The production and circulation of money. Rhythms and dynamics of growth (10th-12th centuries)

by Alessia Rovelli

This study proposes a periodization of the monetary history of the central Middle Ages (10th-12th centuries), with a focus on the Kingdom of Italy and its silver denier coinage. Recent archaeometric research allows a revised interpretation of the monetary reforms traditionally attributed to the Ottonian period, as well as a more nuanced assessment of both growth patterns and phases of stagnation during the 11th century. In the 12th century, particularly in its second half, several processes reached maturity, revealing, from a monetary perspective, significant qualitative and quantitative changes.

Questo contributo propone una periodizzazione della storia monetaria dei secoli centrali del Medio evo (secoli X-XII). L'analisi è focalizzata sul Regno italico e dunque, per quanto riguarda la moneta, sull'area del denaro d'argento. Recenti indagini archeometriche permettono ora una nuova interpretazione delle riforme monetarie attribuite all'età ottoniana e una lettura più circostanziata sia dei ritmi di crescita, sia delle fasi di 'inerzia' che si succedono durante il secolo XI. Nel corso del secolo XII, in particolare durante la seconda metà, giunsero invece a maturazione alcuni processi che ne mettono in luce, anche sotto il profilo monetario, il cambiamento, sia qualitativo che quantitativo, rispetto al periodo precedente.

Middle Ages, 10th-12th centuries, Italic Kingdom, *Honorantie civitatis Papie*, silver *denaro*, *ottolino*, *grosso*, archeometrical analysis.

Medioevo, secoli X-XII, Regno italico, *Honorantie civitatis Papie*, *denaro* d'argento, *ottolino*, *grosso*, analisi archeometriche.

Alessia Rovelli, University of Pisa, Italy, alessia.rovelli@unipi.it, 0000-0002-7161-0266

Referee List (DOI 10.36253/fup_referee_list)
FUP Best Practice in Scholarly Publishing (DOI 10.36253/fup_best_practice)

Alessia Rovelli, *The production and circulation of money. Rhythms and dynamics of growth (10th-12th centuries)*, © Author(s), CC BY 4.0, DOI 10.36253/979-12-215-1076-8.24, in Alberto Cotza, Giuseppe Petralia (edited by), *In Search of the High Middle Ages. Change and Continuity in 11th-12th-century Italy*, pp. 459-483, 2026, published by Firenze University Press, ISBN 979-12-215-1076-8, DOI 10.36253/979-12-215-1076-8

1. *Introduction*

Periodisation presents a fundamental challenge for historical research.[1] In what follows I attempt to integrate our understanding of monetary systems with the current state of research on the period of the Central Middle Ages (10th-12th centuries), bearing in mind that a coin is an artefact that can and should be studied like any material culture, but it is also the expression of institutional and ideological aims which influence its production and circulation.[2]

My analysis will focus on the Kingdom of Italy, and therefore, in terms of money, on the zone of the silver *denaro*.[3] I will start with the Ottonian period, even though this falls slightly outside the chronological framework of this volume. Indeed, the Saxon emperors undertook measures that gave new impetus to the mints, particularly the Palatine mint of Pavia, with obvious repercussions for monetary circulation.

These measures are well known, but the results of archaeometric analysis, when considered with archaeological and documentary data, now permit us to reassess the patterns of growth and the recurrent phases of 'inertia' during the 11th century, a rather 'long' century (at least as far as coinage is concerned). Then, over the following century, especially its second half, processes came to fruition which reveal, even from the perspective of money, significant qualitative and quantitative changes.

The monumental volume edited by William Day, Michael Matzke, and Andrea Saccocci offers a substantially revised picture of northern Italy's coinage from the Ottonian period onwards.[4] We can concentrate, therefore, on highlighting the main phases of development and focussing on the most recent lines of research, such as those opened by archaeometry. Likewise, the archaeological framework has recently been consolidated. The so-called 'Tuscan model' has produced a dataset which also makes it possible to reconstruct the dynamics of monetary circulation at a scale not simply regionally based.[5]

[1] I will refer to Paolo Delogu's introductory pages in *Periodi e contenuti del Medio Evo* and, for the phases that are of most interest here, to Capitani, "I secoli centrali;" and Franceschi, "La crescita economica."

[2] Remarks on the interpretation of hoards and archaeological finds of ancient coins are also valid for the Middle Ages: Casey, *Understanding Ancient Coins*; Howgego, *Ancient History from Coins*.

[3] For an overview of monetary production in southern Italy, see Grierson, Travaini, *Medieval European Coinage*, 14. On the circulation and uses of money, see Martin, "Economia naturale;" Abulafia, "Maometto e Carlo Magno;" and von Falkenhausen, "La circolazione monetaria." More recently, see Martin, "Les échanges monétaires;" Callegher, Morrisson, "Miliareni de follibus;" Travaini, "Monete e circolazione monetaria;" Callegher, "La Puglia bizantina."

[4] Day, Matzke, Saccocci, *Medieval European Coinage, 12* (hereafter *MEC, 12*).

[5] Valenti, "La formazione dell'insediamento;" Cantini, "Dall'economia complessa;" Bianchi, *Archeologia dei beni pubblici*; Cantini,"Costruire lo sviluppo."

2. *From the Ottonian emperors to the beginning of communal coinages: a phase of monetary 'inertia'?*

We begin in Tuscany, building upon the data collected by the *ERC-Advanced nEU-Med project* led by Richard Hodges and Giovanna Bianchi.[6] As part of this project, a number of analyses have been carried out, and the numismatic finds from Tuscan sites (both published and unpublished) for the period between the Carolingian age and the first half of the 11th century have been inventoried.[7] We thus have a sample of 106 specimens. Of these, 71 were part of two hoards ("Galli Tassi" and "Pieve a Nievole").[8] A third set comprises the 21 *denari* dated between the reign of Berengar I (888-924) and that of Conrad II (1024-39) which were found during the excavations of the Vetricella site (Grosseto). Whether this third series belongs to a hoard is a matter of debate, as we shall see.[9]

At a fundamental level, these finds confirm a now well-established picture typical not only of Tuscany: the increased circulation of coins in the Ottonian period. Of our set of 106 *denari*, 40 are *ottolini*. These same data also confirm, once again, the predominance of the coinage of Pavia in monetary circulation at the time, even in Tuscany. In fact, only one *denaro ottolino* comes from Milan, while four were struck in Lucca – i.e. in the local mint. Our sample therefore appears to be consistent with the rules reported in the *Honorantie civitatis Papie,* the main source on the kingdom's administration. In the chapters dedicated to coinage and mints, the *Honorantie* identifies nine *magistri monetarii* to Pavia, compared to only four for Milan.[10] The mint of Lucca is not mentioned, but the material evidence from the *denari ottolini* produced in the royal mints leaves little doubt about the assertion of central control, even if the mint of Lucca, like that of Milan, appears to have played a lesser role than the Palatine mint. It is thus plausible to interpret the evidence from coinage as a consequence of the imperial will to give prominence to the capital of the newly conquered kingdom, in part by strengthening its mint.[11]

The increased production capacity of the Pavia mint is spelled out in the provisions of the *Honorantie* and is evident in both single finds and hoards.

[6] *Origins of a New Economic Union (7th-12th Centuries): Resource Landscapes and Political Strategies in a Mediterranean Region* (*nEU-Med*). The aims and initial results of this project are discussed in Bianchi, Hodges (eds.), *Origins*; as well as Bianchi, Hodges (eds.), *The nEU-Med Project*; and, as regards the numismatic aspects, Benvenuti, Chiarantini, et al.,"Metals and coinage."
[7] Chiarantini, Villa, et al., "Economic Rebound."
[8] On the 'Galli Tassi' (Lucca) and 'Pieve a Nievole' (Pistoia) hoards, see Saccocci, "Il ripostiglio dell'area 'Galli Tassi';" and Saccocci, "Il ripostiglio di monete." To these specimens, whose provenance is known, we can add the evidence of the so-called 'tesoro Toscana 1766', which is made up of at least 119 coins, thus bringing the total number of Tuscan finds for the period under study to over 220. An analysis of the known data up to 2013 can be found in Saccocci, "Rinvenimenti monetali."
[9] Rovelli, "Archeologia mineraria."
[10] Brühl, Violante, *Die Honorantie*; Travaini, "La moneta milanese."
[11] Rovelli, "Archeologia mineraria."

This is the best-known and most conspicuous feature of what has been interpreted as a genuine monetary reform. [12] One of the main aims of this reform, attributed to Otto I, was to regularise the standard weight and fineness of issues, raising it to 10/12, or 833/1000 silver (*ut numquam faciant peiores denarios quam semper fecerunt de pondere et argento de duodecim in decem*).

It is now worth examining the critical aspects of this so-called reform, turning our attention to the expansion of monetary circulation in the 11th century. Important data comes from isotopic analysis, which sought to measure the importance of Tuscan silver mines in the wider context of Italy's medieval monetary production, as well as to determine respective roles of royal power and the local authorities in the management of these resources.[13] The results obtained, albeit taken from a relatively small sample (about 40 specimens), are quite clear (though in some ways unusual[14]) and shed light on some problems already raised by Peter Spufford.[15] These analyses have highlighted the isotopic compatibility between silver from the mines of Saxony, the *denari ottolini* and the pennies of the same period which were struck in Magdeburg and Goslar, suggesting that the mints of the Kingdom of Italy were also largely supplied with silver from the mines of Saxony. These same analyses have also shown that silver from the Colline Metallifere is present only in negligible quantities in the *denari* from the local mint, Lucca. A similar situation is clear for the five coins minted in the name of Conrad II: all of them have an isotopic profile compatible with silver from the mines of the Harz Mountains, although one specimen also points to the possible use of silver from Tuscany.[16]

The varying production capacities of the kingdom's mints, clearly recognisable in the archaeological finds and hoards, is thus possibly explained through the archaeometric analyses. The predominance of coins from Pavia seems to have been a direct consequence of royal policy. As noted, the Pavia mint had a greater number of *magistri monetarii* and seems to have received larger quantities of silver. By contrast, the mints of Lucca and Milan seem to have been relegated to a secondary position so that, even in Tuscany, the *ottolini* of Pavia are the most common.

However, despite the attention paid by the Ottonians to Pavia and its mint, one cannot fail to notice a certain degree of 'parsimony' in the supply to Italian mints, including that of Pavia itself. Although the *Honorantie*, the fineness of the *ottolini,* which was theoretically fixed at 83%, has been found

[12] Herlihy, "Treasure Hoards," 6-7; Cipolla, *Le avventure*, 18; Travaini, "La moneta milanese," 226-8; Matzke, "Vom Ottolinus," 138; *MEC, 12*, 35-6.
[13] The premises of these investigations were presented at the conference *Mine, metal, monnaie. Autour du cas de Melle, les voies de la quantification de l'histoire monétaire du haut Moyen Âge. Paris -EPHE, 12-14 septembre 2011*, and are discussed in Bianchi, Rovelli, "Production métallique."
[14] Coins produced with metal from a single source, as appears to be the case here, are an exception: see Naismith, *Making Money*, 33-6.
[15] Spufford, *Money*, 74-7.
[16] Chiarantini, Villa, et al., "Economic Rebound."

to be highly variable. In the case of *denari* issued by Otto I, it fluctuates between 51 and 89% for Pavia issues and between 69 and 97% for Lucca ones. Similar figures can be observed in the *denari* issued by Otto III. The significant variations in the intrinsic content highlighted by archaeometric analyses bring the topic of silver back to the fore: the irregular availability of the metal may be one cause of repeated changes in intrinsic value, although probably not the only one. Furthermore, they raise the question of whether the rules that established the fineness of the *denari* ('ut numquam faciant peiores denarios quam semper fecerunt de pondere et argento de duodecim in decem') should indeed be attributed to Otto I.[17]

Another finding from archaeometric analysis may help to explain the slow start of the exploitation of the metal resources of the Colline Metallifere. The silver content of the local galena seems to have been rather low. The complex purification processes required to obtain silver here probably made the operation unprofitable.[18] We cannot rule out the possibility – although no analysis has determined this – that a similar problem delayed the exploitation of the silver veins in the mines of Lombardy, which focussed on iron until the late 11th century, and not, as was initially thought, silver.[19]

This apparent 'shortage' of metal[20] at least partly explains why coin production in Ottonian Italy remained confined to the same few mints as in Carolingian times: Pavia, Milan, Lucca, and Verona (which replaced Treviso and came under the control of the Duke of Bavaria, fig. 1).[21] The scarcity of local silver apparently did not prompt the emperors to send sufficient quantities of silver from transalpine mines; Pavia seems to have been the exception rather than the rule. Italy did not witness the remarkable flourishing of minting activity that took place in Germany during the Ottonian period, when some 80 mints were in operation (40 of which were granted to bishops or abbots, who initially only had rights over the proceeds), compared to the two mints that had struck coins in the name of Conrad I of Franconia.[22] The granting, or confirmation, of minting rights to the bishops of Mantua and Ravenna by Otto III was disregarded until the 12th century, as was that to the bishop of Ascoli in 1033-4 and to the bishop of Padua in 1049.[23] The opening of the Susa mint, possibly by Peter I (1060-78), which imitated the coins issued by the

[17] The *Honorantie* is a composite work which has come down to us in a single copy dating from the 15th century; Bougard, "*Minima Ticinensia*;" Rovelli, "*De pondere et argento*;" and Bougard, Rovelli, "Some Remarks."
[18] Chiarantini, Benvenuti, et al., *Medieval Pb (Cu-Ag)*, 16: The Colline Metallifere Cu-Pb-Fe (Ag) ores appear to be characterised by "galena, chalcopyrite, sphalerite associated with variable amounts of silver-bearing minerals, mainly fahlerz (tetrhedrite-tennantite) with up to 2% silver, pyrargirite, proustite; the silver content of galena appears to be negligible".
[19] Rovelli, "Mines et monnaies."
[20] References to the *penuria argenti* and *carestia monetae* can be found in Cipolla, *Le avventure*, 29.
[21] *MEC, 12*, 548-9.
[22] Spufford, *Money*, 76-7.
[23] Matzke, "Il diritto monetario," 230-4.

Fig. 1. Imperial mints in Italy in the second half of the 10th century.

bishops of Vienne, must be analysed within the framework of Franco-Burgundian coinage.[24]

The failure to open new mints leads us to reconsider the well-established view that the centralisation of coin production in a limited number of mints was the positive outcome of effective royal control of coinage, which made it possible to avoid the 'feudal' fragmentation of minting rights.[25] We might, instead, consider the decentralisation of monetary production to several mints to be not simply the inevitable and sole consequence of weak royal control, but rather the result of different choices. Clear evidence of this comes from Germany, where many new privileges to operate a mint (e.g. Otto I's granting to the monastery of St-Gall of the right to open a mint and a market at Rorschach in 947) had the stated purpose of supplying the local markets with money.[26] In England, there were at least 40 mints during the reign of Æthelstan (924-39). More than 120 were active between 970 and 1100, but the issuing of coinage always remained under royal control.[27]

What, then, led the emperors of the House of Saxony to boost the issuing of coins only in Pavia, without sending similar quantities of silver to the other royal mints and without opening new mints? Was this an attempt to supply

[24] Gianazza, "Susa," 1164; Matzke, "Il diritto monetario," 232-4; *MEC, 12*, 99.
[25] Toubert, "Il sistema curtense," 50-1; Menant, *Campagnes lombardes*, 803.
[26] Spufford, *Money*, 77.
[27] Naismith, *Making Money*, 376-7.

the market with a greater quantity of coins, in line with what was happening in Germany? Or was it a decision dictated by 'fiscal' needs, including, as Andrea Saccocci suggests, those related to the financing of military enterprises in Italy? The answer to these questions is far from obvious.

Based on the Tuscan data, Saccocci has noted that *ottolini* are mainly found along the routes of armies and imperial processions, supporting the hypothesis that the need to supply them was the main – although not the only – driving force behind the circulation of such coins.[28]

An economic interpretation may be supported by the discovery of 21 *denari,* dated between the reigns of Berengar I (888-924) and Conrad II (1024-39), at Vetricella, which has been identified as the centre of the royal *curtis* of *Valli*. This discovery has fuelled a debate on the function and supply of money by providing some quantitatively significant evidence. According to this hypothesis, by focusing on the quality of the structures of this 'out-of-scale' site (the term *fuori scala* comes from the excavators), as well as its function as a centre for the collection of raw materials and the considerable quantity of ceramic fragments, the range of productive activities that took place in Vetricella may explain the discovery of such a large collection of coins, which would have been lost in the sale or purchase of these specialised products.[29]

A different hypothesis, which I believe to be more plausible, is that most of the coins come from a hoard that may have been partially dispersed in the Middle Ages and then further scattered by the repeated ploughing that deeply disturbed the archaeological deposit. This is an explanation for the archaeological context; but it should also be noted that the Vetricella find remains unusual and 'eccentric' compared to the finds from other 'out-of-scale' sites, where the number of single finds is typically rather limited. This is the case at Donoratico (Livorno), but also at San Genesio (Pisa), and, further afield, at Villa Clelia (Imola), Lomello (the site of a royal *curtis*, near Pavia) and Sant'Agata Bolognese (Bologna).[30]

Leaving aside the site of Vetricella, the interpretation of which remains controversial, the numismatic data as a whole seems to me to be consistent with Simone Collavini's observations and, to some extent, those of Giovanna Bianchi too. Both of whom believe that the goods produced on 'out of scale' sites, which played a central role in the realm's economy, were redistributed mainly through non-monetary exchanges.[31] The products of local industry, rather than being distributed through markets, would have followed paths limited to internal trade, through what has been called the 'fiscal redistribu-

[28] Saccocci, "Rinvenimenti monetali," 31; *MEC, 12*, 66-8, with further bibliography.
[29] Bianchi, Collavini, "Public Estates," 154; Fiore, "The Knots," 202; Bianchi, *Archeologia dei beni pubblici*, 33 and 39.
[30] Rovelli, "Archeologia mineraria," with bibliography on the cases cited.
[31] Bianchi, Collavini, "Public Estates," 157; and Bianchi, "Spazi pubblici," 315. An overview focusing on central-northern Italy can be found in Cantini, Cirelli, "Mercati, economia," 144-6; and Cantini, "La gestione della produzione," 286-90.

tion circuit'.[32] Following this line of interpretation, we can assume that silver from German mines sent to Italian mints, particularly that of Pavia, also followed non-commercial routes. Likewise, the lead from Frankish mines (especially Melle) that recent analyses have identified in some 9th-century 'sparse glaze pottery' produced in sites belonging to the royal fisc probably also followed non-commercial routes. The lead that Charlemagne sent to restore the roofs of some Roman basilicas arrived in Rome by similar routes.[33]

The production cycles of the mine at Harz must have further affected the supply of silver to the Italian mints; it seems that silver mining did not reach full speed until around 990.[34] These events could explain both the fluctuations in the alloy found in the *ottolini* (the quality and stability of the intrinsic values of the Ottonian coins which were issued by the German mints were, by contrast, remarkable[35]) and the lower productivity of the mints of Milan and Lucca compared to that of Pavia.

Silver from the Colline Metallifere seems to have played a marginal role in the mints' activities even in the first decades of the 11th century, although the volume of issues appears to have gradually increased. Isotopic analysis reveals that the coinage of the first decades of the 11th century repeatedly remelted a metal stock that had been acquired in the Ottonian period, with predominantly Saxon silver and a limited contribution from local silver veins. In our sample, silver from the Colline Metallifere was detected in only one of the five *denari* struck in the name of Conrad II.[36]

The data examined must be viewed within a rapidly changing political context which witnessed the destruction of the royal palace of Pavia (1024). This is not the place to discuss this complex history. However, we can note that both the crisis of imperial power and the simultaneous strengthening of local authorities somewhat diminish the credibility of explaining the limited number of mints in the Kingdom of Italy and the absence of any process of 'feudalisation' of the currency by the effectiveness of royal control over the *moneta publica*.[37]

The problems caused by the changing political and institutional framework were once again accompanied by those related to mining and the availability of metal. It is likely that by this time the flow of silver from the mines of Saxony had diminished further: by 1040 the Harz veins were exhaust-

[32] Lazzari, Tabarrini, "Beni del fisco," 244.
[33] Cortese, "Beni fiscali;" Rovelli, "Archeologia mineraria," 132-3. On the lead used for ceramic linings, see Bianchi, *Archeologia dei beni pubblici*, 127-36, 169-70. For a different hypothesis on the trade in silver metal, see Bianchi, Feller, "Scambi mercantili" (I thank the authors for kindly sending me this article, which is in press).
[34] Spufford, *Money*, 74.
[35] Merkel, *Silver and the Silver Economy*, 184 (Appendix C, Elemental analysis of coins. LA-ICP-QMS). The silver fineness of the *Sachsenpfennige* minted in Magdeburg (and dated to 950-1000), nos. 74-85, appears to be 98.7; 95.5; 98.8; 96.1; 92.8; 97.2; 95.7; 93.5; 96.5; 95.8; 95.3.
[36] Chiarantini, Villa, et al., "Economic Rebound;" Rovelli, "Archeologia mineraria."
[37] Provero, *L'Italia dei poteri locali*.

ed.[38] Renewed difficulty in finding metal for the mints had repercussions not only in Italy, where the emperors were often forced to resort to ecclesiastical treasure. As Cinzio Violante reported, Henry III was even forced to pledge a crown to an ecclesiastical institution at a time when coinage was needed; the emperor was later able to redeem thanks to the intervention of Maginerius, abbot of Hersfeld.[39]

Taking this wider view, it is difficult to imagine that emperors would have been interested in or even capable of supplying the Italian mints with regular shipments of silver. During the 11th century and the first half of the 12th, the volume of money supply increased according to erratic rhythms and by paths that we are not yet able to identify. Private documents reveal considerable regional differences in the actual availability of coinage. In Milan and Como, for example, it seems that coins were systematically used for payments of some importance.[40] Both the prices mentioned in sales of real estate and rents were defined and, it seems, paid in *denari*, *soldi*, and pounds of *denari*. Payments in *res valentes* are rare exceptions. Equally rare are references to rents in kind, or partially in kind.[41] Archaeological finds of coins continue to be infrequent, but the nevertheless fairly high silver content of the *denarii* issued in the 11th century means that they were unlikely to be lost and consequently unlikely to be recovered from archaeological contexts today.

In other regions, especially Lazio and Abruzzo, the picture is different: a prevalence of payments made in *res valentes*.[42] In central Italy, the absence of mints offers a plausible explanation for the shortage of currency that we find documented in notarial deeds. But it is not so easy to explain this absence of mints (Lucca being the only exception) and, above all, the closure of the one in Rome, which remained inactive for about two centuries from the pontificate of Benedict VII (974-83) until around 1180.[43]

The rise and rapid decline in the circulation of the Pavese *denari* offers some concrete clues as to the dynamics of monetary circulation in the 11th century and the spread of payments in *res valentes*. In Tuscany, Lazio, Abruzzo, and southern Italy, the circulation of Pavese coinage was limited to *ottolini* and the first issues of the emperors of the Salian dynasty. This is clear from

[38] Spufford, *Money*, 95-6, 240-1.
[39] Violante, "Gli imperatori Enrico III ed Enrico IV."
[40] Vittani, Manaresi, *Gli atti privati*, I; Manaresi, Santoro, *Gli atti privati*, II; Manaresi, Santoro, *Gli atti privati*, III; Manaresi, Santoro, *Gli atti privati*, IV.
[41] Manaresi, Santoro, *Gli atti privati*, II, no. 281 bis (1050), sale of various goods near the Isola Comacina for *argentum denarios bonos aut in valente libras duas*; Manaresi, Santoro, *Gli atti privati*, III, no. 454, year 1064 in a 29-year lease agreement: *segale bona ad iusta mensura Mediolanense sestaria decem et octo.*
[42] On Abruzzo, see Feller, "Les conditions;" on Lazio, see Rovelli, "Patrimonium Beati Petri." In north-eastern Italy expressions such as, e.g. *inter argentum et alias res valentem* will gradually disappear, to be replaced by more explicit references to minted coinage, such as *argenti denariorum* (*MEC*, *12*, 555).
[43] On this issue, which is still open, see Wickham, *Roma medievale*, 209-15; and Rovelli, "La produzione della moneta a Roma," 219-21.

both excavation finds and hoards. I will use the data from the excavations of the Basilica of St Peter in the Vatican as an example, restricting my analysis to coins minted in Italy. Among the coins of the Ottonian period (962-1002), which here as elsewhere show an initial increase in the money supply when compared to the previous period, those from Pavia are the most frequent. We find 17 coins from Pavia, four from Milan, three from Lucca, and one from Verona. The picture that emerges is therefore very similar to that observed in Tuscany. For the next phase, 18 *denari* of Pavia issued by Henry III and Henry IV, i.e. between 1046 and 1106, are recorded, and no specimen can be attributed to Henry V, while Venetian *denari* are well documented (181 specimens). The archaeological record also suggests that the *papienses* mentioned in the written sources of the late 11th and 12th centuries mainly served as money of account (although we must always bear in mind that the still relatively high silver content reduced the chances of accidental loss).[44] By the turn of the 12th century, the circulation of Pavia currency had essentially withdrawn to what was its natural, regional area of diffusion: Lombardy and Liguria.[45]

The data pertaining to mining helps us to identify the factors which probably contributed to the weakening of coinage in the 11th century, but the problems with the supply of mints were not the only factors hindering the expansion of the circulating medium that had been initiated by Ottonian policy. The growth in monetary production during the 11th century, which accelerated towards the end of the century, is consistent with similar growth rates in the economy when viewed through the lens of material culture, starting with pottery. Alessandra Molinari has highlighted the increase in objects in circulation from the 11th century onwards, but also the limited functional range of the ceramics produced in central-northern Italy as well as the rarity of polychrome pottery. The areas of production and distribution reconstructed by Federico Cantini and Enrico Cirelli for ceramic tableware remain sub-regional. Similar data can be cited for the distribution of limestone building materials. The earliest phases of fortified sites are characterised by the use of wood, while the spread of towers and masonry buildings generally dates from the 11th and 12th centuries.[46]

Obviously, the limited circulation of so many products of material culture reduced the circulation capacity of money, and therefore its use. Until the opening of the communal mints, the production of money was entrusted to the four imperial mints (Pavia, Milan, Lucca, and Verona), which were supplied with silver at irregular intervals and in irregular quantities, and

[44] More details on the circulation of the Pavia coinage can be found in Rovelli, "Patrimonium Beati Petri."
[45] Saccocci, "Billon and Bullion," 45-7.
[46] Cantini, "Dall'economia complessa;" Cantini, "Forme, dimensioni;" Cantini, Cirelli, "Mercati, economia;" Molinari, "Riflessioni sulle economie;" Molinari, Orecchioni, "Le dinamiche dei consumi;" Goodson, "Coins, their Absence, and Household Economies;" Rovelli, "Nuove zecche." On urban structures, see Augenti, "Archeologia della città;" on food supply, see Goodson, *Cultivating the City*, 128-54.

not necessarily (at least in Italy) to meet a demand for money which emerged from economic factors. The fragility of inter-regional exchanges, as revealed by material culture like pottery, had an impact on the currency and slowed down its spread to those regions of central Italy which did not have a mint. Payments in money substitutes thus became a necessity.

The archaeological data, in addition to what has been said above about the ways and means of the dissemination of *ottolini* from Pavia, thus support the hypothesis that Ottonian issues in Italy had a primarily 'fiscal' function, in the broad sense we have adopted. Their presence in the central-southern regions was mainly a consequence of the Ottonian military campaigns rather than the result of trade.[47] This does not diminish their importance and functionality, especially in the middle and upper segments of trade and in the context of forms of hoarding that favoured their long-term survival. They are often still present in significant proportions in late 12th-century hoards.

The mining data is central to dealing with questions relating to the issuing of money. Further details help us to measure monetary production during the 11th century, albeit it is impossible to provide precise estimates. We have already seen how the Saxon emperors increased the activity of the Palatine mint of Pavia without, however, opening new mints, as was instead the case in Germany. Moreover, in the Kingdom of Italy, the rare concessions of regalian rights dating back to the 11th century were initially disregarded. Interventions in the coinage's intrinsic content were also apparently limited. Issues of the imperial mints maintained a fairly high fineness until the end of the 11th century, roughly up to the years of the First Crusade (1096-1101).[48] As far as the early 11th century is concerned, the metallographic analyses available today lead us to exclude, or at least to consider irrelevant, the reuse of metal stocks that had accumulated over time and which included silver objects (sometimes in fragments) or coins (possibly foreign). Instead, these sets of heterogeneous provenances, which later sources refer to as *bolsone*, were often used by the communal mints of the 12th and 13th centuries, when the issue of *denari* increased considerably, partly due to repeated impoverishment of their intrinsic content.[49] Let us not forget that it was precisely the reduction of the intrinsic metal content, by adding copper, which made it possible to increase money supply in the second half of the 12th century before the introduction of the *grosso*. During this period, between the 12th and 13th centuries, I believe we can assume the polymetallic deposits of the Colline Metallifere were used extensively for monetary purposes, with copper being exploited even more than silver.

[47] Between 968 and 970, Otto I led several military expeditions to conquer Apulia and Calabria. Otto III repeated the feat between 981 and 982: see Gay, *L'Italie méridionale*, 289-342.
[48] *MEC*, *12*, 37. Data on intrinsic values are awaiting confirmation. The evolution of the intrinsic content of the 11th-12th-century *denari* can essentially be deduced from written sources or from the destructive analyses carried out in the late 19th century; we do not yet have an adequate set of archaeometric analyses, with the partial exception of the Henrician *denari* from Verona and Venice (*MEC*, *12*, 725-6).
[49] Finetti, *Numismatica e tecnologia*, 15 and n. 21.

3. *The 12th century: a turning point*

The political and institutional developments that accompanied the crisis of royal power and the simultaneous appearance of urban autonomies favoured the opening of new mints in the 12th century to respond to needs of a different nature, political as well as economic. The granting of the right to mint coins was a tool used by emperors to forge alliances or punish opponents. This happened in 1155, when Frederick I transferred Milan's minting rights to Cremona. But it was also a response to the demand for money that was being generated by demographic growth and changing economic conditions. Many aspects of material culture illustrate the ongoing processes.

In December 1138, Genoa received the *ius cudendi* from Conrad III (1138-52), which led to the first communal coinage as early as 1139.[50] Here too, the issue of metal and its provenance is relevant. Chris Wickham has recently noted that in 1131 the lords of Arborea granted Genoa half of the local silver lodes. Other silver may have reached the mint through trade with Lombard towns (and thus also from the Lombard mines), for which Genoa was the natural port. Other silver may perhaps have come from Provence.[51] The importance of trade in the development of Genoese coinage – and not only Genoese coinage – is suggested, as in Venice, by metrological choices. The *grosso minore*, which was introduced around 1200, adopted the weight of the dominant coins in the markets which were of the greatest interest for Genoese trade. This was the case with the silver *miliaresi* minted in Spain and North Africa. These, in turn, were worth half the *dirham*.[52] The plan was clearly to adopt a monetary instrument which could be easily used in the Mediterranean markets. Genoa was quickly followed by other mints, starting with Piacenza (1140) and Asti (1141).[53]

The impact of the late 12th- and early 13th-century issues on monetary circulation was significant and rapid. By the end of the 12th century, the mints of Susa, Asti, Genoa, Milan, Pavia, Brescia, Cremona, Piacenza, Verona, Venice, Trento, Aquileia, Mantua, Bologna, Lucca, Pisa, Volterra, Arezzo, Siena, Ancona, and Rome were operating in central and northern Italy (fig. 2).[54] This is why I instead spoke of 'inertia' in reference to the 11th century at the beginning of this essay.

The excavation of Tremona Castle (Mendrisio, Canton Ticino, Switzerland), a multi-layered site from the Neolithic age to the 13th century, is an interesting case study. The numismatic finds highlight the importance of the Ottonian phase, which endured until the first decades of the 11th century, as

[50] *MEC, 12*, 254.
[51] Wickham, *The Donkey*, 549 and n. 192.
[52] *MEC, 12*, 260.
[53] Matzke, "Il diritto monetario," 235-44.
[54] Spufford, *Money*, 187-91. For more details on individual mints, see the entries in *MEC, 12* as well as in *Le zecche italiane*.

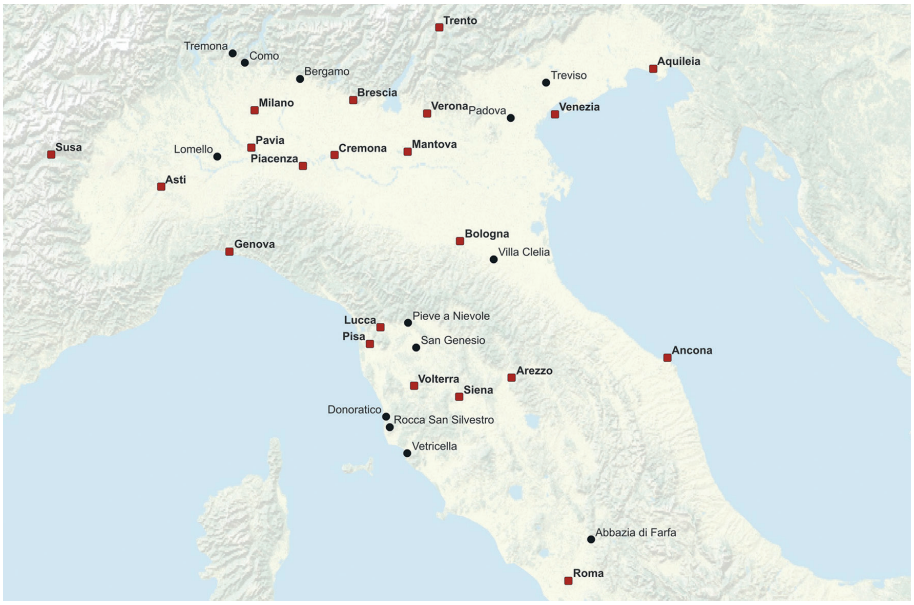

Fig. 2. Map of locations cited in the text. The names of the mints which were working in the 12th century are in bold type.

well as the subsequent slowdown in the circulation of money and the new upswing from the second half of the 12th century.[55] Numismatic finds from urban excavations, e.g. Milan and Brescia, document a similar situation. In north-eastern Italy, the 12th century, particularly the second half of that century, witnessed a great expansion of the money supply with the introduction of two new *denari*: the Venetian 'Veronese' *denaro* and the new *denarius crociatus* or *incruciatus* issued in Verona. The *crociatus* had widespread use, and not only in Verona. *Crociati* are common among the finds in the Veneto, Trentino, Tyrol, and Friuli, and are also quite common in southern Germany, Switzerland, Carinthia, Slovenia, and Croatia. It has been calculated that, in the 12th century, the money supply increased by a factor of about 50 compared

[55] Arslan, "Le monete." As far as the Middle Ages are concerned, the site is documented from the mid-9th century. The single finds are distributed into two main phases. The first begins with a Milanese *denaro* of Lothair II (945-50) and continues until the first decades of the 11th century with two *denari* in the name of Otto I and Otto II dated 962-7, minted in Pavia; one *ottolino* struck in Milan in the name of Otto II or Otto III (973-1002); eight Milanese *denari* of Henry II (1014-24); and three in the name of Conrad II (1026-39). The coinage following Conrad II's *denari* is missing. After a hiatus of about a century, numismatic finds resume with issues dating from the second half of the 12th century, mainly from mints in northern Italy (but there is also one *denaro enriciano* from Lucca). There are 43 *terzoli* from Milan, and they are of the same type as the 701 specimens that, together with 103 *denari* from Cremona, made up the hoard found during the 1991 excavation campaign.

to the 8th-10th centuries.[56] These are rough estimates, based on data from single finds and hoards, but they give us an idea of the phenomenon's scale.[57]

In central Italy, the diffusion of Lucca *denari* in the second half of the 12th century reflects a rapidly changing economic reality marked by the gradual introduction of *denari* from new mints in addition to that of Lucca. The excavations at Rocca San Silvestro (Livorno), the first settlement phases of which have recently been dated to the 9th century, have yielded about 520 medieval coins, starting with a Lucca *denaro* attributed to Henry III or Henry IV of Franconia. This specimen is followed by 17 *denari enriciani* of more uncertain date (possibly as late as the first decades of the 13th century). Another 24 *denari* from Lucca and 178 from Pisa, which have a high copper content alloy, have been dated between the end of the 12th century and the middle of the following century. Even more conspicuous is the nucleus of *denari* from different mints, dated between the mid-13th and mid-14th centuries.[58]

It is worth noting here that a large number of mints does not necessarily correlate to a voluminous coinage (in Carolingian Francia, just to give un example, many mints are known only from a small number of specimens). Yet in 12th-century Italy, the surge in mint-places was matched by the same surge in money supply. In documents from Lazio, expressions such as *precium valens solidos* rapidly disappear with the spread of Lucca issues, which can be dated to the second half or end of the 12th century, and the arrival, around 1170, of *deniers* from the mint of Provins. The latter were joined and then replaced by the *denari provisini* struck by the mint of Rome, which reopened around 1180.[59]

In another geographical context, the finds from the excavation of the cloister of the monastery of St. John in Müstair (Canton of Grisons, Switzerland) illustrate the impact on monetary circulation of the issues of the mints of northern Italy from the second half of the 12th century. Verona is the best-represented mint, with 96 *denari* that can broadly be dated between 1150 and 1200. We then have 100 specimens which are datable between 1200 and 1250 and another 96 *denari* from the next 50 years, while only 13 specimens can be dated roughly between 1050 and 1150. In total, the excavation yielded about 880 finds.[60]

The quantitative data are not the only relevant evidence.[61] Equally, if not more, significant are the changes introduced to the monetary systems with the adoption of different denominations. The *denarius imperialis*, which was

[56] *MEC, 12*, 637 and 656, Saccocci, "Wage Payments," 157-8.
[57] See Morrisson, "Quantifier le monnayage byzantin" for an analysis of the methods and problems involved in quantifying the money supply. The quality of the flans of late 12th-century *denari* makes it difficult, if not impossible, a die-study for an attempt to estimate the size of the coinage.
[58] Finetti, "I reperti numismatici," 130-4; Cicali, "Le monete del castello minerario," 81-117.
[59] Rovelli, "Patrimonium Beati Petri."
[60] Diaz Tabernero, "Die Fundmünzen," 142-3.
[61] In this regard, see the opinions of Philippe Wolf, "Monnaie et développement," 777, on the question: *quel a été, à tout moment de l'histoire dite médiévale, le rapport entre la quantité de signes monétaires disponibles pour la circulation, et le volume de l'activité économique ?*

coined by Barbarossa in the nearby *borgo* of Nosedo after the destruction of Milan in 1162, was an important step in the process that led to the birth of the *grosso* and the development of an articulated and complex monetary system. Because of its silver content (about 0.50 g), which was similar to that of the *denaro* minted by the Milanese mint between 1109 and 1148,[62] the *denaro imperiale* was worth twice as much as the coeval *denarius novus*, also known as the *tertiolus* or *terciolus*, which the Milanese mint (by then *de facto*, though not *de jure*, communal)[63] had begun to strike at an uncertain date, before 1150 (it is mentioned from 1148 onwards).[64] The *denaro terzolo*, with a theoretical weight of about 0.75 g, and a silver content of about 30-3% (equal to 1/3 silver, hence its name), was in any case twice as valuable as the so-called *mezzani* minted in other Lombard mints (Bergamo, Brescia, Como, Cremona, Mantua, and Pavia) from the late 12th century onwards.[65]

The most important innovation, however, was the introduction of the Venetian *grosso*, which was an absolute novelty in terms of both weight (2.18 g) and fineness (98.5% silver). According to Alan Stahl, the first *grossi* of 24 (later 26) Venetian *denari* may have been minted as early as 1194 (the traditional chronology is 1202).[66] According to Andrea Saccocci, their issuing was made possible by the renewed availability of large quantities of silver from mines in the Eastern Alps.[67] The introduction of the *grosso* was therefore not due to the need for currency to finance the construction of a fleet and the imminent crusade.[68] Moreover, its success seems to have been favoured by its metrological consistency with the *miliarese*, a coin of account widely used in Mediterranean trade and corresponding to 1/12 of the 'old' gold *hyperpyron*.[69]

Economic interests, supported by a nascent and prudent monetary policy, now seem to prevail over military ones. As we have seen, a similar choice was adopted in the same years by Genoa. The new *grossi* joined the *denari* and the half-*denari*, although the latter continued to be uncommon, except in Genoa and Venice, where a new fraction was also introduced: the *quarto di denaro* or *quartarolo*.[70]

[62] Matzke, Tabernero, "Eine Börse." In the absence of an adequate series of analyses, the intrinsic content of the *denarius imperialis*, which had a standard weight of about 1.00 g., has been estimated at around 50%. See Spufford, *Money*, 225; *MEC, 12*, 55-8, 75 and 418.
[63] On the rights to operate a mint, see *MEC, 12*, 20-1; on the specific case of Milan, see 73-4 and 416-9.
[64] *MEC, 12*, 418
[65] *MEC, 12*, 741.
[66] Stahl, "The mint of Venice;" Stahl, *Zecca*, 16-27 and 354-7; *MEC, 12*, 637-40.
[67] Saccocci, "Tra Bisanzio, Venezia e Friesach;" *MEC, 12*, 16 and 637-40.
[68] On this earlier hypothesis, which is widespread and partly based on Martin da Canal's account, see Spufford, *Money*, 226 (and the bibliography in n. 2).
[69] *MEC, 12*, 640 and 740; Morrisson, *Byzance et sa monnaie*, 12-28, and 61-104 for an analysis of the Byzantine monetary system and coin use.
[70] *MEC, 12*, 13. In Venice, the introduction of the *quartarolo*, probably in 1205, led to a momentary interruption in the minting of *denari*, which were issued again from around 1268. In this period, the *crociatus* of the Verona mint successfully replaced the Venetian *denaro*, thanks to the good integration of Verona issues with the Venetian monetary system (*MEC, 12*, 558).

At different levels of exchange, thus different denominations and petty cash allowed people to negotiate price fluctuations in urban markets and, more generally, in small-scale transactions.[71] The *denari* of the late 12th century, which had by then lost about 80% of their intrinsic value as specified by the *Honorantie* for the *denari* of the royal mints, were practically pocket change. The *denari* issued in Pavia around 1170 contained about 0.2 g of silver, those from Venice about 0.1 g, and those struck in Verona a little later about 0.08 g.[72]

Byzantine *folles* from the late 10th or early 11th century have been found, mainly in the regions bordering on the northern Adriatic (but also in Lombardy). Since these are bronze coins, it is possible that they were used as pocket money in the absence of similar local issues.[73] Their circulation in a structurally different monetary context, such as the silver coinage in the 10th-11th centuries, could reflect a first response to a growing demand for small change. As far as local issues were concerned, this problem would find a solution in the debased *denari* minted from the second half or end of the 12th century.

In this framework, which was so different from that of the 8th-10th centuries and, in some respects, of the 11th, the spread of rents in kind between the 12th and 13th centuries is anything but paradoxical, as Liubov A. Kotel'nikova has already argued. It corresponds to the desire to make the best possible profit from the sale of agricultural or craft products in urban (and not only urban) markets.[74]

The payment of rents in kind reflects different monetary and economic phenomena from payments in *res valentes,* although they are apparently similar, since in both cases they are made without the use of coinage. In the charters of Farfa Abbey (Rieti), purchases made with coin substitutes account for about 2/3 of land sales in the 11th century, reflecting the need to deal with a shortage of coinage. Consequently, the seller would receive various goods from the purchasing monastery for a value that was described with expressions that varied in form, but not in substance: *de mobilibus appraetiatum iuste valens solidos…*; *precium valens solidos…* In Lazio, but also in Abruzzo, these formulas quickly disappeared at a time that coincides with the arrival of the Provins *denarii* and the later issues of the Rome mint, which reopened around 1180, imitating the Provins types. The simultaneity of the two phenomena, namely the reopening of the mint and the rapid abandonment of payments in *res valentes*, suggests that the latter method of payment was adopted because of an actual shortage of currency in circulation.[75]

[71] For an overview, see Naismith, *Small Change* (on Italy: Goodson, "Coins, their Absence, and Household Economies"; Norrie, "Gendering Money;" Rovelli, "Small Change in Early Medieval Italy").
[72] Spufford, *Money*, 225; Saccocci, *Contributi*, 76-7.
[73] Callegher, "Presenza di «folles anonimi»."
[74] Kotel'nikova, "Rendita in natura," 93-112.
[75] For Tuscany, a recent review of these issues can be found in Tomei, "Il valore delle cose;" for some numismatic data: Degasperi, "La moneta nel medio Valdarno;" on Lazio: Rovelli, "Patrimonium Beati Petri."

Considering local variables and the varying types of exchange, it is therefore possible, for the period under consideration, to go beyond the recurring historiographical question of whether a 'natural economy' or a 'monetary economy' prevailed by assessing the proportion of transactions carried out with coined money as compared to those carried out in kind. A question posed in this way addresses only one side of the problem, namely the supply of money, while ignoring the demand for money, as Enrico Stumpo has pointed out.[76] And it is the latter aspect that best reflects the changes that took place.

The issue of *denarii* with different intrinsic values, a phenomenon facilitated by the establishment of the new communal mints, was therefore an important step towards the concrete use of coinage. In the second half of the 12th century, the monetary system evolved, in a few decades, from an essentially single-denomination one into much more complex forms.[77] The monetary system was now able to drive and even be driven by a wide range of economic and financial activities in which coinage took on an increasingly broader role: the marketing of agricultural products; real estate transactions; and the payment of rents, wages, and taxes. The conversion of the royal *fodrum* into money, which is routinely mentioned from the last third of the 11th century,[78] and the parallel development of new forms of taxation based on payments in money are phenomena that allowed Patrizia di Mainoni to speak of a 'fiscal revolution' in northern Italy during the 12th century. Numerous innovations were introduced as a corollary of the inventories ordered by Frederick Barbarossa and the new forms of surveying which led to the analytical description of landed property, cadastral surveys and the monetary valuation of rents.[79]

Without going into the details of this development (which did not eliminate taxes in kind for the same reasons that rents in kind did not disappear), it is important to note that the public authorities – i.e. the issuing authorities, whether royal or communal – were interested in increasing the money supply. This created the conditions for a gradual return to the synergy between the issuing of money and taxation that is characteristic of tax-based states – a synergy rooted in the Roman imperial model, which lived on in Byzantium and was in turn adopted in the Muslim world.[80] The monetisation of the tax system once again became a driving factor in the production and circulation

[76] Stumpo, "Economia naturale;" 548-51; Palermo, "Strumenti e meccanismi."
[77] On the Carolingian monetary system, see Grierson and Blackburn, *Medieval European Coinage*, *1*, 194-9; on Italy: Rovelli, "Some considerations;" Rovelli, "Produzione e circolazione monetaria," 484-7; on the debate about the use (or non-use) of small coins in early medieval economies, see Naismith, *Small Change*.
[78] Menant, *Campagnes lombardes*, 463-77 and 530-49 on the evolution of taxes in rural communes.
[79] Mainoni, "A proposito della 'rivoluzione fiscale';" Cammarosano, "Le origini della fiscalità."
[80] Hendy, *The Economy, Fiscal Administration*; Hendy, "East and West;" Morrisson, "Byzantine Money;" Molinari, "Le anfore medievali," 303.

of money. The contemporary development of wage labour went in the same direction.[81]

The opening of new mints was accompanied by the simultaneous development of wide-ranging regional monetary policies, which increased the interconnectedness and economic complexity that is a central theme in current historical and archaeological research.[82] An example of this is the treaty drawn up between Lucca and Pisa in 1181, which not only put an end to the Pisan imitation of Lucca's *denari*, but also gave rise to commercial agreements.[83]

4. *Conclusions*

I have here suggested a 'monetary periodisation' of the central Middle Ages in central-northern Italy, focusing on the main junctures as they are attested by documentary sources as well as by the emerging data from numismatic, archaeological, and archaeometrical analysis. I started with the Ottonian period because recent research has reopened for debate several concepts that had long been taken for granted. There is no doubt that the Ottonian period marked the first important change of pace in the production of money in the Kingdom of Italy, with a significant expansion of minting thanks to the influx of silver from German mines. Moreover, this phenomenon concerned mainly the Palatine mint of Pavia. The volume of issues increased, but this is perhaps the only innovative element that can be attributed to the Saxon dynasty: as a whole, its minting activity is marked by a considerable degree of continuity with the Carolingian age and that of the 'Kings of Italy'. This continuity concerned not only the mints, which remained limited to Pavia, Milan, Lucca, and Verona, but also the way in which money was distributed. The monetary system retained its previous structure, based on the exclusive issue of *denari*. The peculiar 'rigidity' of the monetary system and the patterns of redistribution of the goods produced on the vast seigneurial estates – including those of the royal *fiscus* – help to explain the still marginal role of money as a medium of exchange. Coin production followed intermittent phases, which were often triggered by the need to provide a rapid response to contingent needs, such as military ones. However, one should not underestimate the positive impact of *ottolini denari* on the monetary circulation as they enabled a first concrete increase in the money supply. Part of the surplus produced on seigneurial estates was in fact destined to be sold in markets other than the *curtes*.

What happened in the 11th century and the first half of the 12th is in some respects more elusive, and not only, as we have seen, in monetary terms.

[81] Saccocci, "Wage payments;" on wage labour in the Early Middle Ages, see Feller, "Le vocabulaire de la rémunération."
[82] Wickham, "Prima della crescita," 103; Molinari, "Le anfore medievali," 300-3; Wickham, *The Donkey*, 15 and 621.
[83] Baldassarri, *La monetazione*, 12.

The crisis of imperial authority, and therefore of issuing authority, probably slowed down the royal mints' activity without, however, creating the conditions for the development of seigneurial or urban mints (the first was Genoa in 1138-9). Monetary production increased but remained limited by contingent factors. Among these was surely the metal stock, which lacked adequate sources of growth. In this 'in-between' phase, the problems caused by the still-limited availability of money were most noticeable in those regions which lacked mints and where payments in *res valentes* became more common. This aspect seems particularly relevant for the present attempt at 'monetary periodisation'.

The driving forces that converged in the second half of the 12th century had significant consequences which marked a real turning point: the return to a multi-denomination monetary system, the creation of new mints, and the increase in the volume of coinage. The spread of *denari* from Verona in northern Italy and of *denari* from Lucca in central Italy was the result of a very different phenomenon from that which had allowed the Pavian *ottolini* to reach the southern regions. The driving force behind the circulation of money was no longer the imperial armies, to whose needs the *ottolini* had been functional: this circulation was now driven by the expansion of trade circuits at various levels of exchange.

The evolution of the monetary system towards more complex forms is thus consistent with the development of an economy that was itself becoming more complex. Coinage was an integral part of this new complexity.

Works cited

Abulafia, David. "Maometto e Carlo Magno: le due aree monetarie italiane dell'oro e dell'argento." In *Economia naturale, economia monetaria. Storia d'Italia, Annali 6*, a cura di Ruggiero Romano, e Ugo Tucci, 223-70. Torino: Einaudi, 1983.

Arslan, Ermanno Alessio. "Le monete." In *Scavi MM3. Ricerche di archeologia urbana a Milano durante la costruzione della linea 3 della metropolitana 1982-1990*, a cura di Daniela Caporusso, 71-130. Milano: Edizioni ET, 1991.

Arslan, Ermanno Alessio. "Le monete." In *S. Giulia di Brescia gli scavi dal 1980 al 1992. Reperti preromani, romani e alto medievali*, a cura di Gian Pietro Brogiolo, 347-99. Firenze: All'Insegna del Giglio, 1999 (rist. 2024).

Arslan, Ermanno Alessio. "Le monete." In *Tremona Castello. Dal V millennio a.C. al XIII secolo d.C.*, a cura di Alfio Martinelli, 357-86. Firenze: All'Insegna del Giglio, 2008.

Augenti, Andrea. "Archeologia della città medievale." In *Quarant'anni di Archeologia medievale in Italia. La rivista, i temi, la teoria e i metodi*, a cura di Sauro Gelichi, 173-82. *Archeologia Medievale*, numero speciale (2014).

Baldassarri, Monica. "La monetazione della Repubblica di Pisa fino alla prima dominazione fiorentina." In *Pisa nei secoli, la storia, le tradizioni*, a cura di Alberto Zampieri, 9-69. Pisa: Edizioni ETS, 2003.

Benvenuti, Marco, Laura Chiarantini, Cristina Cicali, Alessandro Donati, Alessia Rovelli, Igor Villa, and Vanessa Volpi. "Metals and coinage in Medieval Tuscany: the Colline Metallifere." In *Origins of a new economic union (7th-12th centuries). Preliminary results of the nEU-Med project: October 2015-March 2017*, ed. by Giovanna Bianchi, and Richard Hodges, 135-46. Firenze: All'Insegna del Giglio, 2018.

Bianchi, Giovanna. *Archeologia dei beni pubblici. Alle origini della crescita economica in una regione mediterranea (secc. IX-XI).* Firenze: All'Insegna del Giglio, 2022.

Bianchi, Giovanna. "Spazi pubblici, beni fiscali e sistemi economici rurali nella Tuscia post carolingia: un caso studio attraverso la prospettiva archeologica." In *Spazio pubblico e spazio privato. Tra storia e archeologia (secoli VI-XI)*, a cura di Giovanna Bianchi, Cristina La Rocca, e Tiziana Lazzari, 293-325. Turnhout: Brepols, 2018.

Bianchi, Giovanna, e Simone Maria Collavini. "Public estates and economic strategies in early medieval Tuscany: towards a new interpretation." In *Origins of a new economic union (7th-12th centuries). Preliminary results of the nEU-Med project: October 2015-March 2017*, ed. by Giovanna Bianchi, and Richard Hodges, 147-65. Firenze: All'Insegna del Giglio, 2018.

Bianchi, Giovanna, e Laurent Feller. "Scambi mercantili e non mercantili nel X secolo." Forthcoming

Bianchi, Giovanna, and Richard Hodges, ed. by. *The nEU-Med project. Vetricella, an early medieval royal property on Tuscany's Mediterranean*. Firenze: All'Insegna del Giglio, 2020.

Bianchi, Giovanna, and Richard Hodges, ed. by. *Origins of a new economic union (7th-12th centuries). Preliminary results of the nEU-Med project: October 2015 - March 2017.* Firenze: All'Insegna del Giglio, 2018.

Bianchi, Giovanna, et Alessia Rovelli. "Production métallique et production monétaire en Toscane: un long chemin." In *Mine, métal, monnaie. Melle, les voies de la quantification de l'histoire monétaire du haut Moyen Âge*, éd. par Marc Bompaire, et Guillaume Sarah, 111-39. Genève: Droz, 2017.

Bougard, François. "*Minima Ticinensia*". In «Castrum paene in mundo singulare». *Scritti per Aldo Settia in occasione del novantesimo compleanno*, a cura di Simone Caldano, Gianmarco De Angelis, e Cristina La Rocca, 122-31. Genova: Sagep Editori, 2022.

Bougard, François, and Alessia Rovelli. "Some remarks and hypotheses on the supply and use of money in the kingdom of Italy, 888-962." In *A Dark Matter. History and Archaeology of Fiscal Estates in Medieval Italy (8th-11th c.)*, ed. by Paolo Tomei, and Giacomo Vignodelli. Brill: Leiden-Boston, forthcoming.

Brühl, Carlrichard, und Cinzio Violante, hrsg. von. *Die* Honorantie civitatis Papie. *Transkription, Edition, Kommentar.* Wien: Böhlau, 1983.

Callegher, Bruno. "Presenza di «folles anonimi» in Italia settentrionale: un'ipotesi interpretativa." *Numismatica e antichità classiche* 23 (1994): 293-312.

Callegher, Bruno. "La Puglia bizantina alla vigilia della conquista normanna: un'area ad economia monetaria ai confini dell'impero." In *Oltre l'alto medioevo: etnie, vicende, culture nella Puglia normanno-sveva. Atti del XXII Congresso internazionale di studio sull'alto*

medioevo, Savelletri di Fasano (BR), 21-24 novembre 2019, 45-68. Spoleto: Fondazione Centro italiano di studi sull'alto Medioevo, 2020.
Callegher, Bruno, et Cécile Morrisson. "*Miliareni de follibus*: la trouvaille de folles byzantins de Cannes (milieu du X^{e} siècle). " In Puer Apuliae. *Mélanges offerts à Jean-Marie Martin*, éd par Errico Cuozzo, Vincent Déroche, Annick Peters-Custot, et Vivien Prigent, 105-22. Paris: Collège de France - CNRS, C.R.H.C. de Byzance, 2008.
Cammarosano, Paolo. "Le origini della fiscalità pubblica delle città italiane." In *La gènesi de la fiscalitat municipal (segles XII-XIV)*, Antoni Furiò coord. *Revista d'Història Medieval* 7 (1996): 39-52.
Cantini, Federico. "Dall'economia complessa al complesso di economie. Tuscia V-X secolo." *Post Classical Archaeologies* 1 (2011): 159-94.
Cantini, Federico. "Forme, dimensioni e logiche della produzione nel Medioevo: tendenze generali per l'Italia centrale tra V e XV secolo." In *L'archeologia della produzione a Roma (secoli V-XV)*, a cura di Alessandra Molinari, Riccardo Santangeli Valenzani, e Lucrezia Spera, 503-20. École Française de Rome: Rome, Edipuglia: Bari, 2015.
Cantini, Federico. "La gestione della produzione fra *curtes* fiscali e *curtes* private in età carolingia". In *Spazio pubblico e spazio privato tra storia e archeologia (secoli VI-XI)*, a cura di Giovanna Bianchi, Cristina La Rocca, e Tiziana Lazzari, 261-91. Turnhout: Brepols, 2018.
Cantini, Federico, a cura di. *"Costruire lo sviluppo". La crescita di città e campagna tra espansione urbana e nuove fondazioni (XII-prima metà XIII secolo).* Firenze: All'Insegna del Giglio, 2019.
Cantini Federico, e Enrico Cirelli. "Mercati, economia e incastellamento." In *L'incastellamento: Storia e archeologia. A 40 anni da* Les structures *di Pierre Toubert*, a cura di Andrea Augenti, e Paola Galetti, 143-73. Spoleto: Fondazione Centro Italiano di Studi sull'Alto Medioevo, 2018.
Capitani, Ovidio. "I secoli centrali del Medio Evo: un periodo storiografico?". In *Periodi e contenuti del Medio Evo*, a cura di Paolo Delogu, 89-110. Roma: Il Ventaglio, 1988.
Casey, P.J. *Understanding Ancient Coins: An Introduction for Archaeologists and Historians*. London: Batsford, 1986.
Chiarantini, Laura, Marco Benvenuti, Giovanna Bianchi, Luisa Dallai, Vanessa Volpi, and Rosarosa Manca, "Medieval Pb (Cu-Ag) Smelting in the Colline Metallifere District (Tuscany, Italy): Slag Heterogeneity as a Tracer of Ore Provenance and Technological Process." *Minerals* 11, no. 97 (2021) https://doi.org/10.3390/min11020097.
Chiarantini, Laura, Igor M. Villa, Vanessa Volpi, Giovanna Bianchi, Marco Benvenuti, and Cristina Cicali. "Economic rebound versus imperial monopoly: Metal provenance of Early Medieval coins (9th-11th centuries) from some Italian and French mints." *Journal of Archaeological Science: Reports* 39 (2021): 103139 https://doi.org/10.1016/j.jasrep.2021.103139.
Cicali, Cristina. "Le monete del castello minerario di Rocca S. Silvestro." *Bollettino di Numismatica* 44-5 (2005): 81-272.
Cipolla, Carlo Maria. *Le avventure della lira*. Bologna: Il Mulino, 1975.
Collavini, Simone Maria. "'Mutazione signorile' e trasformazioni economiche. Considerazioni a partire dal destino dei beni fiscali in Toscana." In *Dinamiche economiche e fisco regio: strategie gestionali e circuiti redistributivi fra IX e XIII secolo*, a cura di Lorenzo Tabarrini, e Tiziana Lazzari, 349-70. *Reti Medievali Rivista* 24, no. 1 (2023).
Cortese, Maria Elena. "Beni fiscali e attività minerario-metallurgiche nell'Italia centro-settentrionale (secoli VIII-XI). In *Dinamiche economiche e fisco regio: strategie gestionali e circuiti redistributivi fra IX e XIII secolo*, a cura di Lorenzo Tabarrini, e Tiziana Lazzari, 251-83. *Reti Medievali Rivista*' 24, no. 1 (2023).
Day, William R. Jr., Michael Matzke, and Andrea Saccocci. *Medieval European Coinage 12 Italy (I) (Northern Italy)*. Cambridge: Cambridge University Press, 2016.
Degasperi, Angelica. "La moneta nel medio Valdarno inferiore. Osservazioni sulla circolazione monetaria tra Lucca e Pistoia fra alto e bassomedioevo." *Archeologia medievale* 30 (2003): 557-75.
Delogu, Paolo, a cura di. *Periodi e contenuti del Medio Evo*. Roma: Il Ventaglio, 1988
Diaz Tabernero, José. "Die Fundmünzen aus dem Kloster St. Johann." In José Diaz Tabernero, y Christian Hesse, *Müstair, Kloster St. Johann, II, Münzen und Medaillen*, 11-164. Zürich: VDF Hochschulverlag AG an der ETH, 2004.
von Falkenhausen, Vera. "La circolazione monetaria nell'Italia meridionale e nella Sicilia in epoca normanna secondo la documentazione d'archivio." *Bollettino di Numismatica* 6-7 (1986): 55-79.

Feller, Laurent. “Les conditions de la circulation monétaire dans la périphérie du Royaume d’Italie (Sabine et Abruzzes, IXe-XIIe siècle).” In *L’argent au Moyen Âge, XXVIIIe Congrès de la S.H.M.E.S., Clermont-Ferrand, 30 mai -1er juin 1997*, 61-75. Paris: Publications de la Sorbonne, 1998.

Feller, Laurent. “Le vocabulaire de la rémunération durant le haut Moyen Âge.” In *Rémunérer le travail au Moyen Âge*, éd. par Patrice Beck, Philippe Bernardi, et Laurent Feller, 154-64. Paris: Picard, 2014.

Finetti, Angelo. *Numismatica e tecnologia. Produzione e valutazione della moneta nelle società del passato*. Roma: La Nuova Italia Scientifica, 1987.

Finetti, Angelo. “I reperti numismatici.” In *Rocca San Silvestro*, a cura di Riccardo Francovich, 130-4. Roma: Leonardo - De Luca editori, 1991.

Fiore, Alessio. “The Knots and the Nets: Fisc, Rural Estates and Citied in the Written Sources (Northern Italy, c. 800-1000).” In *The nEU-Med project. Vetricella, an early medieval royal property on Tuscany’s Mediterranean*, ed. by Giovanna Bianchi, and Richard Hodges, 197-206. Firenze: All’Insegna del Giglio, 2020.

Franceschi, Franco. “La crescita economica dell’Occidente medievale: un tema storico non ancora esaurito. Introduzione.” In *La crescita economica dell’Occidente medievale: un tema storico non ancora esaurito. Atti del venticinquesimo Convegno internazionale di studi, Pistoia, 14-17 maggio 2015*, 1-24. Roma-Pistoia: Viella - Centro italiano di studi di storia e d’arte Pistoia, 2017.

Gay, Jules. *L’Italie méridionale et l’Empire byzantin depuis l’avènement de Basile Ier jusqu’à la prise de Bari par les Normands*. Paris : A. Fontemoing, 1904.

Gianazza, Luigi. “Susa”. In *Le zecche italiane fino all’Unità*, I, a cura di Lucia Travaini, 1164-5. Roma: Istituto Poligrafico e Zecca dello Stato, 2011.

Grierson, Philip, and Mark Blackburn. *Medieval European Coinage*, I, *The Early Middle Ages (5th-10th centuries)*. Cambridge: Cambridge University Press, 1986.

Grierson, Philip, and Lucia Travaini. *Medieval European Coinage 14 Italy (III) (South Italy, Sicily, Sardinia*). Cambridge, Cambridge University Press, 1998.

Goodson, Caroline. “Coins, their Absence, and Household Economies in Early Medieval Italy.” In *Small Change in Early Middle Ages. New Perspectives on Coined Money, c. 400-1100*, ed. by Rory Naismith, 135-66. Turnhout: Brepols, 2025 DOI: 10.1484/M.SEM-EB.5.143067

Goodson, Caroline J. *Cultivating the City in Early Medieval Italy*. Cambridge: Cambridge University Press, 2021.

Hendy, Michael F. “East and West: divergent models of coinage and its use.” In *Il secolo di ferro: mito e realtà del secolo X*, 637-79. Settimane di studio del Centro italiano di studi sull’alto Medioevo, 38. Spoleto: Centro Italiano di Studi sull’alto Medioevo, 1991.

Hendy, Michael F. *The Economy, Fiscal Administration and Coinage of Byzantium*, Northampton: Variorum Reprints, 1989.

Herlihy, David. “Treasure hoards in the Italian economy, 960-1139.” *The Economic History Review*”, II ser. 10 (1957): 1-14.

Howgego, Christopher. *Ancient History from Coins*. London: Routledge, 1995.

Kotel’nikova, Liubov A. “Rendita in natura e rendita in denaro nell’Italia medievale (secoli IX-XV).” In *Economia naturale, economia monetaria. Storia d’Italia, Annali 6*, a cura di Ruggiero Romano, e Ugo Tucci, 93-112. Torino: Einaudi, 1983.

Mainoni, Patrizia. “A proposito della «rivoluzione fiscale» nell’Italia settentrionale del XII secolo.” *Studi storici* 44 (2003): 5-42.

Manaresi, Cesare, e Caterina Santoro, a cura di. *Gli atti privati milanesi e comaschi del sec. XI, vol. II (a. 1026-1050)*, Milano: Castello Sforzesco, 1960.

Manaresi, Cesare, e Caterina Santoro, a cura di. *Gli atti privati milanesi e comaschi del sec. XI, vol. III (a. 1051-1074)*. Milano: Castello Sforzesco, 1965.

Manaresi, Cesare, e Caterina Santoro, a cura di. *Gli atti privati milanesi e comaschi del sec. XI, vol. IV (a. 1075-1100)*. Milano: Catello Sforzesco, 1969.

Martin, Jean-Marie. “Les échanges monétaires entre l’Italie méridionale et ses voisins (Xe-XIIe siècles).” In *Les échanges en Méditerranée médiévale*, éd. par Élisabeth Malmut, Mohamed Ouerfelli, 57-68. Aix en Provence: Presses Universitaires de Provence, 2012.

Martin, Jean-Marie. “Economia naturale ed economia monetaria nell’Italia meridionale longobarda e bizantina (secoli VI-XI).” In *Economia naturale, economia monetaria. Storia d’Italia, Annali 6*, a cura di Ruggiero Romano, e Ugo Tucci, 181-219. Torino: Einaudi, 1983.

Matzke, Michael. "Il diritto monetario." In *Le zecche italiane fino all'Unità*, I, a cura di Lucia Travaini, 213-89. Roma: Istituto Poligrafico e Zecca dello Stato, 2011.
Matzke, Michael. "Vom Ottolinus zum Grossus: Münzprägung in der Toskana vom 10. bis zum 13. Jahrhundert." *Schweizerische Numismatische Rundschau* 72 (1993): 135-99.
Matzke, Michael, e José Diaz Tabernero. "Eine Börse mit Mailändischen Denaren de 12. Jahrhunderts aus Lenz/Lantsch GR, Kapelle St. Cassian." *Schweizerische Numismatische Rundschau* 84 (2004): 25-136.
Menant, François. *Campagnes lombardes du Moyen Âge. L'économie et la société rurales dans la région de Bergame, de Crémone et de Brescia du X^e^ au XIII^e^ siècle*. Rome: École française de Rome, 1993.
Merkel, Stephen William. *Silver and the Silver Economy at Hedeby. Raw Materials, Innovation, Technology of Ancient Cultures*. Bochum: VML Verlag Marie Leidorf, 2016.
Molinari, Alessandra. "Le anfore medievali come *proxy* per la storia degli scambi mediterranei tra VIII e XIII secolo?". In *I contenitori da trasporto altomedievali e medievali (VIII-XII secolo) nel Mediterraneo. Centri produttori, contenitori, reti di scambio. Atti del Convegno (Roma, 16-18 novembre 2017). In memoria di Fabiola Ardizzone*, a cura di Sauro Gelichi, e Alessandra Molinari. *Archeologia medievale* 45 (2018): 293-306.
Molinari, Alessandra. "Archeologia medievale e storia economica." In *Quarant'anni di Archeologia medievale in Italia. La rivista, i temi, la teoria e i metodi*, a cura di Sauro Gelichi. *Archeologia Medievale* numero speciale (2014): 95-109.
Molinari, Alessandra. "La produzione artigianale a Roma tra V e XV secolo. Riflessioni sui risultati di uno studio archeologico sistematico e comparativo." In *L'archeologia della produzione a Roma (secoli V-XV). Atti del Convegno internazionale di Studi, Roma 27-29 marzo 2014*, a cura di Alessandra Molinari, Riccardo Santangeli Valenzani, e Lucrezia Spera, 613-35. Bari: Edipuglia, Roma: École Française de Rome, 2015.
Molinari, Alessandra. "Riflessioni sulle economie dei secoli X e XI. Palermo e Roma a confronto." In *Italy and Early Medieval Europe. Papers for Chris Wickham*, ed. by Ross Balzaretti, Julia Barrow, and Patricia Skinner, 155-70. Oxford: Oxford University Press, 2018.
Molinari, Alessandra, e Paola Orecchioni. "Le dinamiche dei consumi attraverso le fonti archeologiche. Secoli VIII-XV." In *La crescita economica dell'Occidente medievale: un tema storico non ancora esaurito. Atti del venticinquesimo Convegno internazionale di studi, Pistoia, 14-17 maggio 2015*, 255-76. Roma-Pistoia: Viella - Centro italiano di studi di storia e d'arte, Pistoia, 2017.
Morrisson, Cécile. *Byzance et sa monnaie (IV^e^-XV^e^ siècle)*. Paris : Lethielleux, 2015.
Morrisson, Cécile. "Byzantine Money: its Production and Circulation." In *The Economic History of Byzantium: From the Seventh through the Fifteenth Century*, III, ed. by Angeliki E. Laiou, 910-66. Washington D.C.: Dumbarton Oaks Trustees for Harvard University, 2002.
Morrisson, Cécile. "Quantifier le monnayage byzantin: données et méthodes, acquis et perspectives." In *Mine, métal, monnaie. Melle, les voies de la quantification de l'histoire monétaire du haut Moyen Âge*, éd. par Marc Bompaire et Guillaume Sarah, 395-414. École Pratique des Hautes Études. Sciences Historiques et Philologiques, 111. Genève : Droz, 2017.
Naismith, Rory. *Making Money in the Early Middle Ages*. Princeton-Oxford: Princeton University Press, 2023.
Naismith, Rory, ed. by. *Small Change. New Perspectives on Money in the Early Middle Ages, c. 400-1100*. Turnhout: Brepols, 2025.
Norrie, James. "Gendering Money: How Women and Men Used Coin in Eleventh-Century Northern Italy." In *Small Change. New Perspectives on Money in the Early Middle Ages, c. 400-1100*, ed. by Rory Naismth, 191-213. Turnhout: Brepols, 2025.
Palermo, Luciano. "Strumenti e meccanismi della crescita: la moneta e il credito." In *La crescita economica dell'Occidente medievale: un tema storico non ancora esaurito. Atti del venticinquesimo Convegno internazionale di studi, Pistoia, 14-17 maggio 2015*, 175-96. Roma-Pistoia: Viella - Centro italiano di studi di storia e d'arte Pistoia, 2017.
Provero, Luigi. *L'Italia dei poteri locali*. Carocci: Roma, 2003.
Rovelli, Alessia. "Archeologia mineraria, archeometria ed emissioni monetarie nel regno italico: considerazioni in margine ai reperti numismatici dagli scavi di una *curtis regia*." *Rivista italiana di Numismatica* 124 (2023): 121-48.
Rovelli, Alessia. "*De pondere et argento de duodecim in decem*. Note sulle emissioni monetarie del regno italico nel X secolo: il contributo delle analisi metallografiche." *Rivista italiana di Numismatica* 125 (2024): 171-80.

Rovelli, Alessia. "Mines et monnaies au haut Moyen Âge. Les sources de l'Italie carolingienne." *Bulletin de la Société française de Numismatique* 59 no. 4 (2004): 58-64.
Rovelli, Alessia. "*Patrimonium Beati Petri*. Emissione e circolazione monetaria nel Lazio settentrionale." *Annali dell'Istituto italiano di Numismatica* 55 (2009): 171-94.
Rovelli, Alessia. "Produzione e circolazione monetaria nell'Europa franca (VIII-IX secolo)." In *I Franchi*. Settimane di studio della Fondazione Centro italiano di studi sull'alto Medioevo, 473-506. Spoleto: Fondazione Centro italiano di studi sull'alto Medioevo, 2023.
Rovelli, Alessia. "Small Change in Early Medieval Italy." In *Small Change. New Perspectives on Money in the Early Middle Ages, c. 400-1100*, ed. by Rory Naismith, 167-90. Turnhout: Brepols, 2025.
Rovelli, Alessia. "Some Considerations on the Coinage of Lombard and Carolingian Italy." In *The Long Eighth Century: Production, Distribution and Demand*, ed. by Inghe Lyse Hansen, and Chris Wickham, 195-224. Leiden: Brill, 2000.
Saccocci, Andrea. "Billon and bullion: local and foreign coins in Northern Italy (11th-15th centuries)." In *Moneta locale, moneta straniera: Italia ed Europa XI-XV secolo. The Second Cambridge Numismatic Symposium. Local coins, foreign coins: Italy and Europe 11th-15th centuries*, a cura di Lucia Travaini, 41-65. Milano: Società Numismatica Italiana, 1999.
Saccocci, Andrea. *Contributi di storia monetaria delle regioni adriatiche settentrionali (secoli X-XV)*. Padova: Esedra Editrice, 2004.
Saccocci, Andrea. "Rinvenimenti monetali nella Tuscia dell'alto medioevo: i flussi (secc. VI-X)." In *Monete antiche. Usi e flussi monetari in Valdera e nella Toscana nord-occidentale dall'età romana al medioevo*, a cura di Antonio Alberti, e Monica Baldassarri, 21-34. Bientina: Edizioni La grafica pisana, 2013.
Saccocci, Andrea. "Il ripostiglio dall'area 'Galli Tassi' di Lucca e la cronologia delle emissioni pavesi e lucchesi di X secolo." *Bollettino di Numismatica* 36-9 (2001-2) [2004]: 167-204.
Saccocci, Andrea. "Il ripostiglio di monete." In *Archeologia a Pieve a Nievole dalla* baselica sita loco Neure *alla pieve romanica*, a cura di Giulio Ciampoltrini, e Enrico Pieri, 69-83. Pisa: Edizioni ETS, 2003.
Saccocci, Andrea. "Tra Bisanzio, Venezia e Friesach: alcune ipotesi sull'origine della moneta grossa in Italia." *Numismatica e Antichità classiche. Quaderni ticinesi* 23 (1994): 313-41.
Saccocci, Andrea. "Wage payments in Italy before the introduction of the «moneta grossa», 11th-12th centuries." *Revue Belge de Numismatique et de Sigillographie* 149 (2003): 151-64.
Stahl, Alan. "The mint of Venice in the thirteenth century." In *Later Medieval Mints: Organisation, Administration, and Techniques,* ed. by Nicholas J. Mayhew, and Peter Spufford, 97-127. BAR International Series 389. Oxford: B.A.R., 1988.
Stahl, Alan M. *Zecca. The Mint of Venice in the Middle Ages*. Baltimore, London, New York: The Johns Hopkins University Press, The American Numismatic Society, 2000.
Stumpo, Enrico. "Economia naturale ed economia monetaria: l'imposta." In *Economia naturale, economia monetaria. Storia d'Italia, Annali 6*, a cura di Ruggiero Romano, e Ugo Tucci, 523-62. Torino: Einaudi, 1983.
Tomei, Paolo. "Il valore delle cose. Nuovi dati e vecchi interrogativi sugli strumenti di scambio nella Toscana marchionale (secoli IX-XI)." In *Dinamiche economiche e fisco regio: strategie gestionali e circuiti redistributivi fra IX e XIII secolo*, a cura di Lorenzo Tabarrini, e Tiziana Lazzari. *Reti Medievali Rivista* 24, no. 1 (2023): 285-309.
Toubert, Pierre. "Il sistema curtense: la produzione e lo scambio interno in Italia nei secoli VIII, IX e X." In *Economia naturale, economia monetaria*, *Storia d'Italia. Annali 6*, a cura di Ruggiero Romano, e Ugo Tucci, 5-63. Torino: Einaudi, 1983.
Travaini, Lucia. "La moneta milanese tra X e XII secolo." In *Atti dell'11° Congresso internazionale di studi sull'alto medioevo, Milano 26-30 ottobre 1987*, 223-43. Spoleto: Centro italiano di studi sull'alto Medioevo, 1989.
Travaini, Lucia, a cura di. *Le zecche italiane fino all'Unità*, I. Roma: Istituto Poligrafico e Zecca dello Stato, 2011.
Travaini, Lucia. "Monete e circolazione monetaria nell'Italia bizantina e post-bizantina." In *L'héritage byzantin en Italie (VIIIe-XIIe siècle)*, II, *Les cadres juridiques et sociaux et les institutions publiques*, éd. par Jean-Marie Martin, Annick Peters-Custot, et Vivien Prigent, 483-504. Rome: Publications de l'École française de Rome, 2012.
Valenti, Marco. "La formazione dell'insediamento altomedievale in Toscana. Dallo spessore dei numeri alla costruzione dei modelli." In *Dopo la fine delle ville: le campagne italiane dal*

VI al IX secolo, a cura Gian Pietro Brogiolo, Alexandra Chavarria Arnau, e Marco Valenti, 193-219. Mantova: SAP Società Archeologica, 2005.
Violante, Cinzio. "Gli imperatori Enrico III e Enrico IV e lo sviluppo dell'economia monetaria." *Studi medievali*, s. III, 40, fasc. II (1999): 515-522.
Vittani, Giovanni, e Cesare Manaresi, a cura di. *Gli atti privati milanesi e comaschi del sec. XI, vol. I. a. 1001-1025*. Milano: U. Hoepli, 1933.
Wickham, Chris. *The Donkey and the Boat. Reinterpreting the Mediterranean Economy, 950-1180*. Oxford: Oxford University Press, 2023.
Wickham, Chris. "Prima della crescita: quale società?" In *La crescita economica dell'Occidente medievale: un tema storico non ancora esaurito. Atti del venticinquesimo Convegno internazionale di studi, Pistoia, 14-17 maggio 2015*, 93-106. Roma-Pistoia: Viella - Centro italiano di studi di storia e d'arte Pistoia, 2017.
Wickham, Chris. *Roma medievale. Crisi e stabilità di una città 900-1150*. Roma: Viella, 2013.
Wolf Philippe. "Monnaie et développement économique dans l'Europe médiévale". In *La moneta nell'economia europea, secoli XIII-XVIII. Atti della Settima settimana di studio, 11-17 aprile 1975. Istituto Internazionale di Storia Economica "F. Datini" - Prato*, a cura di Vera Barbagli Bagnoli, 775-803. Firenze: Le Monnier, 1981.

Alessia Rovelli
Università di Pisa
alessia.rovelli@unipi.it
ORCID: 0000-0002-7161-0266