

# THE END OF CASH — MYTH OR REALITY



## THE FUTURE OF BANKNOTES: PHYSICAL, DIGITAL OR HYBRID?

*Dr. Franklin Noll – President, Noll Historical Consulting*

*Andrei Lipkin – Director of Innovative Technologies, Noll Historical Consulting*

We are heading for a cashless world. At some point, we will say goodbye to all those pieces of paper and polymer and switch to an electronic alternative. The only problem with these statements is that people have been saying them since the late 1960s. Banknotes have a robust technology and will be around for quite some years to come. What is needed is a transitional device that will ease the transition from nineteenth-century cash to twenty-first-century digital currency. The answer is a hybrid banknote. Basically, a hybrid banknote is a physical banknote on a paper or polymer substrate that can transfer value over an electronic network. It is denominated and has all the physical properties of a traditional banknote, allowing it to pass hand to hand. However, when the need arises, the user can access an electronic network and transfer the denominated value off the hybrid banknote.

### THREE HYBRID BANKNOTE OPTIONS FOR TODAY

Building upon the past and incorporating current technology and developments in the cash and payment worlds, we present the most promising hybrid banknote models for CBDC and cryptocurrency use today.

First is a **smart banknote**, a traditional banknote that has the added ability to communicate with an electronic network via chip technology, which can operate on a central ledger or a blockchain.

The second and third models are variations of a **cryptobanknote**, which uses QR codes and is reminiscent of a paper wallet and is based on blockchain technology. Two types of cryptobanknotes are possible: cryptonotes and cryptobills.

#### Smart Banknotes

A smart banknote is like a traditional banknote in that it bears intaglio and offset printing on a paper or polymer substrate. Like a traditional banknote, a smart banknote conveys its value without a network or electricity. It can work completely offline. Its visible denomination presents its discrete value, *prima facie*. A smart

banknote conveys value without the need to connect to an electronic network. However, a smart banknote is capable of conveying its value over an electronic network, acting as an electronic payment vehicle.

This hybrid banknote talks to an electronic network via one or more RFID chips. Using a smart phone, a point of sale device, or other reader, the value of the smart banknote can be moved back and forth on an electronic network. Value can be transferred off of a smart banknote onto a network, or value can be transferred from a network on to an “empty” or valueless smart banknote. The status of the smart banknote, whether it contains its face value or not, whether it is “empty” or not, is indicated by a tactile and visible icon formed by electronic ink.

A smart banknote would appear much like existing Dollar, Euro, or Pound banknotes. The same substrate, intaglio and offset printing, denominators, security features, and overall design could be maintained from existing notes. And, depending on the chip technology employed, the chips may be largely invisible. The icon, indicating the note’s status, could be an existing design feature or new feature worked into an existing design.

Imagine a \$10 US smart banknote. It will appear as a regular \$10 bill but may have a tiny chip or two visible in the substrate. The status icon could be the current Symbol of Liberty in the design: The Statue of Liberty Torch.



\$10 Federal Reserve Note

This smart \$10 bill would circulate hand-to-hand like a current \$10, being used in face-to-face transactions or fed into vending machine bill acceptors. No access to an electronic network is necessary. Everyone would know that this \$10 bill contains its value because the torch symbol is colored and raised above the surface of the note. With this tactile feature, even the visually impaired can gauge the status of the note.



\$10 Federal Reserve Note, Symbol of Liberty Highlighted

Perhaps the smart banknote user then needs to complete an electronic transaction. They want to transfer the \$10 to their bank account, transfer it to a distant relative, or make a transaction at a point that does not accept cash. The user touches the note to their phone or point of sale device and transfers the value over the network.

The value icon or The Statue of Liberty Torch symbol then disappears, indicating visually and tactilely that the smart banknote no longer has value; it is "empty." The user can then turn in the smart \$10 bill to a bank or merchant that will recharge the note and reintroduce it into circulation. Or, the user can hold on to the smart banknote and recharge it themselves by transferring \$10 back on to the bill. At this point, The Statue of Liberty Torch symbol would appear, indicating that the smart banknote bears its face value. And, the smart \$10 can continue circulating hand-to-hand.

#### Cryptobanknotes

A cryptobanknote is also a hybrid banknote. It is a traditional banknote that conveys the value of a digital money but cannot interact directly with an electronic network. But, it is modeled on a paper wallet as used with cryptocurrency, usually bearing the private and public keys needed to access a cryptocurrency address.

Like a traditional banknote, a cryptobanknote conveys its value without a network or electricity. It can work completely offline. Its visible denomination presents its discrete value, *prima facie*. A cryptobanknote conveys value without the need to connect to an electronic network. However, when needed, the value of a cryptobanknote can be transferred over an electronic network, using the keys located on the note. Two types of cryptobanknotes are possible: cryptonotes and cryptobills.

#### Cryptonotes

A cryptonote is a hybrid banknote that bears the public and private keys to access a cryptocurrency account. Cryptonotes can pass hand-to-hand until a user wants to transfer the value of the note to an electronic account. This action will "burn" or invalidate the note, making it incapable of further use. Hence, a cryptonote can be considered single use as regards the electronic transfer of its value.

It would require a design somewhat different from existing Dollar, Euro, or Pound banknotes. It would use a banknote substrate, use intaglio and offset printing, and bear denominators and security features like existing notes. However, the note would require a QR code and a location for a removable foil or other concealing, tamper-evident device.

A £10 note, for example, would bear all the attributes it now has, but the silver foil patch (bearing the crown, top-left) would be removable. Underneath of it would be the private key in QR form. The hologram (bearing "Ten," bottom-left) would be replaced with a visible QR code that would be the public key.



£10 Note

Like a current £10 banknote, the £10 cryptonote would repeatedly pass hand-to-hand and be used in face-to-face transactions or fed into vending machine bill acceptors. No access to an electronic network is necessary. Everyone would know that this £10 contains its value because the foil patch is intact, evidence that no one has accessed the private key necessary to transfer its value electronically.

Perhaps, the cryptonote user then needs to complete an electronic transaction. They want to transfer the £10 to their bank account, transfer it to a distant relative, or make a transaction at a point that does not accept cash. The user scratches off the foil patch to reveal the private key. Then, using their phone or point of sale device, the user scans the QR codes for the public and private keys, accessing the corresponding wallet. The £10 can then be transferred.

Now, with the foil patch removed and the value removed from the note, the cryptonote can no longer be used. And, because of the physical damage to the note, it cannot be reused. The lost foil patch also makes it evident to everyone, including the visually impaired, that the note no longer has value.

### Cryptobills

A cryptobill is a hybrid banknote that bears only the public key of the cryptocurrency holdings of the issuer. The private keys to individual accounts are held by the note issuer. Cryptobills can pass hand-to-hand until a user wants to transfer the value of the note to an electronic account. The note must then be taken to the issuer or its representative to have the value represented by the note transferred. This action does not involve the actual note but only the cryptocurrency accounts holding the backing value for all cryptobills. As a result, the note can be reissued repeatedly and circulate until worn out.

A cryptobill takes as its model past banknotes used in the United States such as Silver Certificates and Gold Certificates. Such bills were certificates of deposit with the banknote representing a certain amount of the backing silver or gold held in the US Treasury. A holder of a Silver Certificate and Gold Certificate could go to the Treasury and turn in the note for the backing silver or gold. After accounting for the payout of this specie in its books, the Treasury would reissue the note for continued circulation until the note was worn out or all the backing silver or gold was depleted. A cryptobill acts in the same way. Only, here, the backing is a cryptocurrency.

It would require a design very similar to that of an existing Dollar, Euro, or Pound banknote. It would use a banknote substrate, use intaglio and offset printing, and bear denominators and security features like existing notes. However, the note would require a QR code, bearing a public key. No chips or removable foil patches.

Like a current banknote, the cryptobill would repeatedly pass hand-to-hand and be used in face-to-face transactions or fed into vending machine bill acceptors. No access to an electronic network is necessary. As with current banknotes, there is no need to determine whether the note actually holds value, because it is irrelevant. A cryptobill, like a current Dollar, Euro, or Pound, is simply a token for its underlying currency. As a result, users are only concerned with the authenticity of the note as they are with current banknotes.



Cryptobanknote Model by Andrei Lipkin

### CONCLUSION

Hybrid banknotes may seem new and radical, but they are not the first instruments to act as hybrid instruments. During the 1970s, hybrid US Treasury securities existed. These securities were meant to bridge the transition from physical (definitive) securities to electronic ones handled in the new book-entry system. This began with Treasury Bills and was slowly expanded to include Notes and Bonds. These physical securities were entered in the book-entry system but were still issued in paper form bearing their CUSIP numbers. This was a hybrid, transitional security able to work in both worlds. Given that 50 years ago the US Treasury was issuing hybrid securities (part definitive, part electronic), it does not take a great stretch of the imagination to believe that a hybrid banknote could be produced today, acting as a transition between definitive and electronic cash.

Transcending the division between the world of banknotes and electronic money through a hybrid banknote will bring many advantages to central banks and cryptocurrency advocates. Such banknotes will use a universally accepted and robust payment technology, cash, to deliver the cutting-edge benefits of digital money, passing hand to hand until used to access an electronic network to transfer value.

Hybrid banknotes can provide anonymous, offline transactions, using a familiar technology. At the same time, they can promote the adoption of digital money and facilitate central bank monetary policies possible only with CBDCs. All this can be done while maintaining the health of the cash industry and meeting the popular demand for cash.

Also, the use of one form of hybrid banknote does not preclude the use of another. Smart banknotes, cryptonotes, and cryptobills can all be used together, serving specific purposes within the same currency. Some issuers may want to use full-feature notes like smart banknotes and cryptonotes for high denominations and use simpler cryptobills for low denominations. And, there may be times, such as during disaster relief, when a single-use note (such as a cryptonote) or a note that can be activated onsite (such as a smart banknote) are preferable. Hybrid banknotes provide many options.

Since their inception in 2010, hybrid banknotes have taken many forms but shared many characteristics. These commonalities stem from the notes having the same overall mission, to create a device that brings together the world of cash and traditional banknotes and the world of cryptocurrencies and electronic networks. These devices were designed to solve a myriad of payment problems that are still with us today and will be into the future.