

Chapter 3

Money, Coins

(2/3/19) Warning: The present text may simplify some issues about which the paucity of data is subject to different interpretations in a vast and growing literature.

Within most families, numerous actions entail, implicitly or explicitly, credits and debts. Most of these can be conducted without money. And there are good reasons to avoid the use of money in these transactions. But they often leave a mark in the memories. The same is true for a small community in which people interact repeatedly.

These days, the balance in a bank account is the result of past monetary transactions. Knowing these transactions, one can compute the balance. In “Money is Memory,” Kocherlakota (1998) analyzes the theory of this equivalence. Actually, in some cases memory may be better than money because it may incorporate some contingent features, for example a debt reduction for people in higher need. Powell (1996) in “Money in Mesopotamia,” writes:

Daniel Snell (1991, 1995) has made the excellent point that ‘barter’ and ‘marketless trading’ cut across time and are still very much alive. That will not surprise the dwindling few who are familiar with rural life at first hand. My mother, who spent her whole life in western Tennessee (USA) and completed her twelfth septad on 24 September 1995, was an expert at “primitive” economy and “traded” almost every conceivable kind of thing, from tangibles to intangibles, without written documentation and usually without bargaining. This was, moreover, conducted in tandem with other “market” trading, sometimes with the formalities of documentation.

Around 2500 BCE during the 3d dynasty of Egypt, before the construction of the three pyramids of Gizeh, the sale document of a house reads (Daumas,1977):

I have purchased this house from the scribe Tjenti. I have given 10 shats for it; a piece of fabric, 3 shats; a bed, 4 chats, a piece of fabric [of a different kind], 3 shats". The scribe answered that "You have completed these payments by installments".

Money as unit of account

The exchanges that are kept in memory pertain to different goods that need to be compared. They are compared by their values and this values are set with respect to a reference, a *unit of account*.

The previous document refers to a barter, but in that exchange, money is used as a unit of account, the *shat*, to compare the values of different goods and there are accounts for the balances of credit.¹ Egypt did not use material money before the arrival of Alexander and of the Greeks who took over the government. In addition, memory is supplemented here by a written record. The scribes (and there are so many representations of them in current museums) kept a written record of the credit balance. Today, the same system is used in Sardinia, where the scribes have been replaced by computers. It is called the *Sardex*. The exchanges that are kept in memory pertain to different goods that need to be compared. They are compared by their values and this values are set with respect to a reference, a *unit of account*.

The existence of a unit of account fits with the fairly high level of sophistication in the administration. The absence of a material support is indicative of the lack of private trades between different parts of the countries, or with other countries. Recall that cities were relatively small and probably not driven by private economic activities. The absence of coins fits with the picture of a linear economy in which the same menu of activities was reproduced mile after mile along the Nile and from which a central government extracted revenues. These revenues were paid in kind. It was important to keep good accounts about the quantities paid in taxes. The central government did not need payments in money. And where would the fellahs (current name for the peasants in Egypt) find the coins to pay the state?

The absence of coins² fits also with the dominant feature of an economy in which the

¹ Near the funerary temple of Khafre (of the second pyramid) an engraving reads: *I have purchased this house from the scribe Tjenti. I gave him 10 shats for it; one piece of cloth with four thread (?), 3 shats; one bed, 4 shats; one piece of cloth with two threads (?), 3 shats. In another engraving, in Karnack, I received its price, 60 debens of gold, in the form of various objects... In another text, I gave him] two cows, which makes 16 shats. Daumas (1977), Weill (1925), Pirenne and Van de Wall (1937).*

²Precious metals were more rare in Egypt than in other regions. Silver in particular was a rare

government exerts a strong presence. Such a government would not want the development of a private “underground” economy that it cannot control for taxation. The absence of money facilitated the monitoring of the taxable resources by the government.³

In Mesopotamia, a unit of reference was the *shekel*, about 8.3 grams of silver, but other units could be used. According to Powell (1996, p. 229),

“The temples in Babylonia from the Ur III period through the Achaemenid period (from about 2000 to 600 BC) use barley like money, especially as a unit of account. These institutions were in a position to store grain. They needed it to feed their dependents, and it is clear that they could turn it rather easily into all sorts of other things they might need, ranging from labor-services to commodities.”

Store of value and medium of exchange

The previous quote refers to Mesopotamia, but in Egypt, the remaining storage buildings that are attached to the temples show that they must have conducted similar transactions. Here, the monetary use of barley is not only a unit of account but a store of value and a medium of exchange. Barley can fulfill the three traditional use of money (unit of account, store of value, medium of exchange) because it is highly divisible and therefore useable for small transactions. Its actual use provides a guarantee that it has value. Its price with respect to other goods may be strongly affected by the crops, but because it is a basic commodity, this reference for a unit of account may actually be more useful than some other good. Its relatively cheap price was convenient for small transactions but it was too unwieldy for large transactions. Furthermore, it was perishable.

How are the traders who bring rare goods in a long-distance caravan going to be paid? By sacks of barley? Mother nature provided an answer. Precious metals, gold and silver were highly valued both for the purpose of decoration and resistance to chemical interactions with the environment. Gold especially is impervious to reactions. In today spacecrafts, gold protects from the corrosion by radiations.

commodity and its price seems to have been at least half of gold.

³ In modern times, it has often been proposed to restrict cash transactions in order to reduce black markets. In the current context of terrorism (February 2016), the ministry of finance in Germany proposed to restrict cash transactions to less than 5000 Euros. A former president of the Bundesbank, Jens Weidmann, vehemently opposed such a proposal. The year before, the chief economist of the Swiss bank UBS, Andreas Höfert had declared: “A fully electronic money system - completely transparent, without any protection of privacy in transactions and with the constant risk of expropriation by the state - means that money will be no more private property. The road to hell is paved with good intentions.” A petition in Germany claimed that “Hitler, Stalin and Mao Tse Tung would have been very glad to benefit from cashless data.”⁴

Gold and silver measured by weight for large transactions

Gold and silver are valuable because they are rare. But gold is much rarer than silver. It has twice the density of silver and its market price in the Antiquity was about 12 times the price of silver. That means that considering two squares of gold of silver with the same thickness, the gold square is five times smaller than the silver square (the square root of 2×12.5). And a shekel with 8.3 grams of silver was worth about one month's wage. As in the above quote of Powell, small transactions were conducted with no money, either from memory or with the help of a scribe, or with some commodity exchange like barley. Large transactions, between professionals, could involve exchanges of precious metals, silver and gold, that were traded by their weight. That system going back to at least 2000 BC, worked in one form or another until the 18th century.



The first coins

Around 450 BC Herodotes wrote:⁵

There are not many marvelous things in Lydia to record, in comparison with other countries, except the gold dust that comes down from Tmolus. [2] But there is one building to be seen there which is much the greatest of all, except those of Egypt and Babylon. In Lydia is the tomb of Alyattes,

⁵Histories, I, 93, 1-4.

the father of Croesus, the base of which is made of great stones and the rest of it of mounded earth. It was built by the men of the market and the craftsmen and the prostitutes. [3] There survived until my time five cornerstones set on the top of the tomb, and in these was cut the record of the work done by each group: and measurement showed that the prostitutes' share of the work was the greatest. [4] All the daughters of the common people of Lydia ply the trade of prostitutes, to collect dowries, until they can get themselves husbands; and they themselves offer themselves in marriage. [5] Now this tomb has a circumference of thirteen hundred and ninety yards, and its breadth is above four hundred and forty yards; and there is a great lake hard by the tomb, which, the Lydians say, is fed by ever-flowing springs; it is called the Gygaean lake. Such then is this tomb.

The customs of the Lydians are like those of the Greeks, except that they make prostitutes of their female children. They were the first men whom we know who coined and used gold and silver currency; and they were the first to sell by retail.



Lydia at the time of Croesus

The text shows that the introduction of money went together with the development of retail activities. One can indeed understand that women in Lydia preferred to substitute in their dowries money for memory.

The archeological evidence indicates that Herodotes was correct. Coins were first introduced in Lydia (in the Western part of current Turkey) shortly before 600 BC. The first coins were a mix of gold and silver (electrum) that was found locally, especially in the river Pactolus.⁶ The emergence of coins is an extraordinary story which is not fully understood. Here are its salient features:

- The introduction of coins was a fast process that took about a century.
- In a first phase (around 600 BC to 550 BC), coins started in Lydia and in close regions. They were made from electrum, a mix of gold and silver. The weights of the coins were set very accurately but the gold/silver mix varied greatly for each type of coin (with the type defined by the weight).

⁶In french a "pactole" is a great windfall.

- Shortly before 550 BC, under King Croesus, gold coins were made in Lydia.
- Thereafter, the use of coins spread quickly: by 500 BC, mints operated around the eastern part of the Mediterranean sea.



The striking features of the first coins raise questions that have excited the minds of many specialists. In addressing these issues, I think that economists have some good tools and I find that François Velde, who has spent much time thinking about these issues, provides the most enlightening comments.⁷ Some of these are used in the present text.

Why were the first coins in electrum? Figure 1 presents the main features of the coins that were found in a hoard on the island of Samos. The main features are the weight and the gold/silver mix. The figure is extraordinary.

The weights follow a very precise rule as fractions of the largest weight and for the same weight, the silve/gold mix varies greatly. How do we interpret this? No text will help us, but the most plausible explanation for an economist is that the value of a coin was determined by its weight. That could be measured very accurately (a proof is the very precision of the weights). But at the time, the technology could not separate gold and silver. The mix between the two did not matter. The weights were the equivalent of the numbers on our current dollar bills. Coins were valued *by tale*.

First coins valued
by tale

Coins valued by weight or by tale

The values by weight and by tale are technical expressions.

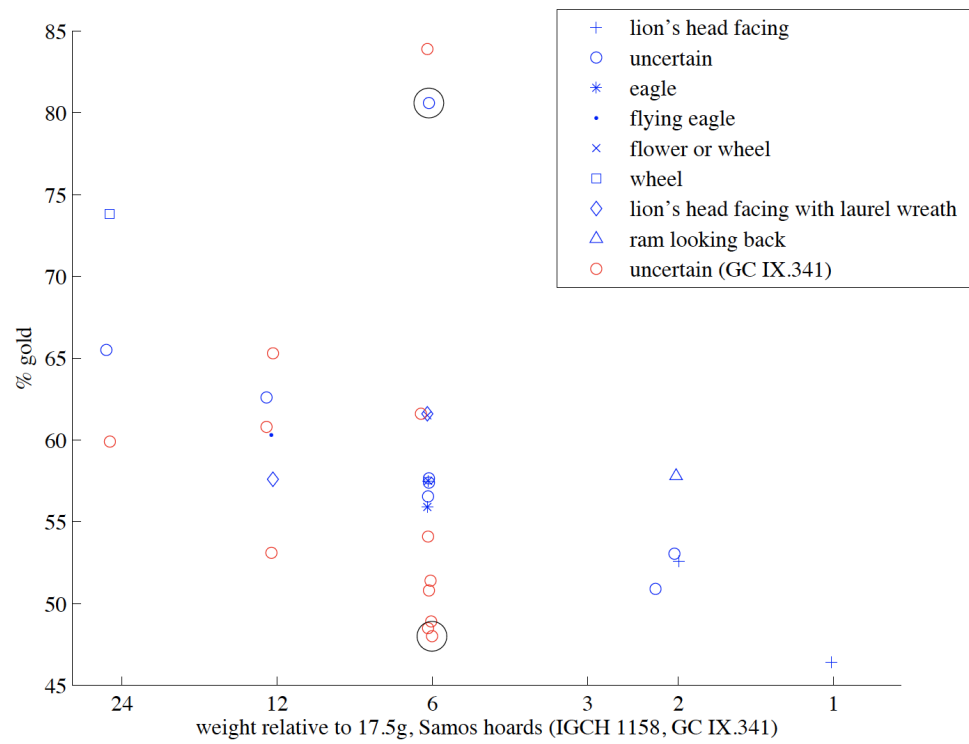
- A coin that is valued “by weight” has the value of the precious metal that it contains. If the coin is melted, there is (theoretically) no loss of value.
- A coin that is value “by tale” derives its value from what it written on the coin. Our dollar bills have no intrinsic value. They are valued by tale.

We will encounter a few times the issue of the valuation by weight and by tale.

Clearly, the exchange value of a coin cannot exceed the value of the metal in it.⁸

⁷Velde (2013). See also Bresson (2006), Mundell (2002).

⁸At the end of the 1970s, in years of double digit inflation, some people started to save the one cent coin for the copper value.



Source: Velde (2013).

Figure 3.1: Features of coins in a Samos hoard

Why would a coin of a given exchange value have different intrinsic values (depending on the gold content). My interpretation is that people did not know how to separate gold and silver and it was under King Croesus that the separating technique was found, which made Croesus legendary rich. (“krusos” means gold in greek). He made a special gift of pure gold to the sanctuary of Delphi.

Gold, silver and copper melt at about the same temperature, around 1000° Celsius. (See Table 3.1). From Velde (2013):

Gold and silver can be separated from the base metals (such as copper) by cupellation: the alloy is melted together with lead under a strong air flow: lead oxidizes and forms lead oxide or litharge which also captures the oxides of other base metals, leaving the “noble” metals, gold and silver, separate. The earliest evidence for the process comes from 4th millennium Uruk (Muhly 1993, 130). It seems clear that the references in Babylonian sources to the purification of gold relate to its separation from copper (Le Rider 2001, 12-13).

Separating gold and silver requires another process. The one used in ancient times is called parting. Gold is prepared into small pieces or thin strips and mixed in layers with salts and brick powder. The mixture is then heated to between 500 (Celsius) and 800 (below the melting point of gold) and the silver reacts with the salt to produce silver chloride. The diffusion process takes place throughout the gold which remains unmelted. The silver chloride is absorbed in the brick powder and in the clay vessel that contains the mixture, if it does not escape. Once the purified gold is removed, the remainder can be ground up and some of the silver retrieved by cupellation.

The question is: When did this technique become available? The process was known in later antiquity (see the surveys by Barrandon and Poirier 1985b and Craddock 2000) but the earliest archaeological evidence appears in a workshop excavated in Sardis, dated to around 575-550 BCE. Figure 5 shows a reconstruction of the workshop. This, not coincidentally, is the time period during which Croesus is believed to have begun the minting of gold and silver coins.

Short of direct evidence for the parting process before that time, one can look at the golden objects made and used, and see if they show any consistent evidence of purification. Craddock (2000) shows that gold objects in early Mesopotamia were burnished, presumably with some sort of salt, so that the surface was depleted of silver and appeared pure. At a minimum,

this suggests that people were aware of the mixed nature of electrum, and valued purer gold over more diluted gold. But, aside from occasional objects showing a high content of gold (for example, a few objects in the Troy II hoard with 93% gold cited by Keyser and Clark 2001), it does not appear that, at any time before 6th c. Lydia, gold was systematically separated from silver. Conversely, the gold coinage of Croesus is made of 98% gold, and the gold beads and foil found in the goldworks of Sardis are similarly pure.

The standard system created by Croesus

Electrum could not provide the basis for the start of a monetary system based on coins, but this system was not stable. The ore contained more gold than silver, but the process of *separation* between gold and silver had been found, new coins could be minted with less gold. When the process of separation has been found has been discussed by scholars, but some estimates put it around the time of the introduction of coins. There is no evidence that contradicts the suggestion that the discovery of this process could have been precisely stimulated by the introduction of electrum coins.

Once the separation has been found, the coin system had to evolve to a bimetallic system with two types of coins, in gold and in silver. That system was introduced by Croesus. It was to be in place until the advent of paper money in the 18th century.

The bimetallic system is pre-ordained by nature. Coins have a metallic support that must satisfy some requirements. First of all, the support must be resistant to natural alterations such as rotting and rusting. Second, they must have some provide a compromise between value and size. The size depends on the density. Nature provides a limited menu of possibilities that is summarized in Table 3.1.

Gold is the best metal because it does not interact chemically with any other metal. (That is why it is so much used today for industrial purposes.) Gold has always been valued for ornaments because of this incorruptibility and a highly pleasant appearance. All the other metals are altered by chemical reactions through time, except a few others like platinum, but platinum is so dull. Silver looks better under the candlelight, but silver loses its shine with time. Gold is divisible in any quantity and it is fairly hard. A tiny amount of copper makes it even harder.

Gold is the heaviest of all the metals that could be used for money⁹

⁹ Metals heavier than gold have the following densities: Iridium 22.65, Osmium 22.61, Platinum 21.40, Plutonium 19.82, Tungsten 19.60. Gold is heavier than uranium (density 18.9).

Metal	Density	Value	Melting point (C°)
Gold	19.32	1,200	1,063
Silver	10.49	100	900-961*
Copper	8.96	0.6	1,085
Lead	11.35	0.05	327.5
Tin	7.28	3.9	232
Iron	7.85	0.2	1150
Bronze	7.4-8.9	1.0	

Densities are gr/cubic cm. The value of silver is normalized to 100. Source for the values: Bresson (2016, p. 262). Bronze is an alloy, mainly in copper with some tin and some other metals.

Table 3.1: Properties of metals

From the above table, gold is more valuable than silver, at equal volume both because it is more dense and because it has a higher value per pound. The higher density of gold means that if a balance is even between good and bad coins, once it is put in the water, the good side will sink. That is probably what Archimedes meant when he had to evaluate the gold content of the crown of his master and yelled *Eureka!* That difference in densities, and the fact that there is no available metal more dense and cheaper than gold, implies that cheating on gold coins is easy to detect. There has never been cheating on gold coins.

When gold and silver coins of equal value are compared, assuming similar thickness (which is a constraint for rigidity), the gold coin is about five times smaller than the silver coin (square root of $12 \times (19.3/10.5)$).

The value of 1 for silver is taken as a reference. In antiquity and until the year 1500, the price of gold in silver (for the same weight) was about 12. During the 16th century the relative value of gold increased because of the inflow of silver from the New World. Take a gold coin and a silver coin of the same value. Because of the price ratio between the two metals, the gold coin weighs only a tenth of the silver coin. Moreover because gold has twice the density of silver, the gold coin has a volume that is about 25 times smaller than the silver coin. For two coins of the same thickness, the gold coin is 5 times smaller. How to use gold coins for small items? On the other hand the specialized merchant who wants to be paid in silver coins may have to prepare for a large cart.¹⁰

¹⁰ Iron is not a good candidate for money. That is precisely why Lycurgus imposed it in the Great Rhetra, the Great Charter that was the constitution of Sparta.

Plutarch's Lives of Noble Grecians and Romans (1952) we read that Lycurgus:

Not content with this [land reform], he resolved to make a division of their moveables too,

- Sparta is no less a democracy than Athens. But it is a land democracy (Athens sea democracy). (Obviously small core). Egalitarianism. Money creates inequalities.

After gold and silver could be separated, coins were used around the eastern Mediterranean sea. The next figure presents a map of active mints around 500 BC.

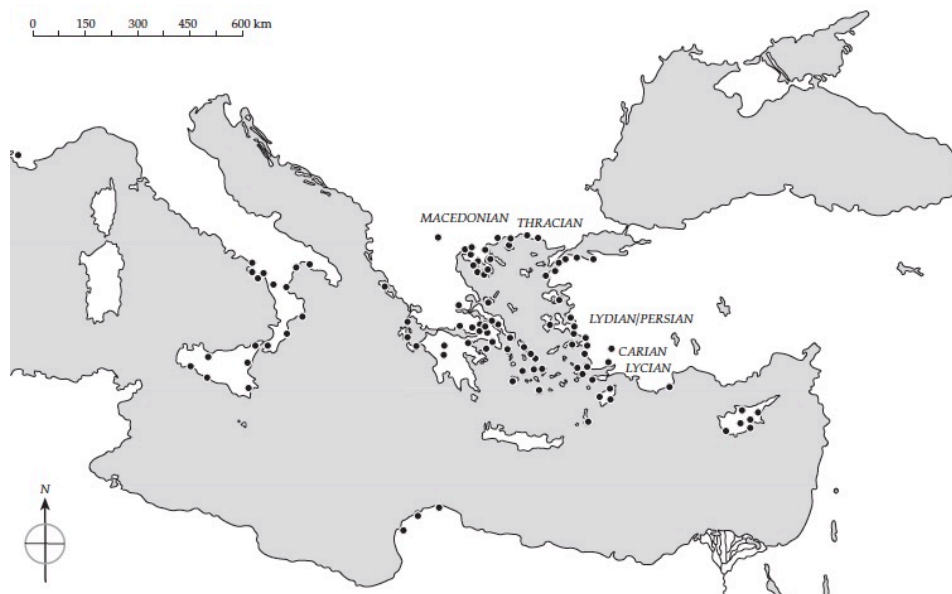


Figure 3.2: Map

Source: Kim (2001).

The standard system: Roman money

The physical constraints have thus determined all monetary system before the introduction of paper money in the 18th century.

that there might be no odious distinction or inequality left amongst them; but finding that it would be very dangerous to go about it openly, he took another course, and defeated their avarice by the following stratagem: he commanded that all gold and silver coin should be called in, and only a sort of money made of iron should be current, a great weight and quantity of which was very little worth; so that to lay up twenty or thirty pounds there was required a pretty large closet, and, to remove it, nothing less than a yoke of oxen. With the diffusion of this money, at once a number of vices were banished from Lacedaemon; for who would rob another of such a coin? Who would unjustly detain or take by force, or accept as a bribe, a thing that it was not easy to hide, nor a credit to have, or of any use to cut in pieces? For when it was just red hot, they quenched it in vinegar, and by that means spoilt it, and made it almost incapable of being worked.

The Roman monetary system used both gold and silver to provide a real value of the coins. It was bi-metallic (as the US dollar in the 19th century). The reference coin was the gold coin, the Aureus, with 8 grams of nearly pure gold¹¹. Soldiers were paid three times a year in Aureus¹². The silver coin was the denarius, with 25 denarii for one aureus. A denarius was made of 3.9 grams of nearly pure silver. The silver was reduced to 3.4 grams by Nero. Note that it is quite possible to reduce the silver content of the denarius while maintaining the 1:25 ratio with the Aureus and without creating inflation (provided that the total quantity of money does not change). Each denarius was worth 4 sesterces (with the symbol HS), a coin in bronze. Since the sesterce has a relatively high value, there is a coin of smaller denomination, the as, which is worth 1/10 denarius (hence the name denarius).

To summarize: 1 Aureus = 25 Denarius = 100 Sesterce = 250 As.



Denarius (19mm)



Sestertius (36mm)

1 Aureus struck at 40-45 to the pound (327 gr), about 8gr

Today, 1 ounce (28gr) is about \$1000 (comment), aureus about \$300

1 HS about \$3 (according to the weight in precious metal comments)

Difficulty in comparing developed and underdeveloped economies.

Denarius: SEVERUS AUG .PART .MAX VIRT.AUGG: silver, weight : 3.3 g, 19 mm

Sestertius struck at the mint in Lyon, Fr., c. AD 64-66 (Nero). Diameter 36 mm. If we take the value of gold today (about \$ 1000 an ounce, but some would argue that it is a bubble price), an aureus is about \$ 300, and a sesterce \$3. Prices ...

The mints

In the early period of the Roman empire, the production of coins was centralized. When the production of coins increased dramatically, more mints had to be used throughout the empire. The next figure (from Wiki) presents a map of these mints.

¹¹ Pure gold is too soft for a coin which must always contain a small amount of alloy.

¹² That practice is useful for the determination of the legionnaires' pay which has to be a multiple of 3 aurei per year.



Figure 3.3: Roman mints (underlined)

References

- Bolin, Sture, (1958). *State and Currency in the Roman Empire to 300 A.D.*, Stockholm: Almqvist & Wiksell.
- Bresson, Alain (2006), “The Origin of Lydian and Greek Coinage: Cost and Quantity,” [mimeo](#).
- Burns A. R. 1927. Money and Monetary Policy in Early Times.
- Cartledge, P., E. E. Cohen and L. Foxhall, eds, (2002). *Money, Labour and Land: Approaches to the Economies of Ancient Greece*, London and New York: Routledge.
- Cook, R. M., 1958. Speculations on the Origins of Coinage. *Historia*, 7(3):257-262.
- Daumas, François (1977). “Le Problème de la Monnaie dans l’Égypte Antique avant Alexandre,” *Mélanges de l’École française de Rome; antiquité*, **89**, 425-442.
- Descat, Raymond (2001). “Monnaie Multiple et Monnaie Frappée en Grèce Archaique,” *Revue numismatique*, Vol 6. 157, 69-81.
- Einzig, Paul. 1966. Primitive Money.
- Gentet, D. (1990). “Pratiques monétaires et redistribution en Égypte pharaonique,” *Cahier Monnaie de l’Université Lyon II*, 8-40.
- Herodotes (~ 450 BCE). *Histories*.
- Jones, *Taxation in Antiquity*, 156-157.
- Kim, Henry S. (2001). “Archaic coinage as Evidence for the Use of Money,” in Meadows, A. and Shipton, K. (eds), *Money and Its Uses in the Ancient Greek World*, Oxford, Oxford University Press, 7-21.
- (2002). “Small Change and the Moneyed Economy,” in Cartledge et al., 44-51.
- Kocherlakota, Narayana, R. (1998). “Money Is Memory,” *Journal of Economic Theory*, Vol. 81, 232-251 ([mimeo](#)).
- Konuk, Koray, 2005. The Electrum Coinage of Samos in the Light of a Recent Hoard. In Elmar Schwertheim and Engelbert Winter (eds.) *Neue Forschungen zu Ionien: Fährli Işik zum 60. Geburtstag gewidmet*, pp. 44-53. Bonn: Habelt.

- Konuk, Koray, forthcoming. Asia Minor to the Ionian Revolt. In William E. Metcalf (ed.) *Oxford Handbook of Greek and Roman Coinages*. Oxford: Oxford University Press.
- Kraay, Colin M. (1964). "Small Change and the Origin of Coinage," *JHS*, 84:76-91.
- Kraay, Colin M. (1976). *Archaic and Classical Greek Coins*, Berkeley, CA: University of California Press.
- Kroll, John H. (2001a). Observations on Monetary Instruments in Pre-Coinage Greece. In Miriam S. Balmuth (ed.) *Hacksilber to Coinage: New Insights into the Monetary History of the Near East and Greece*, no. 24 in *Numismatic Studies*, pp. 77-91. New York: American Numismatic Society.
- Kroll, John H., (2001b). Review of Georges Le Rider: *La Naissance de la monnaie, pratiques monétaires de l'Orient ancien*. *SNR*, 80:201-02.
- Manning, Joseph (2009), *The last pharaohs. Egypt under the Ptolemies, 305-30 BC*, Princeton University Press.
- Le Rider, Georges, 2001. *La Naissance de la monnaie: Pratiques monétaires de l'Orient ancien*. Paris: Presses Universitaires de France
- Maucourant Jérôme (1990). "Pratiques monétaires et individu en Egypte ancienne," *Cahiers Monnaie et financement*, Université Lyon 2, 41-79.
- Meadows, A. and K. Shipton, eds. (2001). *Money and Its Uses in the Ancient Greek World*, Oxford: Oxford University Press.
- Megally, M. (1977a). *Recherches sur l'économie, l'administration et la comptabilité égyptienne à la XVIIIe dynastie d'après le papyrus E. 3226 du Musée du Louvre*, Institut français d'archéologie du Caire (71).
- Megally, M. (1977a). *Notions de comptabilité à propos du papyrus E. 3226 du Musée du Louvre*, Institut français d'archéologie du Caire (71).
- Martin, T. (1996). "Why Did the Greek Polis Originally Need Coins?," *Historical*, 45/3: 257-83.
- Maucourant Jérôme (1991). "La question de la monnaie en Egypte ancienne," *Revue du MAUSS, La découverte* Vol. 13, pp.155-164.
- Menger, C. (1892). "On the Origins of Money," *Economic Journal*, 2, 238-255.

- Menger, C. (1909). "Geld," pp. 1?116 in Hayek, F. A. (ed.) 1970 *Schriften über Geld und W"ahrungspolitik*. Tübingen, Mohr (English translation pp. 25?107 in Latzer, M. and Schmitz, S. (eds), *Carl Menger and the Evolution of Payments Systems*, Cheltenham, Edward Elgar
- Mundell, Robert, A. (2002). "The birth of coinage," **Working paper**.
- Nicolet-Pierre, H. and J.-N. Barrandon (1997). Monnaies d'électrum archaïques : le trésor de Samos de 1894 (IGCH 1158) conservé à Paris. RN , 152:121-35.
- Nicolet-Pierre, H. (2002). *Numismatique grecque*, Paris: Armand Colin.
- Osborne, R. (1996). *Greece in the Making: 1200-479 BC*, London.
- Pirenne and Van de Wall (1937). "Documents juridiques égyptiens, *Archives du Droit Oriental*, Bruxelles.
- Powell, Marvin (1996). "Money in Mesopotamia," *Journal of the Economic and Social History of the Orient*, Vol. 39, No. 3, 224-242.
- Price, M. J. (1983). "Thoughts on the Beginning of Coinage," in C. N. L. Brooke, B. H. I. H. Stewart, J. G. Pollard, and T. R. Volk, eds., *Studies in Numismatic Method Presented to Philip Grierson*: Cambridge, 1-10.
- Roosevelt, Christopher H., 2009. *The Archaeology of Lydia, from Gyges to Alexander*. New York: Cambridge University Press.
- Sargent T. and F. Velde (2000). *No Small Change: From Commodity to Fiat Money*, 42-46.
- Sargent, Thomas J. and François R. Velde (2002). *The Big Problem of Small Change*. Princeton, NJ: Princeton University Press.
- Snell, D.C. (1982). "Ledgers and Prices, Early Mesopotamian Merchant Accounts," *Yale Near Eastern Researches*, vol. 8, New Haven.
- (1991). "Marketless Trading in Our Time," *Journal of the Economic and Social History of the Orient*, Vol. 34, No. 3 (1991), 129-141, 34: 129-141.
- (1995). "Methods of Exchange and Coinage in Ancient Western Asia," in Sasson *et al.*, ed. *Civilizations of the Ancient Near East*, 4 vols., Scribner's, New York 1995, vol. III: 1487-1497.

- Velde, François, R. (2013)., “On the Origin of Specie,” mimeo.
- Weidauer, Liselotte, 1975. Probleme der Frühen Elektronprägung , Typos, vol. 1. Fribourg: Office du Livre.
- Weill, (1925). “L’unité de valeur shat et le Parpyrus de Boulaq no 11,” *Revue. de l’Egypte ancienne*, 1, 45-87 and 243-244.
- Williams, Dyfri, 1991?1993. The ‘Pot Hoard’ Pot from the Archaic Artemision at Ephesus. *BICS*, 38:98-103.
- Zurbach, Julin (2012). “Hésiode oriental, ou: le discours sur l’économie avant le *logo oikinomikos*”, in K. Konuk (ed.), Stephanèphoros. *De l’économie antique à l’Asie Mineur. Hommages à ramound Descat*, Bordeaux, Ausonius, 1’79-91.
- (2013). “La formation des cités grecques: status, classes et systemes foncier,” *AnnalesHSS*, no3, 957-98.