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From the Athenian silver to the bitcoin standard: Private money in a state-enforced free banking model

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Abstract

Currently numerous market-driven cryptocurrencies challenge to dethrone the state-controlled supply of fiat money. The outcome hinges on the old question of whether privately produced money with or without government is possible. This paper revisits the issue by looking for insights in the successful precedent of classical Athens. It is found that in this case the government defined a unit of account (*Attic* drachma), linked it to a commodity (silver), and used it in its domestic and foreign transactions. By drawing on its share of silver from the Laurion mines and other sources, the government acted as a major supplier of the said currency; and lastly, it enacted and enforced rules and regulations that aimed at safeguarding the integrity of the currency while leaving private markets free to co-determine the supply of the currency and credit, and the drachma to circulate in competition with all other foreign currencies within its borders. On this account and the evidence that the *Attic* drachma dominated for three centuries in the wider Mediterranean region, it is concluded that the application of the silver standard in classical Athens provides a most suitable framework of free banking after which to pattern the emerging regime of a privately produced bitcoin-based digital standard with amicable state sponsorship and enforcement.

Keywords: Athenian model of the silver standard • Cryptocurrencies • Roles of government in money • Anonymity of citizens • Civil liberties.
JEL Codes: D78, E42, E5, G21, G28

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From the Athenian silver to the bitcoin standard: Private money in a state-enforced free banking model

1. Introduction

At the beginning, it was just an ingenious insight presented in an academic-like paper that circulated via e-mail.[1] Then, in 2009, it emerged as a digital currency called Bitcoin.[2] The aim of its inventor was modest. The idea was to create a cash-like medium for carrying out and settling transactions from peer-to-peer over the internet under conditions of safety and private secrecy. For this purpose, the inventor followed a two-pronged strategy. First, to keep a detailed and secure record of the transactions among the peers, he adopted the advanced cryptographic ledger technology called *blockchain*. And second, to provide a mechanism for the supply of electronic coins, he created a mine-like mathematical algorithm through which the peers could mine coins by incurring increasing costs, that is, exactly as it would happen in a gold or silver mine that necessitates going deeper and deeper until the vein is exhausted.[3]

The innovation did not take long to reveal the revolutionary nature of the digital coinage. For, in the following few years, it became apparent that currencies based on the bitcoin standard offered a socially unparalleled balance of advantages over disadvantages in comparison to the prevailing order of government-supplied fiat money. To corroborate this assessment, it suffices to summarize briefly the particulars on which the bitcoin standard is based. On the plus side, it is generally accepted that currencies like this, known also as cryptocurrencies or cryptos:

- Preserve the privacy or *anonymity* of economic agents in their everyday transactions, that is, exactly like all traditional commodity and fiat currencies do.
- Function as cash with the extra advantage that they allow contactless payments, whereas cash transactions in all traditional currencies require the physical presence of buyers and sellers.
- Maintain largely the safety that gold and silver provide. This property enables their proponents to insist that cryptocurrencies are "electronic gold". Such claims are not baseless,

[1] See Nakamoto (2008).

[2] Note that this paper does not deal with digital or electronic currencies in general. It focuses solely on those produced using the protocol of the Bitcoin or variations thereof. The latter currencies have the properties mentioned shortly below, which, if taken as a whole, define a generic digital currency standard, which will be referred to henceforth as the "bitcoin standard".

[3] As mining advances towards the maximum supply of 21 million Bitcoins at 100 million Satoshis each, the consumption of energy accelerates, and the same transpires with the time it takes to execute each transaction as their volume on the bitcoin network increases. In turn, the heavy energy consumption and the lack of scalability limit the potential of cryptocurrencies based on the bitcoin standard to evolve into national or international means of payments. But as argued by Ammous (2019, 207-216) and many other experts, these bottlenecks of *Blockchain* technology should not prevent Bitcoin or some other state sponsored cryptocurrency from acquiring eventually the status of national and international reserve currency much like the U.S. dollar, the Euro, or Renminbi.

since upon possession by somebody, exactly like currencies from these precious metals, cryptocurrencies cannot be cloned in any way and stay firmly in one's possession, unless lost by their owners or stolen by thieves.

- Even though their supply does not respond to price changes as in the case of gold and silver, still it is elastic. For, it takes increasingly higher prices to accelerate their mining, due the higher marginal costs involved in terms of time, electricity, and other inputs.
- Have value that cannot be another person's liability. In other words, unlike fiat money, the value of which depends on the credibility of the issuing government, cryptocurrencies carry no counterparty risk because they do not rely on the trust of any third party.[4]
- Offer the possibility of establishing a decentralized system of payments, that is, one in which money markets function along the norms and customs practiced by the participating economic agents, and thus meeting the criteria that White (2012) has proposed for a viable monetary system with private money.

On the minus side of the balance, cryptocurrencies are presumed by adversaries to have two substantive and one technical drawback. Turning to the former, the first is the facility that their property of *anonymity* offers to economic agents to indulge in tax evasion and other illicit activities, whereas the second is that, in contrast to gold, silver, and other commodities, cryptocurrencies lack intrinsic value in the sense that they cannot be utilized as commodities in other human and industrial uses. Are these drawbacks so significant as to counterbalance the great advantages of cryptocurrencies for society? Not really, not even by far, since they have low cost of production and no cost of storage. Irrespective of the prevailing monetary standard, tax evasion and other criminal behaviors evolve anyway and perpetuate, but importantly they remain relatively controlled in free societies. Such phenomena are already present, despite the abolition of banking secrecy and other heavy intrusions of democratic states into the privacy of citizens; and lastly, the paramount value of their benefits for society is reflected in the strong challenge several hundreds of them stake to displace the dominant regime of fiat money. Will they succeed?

Before delving into this question, let us assess the significance of the presumed technical drawback. This has to do with a key difference between gold and the Bitcoin with regard to the nature of their supply. In particular, while the flow supply of monetary gold is price elastic and

[4] This property differentiates cryptocurrencies sharply from the digital currencies that may be offered by central banks or other financial organizations. For, while in the former case currencies are produced in a decentralized mode like all other private goods, in the latter case digital currencies are promissory notes produced centrally.

practically unbounded over the long haul, the flow supply of Bitcoins is programmed to diminish over time and until its stock comes eventually in the year 2140 to rest in the amount of 21 million Bitcoins. At that time, if the demand for Bitcoins increases, say, at the rate of Gross National Product (GDP), the level of prices will keep decreasing in the short and in the long run, thus causing price instability, which is considered an undesirable social outcome. Proponent of this argument is White (2018a). However, for several reasons it should not be expected that this constraint would deter the penetration of cryptocurrencies. For example, one is that there are many close substitutes to Bitcoin. As its value increases in terms of goods and services, it should be expected that people would switch to some of them. Another is that there is already another major cryptocurrency, the Ethereum, the flow supply of which is price elastic, whereas its ultimate stock supply remains uncapped. Lastly, and most importantly, a third reason has to do with the democratic way in which the flow supply of Ethereum may be regulated to avoid destabilizing its value in terms of goods and services. This decision depends on the majority of those who are invested in the network. For, it is only them who may determine on the cost of the mining process and the quantity that may be released per slot of time. Thus, let us now return to the question raised above about the future of the contest between the established order of fiat money and the cryptocurrencies.

If the answer depended solely on the prospects for the resolution of the technical issues that slow down presently the speed of their adoption, certainly it would be positive.[5] However, tradition suggests that governments will not remain aloof. When success will appear imminent or even much earlier, governments can be expected to step in and try in various ways to retain control. That this will happen needs no further assurance than the following evidence-based assessment by Friedman, Schwartz (1986, 43):

> Historically, a single unit of account linked to a single dominant outside money has tended to emerge, initially via a market process of transactors settling on a particular commodity, followed almost invariably by government's exercising control over one or more aspects of the issuance of outside money-typically with the ostensible purpose of standardizing the coinage and certifying its quality (purity, fineness, etc.).

[5] This view is supported strongly by expert assessments as the following, for example, by Akwei (2018):

> A more energy efficient and secure form of Bitcoin will possibly emerge as a World Currency, like the Globo. An easily programmable blockchain ledger, like Etherium, will possibly emerge as a replacement for Stocks and Bonds, and other contracts that are securities. The Bitcoin equivalent in Etherium, Ether, can possible also emerge as a World Currency.

Therefore, looking forward the question is not whether governments will intervene but in what direction and to what extent. On this, there are three general policy options. These are: to ban; to deter; and to encourage the use of cryptocurrencies in domestic and international transactions. Many small and large countries have concluded already that the increasing appeal of cryptocurrencies among their citizens poses insurmountable risks for the prevailing political and financial order, and on various justifications, they have imposed restrictions ranging up to a blanket ban. For example, Saudi Arabia and Qatar have outlawed the use of these currencies, whereas China has attempted to deter their acceptance in trading and payments by prohibiting banks and other financial service providers to deal with cryptocurrency exchanges and companies.[6]

The focus in this paper is on Western type democracies. In these countries, after the landmark decision of the Supreme Court of India last year,[7] the option of democratic governments to ban or restrict the use of cryptocurrencies by other means may be dead, at least for the time being. Hence, given that in free societies it would be impossible for the state to offer a cryptocurrency without compromising privacy, and hence citizen sovereignty,[8] there remain three policy options. These are, to regulate privately offered cryptocurrencies with emphasis on containing the illegal activities to which they may give rise; to embrace and promote actively their adoption for what they can contribute to the robustness of democracy;[9] and lastly, to employ a combination of both.

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[6] It has long been known that a blanket ban in the circulation of a highly sought commodity splits its market into official and unofficial. In the case of cryptocurrencies, outlawing their use renders the unofficial markets stealth, because transactions can still be executed in the so called "Dark web", where enforcement is exceedingly costly and technically ineffective (see for example Piazza (2017)), while in addition it causes significant unintended economic inefficiencies. Nevertheless, in countries where governance is centrally controlled, such interventions are considered normal because citizen sovereignty and economic efficiency are of secondary importance.

[7] On March 4, 2020, the Supreme Court of India made a groundbreaking decision by lifting the ban and removing all restrictions for the trading of cryptocurrencies that the government had imposed two year earlier.

[8] To understand why central banks in democratic states cannot offer such currencies, consider the following. Since, say, the United States is in reality a *virtual community*, it should be obvious that the Federal Open Market Committee or the Fed may turn the U.S. dollar into a *virtual currency* transferred via permissioned ledgers or pseudo-blockchains. In this event, the U.S. dollar would erode gravely *anonymity*. It would not function as in the traditional financial system of fiat money. Instead, it would be completely centralized and *eponymous* in the sense that it would facilitate real-time tracking of customer transactions; all those with bad credit records might be excluded; tax authorities might have access to records, etc. Nevertheless, such powers at the central bank would endow the government and the regulators with sophisticated forensics tools, and hence with unprecedented insights into the spending habits and social behaviors of citizens. If this prospect is dreadful for citizen sovereignty in democracies, only a digital currency in the service of civil liberties may dissuade it. This holds particularly for the proposal that Berentsen, Schär (2018) submitted in support of central bank electronic money and against a central bank cryptocurrency. For, as stressed by White (2018b), the latter authors ought to have reserved judgement in view of the spectacular failure that the central bank of Ecuador suffered when it experimented with the introduction of an electronic currency.

[9] Cryptocurrencies may serve as a potent device of soft power in the arsenal of democracies, should a cold war break out with authoritarian states.

From among them, aside from being balanced and sustainable, the last policy option is recommended also by the following rationale that Berentsen, Schär (2018a,104) have suggested:

> History and current political reality show that, on the one hand, governments can be bad actors and, on the other hand, some citizens can be bad actors. The former justifies an anonymous currency to protect citizens from bad governments, while the later calls for transparency of all payments.

So, is there an example or has there ever been one after which to pattern such a fundamental reform? From Bitros, Economou, Kyriazis (2020, 210-214) it emerges that the application of the silver standard in classical Athens provides a promising case for reference and guidance towards a modern state-enforced bitcoin standard with privately produced money.

To substantiate this claim, the presentation begins in the next section by focusing on three tasks. First, highlight briefly the network of governance- and currency-related institutions in classical Athens. Second, elucidate the roles that the state reserved for itself in the process of coinage. And thirdly, to explain the nature and delimit the range of the state's regulatory reach on the basis of the provisions in the *Coinage Decree* and the *Decree of Kallias*, in the second half of the 5th century, and the *Law of Nicophon* in the first half of the 4th century BCE. Section 3 outlines the monetary system within which the silver standard is envisioned to have operated. By bringing together the markets for currency, silver bullion, bank deposits, and bank loans, the analysis shows how all crucial variables were determined. Then, drawing on the free banking setting in which the silver standard functioned at the time, Section 4 explains how a modern bitcoin standard might be established; and lastly, in Section 5 the paper closes with a summary of the main findings and conclusions.

2. Governance and currency-related institutions and policies in classical Athens

The Athenian democracy was ruled by three entities: The *Ecclesia of Demos* (congregation of citizens for decision making purposes) or *Assembly*; the *Council of 500* or *Boule*; and the *Dikastiria* or *Courts*. The *Assembly*, in which participated all adult male Athenian citizens, was the top decision-making body with all legislative and select ultimate-degree judicial and auditing powers. It convened four times during each *prytany* (tenth of the conciliar year), which lasted from 36 to 39 days, and at least forty times per year in total (Thorley 1996, 30). The *Council* was the executive body of the government. It comprised ten groups with 50 members each from the 10 tribes of Athens. The 50 members of each tribe served for one tenth of each year and they

were replaced by another group at the end of each *prytany*.[10] Thus, in practical terms, each tribe that held this post actually ruled the state with full executive rights (Lyttkens 2013, 59, 76). Among its main duties were the following. Prepare the so-called *probouleumata* (preliminary Decrees) and submit those which were approved for final discussion and voting in the *Assembly* (Demosthenes, *Against Neaera*, 59.4), as well as the agenda for each meeting of the *Assembly*. Care for the arming and staffing of warships and the cavalry. Supervise the execution of the budget, the management of the *Treasuries of the gods* or *Temples*, and the operation of the *Mint*; and to be in constant contact with the public officers who were appointed to manage the affairs of the state on a daily basis (Aristotle, *Athenian Constitution*, 46.1, 49.1-2).

Figure 1 displays how the entities that were responsible in some way or another for the management of the currency were embedded in the wider institutional setup of governance in classical Athens. As with all other matters, the *Assembly* took all decisions about currency-related policy issues and the *Council* implemented them. The *Board of Poletai* (*Sellers*) acted under the latter's supervision and guidance. It auctioned all sorts of leases, mainly for searching and extracting silver from the Laurion mines. It collected the related taxes, fees and the state's share

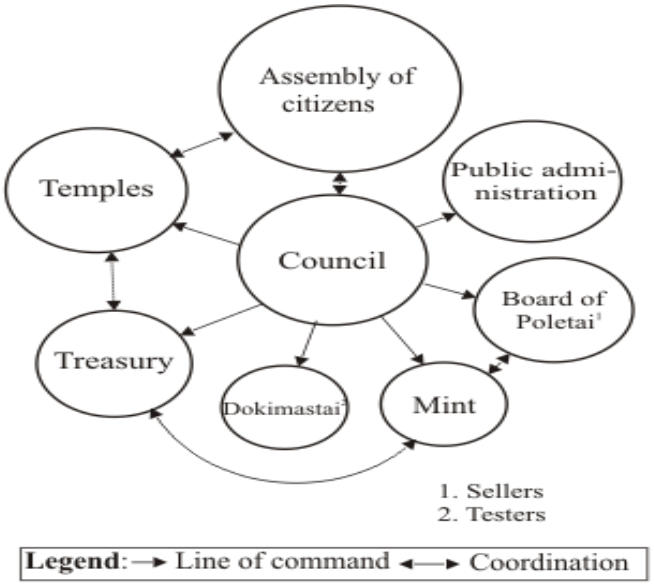

Figure 1: Institutions of governance and currency management in classical Athens

[10] The 500 men who served in the *Boule* were chosen by lot at the *deme* level, each deme having been allotted a certain number of places proportional to its population. At this time, membership was restricted to the top three of the original four property classes, i.e. the *pentacosiomedimnoi*, *hippeis*, and *zeugitai*. The class of *thetes* acquired the right to elect members in the *Boule* later. By contrast, a considerable number of the 700 officials assigned to administrative tasks were elected by vote from lists of knowledgeable and experienced Athenians. For more details on this very significant issue, see Aeschines (*Against Ctesiphon*, 29) and Aristotle (*Politics*, 1317b15-1318a3).

of silver from the mines; and it delivered the revenues to the *Treasury* and the silver bullion earmarked for coinage to the *Mint*. The latter turned the silver bullion into coins and delivered them to the treasury after strict accounting in the presence of council members about yields and costs. Lastly, the *Dokimastai*, one in the *Agora* in Athens and another in the port of Piraeus determined whether the coins brought in front of them had been struck by the Athenian *Mint*, and if not do as provided for in the law.

The *Temples*, in addition to their religious functions, but most likely related to them, played several key roles in the financial affairs of the state (Bitros, Economou, Kyriazis, 2020, 58-64). One was that they served as *Treasurers*. Surplus and deficit years were balanced with the intermediation of the *Temples*. All cash and near-cash valuables were deposited with the *Temples*, partly for safekeeping purposes and partly as donations. Presumably, for safekeeping were the deposits that had been earmarked for covering public expenditures but had not been spent during the year, whereas the rest represented donations of the state to cover possible shortfalls in public outlays in cases of unforeseen circumstances in the future. Included in the latter amounts of accumulated wealth were also the donations by private individuals, which in all probability were of much lesser importance in comparison to the donations by the state. Thus, the *Temples* functioned as *wealth managers*, earning interest income from deposits with private banks and lending funds to the state on interest. In this function, the *Temples* stood also as *bankers of last resort* to whom the state turned for funds to cover expenses arising from unforeseen contingencies like, for example, cost overruns in public works or a war expedition.

To conclude, the network of institutions shown in Figure 1 evolved through gradual adjustments in classical times to support the financing of the Athenian state through peace and war by balancing the public budget in the short-run and without accumulating public debt in the long run. In the process, the state supplemented the monetization of the economy and set the regulatory framework within which the silver standard flourished. Highlighting the latter accomplishment is the subject in the next sub-sections.

2.1.1 Main aims and provisions of the adopted currency policies

Classical Athens applied an astonishingly sophisticated currency policy that aimed at achieving several advantages. By keeping its *Mint* open to cutting fine quality *Attic* coins on demand at relatively low cost and seigniorage charge, currency policies sought to attain economies of scale in the fabrication of coins, raise public revenue, improve the terms of trade, and expand the moneti-

zation of the economy. On a strategic plane, the policies sought to create comparative advantages in favor of the Athenian *Mint*, put pressure on foreign mints to close down, and thus open the avenues for the dominance of the Athenian currency abroad. In turn, for these advantages to remain sustainable, Athens was obliged to keep the integrity of its currency impeccable and consider carefully the interests of its allies. Perhaps, for this reason Athens never prohibited explicitly the circulation of foreign currencies within its borders.

Fortunately, even though questions about dates of enactment and objectives remain unsettled in the relevant literature, enough texts written on marble fragments from three legislative acts have been found to help us understand the thrust of the currency policies that they pursued. The following brief narratives are devoted to these acts

2.1.2 The Coinage Decree or Decree of Coinage Standards (449 BCE)

By calling attention to the language used in its composition, some historians argue that this Decree was nothing but a clear attempt by Athens to compel its allies to stop minting their own coins and instead adopt the Attic drachma as their single and only currency. Some other historians, find considerable indications to argue that the Decree was no more than an attempt to project "a selfish monetary policy of a regional power; and selfish monetary policy is not imperialism". Still a third group of historians side with the interpretation presented by Figueira's (1998, 310-411), according to which the tenets of the Decree were to introduce the Attic drachma as the legal tender in the alliance, along with common weights, but without either prohibiting the minting of coins by other states or forbidding the parallel circulation of their coins. Supportive of this view is also that non-Athenian coins were not demonetized, recalled to Athens or replaced, and that the allies who chose to mint their own coins were obliged to pay their contributions to the alliance in valid Athenian coins, while their mints continued to strike their own coins.

This interpretation stands above all others for an additional reason. Above it was suggested that the economic dynamics in the minting markets were so profoundly in favor of the Athenian *Mint* that those in the other allied states would have closed down anyway. Therefore, it is rather unlikely that the Athenians sought with the Decree to bring about by authoritarian actions an outcome that would have resulted naturally through market forces. For such an interpretation would require assuming that, in order to gain some small tactical and operational economic advantages, Athenians were ready to risk the major strategic advantages that the Alliance offered them.

In short, there is no doubt that the Decree did impinge on the autonomy of the states participating

in the First Athenian Alliance. But it did so in a context in which Athens attempted to establish a *common economic area* within which free exchanges would take place with the help of different currencies in competition with each other but following homogeneous weight standards, with the purpose to reduce transactions costs and expedite trade enhanced economic prosperity. This interpretation is in line with Bury (1900, 226), Hammond (1959, 306) and von Reden (2010) who have long argued that the Decree encouraged the flow of trade through the Aegean and especially between Athens and its allied states. In a wider sense, this Decree introduced a system of parallel currencies within a common economic area, whereas the Law of Nicophon, to which I will turn in due course below, regulated the parallel circulation of currencies within Athens.

2.1.3 The Decree of Kallias (434/433 BCE)

From its content, it follows that it served partly as an accountability report. Partly as an authorizations bill to introduce certain reforms that would render the management of public finances more efficient. Partly as an effort to arrest the tendencies that were observed at the time towards running budget deficits, and partly as a framework for the concentration of the treasures in the various shrines in Attica to the *Temples* in the Acropolis. In the authorizations section, the Decree starts with a reminder that all decision-making authority on borrowing in times of necessity, as during wars, and disposing of surpluses, as in times of peace, rested with the *Assembly*. This body then was asked and decided to provide by vote a roadmap for the management of the budget over periods of war and peace. War operations were to be financed firstly out of the current income, and if this proved insufficient, only with borrowing from the *Temples*. Surpluses during peacetime were to be used partly to repay previous loans and partly, to the extent possible, to beef up the reserves in the sanctuaries for unforeseen contingencies.

The most important message from the Decree is this. The Athenians who participated in the *Assembly* attested that they were well aware of the risks associated with the temptation of giving in to extravagant public expenditures. Therefore, to control themselves from their worst impulses to spend beyond their means, following the example of Ulysses who tied himself to the mast of his ship to resist the bewitching song of the Sirens, they tied themselves to a firm institution that they all respected, that is, the *treasuries of the gods*. At times they did indeed run the reserves in the *Temples* perilously low. But in contrast to what is happening in contemporary democracies, Athens did not run systematic deficits which would require financing through the accumulation of public debt.

2.1.4 The Law of Nicophon (375/374 BCE)

In classical Athens, the ultimate decision makers on all currency issues were the citizens, irrespective of whether they were educated or not. To carry out their duties in this regard, citizens received advice from "experts", who were empowered to introduce proposals in their areas of expertise. Nicophon, after whom this law is named, was such an expert in currency matters. Its objective was to increase quickly state revenues by stimulating trade through free circulation of all good coins within Attica by preventing the infiltration of fraudulent imitations of Athenian coins. An obvious approach to this effect was to liberalize the currency market so as to reduce the cost of doing business in Athens by allowing foreign coins to circulate freely. What this meant was, for example, that an Athenian trader selling his wares to, say, a Massaliot buyer,[11] could accept as payment, if he wished, the massaliotic silver currency, without having to change it into Attic drachmae, thus avoiding the conversion charge that he would have to pay to money changers or banks. In today's terminology this effected a reduction in transaction costs, which was considered a proven means to increase the volume of trade within a region or country.

Because of this reform, even though the parallel circulation of currencies within the alliance and Athens itself continued, foreigner's demand for Athenian coins became so high that in order to acquire Athenian coins, foreign merchants who came to trade in Piraeus quite likely offered their wares at a discount, if paid in Athenian currency. This again benefited both the Athenian state, which received a small margin of seigniorage, but for a vast amount of coins, so that the revenue could have been substantial in total, as well as the Athenian citizens who paid in discounted prices for foreign goods. What becomes clear from Nicophon's Law is the sophistication and openness of the Athenian economy. It is as if Nicophon was aware of the benefits of the parallel circulation of currencies, which promotes economic activity, and which today applies only in a few economies, like Switzerland where there is in fact a parallel circulation of the Swiss franc, the Euro, and electronic currencies like Bitcoin, Ethereum, etc.

Finally, before turning to the presentation of the network of markets through which the silver standard operated, a clarification is in order regarding the distinction between the terms "coins", "coinage" and "currency", on the one hand, and "money" on the other. Cohen (1990, 2008) has established beyond any doubt that the banks in classical Athens created credit by a multiple of

[11] Marseille, in today is southeastern France.

the deposits they received.[12] However, apart from this common feature, those banks differed from the ones of more recent decades in the following notable respects. The currency they dealt with was silver coins and bullion convertible into coins on demand at the state mint. Their so-called base money consisted of coins and bullion they themselves owned and/or derived from *primary deposits* by wealthy citizens, metics, and *treasuries of the gods*. *Secondary* or *derivative deposits*, amounting to primary deposits times the inverse of the *reserve ratio*, emanated from advances of bank loans for consumption and production purposes. Lastly, since there was no central bank to generate for them base money and require that they apply a specific reserve ratio, the banks determined it along with all other variables in the monetary system. Does the absence of an exogenously imposed reserve ratio imply that the Athenian banks were very prudent and abstained from creating excessive amounts of credit? Not necessarily; For, some banks did issue excess credit and from Cohen (1992, 215-224) we know that a number of them failed. But given that depositors had all the incentives to guard against banks that overextended in the quantity and the quality of loans that they advanced, on the whole banks should have practiced restraint from the fear of having to face a run by their depositors.

To conclude this section, according to Van Alfen (2011, 127), between 460 and 404 BCE Athens produced a colossal amount of coins, mainly *tetradrachms* from two streams of silver, i.e. the Laurion mines and the tributes contributed from its allies in the First Athenian League. From the sheer size of this coinage it follows that Athenians should have managed to put in place institutional arrangements for large scale minting of exceptionally high quality coins, and maintaining their integrity in domestic and international transactions.

3. The Athenian silver-based free banking model

In the monetary sector of Athens in classical times operated four markets of particular interest. These were the markets for silver bullion, currency in the form of silver coins called drachmae, bank deposits, and bank credit or loans. The markets for bullion and currency were closely interconnected because, for some relatively small cost, bullion could be converted on demand into coins at the state *Mint*. Hence, the supply of currency in every period was equal to the quantity of bullion that was worth holding in the form of coins on the grounds of its purchasing power in terms

[12] Research interest in the range of activities of the Athenian banks in classical times antedates Cohen's (1990, 2008) definitive assessment of the available historical evidence by several centuries. For example, from the study by Vernadakis (1881) we learn that the first attempt to put together an account of the evidence was undertaken in a dissertation by Claude de Salmasio in 1740.

of goods and services. Or, more accurately, it was equal to the quantity of bullion that was worth holding in the form of coins for its purchasing power of goods and services all over the then known world, because the economy was completely open and local silver markets for currency and bullion coincided with the international ones.

Figure 1 brings all four markets together in order to explain how the relative prices of currency, bullion, bank deposits, and bank loans, guided the self-centered decisions of economic agents who participated in them towards the equilibrium quantities of the respective assets along with the reserve ratio. Graph (i) depicts the market for currency. The supply curve has been drawn in an upward sloping fashion because it is reasonable to assume that, as the price of the currency in term of goods and services increases, bullion holders would be motivated to convert more and more of its quantity into currency. On the contrary, regarding those who demand currency by offering goods and services, it is reasonable to assume that, as its price rises they will reduce the

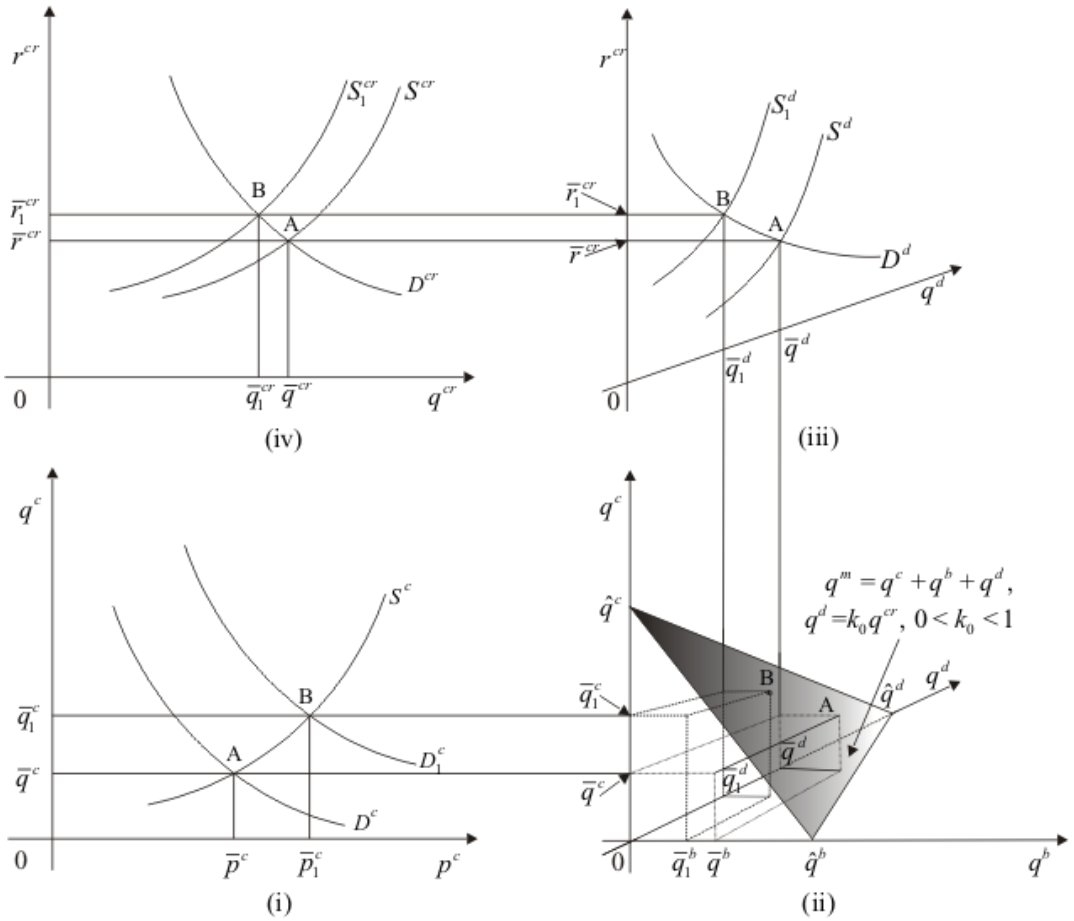

Figure 2: Equilibrium in the money market

quantities that they are willing to purchase. This explains why the curve of the demand for currency has been drawn as downward sloping. However, the interests of buyers and sellers of currency are opposite, because those who sell currency for goods and services wish to buy low, whereas those who sell goods and services for currency wish to sell high. Consequently, repeated exchanges among them would lead to a position where everybody is satisfied with the results. In the Graph (i) this situation is shown at point A where the quantity of currency and price that prevail are marked by the symbols $(\bar{q}^c, \bar{p}^c)$. At that price of the currency, Graph (ii) shows that from the total available quantity of bullion $\hat{q}$, quantity $\bar{q}^c$ would be converted into currency and the remaining $\hat{q} - \bar{q}^c$ would be traded in the form of bullion and other wares from this precious metal.

Next, suppose that while the production of goods and services increases, the overall quantity of the available silver bullion remains fixed at $\hat{q}$. How would this change affect the allocation of bullion between currency and commodity uses? Since silver in the form of currency would become dearer in terms of goods and services, more of the silver in the form of bullion would be converted into currency and a new equilibrium would be established at point B in which the equilibrium values would be $(\bar{q}_1^c, \bar{p}_1^c, \bar{q}_1^b)$. Using the same analytical apparatus, the opposite case could be examined also in which the production of goods and services remains fixed and the overall quantity of bullion increases, as happened in the case of the discovery of the Laurion mines in 483 BCE. In that event, goods and services became dearer in terms of silver bullion and certainly some of its available quantity was converted into currency. But how much currency was necessary each time to carry out efficiently the transactions on the goods and services that were produced was determined in the two markets through the mechanism of relative prices and the competition between the opposing interests of currency buyers and sellers in terms of goods and services. So, in effect, one function of a modern central bank was performed by the stock of bullion that cushioned the shocks in the goods and services markets. Except that the stock was not held monopolistically by one organization, but by many individual and uncoordinated speculators who stood to make a profit or suffer a loss depending on the particular nature of the shocks.

The preceding analysis is partial in a very important respect. This has to do with the following considerations. The stocks of currency and bullion in the economy bore no interest. By implication, those who held purchasing power in the forms of liquid currency and slightly less liquid bullion lost the opportunity to make a deposit in a bank and earn interest. They absorbed an op-

portunity cost. This cost motivated the holders of wealth in these forms to try to allocate it among currency, bullion, and bank deposits to maximize their benefits.

Looking closer at Graph (ii), observe that the rise in the use of currency would come about partly from a reduction in the form of money held in bullion, the quantity of which would decline from $\bar{q}^b$ to $\bar{q}_1^b$, and partly from a reduction in the deposits held by bankers. What would happen in the market for deposits is shown in Graph (iii). As deposits would decline with the shift from S^d to S_1^d, the interest rate and quantity of deposits would shift from point A to B. In particular, at the latter point the interest rate would increase from $\bar{r}$ to $\bar{r}_1$, whereas the quantity of deposits would decline from $\bar{q}^d$ to $\bar{q}_1^d$. This analysis explains the chain of changes in response to an isolated increase in the production of goods and services. But it remains mute regarding the nature of the interest rate $\bar{r}$ and it is in need of some further explanation.

Graph (iii) represents the segment of the money market that has to do with the demand and supply of primary deposits. Keeping with the preceding analysis, the equilibrium interest rate for deposits ought to have been symbolized by $\bar{r}^d$, because this would represent the interest rate that the banks offer to depositors in order to secure the quantity of deposits $\bar{q}^d$. Instead, the symbol $\bar{r}$ was used to draw attention to the importance of this issue. Recall that when a certain amount of currency or bullion is deposited with the banks, they use it to extend interest-bearing loans by the multiple of the inverse of their reserve-ratio k. To attract the quantity of primary deposits $\bar{q}^d$ (see Graph (iii)), assume that the Athenians banks offered to depositors the interest rate $\bar{r}^d$. In a competitive business environment, the interest rate on loans $\bar{r}$ (see Graph (iv)), and hence on credit, has to be consistently aligned with the interest rate the banks pay to depositors, because in general $\bar{r} > \bar{r}^d$.[13] How might this be achieved? The simplest conceptualization is to postulate that the demand curve D^d in Graph (iii) includes an interest rate for the attraction of primary deposits from households and enterprises. With this issue settled, let us address now the equilibrium in the credit market.

In Figure 1 relevant to the analysis of the market for credit or loans is Graph (iv). Let us concentrate first on the determinants of the curve labeled S^{cr} which stands for the supply of credit. Active on this side of the market were financial and non-financial intermediaries, including individual

[13] How larger is the average interest rate on loans in comparison to the average interest rate offered on deposits depends on factors like the operating costs of the banks, the pricing of default risks on their loans, the robustness of competition in the money market, etc.

Athenians not necessarily rich. For example, aside from the *treasuries*, which acted like banks, Harris (2002, 81) reports several cases of small loans advanced by non-professional lenders. In addition, in order to facilitate the selling of their goods and services, enterprises offered credit to buyers. From a legal point of view, selling on credit was forbidden. But *de facto* in everyday commercial relations such transactions were quite widespread (see for example Cohen (1992, 14)) and affected the overall supply of credit by expanding or contracting the outstanding stock of "trade credit". These written debt claims could be transferred to third parties (Cohen *ibid*., 14-18). Yet as is the case today, advances of such credit as well as loans offered by isolated individuals should have been limited in scale relative to the total, so they are assumed not to have played a decisive role in the credit market. For this reason, let us concentrate on the role of financial intermediaries, i.e. banks.

Since they accepted deposits and extended loans, banks affected the supply of credit through three channels. The first and very likely the most important was the well-known multiplier mechanism. In particular, drawing on the realization that only a limited proportion of the deposits they kept was withdrawn each period, banks felt confident about their liquidity to lend out the rest in the form of business and consumer loans. Therefore, since some part of the latter returned to banks as new deposits, they continued lending up to a limit, which corresponded to so many times the initial deposit as it was warranted by the inverse of the reserve-ratio k that they applied at the time. The explanation of this process and its documentation by Cohen (2008, 76-83) leaves no doubt that the Athenian banks did create credit in the same way systemic banks do in present day fractional reserve monetary systems. More specifically, looking at the Graphs (iii)-(iv) in Figure 1, it is unlikely to miss that the money market determined not only the interest rate $\bar{r}$ but the reserve-ratio $\bar{k} = k_0$ as well. For, the latter can be computed readily by dividing the volume of credit $\bar{q}^{cr}$ (see Graph (iv)) by the volume of primary deposits $\bar{q}^{d}$ (see Graph (iii)).

The second channel was the amount of base money, which consisted of the quantity of currency held by banks in the form of coins and coins-equivalent of bullion, i.e. $\hat{q}^c + (p-e)\hat{q}^b$. If the price of the currency in terms of goods and services increased above the price of the bullion plus the charges for the latter's monetization, the banks would be motivated to convert into currency silver bullion they owned and possibly, even from the quantities they held for safekeeping purposes for their customers. Perhaps because they found no evidence of such episodes or they construed them to be insignificant relatively to the mass of coins in circulation, neither Cohen (1992, 2008)

nor Amemiya (2007) make any reference to such conversions of bullion into coins, and vice versa. However, given that the *mint* was open to such business, the hypothesis that the banks were guided by the price mechanism to the optimal allocation between currency and silver bullion is credible.

Finally, regarding the third channel, it is helpful to note that, with the exception of state intervention in the determination of the prices of cereals, foodstuffs like oil and fish, and charcoal, markets were free and the same held true for the parallel circulation of domestic and foreign currencies. Hence, technically speaking, the position of the S^{cr} curve in Graph (iv) would be subject to the arbitrage that economic agents might be motivated to undertake depending on the differences in the relative prices. To see this, assume, for example, that the rise of productivity in the domestic economy shifted the curve S^{cr} to the position S_1^{cr}, thus raising the equilibrium interest rate from $\bar{r}$ to $\bar{r}_1$. If this rise was considered undue in the light of the financial conditions that prevailed abroad, other things remaining equal, importing of coins and bullion would shift the curve S_1^{cr} to the right and the amount of equilibrium credit would shift back from $\bar{q}_1^{cr}$ to $\bar{q}^{cr}$.

Turning next to curve D^{cr} in Graph (iv), the demand for loans stemmed from domestic and foreign borrowers and aimed mostly for productive purposes. In general the loans were secured by property collaterals worth at least double the value of the loans and the interest rate they carried varied depending on the risk of the venture for which the loans were advanced and other considerations.[14] Examples abound. Amemiya (2007, 86-87) for instance describes in detail the terms and the interest rates lenders charged for bottomry loans. They varied on account of the risks of the journey and the season that it took place, since ship losses during winter times were higher than similar journeys during summers. The view that emerges from the evidence is that much like today there prevailed a whole structure of interest rates which moved up or down depending on the direction in which the conditions in the credit market moved the equilibrium interest rate. In other words, assuming that the credit market determined a basic relatively riskless interest rate, the structure of interest rates guided lenders on how to adjust it in order to reflect the circumstances that applied to the particular borrowers, the intended uses of the loans, the quality of the property offered for security, etc.

[14] It should be clear that the volume of acceptable "bankable" collateral would be a strongly limiting factor restraining credit growth and enhancing stability in the economy. But at the same time, it would retard economic growth by curtailing the expansion of the money supply.

Drawing on the above, let us return to the question that was posed earlier regarding the equalization interest rates in the markets for deposits and loans. Consider an interest rate $r\%$ in the credit market that is higher than $\bar{r}$. The margin of the former interest rate over the latter would signify that the bankers are able to make a pure profit rate[15] on the deposits they manage to attract. However, in a competitive market with uninhibited circulation of information this situation cannot last for long. The reason is that the pure profit on the part of bankers will motivate enough depositors to withdraw deposits and instead become themselves direct lenders. As a result, while the curve S^d in Graph (iii) would start moving slowly rightwards, thus leading to a downward pressure on the equilibrium rate for deposits, the curve S^{cr} in Graph (iv) would move rightwards more violently as bankers lose deposits. Hence, eventually, as the interest rate $r\%$ in the loans market declines faster than the interest rate in the market for deposits, the two interest rates would come to rest in the same lower equilibrium interest rate, which allows the bankers to earn only the normal net rate of profit, which by assumption is included in curve D^d of Graph (iii).

3.1 Equilibrium in the money market

Money in classical Athens consisted of three components. Currency in the form of silver coins; silver bullion readily convertible into coins at a small fabrication and seigniorage charge; and loans advanced by banks to their customers for consumption and production purposes. The quantity of money at any given time was determined endogenously by economic agents interacting in the money markets, and the same is true with regard to its composition.

Presumably, some part of the coins and bullion was stashed away in response to the demand for hoarding. A second part, multiplied by the so-called "velocity of circulation" was used to carry out the volume of transactions that took place each year, and still a third part was deposited with the banks to earn interest income. How economic agents allocated their holdings in means of payment among currency, bullion, deposits and loans, was determined by the price mechanism in the framework of the markets exhibited in Figure 1. In particular, given for example a change in the demand for loans from q^{cr} to $\bar{q}^{cr}$, with the intermediation of banks, household and non-financial enterprises possessing portfolios of $(\text{currency} = q^c, \text{bullion} = q^b, \text{deposits} = q^d, \text{loans} = q^{cr})$, were brought into contact with households and enterprises which, under appropriate market

[15] This profit rate is called "pure" to signify that it is over and above a "normal" profit rate required by banks to stay in the business of banking. By assumption, the latter is included in the curve D^d in Graph (iii).

conditions, stood ready to restructure into (currency $= \bar{q}^c$, bullion $= \bar{q}^b$, deposits $= \bar{q}^d$, loans $= \bar{q}^{cr}$). Depending on the direction of this change, the prevailing interest r would increase (decrease), say to $\bar{r}$, the deposits at the banks would rise (decline) to $\bar{q}^d$, and the latter would respond by expanding (shrinking) credit at the multiple of the inverse of their equilibrium reserve-ratio. These adjustments would bring about equilibrium in the markets for bank loans and deposits. However, in the process, the change in bank deposits would force the prices in the markets for currency and bullion to change in the directions $p^c \to \bar{p}^c$ and $p^b \to \bar{p}^b$. Finally, as these price changes would take effect, the quantities of currency and bullion would change in the directions $q^c \to \bar{q}^c$ and $q^b \to \bar{q}^b$.

In short, all financial markets adjusted optimally to accommodate the change in the demand for loans. The same would happen given any other change like for instance an influx of specie into the economy, a shift in the seigniorage charge at the *mint*, or even changes in psychological factors that might influence the propensity of hoarding, and hence the velocity of circulation. Central to the aforementioned sequence of adjustments from the one equilibrium position to another was the determination in financial markets of the equilibrium reserve-ratio. What percentage of each deposit banks retained in order to safeguard their ability to cover withdrawals at any given time was then as paramount as it is today in the prevailing "fractional-reserve" monetary systems. Hence, banks were obliged to hedge against loan risks on their own by balancing their urge for profit against the trust and the loyalty of their depositors[16]

In addition to the above *first best* results for all participants, the results turned out to be also *first best* for the economy as a whole, because the money market allocated the available quantity of bullion into bullion, currency, deposits, and bank loans in the most efficient manner. To corroborate this proposition, it is convenient to raise the question: Could a central bank under any circumstances improve on the results of the money market in a monetary system like the one depicted in Figure 2. The answer is definitely not for two reasons. First, because the central bank ought to have better information about the actual conditions that prevail in the markets than the market participants themselves, which was established as impossible in Sub-section 2.2. And, secondly, because the central bank ought to be able to simulate the plans of market participants in advance, which is again an impossible problem to solve, given that the central bank cannot

[16] Bankers knew that, if they failed and were found guilty of fraud or gross negligence, their personal freedoms were at stake, and presumably exercised prudence. Still, banking is a risky business and as Cohen (1992, 216-222) reports several banks failed at the time.

know the preferences of market participants before they are revealed by their choices

4. Leads from the Athenian for a modern bitcoin-based monetary system

Now the time has come to raise the question: Is the application of the silver standard in classical Athens a suitable paradigm after which to pattern the foundation of a modern bitcoin-based monetary system? Before answering, it is convenient to summarize the main findings so far. Key among them is that the Athenian model of free banking was very successful because the *Attic* drachma contributed big to the reputation and the wonders Athens achieved in classical times. Hence, it offers a premium historical precedent for reference and adaptation. A second important finding is that the currency was produced in a private competitive setting, in which the state was a major participant, it served for reserve as well as payments purposes, and the state had established institutions and enforced policies for the orderly functioning of both domestic and foreign money markets. Lastly, very much related to the above, is that Athens dealt in the said currency, it abstained from deficit spending and the accumulation of public debt, and the integrity of the currency was among the pillars of democracy and citizen sovereignty. On account then of these findings, the answer is that indeed the Athenian case of silver-based free banking provides a safe guide for building a bitcoin-based monetary system through the following arrangements:

- The government announces that all its transactions with the public will be carried out, say, in Bitcoins.[17] In view of this determination and the large scale of the public sector, it is certain that households and non-financial enterprises will adopt Bitcoin as their main medium of exchange and store of value.
- However, due mainly to its lack of scalability, soon households and non-financial enterprises will find it difficult to transact with the government in Bitcoins, and the government certainly will oblige by accepting transactions in Bitcoin-denominated banknotes.[18] Thus, like gold and silver under the respective standards in recent centuries, Bitcoin will turn into a reserve currency.
- The demand for Bitcoin-denominated notes and other Bitcoin-denominated financial in-

[17] The government may adopt of course any other digital currency based on the bitcoin standard. For example, Ethereum would be a much better choice because its maximum stock supply is not capped.

[18] To bypass the problems of scalability and heavy energy consumption mentioned in footnote 3, the *blockchain* ledger may be programmed to allow only large scale clearing transactions among financial institutions, which by necessity are limited and will not clog the bitcoin network. Thus, like gold and silver, Bitcoin will be used mainly for reserve purposes.

struments will create strong incentives for financial institutions to supply them in adequate quantity and conditions of security, about which shortly below.

- Financial institutions are free to issue Bitcoin-denominated notes, as well as any other digital currency of their choice, without government imposed convertibility obligations or reserve requirements. Given that digital currencies issued by financial institutions are de facto of inferior quality relative to Bitcoin, the notes denominated in the latter can be expected to dominate in the preferences economic agents.
- As in classical Athens, there will be no lender of last resort. Therefore, competition among Bitcoin-denominated note-issuing financial institutions will take place along several fronts. For example, one is the provision of conversion rights into Bitcoins, gold, silver, or even shares in a value preserving portfolio of commodities and other assets. Another is the risk of default as reflected in the fraction of Bitcoin reserves held by financial institutions relative to the amount of Bitcoin-denominated notes they have issued. Still another is the interest offered on Bitcoin bank deposits; and last, but not least, is the hedge against inflation that financial institutions may offer to stimulate the acceptance of their Bitcoin-denominated notes. To understand this mechanism, suppose that the economy in 2020 experienced inflation of 5%, because ceteris paribus financial institutions issued an excessive amount of notes relative to the available supply of goods and services. Would this be a persistent or a transitory equilibrium? It would be transitory, because soon the note-issuing institutions would discover that their demand for Bitcoins to cover the required reserves would raise their price, thus cutting into their profit margins. So they would find it profit maximizing in 2021 to start shrinking the supply of notes until eventually the economy would return to price stability. Instead, suppose that productivity in 2020 increased the supply of goods and services and deflation in the economy reduced the price level by 2%. Would this deflation mark a new permanent equilibrium? Rather not, because note-issuing financial institutions would find it to their interest in 2021 to start increasing the supply of notes somewhat faster than the supply of goods and services, thus pushing the economy back to price stability.

In the above setup, the government would not issue its own cryptocurrency, since such and initiative would undermine gravely democracy and citizen sovereignty. But it would retain all its prerogatives to enact and enforce rules and regulations for keeping all markets open to potential and observed competition, to combat tax evasion and illicit activities, and to make sure through

the courts that contracts are respected and the property rights are safeguarded as best as institutionally possible.

5. Summary of findings and conclusions

Over three decades ago, while assessing the models of free banking found in the literature, Friedman, Schwartz (1986, 8, 11) concluded that:

> History suggests both that any privately generated unit of account will be linked to a commodity and that government will not long keep aloof….If free private competitive enterprise can produce a viable money without government, it has yet to do so.

At the time they were writing, not enough was known from which to piece together a model of money and banking in classical Athens. Hence, they were justified in invoking the lack of a historical precedent as a condition for the possibility "privately produced viable money without government" to ever emerge. In the meantime, circumstances changed as new research has expanded vastly our knowledge about the Athenian society and economy in classical times. As a result, it has become possible to revisit the issue in search also for insights regarding the current challenges that emanate from the emergence of *cryptocurrencies*. The main finding is that the application of the silver standard in classical Athens offers a solid historical precedent after which to pattern the foundation of a modern bitcoin-based free banking system.

Was money viable? There is no doubt that it was, since the *Attic* drachma became over three centuries equivalent to today's U.S. dollar in the Eastern Mediterranean and beyond. Was money produced by private agents operating in competitive markets? Again, there is no doubt that it was, since as explained by reference to Figure 2, all critical equilibrium values in the monetary system were determined in open domestic and international financial markets, free of direct administrative controls. Was money produced without government? The above-mentioned world-renowned monetary experts have not held anarchist views. Therefore, it is certain that by using the terms "without government" they did not mean the absence of government from its general institutional and regulatory tasks in the economy. In classical Athens, the state exercised the following tasks. It defined a unit of account (*Attic* drachma), linked it to a commodity (silver), and used the said currency it in its domestic and foreign transactions. By drawing on its share of silver from the Laurion mines and other sources, it acted as a major provider of the said currency. Moreover, it enacted and enforced rules and regulations that aimed at safeguarding the integrity of the currency, leaving money and banking markets to operate freely under the laws that applied to all markets,

and the Attic drachma to circulate in parallel with all other foreign currencies. None of these roles implies that the state determined the supply of money. Therefore, the answer to the question is that money was produced privately in competitive market as all other commodities under the normal regulatory arrangement of the state.

Finally, drawing on these findings, a framework of institutional and policy arrangements was sketched for setting up a modern monetary system based on a Bitcoin digital standard. While in the context of this framework governments in Western type democracies are envisioned to abstain from issuing their own electronic currencies to protect the anonymity of citizens, and hence their civil liberties, governments retain and should exercise all prerogatives under the law to control abuses of competition in private markets, tax evasion, and other illicit activities.

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This finding suggests in turn that the first best policy on the part of democratic government is to: a) abstain from the temptation to offer an official cryptocurrency because of the awful implications that the loss of anonymity will have for the sovereignty of citizens; b) declare one of the private cryptocurrencies as official and require that all transactions in the public sector be carried out in that currency; c) intervene to make sure that illicit activities are kept under tight control; and d) allow the parallel circulation of domestic and foreign cryptocurrencies.

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ATHENS UNIVERSITY OF ECONOMICS AND BUSINESS

ΣΧΟΛΗ ΟΙΚΟΝΟΜΙΚΩΝ ΕΠΙΣΤΗΜΩΝ
SCHOOL OF ECONOMIC SCIENCES

ΤΜΗΜΑ ΟΙΚΟΝΟΜΙΚΗΣ ΕΠΙΣΤΗΜΗΣ
DEPARTMENT OF ECONOMICS

Department of Economics
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The Department is the oldest Department of Economics in Greece with a pioneering role in organising postgraduate studies in Economics since 1978. Its priority has always been to bring together highly qualified academics and top quality students. Faculty members specialize in a wide range of topics in economics, with teaching and research experience in world-class universities and publications in top academic journals.

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