chairman
Committee on Appropriations
United States Senate
Washington, DC 20510

Dear Mr. Chairman:

On June 21, 2018, the Appropriations Committee considered the fiscal year (FY) 2019 Financial Services and General Government Appropriations bill. Overall, according to preliminary OMB estimates, the bill appears to increase funding by about \$0.2 billion, or nearly 1 percent above the FY 2019 Budget request. The Administration appreciates the opportunity to weigh in on this bill.

The President's FY 2019 Budget request, as amended, accounts for the Bipartisan Budget Act of 2018 (BBA's) new Defense and non-Defense discretionary spending caps for FY 2019. As we have noted in previous letters as well as the FY 2019 Budget, the Administration strongly supports the overall defense levels included in the BBA. However, given the Nation's long-term fiscal constraints and the need to right-size the Federal Government, the Administration does not support spending at the BBA's non-Defense caps.

The Administration appreciates that the Committee bill includes funding for critical priorities, including:

- Internal Revenue Service (IRS). The bill provides the IRS a total of \$11.3 billion, \$128 million above the FY 2019 Budget request. This amount includes \$77 million in dedicated funding for tax reform implementation. The Administration appreciates the Committee's support for tax reform and the amounts provided in the bill fully fund the Administration's two-year proposal requested in FY 2018.
- Office of Terrorism and Financial Intelligence (TFI). The bill provides \$159 million for the Department of the Treasury's TFI, equal to the FY 2019 Budget request. The Administration appreciates the Committee's support for TFI to continue its critical work safeguarding the financial system from abuse and combatting other national security threats using non-kinetic economic tools.
- Bureau of Engraving and Printing (BEP). The bill includes a provision that would allow BEP to acquire land and construct a replacement for its currency production facility in the National Capital Region using its existing resources. The Administration appreciates the Committee's support for this proposal which would allow BEP to avoid a costly renovation of its current facility and ultimately lower the operating costs of producing the Nation's paper currency.

- Treasury Departmental Offices. The bill provides \$209 million for the Department of the Treasury's Departmental Offices, which is \$7 million above the FY 2019 Budget request. These additional funds could be used to strengthen review of foreign investment in the United States and address other emerging priorities. The Administration looks forward to working with the Congress to provide adequate resources to support anticipated increases in the caseload for review by the Committee on Foreign Investment in the United States.
- Commodity Futures Trading Commission (CFTC). The bill provides CFTC with \$282 million, in line with the resources requested in the FY 2019 Budget, to expand examination and analysis capabilities and address financial technology innovation. The Administration urges the Congress to support legislation authorizing user fees to fund certain CFTC activities, as proposed in the FY 2019 Budget.
- Environmental Review Improvement Fund. The Administration appreciates that the Committee has fully funded the requested levels for the Federal Permitting Improvement Steering Council, which is administratively supported by the General Services Administration (GSA). The Federal infrastructure permitting process is fragmented, unpredictable, and inefficient, causing delays in approvals needed to start project construction. Fully funding the Environmental Review Improvement Fund will allow the Council to create a more standardized, coordinated, and predictable permitting process that protects public health, safety, and the environment.

However, the bill underfunds key investments in critical areas supported in the FY 2019 Budget request and/or includes funding that the Administration believes is not in line with the overall restraint in non-Defense spending reflected in the FY 2019 Budget request, including:

- Executive Office of the President. While the Administration appreciates the Committee's support for the Executive Office of the President, including an increase for the Office of Management and Budget, the bill does not fully fund the Information Technology Oversight and Reform (ITOR) account. Inadequate funding for ITOR would necessitate significant staff reductions and severely hinder OMB's ability to perform statutorily required IT oversight functions. Furthermore, the U.S. Digital Service would be less able to respond to significant security breaches or recover failed systems, placing the Nation's critical systems at undue risk. The Administration urges the Congress to fund ITOR and the GSA Office of Government-wide Policy at the levels requested in the FY 2019 Budget, which would facilitate the transition of certain ITOR activities to GSA. The Administration is also concerned that \$2 million of OMB's appropriation is directed to the Office of Information and Regulatory Affairs (OIRA). OIRA plays a key role in the Administration's deregulatory agenda and will continue to receive the resources it needs to execute its critical mission within OMB's budget. Directing a specific funding level impinges on the President's flexibility to adjust staff resources as mission needs change.

- Community Development Financial Institutions (CDFI) Fund. The bill provides \$250 million, \$236 million above the FY 2019 Budget request, for the CDFI Fund within the Department of the Treasury. The \$14 million requested for administrative expenses in the FY 2019 Budget is sufficient to support all ongoing CDFI Fund activities, including the New Markets Tax Credit and the zero-subsidy Bond Guarantee Program.
- Federal Buildings Fund. While the Administration appreciates that the bill provides nearly \$2 billion in capital funding, including the necessary funds to purchase the Department of Transportation headquarters building, the Administration is disappointed that the bill diverts nearly \$500 million in GSA rent receipts intended to fund GSA capital projects to other non-GSA congressional priorities. The diversion of receipts fails to provide Federal agencies with the commercial equivalent space and services that agencies pay for in rent payments. In addition, the bill only partially funds the construction of the Land Port of Entry in Calexico, CA and the next phase of the consolidated headquarters for the Department of Homeland Security; neither project can be initiated until full funding is secured.
- Workforce Fund. The Administration looks forward to working with the Congress to enact authorizing legislation to establish the President's Management Council Workforce Fund housed within GSA and urges the Congress to provide appropriations upon its enactment. The Congressional Budget Office has reported that many types of Federal workers are significantly underpaid or overpaid relative to labor market wages and across-the-board increases applied to the existing pay structure exacerbate this situation. The Administration believes it is essential to develop and fund innovative solutions aimed at recruiting, retaining, and rewarding high-performing Federal employees and those with critical skills sets.
- Technology Modernization Fund (TMF). The Administration appreciates the Congress's prior attention to modernizing vulnerable and inefficient legacy IT systems with initial funding provided to the TMF in FY 2018, and urges continued support for the TMF in FY 2019 as a means to address these pressing challenges. The bill provides no funding for the TMF, which would halt the Technology Modernization Board's ongoing work to tackle impactful, Government-wide IT modernization efforts. The Administration believes that any additional funding would be well utilized and will continue working with the Congress to demonstrate the taxpayer value generated by the TMF.
- Small Business Administration (SBA) Disaster Loans Program Account. The Administration is concerned that the bill does not provide funding for SBA disaster loan administrative expenses, despite the \$186 million included in the FY 2019 Budget request. The bill assumes that SBA would rely on balances from appropriations enacted in the Further Additional Supplemental Appropriations for Disaster Relief Requirements Act, 2018 (Public Law 115-123, division B, subdivision 1), which would not adequately support typical annual disaster lending levels.

- SBA Entrepreneurial Development Programs. The bill provides \$242 million for SBA's Entrepreneurial Development Programs, \$50 million above the FY 2019 Budget request. The Administration is concerned that the bill does not include proposed reforms to the Small Business Development Centers program to create a competitive set-aside and allow for data sharing, which would enable the program to better measure and evaluate effectiveness.

The Administration is concerned that the bill does not include language necessary to enable SBA to establish and operate a Working Capital Fund for IT-related expenses, pursuant to the authorities granted in the Modernizing Government Technology Act. The Administration is also concerned that certain language in the bill seeks to infringe on the President's prerogative to make budgetary recommendations concerning the Army Corps of Engineers, which helps ensure careful stewardship of taxpayer funds.

In addition, while a fully-funded GSA Federal Buildings Fund is critical to making smart real property decisions, the Administration also recognizes that larger, more complex capital transactions would still be difficult to achieve, given competing priorities, particularly for annual operating needs. That is why the Administration has proposed a new budgetary mechanism for large civilian real property projects, the Federal Capital Revolving Fund (FCRF), which would allow the appropriations committees to receive upfront full mandatory funding from the FCRF, in return for committing to repaying those amounts with discretionary budget authority over 15 years. The Administration transmitted legislative language on June 12, 2018 and looks forward to working with the Congress to enact the FCRF proposal.

In addition, the FY 2019 Budget request reflects the Administration's desire to bring more Federal spending under the caps reached in the 2018 BBA by limiting the use of changes in mandatory programs, or CHIMPs, that generate no net outlay savings to offset real increases in discretionary spending. While there are programmatic reasons for some CHIMPs, most of them simply push the availability of funding from one year to the next, or rescind money from a program that no one actually expected would be spent. The Administration encourages the Committee to achieve its discretionary topline while minimizing the use of CHIMPs.

As the Senate takes up the Financial Services and General Government Appropriations bill, the Administration looks forward to working with you to address these concerns.

Sincerely,



Mick Mulvaney
Director

cc: The Honorable James Lankford
The Honorable Christopher Coons

Identical Letter Sent to The Honorable Patrick Leahy

**STATEMENT OF DAVID J. RYDER
DIRECTOR
UNITED STATES MINT
UNITED STATES DEPARTMENT OF THE TREASURY
BEFORE THE
SUBCOMMITTEE ON MONETARY POLICY AND TRADE:
HOUSE COMMITTEE ON FINANCIAL SERVICES
“The Future of Money: Coins and Banknotes”
September 5, 2018**

Chairman Barr, Ranking Member Moore, and Members of the Subcommittee, it is my honor to appear before you, and I thank you for the opportunity to testify during this hearing.

I look forward to updating you on the United States Mint’s progress as a first class manufacturer and an organization driven by the commitment to outstanding products and customer service. Today, my goal is to share the vision of the Mint’s operations and programs, discuss our circulating coins, alternative metals, bullion, and commemorative coin programs, and update you on our future endeavors.

During my nomination hearing, I discussed financial awareness education for our youth to improve our customer base, various technologies that will be analyzed as a way to improve the security of our coinage, and technologies to improve our operations. I plan to update you today on these initiatives, as well.

Mint Overview

It is my honor to lead one of our Nation’s oldest and most venerable public institutions. In 1792, Congress established the first United States Mint facility in Philadelphia. We now have six locations and are the largest coin manufacturer in the world. We are privileged to connect America through coins and medals, which reflect the remarkable history and culture of our Nation.

Congress has given the Mint three primary missions: producing coins at sufficient levels to meet the daily needs of commerce, manufacturing of numismatic and bullion products, and managing and protecting the assets of the American people stored at Ft. Knox, Kentucky.

The United States Mint operates as a matrix organization with multiple lines of operations. Our headquarters are located in Washington, D.C., and there are four production facilities across the country—Philadelphia, West Point, Denver, and San Francisco. Fort Knox is home to the U.S. Bullion Depository.

The Mint's operations are sustained through the sale of circulating coins to the Federal Reserve, numismatic products to the public, and bullion coins to authorized purchasers.

I have visited all four United States Mint production facilities and held town-hall meetings to engage with employees across the organization. This workforce is well-equipped, enthusiastic, engaged, and committed. Our employees have embraced the core values of service, quality and integrity. At any one of these facilities, you'll find safety statistics and a level of morale that rival the best in private industry. This team is committed to quality and efficiency. We have multiple process improvements in manufacturing that have been developed by Lean Six Sigma teams and individual employees.

The Mint employs cutting-edge technology across its three key production phases: design, manufacturing, and packaging. Sculptor engravers use advanced digital tools to transcribe the flat line art of coin designs into 3-dimensional renderings. Robotic technology has reduced the time required for die polishing and grinding from more than two days to just over a half day. A series of robotic arms boosted proof coin packaging from a rate of 600 units per hour to 1,800 units per hour.

By law, the United States Mint operates two fiscally separate programs—a circulating coin program and a numismatic products program that includes collectible coin and medal products in addition to precious metal bullion coins. These programs drive three business lines—circulating coins, numismatic items, and bullion coins—in which each of the Mint's four production facilities plays a distinct role. Denver and Philadelphia produce all of the Nation's circulating coins and together they will account for more than 13.9 billion coins by the close of the fiscal

year. San Francisco leads in numismatics, producing more than 1.5 million items annually. More than 98 percent of American gold and silver bullion coins are produced at the West Point facility.

The U.S. Bullion Depository at Fort Knox—perhaps the most well-known Mint facility—has the mission of storing and securing most of America’s gold reserves.

Coin Efficiencies

The Federal Reserve’s demand for circulating coins and the market’s demand for bullion coins will continue to fluctuate due to economic cycles. To manage market uncertainty and commodity risk, the Mint has identified and executed on opportunities for advancing manufacturing processes. Over the last five years, the Mint has implemented operating cost reductions, strategies and systems to generate cost savings. In fiscal year (FY) 2017, cost of goods sold decreased by \$1.8 billion, as compared to FY 2013.

In FY 2017, the total per unit cost decreased for all denominations compared to FY 2013. The unit cost for the penny decreased 1%, the nickel decreased 30%, the dime decreased 27%, and the quarter decreased 22%. In contrast, FY 2017 unit costs increased for all denominations when compared to FY 2016. The unit cost for both pennies and nickels remain above face value for the twelfth consecutive fiscal year. The Mint is collaborating with the Federal Reserve to explore cost reduction strategies for the penny. As of July 2018, the unaudited unit cost of producing and distributing the penny is \$0.0200, the nickel \$0.0738, the dime \$0.0361 and the quarter \$0.0863.

Lean practices and management controls, zero-based budgeting and cash management, have helped the Mint return \$269 million to the Treasury general fund in FY 2017.

Commemorative Coin Programs

Commemorative coin programs play a key role in our ability to connect America through coins. Therefore, it is especially critical that the Mint work closely with the Congress during the legislative development of these coin and medal programs—together we can identify program themes that both resonate with the public and address the preferences of collectors. Since 1982

Congress has authorized 71 commemorative coin programs; the United States Mint is proud to be the administrator of these programs.

Surcharges from the sales of these coins are authorized to help fund a variety of organizations and projects that benefit the public at large. These coin programs have generated more than \$522.7 million in surcharges for the designated recipient organizations through June of 2018.

I am pleased to say there is much excitement surrounding the 2019 Apollo 11 50th Anniversary commemorative coin program. We believe this program—a tribute to an event that propelled America to the front of the Space Race and captured the imagination of the world—will be particularly popular with both seasoned collectors and new customers because of the subject matter and the innovative curved coin design. We are also excited about next year's American Legion 100th Anniversary commemorative coin program.

We are eager to engage in discussions regarding commemorative coin programs for 2020 and beyond. We also look forward to opening a dialogue about a successor to the circulating commemorative quarter program, as the current America the Beautiful Quarters Program® ends in 2021.

Numismatic Customer Base

Over the past ten years the Mint's numismatic customer base has been declining—from 1.2 million unique customers in 2007 to approximately 500,000 today. The Mint is developing an outreach strategy aimed at increasing general awareness and promoting specific numismatic products. Our revised strategy will strive to reverse negative customer and numismatic unit sales trends.

Bullion Coins

One of our core priorities is minting and issuing gold and silver bullion coins to meet the needs of precious metal investors. We are the largest producer of gold and silver bullion coins in the world. We also mint and issue platinum bullion coins, and last year, we brought to market our first ever palladium bullion coin.

Our American Eagle Gold and Silver Bullion Coins are the coins of choice for investors around the world. Over the years, we have seen demand for our silver bullion coins increase from 8 million coins in FY 2007 to approximately 47 million in FY 2015. This dramatic increase led to shortages of silver blanks from our suppliers during some periods, which forced the allocation of silver bullion coins. We have successfully worked with our blank suppliers to increase their capacity and supply of blanks to the United States Mint.

Beginning in early calendar 2017, however, demand for both gold and silver bullion coins worldwide, including our American Eagle coins, slumped dramatically, as investors apparently focused more on other competing investment classes. In the last couple of months, demand has shown signs of stabilizing, but it seems unlikely that we will return to pre-2017 levels of demand anytime soon. We have adjusted our production levels to be in line with market demand.

We produce all our bullion coins at the United States Mint in West Point, New York, except for America the Beautiful 5-ounce silver bullion coins, which are minted in Philadelphia. Our bullion coin program is a manufacturing success story, and we thank our suppliers, our network of authorized distributors, and, most importantly, our manufacturing team, for their contributions to this important program.

The Future of Money

The pace of technological change, market uncertainty, and the increasing sophistication of criminals are key external factors that will influence the future.

The growth of Blockchain use in the e-commerce space and other monetary factors such as the reduction of coin transactions and the consolidation of settlement outlets will affect Mint operations. The Mint is gathering and analyzing data in order to make informed operational decisions. We will continue to track the pace of technological change and work to gain an understanding of how, where, what, and when emerging platforms will impact our mission and operations.

The Federal Reserve's demand for circulating coins and the market's demand for bullion coins will continue to fluctuate with economic cycles—to which we must remain attuned in order to better forecast and project impacts on Mint operations.

Technological advancements will lead to more sophisticated criminals in the form of cyber-attacks and counterfeit goods. As these threats evolve, the Mint must continue to enhance its capabilities to respond effectively to them. The Mint has implemented hardware, software, and vulnerability management capabilities that provide visibility into the cyber environment and strengthen our resilience to an attack. We are also developing anti-counterfeiting measures, focusing particularly on safeguarding our bullion products. I have assembled a team within the Mint who will develop a multi-level approach including consumer awareness information campaigns, new secure product packaging features, as well as product-integrated protections.

The use of coinage is not in immediate danger of being usurped by any of these factors. I believe that for the foreseeable future, coins will remain important instruments for settling financial transactions. However, with expanded cryptocurrency options on the horizon, the importance of their serious study cannot be underestimated. Full understanding of their potential impact on the Mint and commerce across the globe is wholly necessary.

In view of these external factors, my vision for the Mint is an organization that is more agile in responses to changing conditions—able to nimbly adapt to challenges while working in unison as “One Mint.” The future state outlook can be understood in three areas of focus: workforce, process, and technology infrastructure. To prepare for future human capital needs, the Mint will foster a workforce capable of responding to evolving technology, security, and customer needs.

The Mint will continue to operate as a cross-functional organization, focused on collaborating across all business lines. While the Mint will continue to serve its external customers, Mint employees will also serve each other as internal “customers” of other offices and directorates.

The Mint will increasingly integrate information technology into all of its lines of operation. Capital investments, as well as research and development programs, will be prioritized to drive innovation and seamless operations. Employees will remain vigilant and prepared to address threats to physical and cyber security.

Alternative Metals

The Mint has completed three biennial reports (2012, 2014 and 2016) on research and development (R&D) efforts conducted to examine alternative metallic materials. As you know the reports are authorized by the Coin Modernization, Oversight, and Continuity Act of 2010 (Public Law 111-302).

We have identified two potential compositions for the nickel, dime, and quarter. One project involves reducing the amount of nickel in the 5, 10 and 25-cent coins and projects a cost savings of \$4.1 million annually. The other project is exploring the development of a suitable replacement alloy that could offset the production costs of the 5-cent coin. Its projected cost savings is \$16.6 million annually.

We realize that changing the metallic composition of the coin denominations commonly used in vending will impact a variety of stakeholders in both large and small businesses and in different ways. Therefore the Mint is actively seeking feedback from those industry stakeholders who may be impacted in vending areas such as parking meters, coin-operated laundry, amusement, public transportation, banking, and supermarkets. Our plan is to actively seek input from these groups and the public at large with multiple surveys and requests for public comment and other outreach efforts.

We will also be soliciting comments on the public's use of coins in financial transactions and views on alternative coin options. We will use this input in our analysis of determining an alternative metal and cost-saving options for all denominations.

Youth Financial Awareness

In today's electronic and digital environment, younger generations are most likely to know money through their parents' debit or credit cards. However, coins and paper bills are still the most tangible way to lay the foundation for learning about the importance of money.

Helping our youth understand the role of coins can be a gateway for financial awareness. Helping our youth understand the importance of saving their hard-earned money will better enable them to take control of their personal economics and empower their future.

Mr. Chairman, I thank you for your interest in the mission of the United States Mint. I am pleased to answer any questions that you may have.

The Economics of Eliminating or Retaining the U.S. Penny

Robert J. Shapiro

August 2017

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Table of Contents

<i>Executive Summary</i>	2
I. Introduction and Summary	4
II. Background: The Character of American Money	7
III. Measuring the Costs and Value of Coins in a Modern Currency System	8
IV. The Debate Over the Metal Composition of U.S. Coins	14
V. The Impact of Eliminating the Penny on Coin Recirculation through the Economy ...	18
VI. The Costs to Consumers of Rounding Cash Transactions to the Nearest Nickel	21
VII. The Value of the Penny in the American Economy	22
VIII. The Costs to U.S. Investors of Eliminating the Penny as a Pricing Unit	25
IX. Conclusions	28
<i>References</i>	30
<i>About the Author</i>	35

Executive Summary

In recent years, some commentators have urged the U.S. government to eliminate the penny, based on the costs to produce and distribute the coin and claims that pennies are “more trouble than they’re worth.” This study found that eliminating the penny would generate large additional costs far greater than the costs to produce it, and that American consumers and businesses value their ability to conduct cash exchanges in pennies, as well as in nickels, dimes and quarters.

- At 2015 metal prices, it cost 1.4 cents to produce a new penny and 7.3 cents to produce a new nickel. At those prices, eliminating the penny and producing more nickels with the same combined face value would *raise* production costs by \$5.3 million per year.
- Global metal prices fluctuate, so we used the low, average and high metal prices for the last decade to estimate the cost or savings from eliminating the penny and producing nickels with comparable total face value. This shift produced net costs in all cases.
 - Applying the lowest metal prices of the last decade, the shift would produce net costs of \$1.3 million per year; using the average metal prices of the last decade, the shift would produce net costs of \$25.1 million per year; and using the highest metal prices of the last decade, the shift would produce net costs of \$54.4 million per year.

A coin’s economic value in a modern cash economy is based not on the price of the metals used to produce it, as it was when coins were made of gold and silver, but on its use as a medium of exchange.

- Based on the number of consumer cash transactions, the 25-year lifespan of an average penny, the average number of pennies received or used in cash transactions and the number of pennies in active circulation, we estimate that an average penny turns over 2.18 times per year or 54.5 times over its useful lifespan. Therefore, the penny’s economic value as a medium of exchange is 55 cents, compared to its current production cost of 1.4 cents.

At the direction of Congress, the U.S. Mint has assessed how changes in the metal composition of American coins might reduce their production costs.

- The Mint found that there were no alternative metal compositions that could lower the cost of producing the penny while preserving its usefulness as a medium of exchange.
- The Mint further found only one alternative composition that could lower the costs of producing nickels, dimes and quarters, but the net savings would be very modest.

Most coins exchanged in the United States are used coins recirculating through the economy. Coin-counting services that accept and collate excess coins from businesses and consumers and sell them to the Federal Reserve account for 66 percent of all coins recirculated through the Federal Reserve and financial institutions.

- Pennies play a key role in this process, as they comprise a majority of the coins recirculated through coin-counting services. When Canada phased out its penny in 2013, the volume of Canadian nickels and dimes recirculated through these services fell 35 percent.
- If the U.S. penny were eliminated, the Mint would have to offset some of any comparable net decline in the recirculation of coins by producing and distributing more new coins.
 - At current metal prices, if the Mint offset 25 percent of the reduced volume of recirculated coins with new nickels, dimes and quarters, it would cost an additional \$77 million per year; if the Mint offset 50 percent of that reduced volume, it would cost an additional \$154 million per year; and if the Mint offset 75 percent of that reduced volume, it would cost an additional \$230 million per year.
 - Applying the lowest metal prices of the last decade, offsetting the reduced volume of recirculated coins to the same extent as above would still cost the Mint an additional \$60 million to \$181 million per year; using average metal prices over the last decade, the Mint's additional costs would range from \$85 million to \$256 million per year; and using the highest metal prices of the last decade, the Mint's additional costs would range from \$111 million to \$334 million per year.

Eliminating the penny while retaining its use as a pricing unit also would impose new costs on consumers, as billions of cash transactions would be rounded up or down to the nearest nickel. Based on studies of consumer cash transactions, between 60 percent and 93 percent of transactions would involve rounding up the final charge.

- The rounding up or down of cash transactions to the nearest nickel would cost consumers an estimated \$438 million to \$1.13 billion per year – and even more if merchants adopt strategic pricing practices to ensure that more transactions are rounded up.

If the U.S. penny were eliminated and its role as a pricing unit also ended, it would impose new costs on U.S. retail investors. In 2001, the Securities and Exchange Commission (SEC) directed U.S. stock exchanges to quote all prices in pennies rather than in sixteenths of a dollar. Researchers found that this change lowered investors' trading costs.

- Based on these studies, moving from penny-based pricing of stocks to nickel-based pricing would increase the trading costs of retail investors by at least \$410 million per year.

Eliminating the penny could cost Americans \$909 million to \$1.93 billion per year: \$1.3 million to \$54.4 million for nickels to replace the face value of pennies, depending on metal prices; \$60 million to \$334 million for the additional nickels, dimes and quarters needed to maintain current levels of coin recirculation, depending on metal prices; \$438 million to \$1.13 billion for the rounding up of cash charges to the nearest nickel; and \$410 million in new costs for retail investors.

Finally, American consumers and businesses continue to prove the penny's value as a medium of exchange by using it. Based on their demand, the Mint produced 103 billion new pennies from 2001 to 2015, and pennies account for the majority of all coins in circulation.

The Economics of Eliminating or Retaining the U.S. Penny¹

Robert J. Shapiro

I. Introduction and Summary

For more than a decade, some commentators have called on Congress to revamp American coinage by eliminating the U.S. penny. These advocates note that the penny costs more than one cent to produce, claim it has little value in modern commerce, and conclude that the United States could save millions of dollars by phasing out its use. This case against the penny is based ultimately on the 18th- and 19th-century view of coins as stores of value, because coins in those years contained gold and silver, and a government could claim "seigniorage" profits by minting coins with face values less than the cost of their precious metals. In modern currency systems in the United States and every other nation, consumers and businesses use coins (as well as paper currency) purely as mediums of exchange, not as stores of value. Moreover, as we will see, economic analysis shows that eliminating the penny as a medium of exchange would result in substantial net costs for the government, the economy, consumers and investors totaling an estimated \$909 million to \$1.9 billion per year.

The circulation of new coins – pennies, nickels, dimes and quarters – is a core function of government. The U.S. Mint estimates the annual demand for new coins and produces and sells them at face value to the Federal Reserve. The Federal Reserve resells those new coins to commercial banks and thrifts through its 12 regional banks, and those banks and thrifts distribute them to businesses and consumers. Most of the coins circulating through the economy, however, are used coins, and the process for recirculating them depends on private entities as well as government. Coin-counting services operate at the center of this process. Coin-counting technologies throughout the United States accept and separate customers' change and provide cash vouchers or gift cards in exchange; they then sell the coins to the Federal Reserve through its 12 regional banks or through more than 175 "sanctioned coin terminals" operated by armored vehicle companies. (These companies also transport coins to and from commercial banks and thrifts for recirculation.) In 2015, the leading firm providing coin-counting services (Coinstar) processed some 37 billion coins for recirculation, or more than twice the volume of new coins produced by the Mint in that year. The coins recirculated through this process accounted for 66 percent of all non-new coins handled by the Federal Reserve in 2015 and 51 percent of all coins, new and old, received by the Federal Reserve for circulation and recirculation.

The penny's critics are correct in one respect: the face value of the penny is less than the cost to produce and distribute it. Similarly, the nickel, which would have to replace the penny as the smallest-denomination coin, also costs more to produce than its face value. In 2015, it cost

¹ I want to acknowledge the superb research assistance of Siddhartha Aneja of Sonecon and the support for that research provided by Outerwall. The views and analyses expressed here are solely those of the author.

\$130.1 million to produce and ship new pennies with a combined face value of \$93.7 million and \$109.7 million to produce and ship new nickels with a face value of \$80 million. At 2015 metal prices, the production of new pennies resulted in net costs of \$36.4 million, compared to net costs of \$29.7 million for new nickels. As noted, the Federal Reserve buys these new coins at face value from the Mint, and the Treasury pays or pockets the difference between the price paid by the Federal Reserve and the Mint's production costs. Therefore, the production of new pennies and nickels in 2015 involved merely transfers of \$36.4 million and \$29.7 million, respectively, in net costs for the Mint to net gains for the Federal Reserve. Moreover, as we will see, shifting the production of new pennies to new nickels of comparable face value would also produce net losses.

Since pennies and nickels, along with dimes and quarters, are purely mediums of exchange, a coin's economic value is based not on its production costs, but on its face value times the number of times it is used or turns over, relative to its costs of production and distribution. An average coin lasts 25 years, until it is withdrawn from circulation due to wear and tear. There are no studies of how often an average penny is used, so we estimated the average turnover of a penny using data on cash transactions, the change that consumers use or receive, and the number of pennies in active circulation. On that basis, we estimate that an average penny is used in cash transactions 2.18 times per year, or 54.5 times over its useful life. A penny's economic value over its lifespan, therefore, is \$0.55, compared to the \$0.014 it cost in 2015 to produce a new penny. Adjusting for inflation over the last 25 years, the economic value of a penny as a medium of exchange is \$0.303, compared to its inflation-adjusted production cost of less than eight-tenths of one cent (\$0.0077).

The costs to produce new coins are determined in part by global commodity metal prices. In 2010, Congress directed the Mint to assess how changes in the metal composition of U.S. coins could reduce those production costs. The Mint concluded that there were no alternative metal compositions that would reduce the penny's production costs while preserving its usefulness as a medium of exchange based on criteria such as hardness, recyclability, toxicity, "wear and tear" and its usability in coin-operated technologies. The Mint further found that only one alternative met those criteria for nickels, dimes and quarters: an 80/20 copper/nickel composition. The Mint also found that the annual net savings from adopting the new composition would be very small: \$3.2 million for nickels, \$800,000 for dimes and \$1.3 million for quarters.

Global metal commodity prices fluctuate. Since eliminating the penny would make the nickel the smallest U.S. coin, we also estimated the costs of shifting from pennies to nickels using the lowest, average and highest metal prices from the last decade. Assuming the Mint would replace new pennies with increased production of new nickels with the same combined face value, we estimate that this shift would produce net losses for the government, ranging from \$1.3 million (at the lowest metal prices) to \$25.1 million (at average metal prices) to \$54.4 million (at the highest metal prices). The only way to reduce total production costs would be to shift the production of new pennies to new dimes – but such a shift also would produce shortages of nickels for cash transactions and additional costs for consumers as merchants round cash charges up or down to the nearest nickel or dime.

Eliminating the penny would generate other significant costs. Pennies are the most common and frequently used coin, and they account for the largest share of coins recirculated through the economy by coin-counting services. Eliminating the penny, therefore, could reduce the frequency and volume with which consumers and businesses use those services to recirculate other coins. In 2013, Canada phased out the Canadian penny, and this policy reduced the volume of five- and 10-cent Canadian coins recirculated through coin-counting services by about 35 percent each. It also reduced the recirculation of 25-cent Canadian coins by some 25 percent.

If the United States eliminated the U.S. penny and the same dynamic occurred here, the Mint would have to increase its production of nickels, dimes and quarters in order to maintain the current availability of those coins. The Mint might not have to offset all of the reductions in the coins recirculating through coin-counting services, since businesses and consumers might recirculate some of the “missing” coins by using more coins in their cash transactions. Businesses and consumers also might increase the number of nickels, dimes and quarters recirculated each time they used coin-counting services. To account for these responses, we estimated the costs if 25 percent, 50 percent or 75 percent of the reduced volume of coins processed by coin-counting services were held back from recirculation at any moment and the Mint offset those shortfalls by producing more new nickels, dimes and quarters. At current metal prices, the Mint would have to spend \$77 million to \$230 million per year to offset these reductions. Applying the lowest, average and highest metal prices from the last decade, the Mint would have to spend, respectively, an additional \$60 million to \$181 million per year, \$85 million to \$256 million per year and \$111 million to \$334 million per year, respectively.

Eliminating the penny also would produce large-scale rounding up or rounding down to the nearest nickel in billions of cash transactions. In one prominent study, a researcher examined the pricing of many thousands of consumer transactions involving one, two or three items to determine the distribution of transactions that could be rounded up or down. The author found that 60 percent to 93 percent of those transactions would involve rounding up the final charge to the nearest nickel.² All told, we estimate that this rounding up or down of cash transactions to the nearest nickel would cost consumers \$438 million to \$1.13 billion per year (in 2015 dollars). These costs to consumers could be much larger if, as expected, merchants engage in strategic pricing to ensure that even more transactions would be rounded up.

Rounding charges up or down assumes that we could eliminate the penny from circulation while retaining its use as a pricing unit. However, history suggests that once a coin is withdrawn from circulation, its use in pricing usually declines and finally ends, as seen in the 1980s when Great Britain withdrew its halfpence from circulation. In that case, phasing out the U.S. penny’s use in pricing would impose additional costs on investors in American equity markets. In 1997, U.S. stock markets moved from quoting prices in units of one-eighth of a dollar to units of one-sixteenth of a dollar, and in 2001, the Securities and Exchange Commission (SEC) directed all U.S. exchanges to adopt “decimalization” and quote all stock prices in pennies. Numerous researchers studied the effects and found that this change reduced the spread between the prices sellers ask and the prices buyers bid, thereby lowering investors’ trading costs.³ Based on these studies, we estimate that moving to nickel-based pricing for U.S. stocks

² Lombra (2001).

³ See, for example, Chakravarty, Wood and Van Ness (2004); Fufine (2003); Hillman (2005); Oppenheimer and Sabherwal (2003); Bessembinder and Vankataraman (2010); and Angel, Harris and Spatt (2013).

would increase the trading costs borne by American retail investors by at least \$410 million per year.

All told, we found that eliminating the penny could cost between \$909 million and \$1.93 billion per year: \$1.3 million to \$54.4 million to produce additional nickels to replace the face value of pennies, depending on metal commodity prices; \$60 million to \$334 million to produce the additional nickels, dimes and quarters required to maintain current levels of recirculating coins, depending on metal commodity prices; \$438 million to \$1.13 billion per year for the net rounding up of consumer charges to the nearest nickel; and \$410 million per year in additional transaction costs for retail investors.

Finally, the most reliable economic evidence for the value of the penny as a medium of exchange comes from how American consumers and businesses use the coin every day. Based on actual demand, the Mint produced 103 billion new pennies over the last 15 years, or 56.7 percent of all new U.S. coins. Given the steady production of an average of 6.87 billion new pennies per year from 2001 to 2015, pennies also account for a majority of recirculating used coins, and therefore for a majority of all U.S. coins in circulation. This evidence refutes any claim that pennies are “worthless” or “more trouble than they’re worth” and demonstrates that American consumers and businesses value the penny and the ability to conduct their exchanges in pennies.

II. Background: The Character of American Money

Economists and governments have long debated the character of money and national currencies, and whether coins and notes are stores of value or simply mediums of exchange. In the 18th and 19th centuries, this debate involved not only the character of coins and notes, but also the nature of economic value itself: is the value of a good or service determined by the costs of its inputs and production, or do markets determine value? This larger debate continues today, but the character of money is more settled. Since gold and silver coinage ended in the 19th century and governments stopped backing up currency with precious metals in the 20th century, coins and paper money have been recognized as purely mediums of exchange, rather than repositories of value. So today, American coins and the dollar are backed by the full faith and credit of the United States government, and nothing else.

As this brief summary suggests, precious metals comprised or backed up U.S. coins and notes for many years. The Coinage Act of 1792 created the U.S. Mint and the legal requirement that every U.S. dollar coin contain 371.25 grains of silver.⁴ The Coinage Act also set the value of gold at 15 times the value of silver; the \$10 eagle coin, for example, had to contain 24.75 grains of gold.⁵ Coins of lower denominations, including the half dollar, quarter dollar, dime and half dime, contained the amount of silver corresponding to their face values under the Coinage Act. Similarly, the cent and half-cent coins contained 11 pennyweights of copper and 5.5 pennyweights of copper, respectively. In most cases, the government claimed “seigniorage,” a profit based on the face value of the coins compared to the costs to produce them.

⁴ U.S. Congress (1792).

⁵ $371.25 \times 10 = 3712.5 / 15 = 247.5$

For the first 75 years of the United States, private banks and the Bank of the United States issued paper currency. By law, these notes could be converted to gold or silver at an exchange rate of 371.25 grains of silver or 247.5 grains of gold for each U.S. dollar. In practice, people could convert their bank notes to gold or silver only at designated places, such as the bank that issued the note, and most banks hired agents to distribute their “dollars” in remote places that made redemptions unlikely. In 1862, Congress formally designated the U.S. dollar as legal tender in the United States for all debts, to meet financing pressures from the Civil War. This move meant that lenders would no longer demand gold or silver, and that the first U.S. paper money issued in 1862 was not backed up or convertible to gold or silver. After the Civil War, Congress returned the United States to coins and notes composed of or backed by precious metals, and the millions of greenbacks issued to help finance the war were withdrawn gradually.⁶

The United States remained on a gold standard for the next 55 years, with full currency convertibility or exchangeability, and all coins above the five-cent piece contained the requisite silver. Over much of this period, the banking system was subject to periodic bank runs. In 1913, Congress created the Federal Reserve System to serve as a lender of last resort to banks during such runs, and to issue Federal Reserve notes as the currency of the United States.⁷ These notes remained redeemable for gold until 1933, when President Roosevelt suspended the gold convertibility of American currency by private individuals or entities. For the next 40 years, the United States remained on this “quasi-gold standard” under which the value of gold was pegged to the dollar, but no person or firm could exchange U.S. dollars for gold.⁸ In practice, U.S. paper currency lost any character as a store of value and became purely a medium of exchange.

The 1933 measures did not address the dollar’s convertibility to gold by governments, but the 1944 Bretton Woods Agreement recognized the right of foreign governments to convert dollars to gold at a fixed exchange rate. For 28 years, the Federal Reserve used gold sales and purchases to maintain the established exchange rate or peg. As the rest of the world recovered from World War II over those decades, however, the official price of gold became increasingly expensive to maintain. Finally, President Richard Nixon halted dollar-gold convertibility by foreign governments in 1972, ending the last vestigial role of precious metals in the U.S. currency system.

III. Measuring the Costs and Value of Coins in a Modern Currency System

Since the supply of new U.S. coins and notes is no longer determined in any way by the government’s stores of gold and silver, supply decisions fall to the Federal Reserve System and the U.S. Mint. The Federal Reserve analyzes the demand for paper bills and submits those estimates as print orders to the Bureau of Engraving and Printing.⁹ The U.S. Mint determines the supply of new coins based on 12-month forecasts from the Federal Reserve, economic indicators and seasonal trends that affect coin demand. The Mint then produces the coins at facilities in Philadelphia and Denver, and the Federal Reserve purchases them at face value and distributes

⁶ Elwell (2011).

⁷ *Ibid.*

⁸ *Ibid.*

⁹ Federal Reserve Bank of San Francisco (2013).

them to its 12 regional banks. The Federal Reserve's regional banks then circulate the coins to financial depository institutions (banks and thrifts).¹⁰

Most businesses that use substantial amounts of coins and paper currency in their daily operations depend on banks and thrifts, which provide circulating coins and notes for their customers and accept their excess coins and notes. When financial institutions need more coins or currency, they can order them from a regional Federal Reserve Bank; similarly, when these institutions hold excess coins or notes, they can deposit their excess inventory at a regional Federal Reserve Bank. These regional banks check every coin and note for counterfeits and excessive wear and tear, and authentic coins and notes fit for use are returned through the orders from financial institutions. Badly worn coins and notes are deemed "uncurrent," shipped to the Mint and replaced with new coins and notes.¹¹ In 2015, the Federal Reserve's regional banks circulated 16.2 billion new coins and recirculated 55.2 billion coins, for a total of 71.4 billion coins. The regional banks also collected 55.9 billion coins in 2015 from sources such as banks, thrifts and coin-counting services; based on a 25-year average lifespan of coins, some 1.68 billion of these coins were deemed "uncurrent" and withdrawn from circulation.¹²

These arrangements represent only part of a larger system for the circulation and recirculation of U.S. coins. The Federal Reserve also authorizes more than 175 "sanctioned coin terminals" operated by armored vehicle carrier companies to receive and process orders for coins from financial institutions and receive coins from independent coin-counting services. The firms that operate the coin terminals also transport the coins, lowering recirculating costs. In a given year, some 60 percent of coins handled by the Federal Reserve have been held in coin terminals.¹³

As suggested above, the independent coin-counting industry plays a critical role in recirculating coins through the U.S. economy. For a small fee, coin-counting services separate and count a customer's change and provide a cash voucher or gift card in exchange for the coins. For many years, coin-counting companies have been responsible for recirculating more coins than the Mint issues in any given year. Moreover, coin-counting services are responsible for a majority of the coins recirculated every year through the Federal Reserve. The leading firm in the industry (Coinstar) processed and returned for recirculation 37 billion coins with a face value of \$2.55 billion in 2015, while the Mint circulated 16.2 billion coins worth \$1.1 billion. The coins recirculated by the largest coin-counting company in 2015, therefore, accounted for 66.2 percent of the 55.9 billion non-new coins that the Federal Reserve's regional banks received in that year from all sources, and for 47.2 percent of their \$5.4 billion combined face value (Figure 1, below). As noted previously, the Federal Reserve also circulated 16.2 billion new coins in 2015, so the leading coin-counting company accounted for 51.3 percent of all coins, new and old, received by the Federal Reserve for circulation to the U.S. economy in that year.

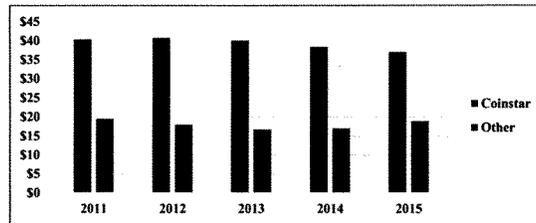
Figure 1: The Volume of Non-New Coins Received and Recirculated By the Federal Reserve from Coin-Counting Services and Others (in billions)

¹⁰ Board of Governors of the Federal Reserve System (2016).

¹¹ United States Department of Treasury (2016).

¹² Board of Governors of the Federal Reserve System (2016-A).

¹³ U.S. Government Accountability Office (2008).



These arrangements for recirculating U.S. coins sharply reduce the need to produce new coins. Coins that otherwise might have remained stored in boxes and jars gain additional useful life through the exchanges conducted by independent coin-counting companies. More generally, the coins recirculated by those companies, as well as by financial institutions and the Federal Reserve, preclude the need for the Mint to produce more new coins. Some of the coins processed by coin-counting services would make their way back into circulation without those services, and some of the coins processed by them, once transferred to the Federal Reserve, are worn too badly to remain in circulation. Nevertheless, along with the Federal Reserve, independent coin-counting services have come to play a dominant role in the American economy's system for circulating cash. It is, as the president of the Royal Canadian Mint recently described it, "a cost-effective and efficient way to provide coins to the marketplace."¹⁴

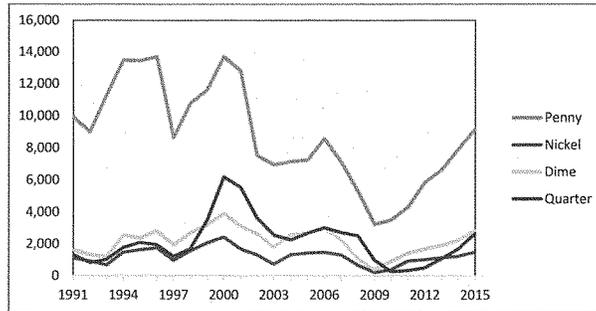
The Government's Costs to Produce New Coins

In 2015, the U.S. Mint produced nearly 17 billion new coins, including 9.4 billion pennies, 1.6 billion nickels, 3 billion dimes and 2.9 billion quarters, most of which were put into circulation through the Federal Reserve (Figure 2, below). The Mint also produced three other coins for circulation that have much lower consumer demand – 4.6 million half dollars, 5 million Native American dollars, and 40.3 million presidential dollars.

Figure 2: New Coins Introduced into Circulation, 1991-2015 (in millions)¹⁵

¹⁴ Aquino, Christine (2007).

¹⁵ U.S. Mint (2016).



Over the past 25 years, the production of each of the four common U.S. coins has risen and fallen based on fluctuating demand. In 1991, for instance, the Mint circulated 9.9 billion new pennies, 1.1 billion new nickels, 1.6 billion new dimes and 1.3 billion new quarters. By 2000, the Mint had increased the production and circulation of new pennies by some 38 percent to 13.7 billion, while the number of new nickels rose 118 percent to 2.4 billion; the number of new dimes more than doubled to 3.9 billion; and the number of new quarters increased nearly five-fold to 6.2 billion. By 2015, the number of new coins circulated had fallen to 9.2 billion pennies, 1.5 billion nickels, 2.9 billion dimes and 2.6 billion quarters. The Mint also produces gold, silver and platinum bullion coins for investors, which are not circulating tender, as well as specialty products for collectors such as commemorative coins and medals.¹⁶

In recent years, the government's costs to produce and distribute new pennies and nickels have exceeded their face values, while the costs to produce and distribute new dimes and quarters have remained less than their face values. In 2015, it cost the U.S. Mint \$130.1 million to produce new pennies with a total face value of \$91.6 million and \$109.7 million to produce new nickels with a total face value of \$73.8 million. The face value of new pennies equaled 70.4 percent of their total cost of production and shipment, and the face value of new nickels equaled 67.2 percent of their total costs. In contrast, the cost of new dimes with a total face value of \$287.3 million came to \$101.6 million, and the cost of new quarters with a total face value of \$661.3 million came to \$223.2 million. Most of these costs represent materials and production (Table 1, below).

Table 1: Numbers and Costs of New Pennies, Nickels, Dimes and Quarters, 2015 (in millions)¹⁷

	Coins	Coins	Face Value	Total Cost	Unit Cost of	Unit Cost of

¹⁶ *Ibid.* In 2015, the Mint sold more than 1 million ounces of gold bullion coins, 48.7 million ounces of silver bullion coins, and 3 thousand ounces of platinum bullion coins. In that year, the Mint also sold 5.4 million specialty units for collectors, for a total of \$453.2 million and profits of \$66.8 million.

¹⁷ *Ibid.*

	Produced	Circulated			Production	Distribution
Penny	9,365	9,155	\$91.6	\$130.1	\$0.0140	\$0.0003
Nickel	1,600	1,477	\$73.8	\$109.7	\$0.0732	\$0.0012
Dime	3,041	2,874	\$287.3	\$101.6	\$0.0348	\$0.0006
Quarter	2,991	2,645	\$661.3	\$223.2	\$0.0831	\$0.0013

The gaps between the face value and the costs of producing coins recall traditional notions of “seigniorage,” under which governments secured “gains” when the face value of a coin exceeded the value of its precious metal content and “losses” when a coin’s precious metal content was worth more than its face value. In those antiquated terms, the current gaps imply that the U.S. government “loses” \$0.0043 per penny and \$0.0244 per nickel and “gains” \$0.0654 per dime and \$0.1669 per quarter. In practice, the Federal Reserve buys the new coins at their face value from the Mint and circulates them, and the Treasury Department pays or pockets the difference between the price the Federal Reserve pays for the coins and the costs the Mint bears to produce them. So, the cost and price differences for pennies and nickels do not represent seigniorage “losses” for the Mint and seigniorage “gains” for the Federal Reserve; nor do the costs and price differences for dimes and quarters represent seigniorage “gains” for the Mint and “losses” for the Federal Reserve. Rather, in modern currency systems, here and in every country in the world, these gains and losses are simply matters of government transfers and accounting. As such, they demonstrate that a seigniorage-based perspective focused on the costs to produce a coin compared to its face value is irrelevant to issues involving modern coins and notes.

The Value Proposition of U.S. Coins as Mediums of Exchange

U.S. coins, properly understood, are purely mediums of exchange. As such, their economic value is based not on the ratio of their face values to their costs of production and circulation, but rather on their face values times the number of times each coin is used, relative to their costs of production and distribution. Coins circulate between consumers and retailers, and coin-counting services and other institutions with excess coins return them to a regional Federal Reserve Bank or sanctioned coin terminal, which then recirculates them to financial institutions or, if they’re badly damaged, returns them to the Mint. Each time a coin is used, it offsets the need for a new coin; and as noted previously, U.S. coins are used for an average of about 25 years before being melted down.¹⁸ At the same time, the Mint has to produce large numbers of new coins every year, because the economy grows larger, and because substantial percentages of all “circulating” coins at any given time are held in Federal Reserve regional banks and commercial banks, as well as in private caches in households and business establishments, and are thus unavailable for cash transactions.

The economic value of a penny as a medium of exchange depends on how many times it is used in cash transactions over the coin’s lifespan. There are no economic studies on how many times each year an average coin is used – or, in economic terms, the “monetary velocity” of coins. However, we can estimate the number of times an average penny is used by dividing the total number of pennies spent in cash transactions over one year by the number of pennies in

¹⁸ U.S. Mint (2016)

active circulation, multiplied by the average penny's lifespan of 25 years. The Federal Reserve reports that in 2012, consumers participated in 122.4 billion non-cash transactions (paying by credit card, debit card, checks and electronic transfers),¹⁹ and that cash transactions accounted for 40 percent of all transactions.²⁰ Therefore, there were 204 billion consumer transactions in 2012, including 81.6 billion cash transactions.²¹ In any given cash transaction, consumers could use or receive in change zero pennies, one penny, two pennies, three pennies or four pennies; therefore, the average cash transaction involves two pennies. Consequently, we estimate that the 81.6 billion cash transactions in 2012 involved the exchange of 163.2 billion pennies.

As noted above, a majority of pennies and other coins at any given time are held by Federal Reserve regional banks, commercial banks and thrifts, sanctioned coin terminals, cash-counting services and the private caches of individuals and businesses. The Director of the U.S. Mint estimated in 1999 that just one-third of all pennies in use at that time were in active circulation at any moment.²² The Mint produced 224.7 billion pennies in the 25 years leading up to 2012,²³ and based on the Director's estimate, we calculate that at any given time in 2012, 74.9 billion pennies were in active circulation. Since we found that cash transactions in 2012 involved the exchange of 163.2 billion pennies, we can estimate that the average penny in circulation in 2012 was used 2.18 times in that year, and 54.5 times over its useful lifespan. The economic value of an average penny as a medium of exchange, therefore, is about \$0.55, or more than 38 times the current cost to produce and distribute a penny. Adjusting for inflation over 25 years (1990-2015), the economic value of each penny produced by the U.S. Mint, as a medium of exchange, is \$0.303, compared to its inflation-adjusted production and distribution costs in 1990 of less than eight-tenths of one cent (\$0.0077).

Contrary to a seigniorage framework, this analysis, based on the current character of coins as mediums of exchange, shows that the U.S. economy gains substantially from the production of pennies and all other common coins. Table 2, below, presents these calculations for the penny, again assuming 2.18 turnovers per year and a 25-year lifespan.

Table 2: The Economic Value of the U.S. Penny as a Medium of Exchange Over 25 Years

	Total Cost Per Unit	Value in Use Over 25 Years Per Unit	Value Per Unit Adjusted for Inflation	Cost Per Unit Adjusted for Inflation
Penny	\$0.0143	\$0.55	\$0.30	\$0.0077

The 25-year useful lifespan of U.S. coins also produces large savings for the U.S. government and economy, compared to the roughly six-year useful lifespan of a U.S. one-dollar bill. If coins had the durability of the one-dollar bill, the Mint would have to replace each coin more than four times over 25 years. Using the production costs of new coins in 2015, we can

¹⁹ Gerdes, Liu, Berkenpas, Chen *et al.* (2013).

²⁰ Bennett, Conover, O'Brien, and Advincula (2014).

²¹ This is consistent with an academic estimate of between 54 billion and 88 billion cash transactions in 2000. Lombra, Raymond (2007).

²² Tierney, John (1999).

²³ The public data on penny production begin in 1990, so we impute penny production in 1989 and 1988 based on the average from 1990 to 2012.

calculate the savings derived from the 25-year useful lifespan of coins, compared to the costs if each coin had the six-year useful lifespan of the U.S. dollar. Table 3, below, presents those calculations.

Table 3: Savings from the 25-Year Useful Lifespan of U.S. Coins, Compared to the Six-Year Useful Lifespan of U.S. Paper Currency

	Number of Coins over 25 Years (billions)	Total Costs Over 25 Years (millions)	Costs Over 25 Years if Coins Lasted Six Years (millions)	Savings Over 25 Years (billions)	Annual Savings (millions)
Penny	224.72	\$3,146.10	\$13,330.95	\$10,184.85	\$407.39
Nickel	30.57	\$2,237.97	\$9,482.93	\$7,244.96	\$289.80
Dime	53.11	\$1,848.32	\$7,831.84	\$5,983.53	\$239.34
Quarter	54.18	\$4,501.98	\$19,076.18	\$14,574.20	\$582.97

As noted above, in 2015 it cost the U.S. Mint \$130.1 million to produce and distribute new pennies, \$109.7 million to produce and distribute new nickels, \$101.6 million to produce and distribute new dimes and \$223.2 million to produce and distribute new quarters. Therefore, the annual production and distribution savings from the 25-year useful lifespan of pennies, compared to the six-year useful lifespan of paper currency, is \$407.4 million, or 3.1 times the cost to produce and distribute all new pennies in 2015. The ratios for the three other common coins are somewhat smaller. The annual savings from the long useful lifespan of nickels is \$289.8 million, nearly 2.6 times the cost of new nickels in 2015; the annual savings for dimes is \$239.3 million, or 2.4 times the cost to produce dimes in 2015; and the annual savings for quarters is \$583 million, or 2.6 times the cost to produce new quarters in 2015.

This analysis is consistent with studies by the Congressional Budget Office (CBO), the General Accountability Office (GAO) and the Federal Reserve on the potential savings from shifting from the dollar note to a dollar coin.²⁴ All three studies concluded that the longevity of coins produced large savings. Our turnover analyses and the government studies also all establish that seigniorage is an outdated metric for measuring the value of and gains or losses from producing and using modern forms of money that are not stores of value but purely mediums of exchange.

IV. The Debate Over the Metal Composition of U.S. Coins

Total coin production costs are based on metal prices, production costs, overhead costs and production volume. In 2010, Congress enacted the "Coin Modernization, Oversight, and Continuity Act," which directed the U.S. Mint to evaluate the costs to produce U.S. coins, based

²⁴ The three government studies produced varying conclusions, based on differing assumptions. The GAO and CBO analyses concluded that shifting to a one-dollar coin would produce significant savings, while the Federal Reserve study took a broader view of economic costs and found that shifting to a dollar coin could increase costs to the economy. See Blum, James (2011); Lambert, Ferrar, and Wajert (2013); and U.S. Government Accountability Office (2014).

on commodity metal prices and the costs and benefits of shifting to alternative metals.²⁵ Currently, the penny is composed of 97.5 percent zinc and 2.5 percent copper, while the nickel is composed of 75 percent copper and 25 percent nickel; the dime and quarter are both clad coins that contain about 92 percent copper and 8 percent nickel. In response to the 2010 Act, the Mint established first that there is no alternative metal composition that would significantly reduce the costs of producing the penny while preserving its usefulness as a medium of exchange. The Mint also considered 29 different metal compositions for nickels, dimes and quarters (Phase I) and identified six of these new metal compositions for further analysis (Phase II). The new metal compositions for Phase II tests were evaluated on various criteria including hardness, conductivity, recyclability, toxicity, ability to handle “wear and tear” and ability to be used efficiently by coin sorters.²⁶

The Mint found that six new metal compositions could reduce the costs of producing dimes, nickels and quarters, but that none of them represented practical alternatives. Only one of the tested new compositions, the 80/20 copper-nickel alternative, was found to be a “seamless material” that would have little impact on industries that rely on coin-operated technologies, such as vending machines. The other five new compositions were “co-circulate materials,” which, while possibly suitable as circulating mediums of exchange, had different weights and/or electromagnetic signatures (EMS) from current coins. As such, they could not be used in currently configured coin-operated equipment that validates the unique weight and EMS of coins to determine whether they are authentic or counterfeit. (The Mint estimated that shifting to the co-circulate materials would cost industries that rely on coin-accepting technologies \$2.4 billion to \$6 billion.)²⁷ Finally, the Mint found that the only seamless alternative would produce very small annual production savings of just \$3.2 million for nickels, less than \$800,000 for dimes and less than \$1.3 million for quarters. In 2015, the GAO published a report that raised some questions about the Mint’s estimates. The GAO noted that all vending machines might not have to be updated if only the metal composition of nickels and dimes changed, and questioned the Mint’s estimates of the number of coin-operated technologies. The GAO did not dispute the small savings from changing the composition of the coins to the only seamless alternative.²⁸

The Impact of Commodity Prices on the Costs of Producing U.S. Coins

Given the Mint’s findings, it seems certain that the metal composition of the penny will not change and highly unlikely that the composition of the other three common coins will change. Nevertheless, a number of commentators continue to argue that continuation of the penny, given its composition, imposes unacceptable costs on U.S. taxpayers. In practice, the costs to produce the penny and the three other common coins fluctuate substantially, based primarily on the prices of metals set by global commodity markets.

²⁵ U.S. Mint (2014), Appendix A.

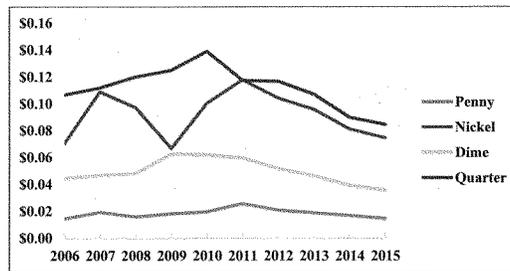
²⁶ *Ibid.*

²⁷ The Mint further found that two of the co-circulate materials failed other Phase II tests. The remaining three co-circulate materials (nickel-plated steel, multi-ply plated steel and stainless steel) produced annual savings equal to less than one percent of the costs to industries using coin-based technologies. *Ibid.*

²⁸ U.S. Government Accountability Office (2015).

The cost of producing a penny has varied from about \$0.014 per unit in 2006 to \$0.025 per unit in 2011. However, a decision to phase out the use of pennies would also involve increased production of nickels, and the cost to produce nickels has varied from \$0.067 in 2009 to \$0.118 in 2011 (Figure 3, below). Meanwhile, the cost of producing the dime has varied from \$0.062 in 2009 to \$0.035 in 2015, and the cost of producing the quarter has varied from \$0.139 in 2010 to \$0.084 in 2015. Based on production costs, therefore, the approach used by critics of the penny implies that the United States should abandon both nickels and pennies and move to cash transactions based solely on dimes, quarters and paper currency.

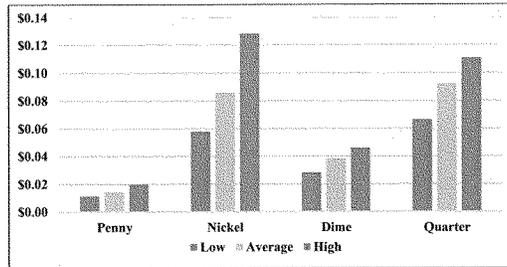
Figure 3: Unit Costs to Produce Common U.S. Coins, 2006-2015



If we consider proposals to eliminate only the penny, that change also would impose substantial costs on the government and the economy. For example, the production of nickels, and perhaps dimes and quarters as well, would have to increase, and the cost of cash transactions would have to be set or rounded up or down to the nearest nickel. To evaluate these costs, we begin with the rising and falling of global commodity prices for the metals used to produce U.S. coins. (The costs to produce and distribute U.S. coins, apart from the prices of their constituent metals, are unlikely to change significantly in the foreseeable future.) Figure 4, below, graphs the costs to produce the four common U.S. coins based on the lowest, average and highest commodity prices for the metals comprising those coins over the last 10 years.

Figure 4: Lowest, Average and Highest Unit Costs to Produce U.S. Coins, Based on Global Commodity Metal Prices, 2006-2015²⁹

²⁹ The World Bank (2016); and U.S. Mint (2016).



Based on the lowest, average and highest metal prices over the last decade, and assuming that other production and distribution costs remain the same as in 2015, the cost to produce a penny in the future would range from \$0.011 (lowest) to \$0.014 (average) to \$0.02 (highest), a range of 81.8 percent. The cost to produce the nickel in the future would range from \$0.058 (lowest) to \$0.085 (average) to \$0.128 (highest), a range of 120.7 percent. Dimes and quarters have the same metal composition, so their ranges are comparable: the cost to produce a dime in the future would range from \$0.028 (lowest) to \$0.038 (average) to \$0.046 (highest), or a range of 64.3 percent, while the cost to produce a quarter in the future would range from \$0.066 (lowest) to \$0.092 (average) to \$0.111 (highest), or a range of 68.2 percent.

Based on these ranges, the production costs for new coins can and do vary substantially. Using the quantity of new pennies, nickels, dimes and quarters produced in 2015, the costs to produce pennies in the future could range from \$107 million to \$184.5 million (Table 4, below). Similarly, the costs to produce new nickels in the future could range from \$92.5 million to \$205.1 million. As expected, the range is less for producing new dimes and quarters in the future, from \$85.6 million to \$139.3 million for dimes, and from \$198.9 million to \$330.7 million for quarters.

Table 4: Range of Total Production Costs for New Coins, Based on Varying Global Metal Commodity Prices and 2015 Production Levels (in millions)³⁰

Penny	<i>Lowest</i>	\$106.96
	<i>Average</i>	\$135.17
	<i>Highest</i>	\$184.52
Nickel	<i>Lowest</i>	\$92.51
	<i>Average</i>	\$137.34
	<i>Highest</i>	\$205.12

³⁰ The World Bank (2016); and U.S. Mint (2016).

Dime	<i>Lowest</i>	\$85.62
	<i>Average</i>	\$116.55
	<i>Highest</i>	\$139.25
Quarter	<i>Lowest</i>	\$198.85
	<i>Average</i>	\$274.91
	<i>Highest</i>	\$330.72

The Net Costs and Savings of Eliminating the Penny, Based on Metal Prices

As noted above, commentators who call for elimination of the penny, writing in outlets from the *Wall Street Journal* to the website *Slate*, argue that since the Treasury “loses” money on producing pennies, the government should eliminate the coin.³¹ To begin, eliminating the penny, as noted earlier, will require increased production costs for other coins, especially nickels. To analyze the net costs, we begin with 2015 commodity metal prices and the coin’s production costs. In 2015, the Mint produced 91,550,000,000 pennies with a combined face value of \$91.55 million. If the Mint eliminated new pennies and replaced their combined face value with nickels – an additional 1,831,000,000 nickels with a combined face value of \$91.55 million – it would save \$130.92 million in penny production costs but cost an additional \$136.23 million in expanded nickel production costs. This shift, therefore, would produce a *net loss* of \$5.31 million (Table 5, below).

To generate a net gain while eliminating the penny, the Mint would have to shift production of pennies to dimes. The production of an additional 915,500,000 dimes with a total face value of \$91.55 million would save \$130.92 million in penny production costs, while the production of the additional dimes would cost \$32.41 million, resulting in a net gain of \$98.5 million. However, this shift also would lead to a shortage of nickels for change in cash transactions, forcing the Mint to produce more nickels at an additional cost, and imposing significant consumer costs from rounding up to the nearest dime.

**Table 5: Annual Costs or Savings from Eliminating the Penny,
Based on 2015 Production Costs³²**

	Value	Nickels	Dimes	Total Cost	Savings
Shift to Nickels	\$91,550,000	1,831,000,000	-	\$136,226,400	-\$5,309,900
Shift to Dimes	\$91,550,000	-	915,500,000	\$32,408,700	\$98,507,800

We also applied the lowest, average and highest metal prices over the last decade to the analysis of the costs of eliminating the penny. Under a scenario in which the production of

³¹ McGinty (2014); and Yglesias (2012).

³² *Ibid.*

pennies is replaced by increased production of nickels with the same combined face value, the net costs range from \$1.3 million at the lowest metal prices, to \$25.1 million at average metal prices and \$54.4 million at the highest metal prices (Table 6 below). In short, all reasonable scenarios for replacing pennies with nickels would cost the Mint more than it would to retain the penny. Again, the only way to save production costs would be to shift the total face value of all new pennies to new dimes. The net gains in that case would range from \$78.8 million (at the lowest metal prices) to \$97 million (at average metal prices) and \$138.5 million (at the highest metal prices). However, as noted above, a shift from pennies to dimes would produce a nickel shortage for cash transactions and substantial consumer costs from rounding up or down to the nearest dime.

**Table 6: Annual Costs or Savings from Eliminating the Penny,
Based on Lowest, Average and Highest Metal Commodity Prices, 2006-2015³³**

	2015 Prices	Highest Prices	Lowest Prices	Average Prices
Shift to Nickels	-\$5,309,900	-\$54,424,393	-\$1,329,662	-\$25,072,705
Shift to Dimes	\$98,507,800	\$138,450,250	\$78,786,302	\$97,046,602

V. The Impact of Eliminating the Penny on Coin Recirculation through the Economy

The analysis above does not consider how the elimination of the penny would affect the rate at which nickels, dimes and quarters recirculate through the economy. As noted earlier, coin-counting services play a major role in the recirculation of U.S. coins. Coins channeled through the leading coin-counting service alone account for nearly two-thirds of all non-new coins and more than half of all coins, new and old, circulated and recirculated by the Federal Reserve System. Measures that adversely affect these arrangements for the recirculation of coins through the U.S. economy would also generate additional costs, by requiring the minting of more new coins.

The elimination of pennies would almost certainly impair the current system for recirculating coins through its impact on coin-counting services. As the most common U.S. coin, pennies account for the largest share of the coins recirculated through independent coin-counting companies. Consider the individuals and businesses that use coin-counting services to carry out exchanges when their receptacles for spare coins reach a certain level. Since that process is driven by pennies as the most common coin, withdrawing the penny from circulation would likely reduce the frequency with which individuals and businesses recirculate their coins through coin-counting services, which in turn would reduce the volume of coins recirculating through the cash economy.

The potential dimensions of this effect were demonstrated when the Royal Canadian Mint ended production of the Canadian penny in 2013 and began the process of removing them from the economy. As expected, the volume of coins handled by independent coin-counting services fell substantially, including the volume of nickels, dimes and quarters, as well as pennies. Based on the Canadian experience, the elimination of the U.S. penny could reduce the volume of

³³ The World Bank (2016); U.S. Mint (2016).

nickels and dimes recirculated through coin-counting services by 35 percent each, and the volume of quarters handled by those services by 25 percent.³⁴ To maintain the current availability of coins, such large reductions in the coins recirculated through coin-counting arrangements would have to be offset by increased coin production by the Mint.

The Mint would not have to offset all of the coins held back if the penny were eliminated and people and businesses turned in their accumulated change less frequently. Some of those “missing” coins would be used in other cash transactions, and the volume of nickels, dimes and quarters returned in each less-frequent coin-counting exercise would likely increase. On balance, however, eliminating the penny would increase the volume of coins held back at any given time and hence make them unavailable for recirculation; and ultimately, the Mint would have to respond to these implied shortages of nickels, dimes and quarters. Table 7, below, presents estimates of the volume of nickels, dimes and quarters held back from circulation by a slowdown in coin-counting associated with the elimination of the penny. These estimates are based on the impact of the elimination of the Canadian penny on the volume of other coins handled by independent coin-counting services, and the assumption that 75 percent, 50 percent or 25 percent of these reduced volumes of coins are held back from circulation at any given moment.

Table 7: Estimated Number of Nickels, Dimes and Quarters Held Back from Circulation By a Slowdown in Coin-Counting Arising from the Elimination of the U.S. Penny (in millions)

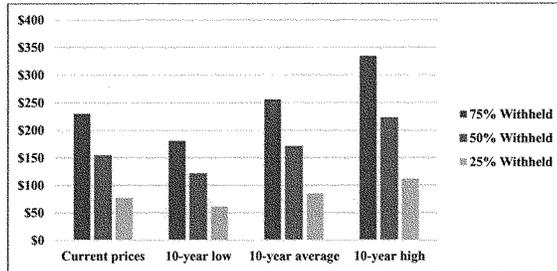
	Coins Recirculated by Coinstar, 2015	Number of Coins “Missing” from Circulation		
		75% Withheld	50% Withheld	25% Withheld
Nickels	4,079.9	1,071.0	714.0	357.0
Dimes	6,146.3	1,613.4	1,075.6	537.8
Quarters	5,916.7	1,109.4	739.6	369.8
Total	16,142.9	3,256.0	2,529.2	1,264.6

This analysis shows that eliminating the U.S. penny would likely affect the recirculation of nickels, dimes and quarters through the economy by reducing the use of independent coin-counting services. The estimated reductions in the volume of coins recirculated from coin-counting services to the Federal Reserve and then through to the economy range from 357 million to 1.07 billion nickels, 538 million to 1.61 billion dimes and 370 million to 1.11 billion quarters (Table 7 above).

These substantial reductions in recirculating coins would force the Mint to produce additional coins at additional costs. At current metal prices, the Mint would have to spend \$230 million to produce additional new coins if 75 percent of the reduction in coins recirculated through independent coin-counting services remained out of circulation at any given time. Similarly, the Mint would have to spend \$154 million if 50 percent of this reduced recirculation of coins remained out of circulation and \$77 million if 25 percent of this reduced recirculation of coins remained out of circulation (Figure 5, below). The impact of eliminating the penny on the volume of coins recirculating through the economy, therefore, would impose large additional costs.

³⁴ Coinstar (2015).

Figure 5: Costs for the U.S. Mint to Produce Additional Coins If the Elimination of the Penny Slows the Recirculation of Coins by Reducing the Use of Independent Coin-Counting Services



We also conducted this analysis using the lowest, average and highest global metal commodity prices from the last decade. Table 8, below, depicts the range of costs to produce the additional coins needed if, as expected, the elimination of the penny reduces coin recirculation through the coin-counting industry. For each price point, we present the range of estimated costs for the Mint, based on whether 75 percent, 50 percent or 25 percent of the expected reduction in coin recirculation by coin-counting services remained out of circulation. These costs range from \$60 million (25 percent of the reduced recirculation remains out of circulation, based on the lowest metal prices of the last decade) to \$334 million (75 percent of the reduced recirculation remains out of circulation, based on the highest metal prices of the last decade). There is no scenario in which eliminating the penny produces net savings.

Table 8: Costs to the Mint to Produce Additional Coins to Offset the Impact On Coin Recirculation From the Reduced Use of Coin-Counting Services (in millions)

Share Remaining Out of Recirculation	Commodity Prices for Metals Used to Produce U.S. Coins			
	Current	10-Year Low	10-Year Average	10-Year High
75 Percent	\$230	\$181	\$256	\$334
50 Percent	\$154	\$121	\$171	\$223
25 Percent	\$77	\$60	\$85	\$111

VI. The Costs to Consumers of Rounding Cash Transactions to the Nearest Nickel

When Congressman Jim Kolbe proposed the “Currency Overhaul for an Industrious Nation (COIN) Act” in 2006, it directed not only that the Mint stop producing new pennies, but also that all cash transactions would be rounded up or down to the nearest nickel.³⁵ This approach was also adopted in the program enacted in Canada in 2012. Under The Canadian

³⁵ Zappone (2006).

Economic Action Plan, the Royal Canadian Mint stopped the production and distribution of new pennies on February 4, 2013. While the Canadian penny remained legal tender, merchants were encouraged to round all final cash transactions up or down to the nearest \$0.05.³⁶ This approach was based on the view that Canada could reduce its coin production costs by eliminating new pennies and, since the penny would remain a pricing unit, there would be no negative effects on consumers or the economy. In practice, this approach entails significant, unintended costs.

Congressman Kolbe and the authors of Canada's program were correct in one respect: retaining the penny for pricing purposes while eliminating it from circulation involves large-scale rounding up or rounding down to the nearest nickel on billions of cash transactions. Economists have analyzed the likely distribution of such rounding adjustments, between those rounded up and those rounded down. The leading study examined pricing by a major convenience store chain in 1999 and 2000. Using actual prices, the researcher simulated 1,000, 5,000 and 10,000 different transactions involving purchases of one, two or three items, and found that between 60 percent and 93 percent of those transactions would involve rounding up to the next nickel.³⁷ As a result, the author concluded that the rounding up and rounding down of all cash transactions to the nearest nickel would create additional costs for U.S. consumers totaling \$318 million to \$818 million in 2000, or in 2015 dollars, consumer losses of \$438 million to \$1.13 billion. Even the low estimate of \$438 million is more than three times the total cost of producing all new pennies in 2015 (\$130.1 million) and more than four times the theoretical production savings from eliminating the penny and shifting the equivalent total face value to dimes.³⁸

Moreover, this analysis almost certainly understates the additional costs to American consumers from eliminating the penny, because many firms would engage in strategic pricing to increase their revenues by ensuring that more transactions would be rounded up. Economic theory and evidence establish that firms set prices to maximize their profits, and we should expect that merchants dealing with large volumes of cash transactions would approach the elimination of the penny as an opportunity to do that, especially in high-volume, low-margin industries. For example, gasoline stations often price their products in denominations of fractions of one cent and round up the final charge; one study estimated that gasoline providers earn an additional \$200 million to \$400 million per year from this process.³⁹

These consumer costs from rounding up to the nearest nickel would also fall disproportionately on lower-income households. When Canada eliminated its penny, electronic payments with credit cards, debit cards and checks continued to be denominated in pennies, without rounding to the nearest nickel. A study from the Federal Reserve Bank of San Francisco found that 55 percent of people living in households with annual incomes of less than \$25,000 prefer cash to other forms of payment, compared to 10 percent of those living in households with

³⁶ Royal Canadian Mint (2012).

³⁷ Lombra (2001).

³⁸ One researcher criticized Lombra's study for failing to take account of sales taxes and argued that his own analysis of transactions in seven states with sales taxes found little evidence of net rounding up or rounding down (Whaples 2007). In Lombra's response, he noted that many states, including the ten largest states, do not charge sales tax on food, the most common cash item. Lombra further found that after applying sales taxes of 3 percent, 5 percent and 7 percent, consumers were still subject to a rounding tax (Lombra 2007).

³⁹ Gephard (2015).

annual incomes of more than \$200,000.⁴⁰ The study further found that lower-income people use cash for about 57 percent of their purchases, compared to 33 percent of transactions by high-income people. The cost of rounding up is at most \$0.02 per transaction, but those costs would accumulate much faster among lower-income people least able to afford it.

This dynamic would also disproportionately affect younger people, as they are more likely to use cash for their purchases as well. The San Francisco Federal Reserve Bank study found that 40 percent of people ages 18 to 24 prefer using cash to other payment methods, compared to 25 percent of those ages 55 to 64 and 65 and older. Furthermore, people ages 18 to 24 use cash for about 48 percent of their purchases, compared to 40 percent of the purchases made by people ages 55 to 64 and 36 percent of purchases made by people ages 65 and older.⁴¹

Given these dynamics, it is also likely that some merchants would restrict electronic payments, especially in high-volume, low-margin businesses. Under current law and regulation, merchants can set a \$10 minimum for credit card transactions, but minimums are not permitted for debit card transactions. In practice, many merchants do apply minimums to debit card purchases: a survey by the Federal Reserve Bank of Richmond of 420 merchants across 26 different sectors found that 29 percent of them used debit card minimums.⁴² Since eliminating the penny would increase the potential profits from cash transactions, it also would likely increase merchants' use of restrictions on electronic payments to avoid cash, and thereby reduce the economic benefits associated with such payments.⁴³

VII. The Value of the Penny in the American Economy

Apart from cost issues, advocates of eliminating the penny often claim that the coin is virtually worthless as a unit of exchange. The home page of "Citizens to Retire the Penny," an organization devoted to "educating the public on the advantages of retiring the penny from general circulation," is entitled, "What can you buy with a penny?"⁴⁴ The best evidence for the value of the penny as a medium of exchange comes from its actual use. To begin, surveys find that most Americans value the penny. A 2012 poll by the Opinion Research Corporation found that 67 percent of respondents favored keeping the penny in circulation and 66 percent opposed eliminating it and establishing a price rounding system.⁴⁵ These findings echoed those from a 2006 Gallup survey, which also found broad support for the penny especially among lower- and moderate-income Americans: 65 percent of those earning less than \$30,000 per year saw the penny as useful, compared to 44 percent of those earning more than \$75,000 per year.⁴⁶ Since access to electronic forms of payment such as credit and debit cards increases with income, the survey showed that those who depend most on the cash economy also view the penny as most useful and valuable.⁴⁷

⁴⁰ Federal Reserve Bank of San Francisco (2014).

⁴¹ *Ibid.*

⁴² Wang, Schwartz, and Mitchell (2014).

⁴³ Chakravorti, Sujit (2003).

⁴⁴ Citizens to Retire the Penny (2016).

⁴⁵ Americans for Common Cents (2012).

⁴⁶ Gallup Organization (2006).

⁴⁷ The value of pennies also is evident in the practices of many charities. For example, Habitat for Humanity branches throughout the United States use penny drives to raise funds for affordable housing, as do many schools

More compelling evidence for the value of the penny as a medium of exchange comes from how frequently consumers and businesses use the coin. Earlier, we estimated that an average penny is used in cash transactions some 55 times over its lifespan. Furthermore, the U.S. continues to produce billions of new pennies year after year, even as most monetary transactions have migrated to electronic forms. In fact, the Mint produces far more pennies than any other coin. From 2001 to 2015, the Mint produced 6.4 times as many pennies as nickels, 3.4 times as many pennies as dimes and 3.2 times as many pennies as quarters (Table 9, below). As a result, 56.7 percent of all new coins produced by the Mint in this period were pennies, compared to nickels (8.9 percent), dimes (16.8 percent) and quarters (17.7 percent). If businesses and consumers did not find pennies useful, the Mint would not have produced nearly 103 billion of them over the last 15 years.

Table 9: Annual Production of New Coins by the U.S. Mint, 2001-2015 (in millions)

	Penny	Nickel	Dime	Quarter	Penny's Share
2001	12,773	1,668	3,123	5,531	55.3%
2002	7,520	1,302	2,633	3,616	49.9%
2003	6,926	714	1,808	2,550	57.7%
2004	7,130	1,314	2,569	2,242	53.8%
2005	7,220	1,418	2,669	2,656	51.7%
2006	8,553	1,461	3,023	3,007	53.3%
2007	7,084	1,289	2,247	2,711	53.1%
2008	5,272	647	1,070	2,510	55.5%
2009	3,218	207	358	965	67.8%
2010	3,487	359	887	252	69.9%
2011	4,289	914	1,403	323	61.9%
2012	5,835	1,006	1,658	486	64.9%
2013	6,610	1,123	1,901	1,062	61.8%
2014	7,920	1,211	2,233	1,683	60.7%
2015	9,155	1,477	2,874	2,645	56.7%
Total	102,992	16,110	30,456	32,238	56.7%

The Federal Reserve System does not publish comparable data on the distribution of coins, by type of coin, recirculated every year through Federal Reserve regional banks, coin-counting services, sanctioned coin terminals and commercial banks and thrifts. Given the steady production of the penny, averaging 6.87 billion new pennies per year from 2001 to 2015, it is certain that pennies also account for a majority of the coins recirculated, and therefore a majority of all coins in circulation through the U.S. economy at any given time. If American businesses and consumers found pennies to be "worthless" or simply "more trouble than they're worth," the penny would gradually decline as a circulating medium of exchange. The evidence, however, refutes that claim and demonstrates that within the U.S. cash economy, consumers and

trying to fund their extracurricular activities (Habitat for Humanity (2012)). Similarly, the Leukemia and Lymphoma Society has collected more than \$150 million in pennies (15 billion) through its "Pennies for Patients" campaign (Americans for Common Cents (2016)), and Panda International's efforts to ensure the survival of giant pandas includes a "Pennies 4 Pandas" program to enlist the participation of children (Pandas International 2016).

businesses find value in the U.S. penny and their ability to conduct exchanges in units of a hundredth of a dollar.

A Response to the Latest Call to Phase-Out the Penny

In March 2017, the “Coin Dollar Alliance” a coalition of trade associations and other groups, issued a study claiming that taxpayers could save billions of dollars (over 30 years) by switching from the dollar note to the dollar coin, ending the production of the penny, and changing the metal composition of the nickel.⁴⁸ The authors’ arguments, especially regarding the penny, seem skewed and methodologically flawed. For example, the authors use international comparisons only when it serves their conclusions: They note that other major countries have replaced or supplemented their lowest denomination paper note with a corresponding coin; yet they fail to mention that the same countries continue to use small denomination coins akin to our penny -- from the Euro’s one-cent piece worth about one U.S. penny, and Japan’s one Yen coin worth about nine-tenths of our penny, to China’s one-Fen coin worth one-tenth of the Chinese one-Jiao coin, which in turn is worth about 1.6 U.S. cents. Every major economy continues to find economic value in producing and using small denomination coins.

When the study’s authors turn to the penny, they note that the U.S. Mint increased its production of pennies by 58 percent from 2012 to 2016 and ask, incredulously, “Do you, or anyone you know, want 58% more pennies than four years ago?” The authors know the answer but chose not to share it: The U.S. Mint produces the numbers of pennies, nickels, dimes, quarters and paper notes it does, based on demand from financial institutions tracked by the Federal Reserve.

The study’s most glaring methodological flaws involve its curious treatment of costs and inflation. “It is important to remember,” the authors assert, that “the cost of [producing and distributing] money increases over time, but the value of that money stays constant.” That is simply false. The costs of producing pennies, nickels, dimes and quarters are very sensitive to shifts in the prices of the metals used to produce them; and the price of zinc, the main component of pennies, varied over the last 10 years from a high of \$1.61 per pound to a low of 50.5-cents per pound, and ended June 2017 at \$1.17 per pound.⁴⁹ Despite the regular and substantial fluctuations in zinc prices, the study pumps up its undocumented estimate of \$1 billion in “losses to taxpayers” from producing pennies over the next decade by starting with a per-penny cost of 1.64-cents that reflected high zinc prices, rather than the latest cost reported by the Mint of 1.4-cent. The authors compound that error by assuming that those costs will only go higher, year after year – to be precise, by 3 percent per-year for a decade. In fact, an analysis of the monthly changes in actual spot zinc prices from June 2007 to June 2017 finds that the average monthly change was not an average increase of 0.25 percent (3 percent / 12 months) but an average *decline* of 0.11 percent.⁵⁰

They further compound their mistakes by ignoring the fact that if the Mint ends penny production, demand will increase for nickels as the smallest denomination coin widely available

⁴⁸ Klein and Hoagland (2017).

⁴⁹ Index Mundi (2017). “Zinc Prices.”

⁵⁰ *Ibid.*

– and so they omit the additional cost of producing more nickels. As we saw, replacing pennies with nickels with the same combined face value – so the Mint would produce one additional nickel for every five pennies it no longer produced – yields a net loss whether we use the low, average or high metal commodity prices of the last decade. The ten-year net cost would range from \$13.3 million (low) to \$250.7 million (average) to \$544.2 million (high). (See Table 6, above)

To be sure, the authors also embrace an option discussed by the Mint to reduce the cost of producing new nickels by changing its metal composition to 80 percent copper and 20 percent nickel alloy.⁵¹ The Mint also noted that this change would produce very marginal gains estimated at \$3.2 million per-year, based on the nickel's current production levels. However, the authors still fail to acknowledge that their plan require substantial additional costs from increasing the numbers of new nickels produced.

The study also fails to acknowledge or discuss how ending the production of pennies would lead to large-scale rounding-up or rounding-down to the nearest nickel the prices that consumers pay retailers. As noted earlier, researchers have found that retailers already price 60 percent to 93 percent of all goods sold at a penny price-point in the top half of a ten-cent range – that is, at prices ending in 6, 7, 8 or 9-cents. The Coin Dollar Alliance study omits this issue entirely, because the expected rounding-up and rounding-down process would cost U.S. consumers a net \$200 million to \$400 million per-year, most of that borne by lower and moderate-income households. Moreover, if the penny were phased out, “strategic pricing” by retailers would only increase the share of purchases rounded up to the nearest nickel, rather than rounded down, and the consequent costs to consumers.

The study suffers from other conceptual problems. It casts the difference between the cost of producing a penny and its face value as a “seigniorage” loss to taxpayers, when it is a government accounting issue registering as a loss for the Mint and a corresponding gain for the Federal Reserve. The study ignores the penny's economic value, as a medium of exchange. We calculated that each penny is used an average of some 55 times during its time in circulation; so on an inflation-adjusted basis over 25 years, it costs less than eight-tenths of a cent to produce a penny that provides 30-cents in transactional value as a medium of exchange. Finally, the authors ignore the most basic economic evidence that consumers and businesses demonstrate the value of the penny by using it. The simple fact that Americans use more pennies, per-year, than any other coin is dispositive evidence of its economic value. When people and businesses stop using pennies, we will know that its value as a medium of exchange has ended.

VIII. The Costs to U.S. Investors of Eliminating the Penny as a Pricing Unit

Finally, phasing out the U.S. penny also would have a substantial adverse impact on U.S. financial markets and individual or retail investors. As noted earlier, when Canada recently withdrew its penny from circulation, it preserved the coin's use as a pricing unit. Some Canadian commentators have urged Ottawa to eliminate the penny from pricing, and historical precedent favors ending a coin's use in pricing once it is withdrawn from circulation. When the United States withdrew the half cent from circulation in 1857, U.S. prices moved quickly to a penny

⁵¹ It is only fair to note that the Coin Dollar Alliance, which financed the study, is itself supported financially by the Copper and Brass Fabricators Council, the Copper Development Association, Global Brass and Copper, the Arizona Mining Association, and the National Mining Association.

basis. More recently, Great Britain created a half-penny coin when it moved to the decimalization of the British pound in 1971 and then withdrew the half penny from circulation starting in 1984 – and British prices quickly adopted the British penny as the base, despite the wide use of electronic payments.⁵² Some current advocates of eliminating the U.S. penny would retain its use in pricing, while others would end it. If American consumers react negatively when merchants routinely round up their charges to the nearest nickel, economy-wide pricing based on the nickel could be the natural response.

U.S. financial markets adopted penny-based pricing only recently, but the benefits suggest that moving to nickel-based pricing would reverse those benefits. From 1817 to 1997, the New York Stock Exchange (NYSE) and other U.S. equity markets used a system based on Spanish base-eight pricing, such that all stock prices were quoted in increments of \$0.125 (one-eighth of a dollar). Economists long argued that a system based on a smaller denomination would enhance the liquidity of equity markets and narrow the spreads between asks and bids, saving investors money. Accordingly, U.S. stock markets moved to a base-16 system in 1997, with prices set in increments of \$0.0625; and in April 2001, the SEC directed all U.S. equity markets to quote their prices in pennies, the smallest available denomination.

This shift to a more refined, penny-based pricing structure for stocks was a test of the claimed advantages of decimalization, especially regarding liquidity and spreads in financial markets. Liquidity here refers to a stock's availability in a market, or how easily an investor can buy or sell it without affecting its price. One study found that the new decimalization for pricing stocks reduced the spread between the highest price a buyer will pay (the "bid") and the lowest price a seller will accept (the "ask") by an average of \$0.022, thereby reducing investors' transaction costs.⁵³ The researchers also found, however, that decimalization appeared to reduce another aspect of liquidity: the number of "buy" and "sell" orders for a stock, or its "depth."⁵⁴ Another study of decimalization from the Federal Reserve Bank of Chicago examined 1,339 NYSE stocks, based on how frequently they were traded.⁵⁴ Like the other researchers, the study found that after decimalization, spreads narrowed, but depth decreased. Its author also created an overall measure for liquidity using both spreads and depth and concluded that liquidity increased substantially after decimalization.⁵⁵

Similarly, a study by the GAO found that decimalization reduced bid-ask spreads, trading costs and the average volatility of stock returns across both the NYSE and NASDAQ exchanges;⁵⁶ and other researchers confirmed the GAO's findings on trading costs and volatility.⁵⁷ Decimalization also aligned American equity markets with those in other financial centers, as U.S. stock markets had been alone among the world's top 20 financial centers in not using a base-ten system. This alignment also enhanced liquidity in U.S. equity markets: a study of stocks cross-listed on U.S. and Canadian exchanges found that after decimalization, the trading and dollar volume of Canadian stocks on U.S. exchanges increased more than the trading

⁵² Barford (2014).

⁵³ Chakravarty, Wood and Van Ness (2004).

⁵⁴ Furfine (2003).

⁵⁵ *Ibid.*

⁵⁶ Hillman (2005).

⁵⁷ Bessembinder, Hendrik (2003).

and dollar volume of other stocks on those exchanges, without reducing trading or dollar volume on the Canadian exchange.⁵⁸

Based on all of these studies, if the United States eliminated the penny and moved to nickel-based arrangements for pricing, it would adversely affect U.S. equity markets and their investors. To estimate the dimensions of those effects, we return to the GAO study. Its author found that after decimalization, quoted spreads narrowed by 73 percent for NYSE stocks (from \$0.154 to \$0.042) and by 68 percent for NASDAQ stocks (from \$0.17 to \$0.054). Further, “effective spreads” based on actual transaction prices rather than the quoted best prices declined 62 percent for NYSE stocks and 59 percent for NASDAQ stocks.⁵⁹ To be sure, a number of factors in addition to decimalization contributed to these cost reductions, including the spread of electronic trading, algorithmic trading and SEC reforms to improve the operations of equity exchanges.

To estimate the potential effects for American retail or individual investors if the United States moved from decimalization to nickel-based equity trading, we focus first on the volume of shares traded by those investors. A 2010 study estimated that retail investors account for 11 percent of all shares traded, compared to institutional investors (e.g. pension funds, hedge funds, insurance companies, etc.). Based on current daily trading volumes of 3.5 billion shares on the NYSE and 1.8 billion shares on the NASDAQ, individual investors trade an average of 385 million shares per day on the NYSE and 198 million shares per day on the NASDAQ. Economists estimate that the execution costs of a stock trade are equal to half the bid-ask spread.⁶⁰ A recent study found that from 2008 to 2013, effective spreads averaged between \$0.01 and \$0.02 per share for stocks traded on the NYSE (for an average of \$0.015) and between \$0.02 and \$0.03 per share for stocks traded on the NASDAQ (for an average of \$0.025).⁶¹ Based on these findings, we estimate that under the current decimal-based arrangements, trading by retail investors in NYSE stocks involves execution costs of approximately \$2.9 million per day, and trading by retail investors in NASDAQ stocks involves execution costs of nearly \$2.5 million per day (Table 9, below).

The issue here is this: how would the elimination of the penny for pricing stocks affect the execution costs of retail investors? Again, we know that spreads became smaller as a result of not only decimalization but also the advent of electronic trading, algorithmic trading, and new SEC rules. However, the SEC conducted a pilot program that tracked trading costs before and after the 2001 shift to decimalization, and analysis of that data indicates that decimalization alone reduced trading costs for retail investors by 24.2 percent.⁶² This implies that moving to a nickel-based system, or one close to the 16-base system preceding decimalization, would increase spreads by 31.9 percent ($1/1-0.242 = 1.3193$). Based on the finding that effective

⁵⁸ Oppenheimer and Sabherwal (2003).

⁵⁹ Hillman (2005).

⁶⁰ Bessembinder and Venkataraman (2010).

⁶¹ Angel, Harris, and Spatt (2013).

⁶² Chakravarty, Wood, and Van Ness (2004). The authors estimated that decimalization reduced effective spreads by 27.4 percent for trades of less than 500 shares, by 24.2 percent for trades of 500 to 999 shares, by 24.3 percent for trades of 1,000 to 4,999 shares, by 23.5 percent for trades of 5,000 to 9,999 shares and by 0.5 percent for trades of 10,000 shares or more. According to a 2008 study, the executed orders of retail investors average 770.9 shares. Kaniel, Sarr, and Titman (2008).

spreads today average about \$0.015 per share for NYSE trades and \$0.025 per share for NASDAQ trades,⁶³ a shift from penny-based arrangements to nickel-based arrangements would increase those spreads to \$0.019 and \$0.033, respectively. This analysis suggests that a shift to nickel-based pricing for stocks would increase the trading costs of retail investors by more than \$1.7 million per day, or \$410 million per year (Table 9, below). Moreover, these estimates are conservative, because they do not take into account how shifting from decimal-based trading to nickel-based trading might interact with other factors that also lowered spreads.⁶⁴

Table 10: Execution Costs for Retail Equity Trades, With and Without Decimalization

	Total Daily Volume	Retail Investors	Effective Spread	Execution Costs	Alternative Spread	Alternative Costs	Additional Costs
NYSE	3,500,000,000	385,000,000	\$0.015	\$2,887,500	\$0.0198	\$3,809,367	\$921,867
NASDAQ	1,800,000,000	198,000,000	\$0.025	\$2,475,000	\$0.0330	\$3,265,172	\$790,172
Total	5,300,000,000	583,000,000		\$5,362,500		\$7,074,538	\$1,712,038

IX. Conclusions

Calls to eliminate the U.S. penny are commonplace, and proposals to do so invariably claim that the government and taxpayers would save substantial sums. This study analyzed the actual fiscal and economic effects of eliminating the penny. We found that the most common approach, shifting from penny-based transactions to a nickel-based system, would impose large costs on American consumers and taxpayers. Eliminating the penny and producing additional nickels with the equivalent combined face value would cost the government, on a net basis, an additional \$5.3 million per year at 2015 prices. Since much of the cost of producing new coins depends on global commodity metal prices, we also analyzed the losses and gains from this shift, using the lowest, average and highest metal prices from the last decade. This analysis found that the shift would produce net costs of \$1.3 million per year using the lowest metal prices, net costs of \$25.1 million per year using average metal prices and net costs of \$54.4 million per year using the highest metal prices.

Moreover, the economic value of the penny and other coins is not based on the metals used to produce it, as it was in the 18th and 19th centuries, when coins were made of silver and gold, but rather on its use as a medium of exchange. As such, the value of a coin is expressed every time it is exchanged, and we found that the average penny turns over 2.18 times per year. Since the penny's average lifespan is 25 years, its economic value as a medium of exchange is \$0.55, compared to its 2015 cost of production of \$0.014. Adjusting for 25 years of inflation

⁶³ Angel, Harris, and Spatt (2013).

⁶⁴ The impact for institutional investors is more ambiguous, based on studies showing that decimalization was followed by a decline in the depth of trades by institutional investors. Nevertheless, the empirical evidence suggests that transaction costs for institutional investors also declined following decimalization. The GAO reported that data from three equity analytics firms indicated that after decimalization, the transaction costs of institutional investors fell by 30 percent, 40 percent and 53 percent for NYSE stocks and by 44 percent, 46 percent and 53 percent for NASDAQ stocks (Hilman, 2005). Academic studies confirm the direction of the effect reported by GAO. One analysis used data for 80,000 orders for NYSE stocks by institutional investors and found that their trading costs declined by about 11 percent. Another study found that transaction costs for institutional investors on NASDAQ trades declined 49 percent on orders of more than 10,000 shares (Werner 2003).

(1990-2015), the economic value of an average penny as a medium of exchange is \$0.303, compared to the inflation-adjusted cost of \$0.008 to produce it.

There is also no acceptable way to reduce those costs of production. The Mint reports that there are no alternative metal combinations that could lower the costs of producing pennies while preserving their usefulness as a medium of exchange. The Mint did identify one acceptable alternative for nickels, dimes and quarters, but the projected savings were minimal.

Most coins in use in the United States are not new coins from the Mint but used coins recirculating through the economy. Independent coin-counting services are a principal force in the recirculation process, since two-thirds of all coins recirculated through the Federal Reserve System and commercial banks and thrifts come from coin-counting services. Since pennies comprise a majority of the coins recirculated through this process, eliminating the penny could disrupt the current system for recirculating all coins. When Canada eliminated its penny in 2013, the volume of Canadian nickels and dimes recirculated through these services fell by 35 percent. So if the U.S. penny were eliminated, and the Mint offset just 25 percent of the reduced volume of recirculated coins with new nickels, dimes and quarters, produced at 2015 metal prices, it would cost the Mint an additional \$77 million. The net costs rise or fall with metal prices. Using the lowest metal prices over the last decade, the Mint would have to spend an additional \$60 million per year to maintain adequate coin recirculation; applying the highest metals price of the last decade, the Mint would have to spend an additional \$181 million per year to maintain adequate coin recirculation. The net costs would also rise if the Mint has to offset 50 percent or 75 percent of the reduced volume of recirculated coins.

Eliminating the penny while retaining its use as a pricing unit would also impose new costs on American consumers, since billions of cash transactions would have to be rounded up or down to the nearest nickel. Based on studies of consumer cash transactions, 60 percent to 93 percent of cash transactions would involve rounding up the final charges, and we found that this process would cost consumers \$438 million to \$1.13 billion per year.

Furthermore, if pennies were eliminated and their role in pricing ended as well, U.S. investors would also bear additional costs. Since 2001, all U.S. stock prices have been quoted in pennies, and the change from the former regime of selling and buying stocks for prices quoted in eighths or sixteenths of a dollar lowered trading costs for individual or retail investors. We found that reversing course by shifting to nickel-based stock quotes would raise those trading costs by at least \$410 million per year.

Based on public demand, the U.S. Mint produces almost 6.9 billion new pennies every year, and pennies account for a majority of all U.S. coins circulating through the economy. However loudly the penny's critics complain, it is clear from the use of the coin by consumers and businesses that Americans value the penny as a medium of exchange. All told, our analysis found that eliminating the penny as a medium of exchange would result in substantial net costs totaling some \$909 million to \$1.9 billion per year for the government, the economy, businesses, consumers and investors. Ultimately, the campaign to phase out the U.S. penny lacks any economic foundation or justification.

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