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**The Monetary Origins of the 'Price Revolution' : South German Silver Mining, Merchant-Banking, and Venetian Commerce, 1470-1540'**

by

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## The Monetary Origins of the 'Price Revolution' : South German Silver Mining, Merchant-Banking, and Venetian Commerce, 1470-1540'

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This paper seeks to provide a new and chiefly monetary explanation for the origins of the sixteenth-century era of sustained inflation (c.1520 - c.1640) commonly known as the 'Price Revolution'; and in particular it provides an answer to the question: *not*, as traditionally posed, why did the Price Revolution commence so early; but rather why did it commence so late? Beginning with the Salamanca School (1556), and then the French philosopher Jean Bodin (1568) and culminating with Earl Hamilton and Keynes (1929, 1936), most economists and historians had attributed this sustained European inflation to the influx of Spanish-American 'treasure', chiefly silver from Peru-Bolivia and Mexico. But with advances in our knowledge of price history in the post-war era, economic historians pointed out that European inflation had commenced as early as the 1520s, some three decades before any substantial amounts of silver had been imported from the Americas. They therefore sought an alternative explanation: unfortunately, one that wrongly made population growth the 'prime mover' for inflation, with grave deficiencies in their economic theory. Most have confused a change in relative prices (e.g. a rise in wheat prices) with a change in the overall price level (CPI). Only one (Jack Goldstone) has sought to link population growth, and urbanization in particular, to monetary variables: i.e. to changes in payment structures and thus to the income velocity of money (or to changes in Cambridge  $k$ ). This paper focuses on the role of two other monetary factors, both of which preceded any sustained population growth in western Europe: the South-German silver-copper mining boom, commencing in the late 1450s, and reaching its peak in the 1530s; and then the revolutionary changes in credit institutions from c. 1510: in particular legal sanctions for and widespread use of negotiable, transferable bills; and the rapid rise of fully negotiable *rentes* as the principal agency for West European public finance, with an explosive expansion in the use of credit instruments in general. The other argument of this paper is that the South German silver mining boom did not initially, not before c. 1515-20, produce sustained inflation in western Europe for four reasons: (1) much of the silver (and copper) so produced was exported by the Venetians to the Levant, in purchasing Asian luxuries, until major conquests of the Ottoman Turks seriously disrupted this trade, c. 1515-20, diverting much more of that silver to the Antwerp market; (2) increased European money supplies from the silver-mining boom merely accommodated the revival and expansion of the European economy from the 1460s to c. 1510 (i.e., in terms of the equation  $M.V = P.y$ , that  $\Delta (M.V) > \Delta y$ ); (3) that really large quantities of silver were not being mined before about 1510; (4) that the institutional changes in credit, and their impact on changes in both  $M$  and  $V$ , did not make themselves felt until after the 1520s.

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For almost four centuries, the influx of Spanish-American silver had been viewed as the primary culprit responsible for the inflation of the Price Revolution era in early modern Europe, a sustained rise in almost all prices, lasting well more than a century: in England, a seven-fold increase by the later 1640s (see Table 1). Such a view was first espoused during the Price-Revolution era itself, first indeed, within Spain itself, in a treatise that the cleric Azpilcueta Navarra, of the Salamanca School, produced in 1556.<sup>1</sup> Much more famous, however, is the debate that took place twelve years later (1568), between the French Philosopher Jean Bodin and his opponent the royal councillor Jean Cherruyt de Malestroit: in the *Response de maistre Jean Bodin au paradoxe de Monsieur de Malestroit touchant l'enchérissement de toutes choses et le moyen d'y remedier*.<sup>2</sup> The best known modern version is, of course, Earl Hamilton's classic 1934 monograph: *American Treasure and the Price Revolution in Spain, 1501-1650*.<sup>3</sup> In the past several decades,

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<sup>1</sup> Marjorie Grice-Hutchinson, *The School of Salamanca: Readings in Spanish Monetary Theory, 1544 - 1605* (Oxford, 1952): Appendix III, p. 95: 'And even in Spain, in times when money was scarcer, saleable goods and labour were given for very much less than after the discovery of the Indies, which flooded the country with gold and silver'.

<sup>2</sup> George A. Moore, ed., *The Response of Jean Bodin to the Paradoxes of Malestroit and The Paradoxes, translated from the French Second Edition, Paris 1578* (Washington, 1946). See also Jean-Yves Le Branchu, ed., *Écrits notables dur la monnaie, XVIe siècle: De Copernic à Davanzati reproduits, traduits, d'après les éditions originales et les manuscrits, avec une introduction, des notices et des notes*, Collection des principaux économistes, nouvelle édition, 2 vols. (Paris, 1934): *Les paradoxes du Seigneur de Malestroict, conseiller du Roy, et Maistre ordinaire de ses comptes, sur le faict des monnoyes, presentez à sa Majesté, au mois de mars MDLXVI* (Paris, 1566); *La response de maistre Jean Bodin advocat en la cour au paradoxe des monsieur de Malestroit touchant l'enchérissement de toutes choses et le moyen d'y remedier* (Paris, 1568).

<sup>3</sup> Earl J. Hamilton, 'American Treasure and the Rise of Capitalism (1500-1700),' *Economica: A Journal of the Social Sciences*, 27 (Nov. 1929): 338-57; E.J. Hamilton, 'Imports of American Gold and Silver Into Spain, 1503 - 1600,' *Quarterly Journal of Economics*, 43 (1929): 436-72; E.J. Hamilton, *American Treasure and the Price Revolution in Spain, 1501-1650* (Cambridge, Mass., 1934; reissued 1965); Fernand Braudel, *La Méditerranée et le monde méditerranéen à l'époque de Philippe II*, 1949; 2nd rev edn. (Paris, 1966); republished as *The Mediterranean and the Mediterranean World in the Age of Philip II*, translated by Sian Reynolds, 2 vols. (London and New York, 1972-73), especially 1: 476-510.

however, this Bodin-Hamilton thesis, and more generally the primary role of precious metals in ‘generating’ the European Price Revolution, have fallen into great disfavour, as many historians have instead sought the causes of this and other inflations in pre-20th century economic history in the dynamics of demographic and other ‘real’ variables.<sup>4</sup>

The most compelling reason for rejecting the Hamilton-Bodin thesis, especially in explaining the *initial* phase of the Price Revolution, is the simple irrefutable fact that persistent inflation had commenced

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<sup>4</sup> For standard, classic representations of the now enormous literature concerning the demographic and other ‘real’ variables that historians have sought to employ in their explanations of the European Price Revolution, see in particular R.B. Outhwaite, *Inflation in Tudor and Early Stuart England*, Studies in Economic and Social History Series, (1969; 2nd edn., London, 1982); Peter Ramsey, ed., *The Price Revolution in Sixteenth-Century England*, Debates in Economic History series (London, 1971); Peter Burke, ed., *Economy and Society in Early-Modern Europe: Essays from Annales* (London, 1972). For the most recent study emphasising the primary role of demographic factors, see David Hackett Fischer, *The Great Wave: Price Revolutions and the Rhythm of History* (Oxford and New York, 1996), which I have reviewed for *EH.Net Review* <ehreview@eh.net>, 24 February 1999. Some recent scholars, however, have also sought to combine monetary and demographic variables in an Income-Velocity model to explain inflation; and their publications (Goldstone, Lindert, Mayhew) are discussed below on pp. 00 and in nn. 39, 42-43. A relatively recent and even more profound monetary explanation of inflation during the Price Revolution utilizes the ‘Monetary Approach to the Balance of Payments.’ Space does not permit an examination of this important model, other than a listing of the major studies: Dennis O. Flynn, ‘A New Perspective on the Spanish Price Revolution: The Monetary Approach to the Balance of Payments,’ *Explorations in Economic History*, 15 (1978): 388-406; Douglas Fisher, ‘The Price Revolution: A Monetary Interpretation,’ *Journal of Economic History*, 49 (December 1989): 883 - 902; Winfried Stier, ‘Meaning and Function of New Methods of Time Series Analysis for Economic History,’ in *Precious Metals, Coinage and the Changes of Monetary Structures in Latin-American, Europe, and Asia (Late Middle Ages - Early Modern Times)*, ed. Eddy Van Cauwenberghe (Leuven, 1989):209-22. See also the related studies of: Dennis Flynn, ‘Sixteenth-Century Inflation From a Production Point of View,’ in *Inflation Through the Ages: Economic, Social, Psychological, and Historical Aspects*, ed. E. Marcus and N. Smukler (New York, 1983), 157 - 69; Dennis Flynn, ‘The Microeconomics of Silver and East-West Trade in the Early Modern Period,’ in *The Emergence of a World Economy, 1500 - 1914*, ed. Wolfram Fischer and R. Marvin McNinnis, Beiträge zur Wirtschafts- und Sozialgeschichte, 1 (Wiesbaden, 1986), 37 - 60. For the theoretical literature on this model, see: Jacob A. Frenkel and Harry G. Johnson, eds., *The Monetary Approach to the Balance of Payments* (Toronto, 1976), including Donald N. McCloskey and J. Richard Zecher, ‘How the Gold Standard Worked, 1880-1913,’ pp. 357-85; John E. Floyd, *World Monetary Equilibrium: International Monetary Theory in an Historical-Institutional Context* (Philadelphia, 1985); and Trevor Dick and John Floyd, *Canada and the Gold Standard: Balance of Payments Adjustment under Fixed Exchange Rates, 1871 - 1913* (Cambridge and New York, 1992). For my own, basically sympathetic, discussion of this monetary model in the context of the 16<sup>th</sup>-century Price Revolution, see John Munro, ‘The Central European Mining Boom, Mint Outputs, and Prices in the Low Countries and England, 1450 - 1550,’ in *Money, Coins, and Commerce: Essays in the Monetary History of Asia and Europe from Antiquity to Modern Times*, ed. Eddy Van Cauwenberghe, Studies in Social and Economic History, Katholieke Universiteit Leuven, no. 22 (Leuven, 1991), 150-3.

about thirty or so years before Europe had received any large quantities of Spanish-American silver: as early as c.1516-20 in north-west Europe, and by 1521-25 in Spain itself (Table 1). Before joining those who seek purely ‘real’ explanations for the Price Revolution, let us first consider other possible monetary factors, at least as contributory causes, beginning with the thesis of Bodin’s opponent, Malestroit, who believed that coinage debasements were primarily responsible. Certainly in the two prior, late-medieval centuries, western Europe had experienced many episodes of debasement-induced inflations, some quite horrendous, particularly in France, the Low Countries, and Italy. In the Price Revolution era itself, England’s ‘Great Debasement’ under Henry VIII immediately comes to mind. But those debasements commenced far too late, in 1542, and ended too soon, in 1552, to do more than aggravate, temporarily albeit seriously, the ongoing inflationary processes of England’s own Price Revolution. Prior to that, from 1464-5 to 1542, England had enjoyed almost perfect monetary stability, briefly interrupted in 1526 by one relatively minor ‘defensive’ debasement (11.25 percent weight reduction), when the bulk of the coinage was underweight.<sup>5</sup> England’s commercial partner, in the Cross-Channel Burgundian Low Countries, had similarly enjoyed an almost perfectly stable coinage from 1496 to 1553, except for a very minor silver-coinage debasement of 3.3 percent in 1521.<sup>6</sup> Even France, by far the worst medieval offender, had also enjoyed a stable coinage from 1488 to

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<sup>5</sup> See Nicholas J. Mayhew, ‘From Regional to Central Minting, 1158-1464,’ and Christopher Challis, ‘Lord Hastings to the Great Silver Recoinage, 1464 - 1699,’ in *A New History of the Royal Mint*, ed. Christopher Challis (Cambridge, 1992), 83-178, 179-397; Christopher Challis, ‘The Circulating Medium and the Movement of Prices in Mid-Tudor England,’ in *The Price Revolution in Sixteenth-Century England*, ed. Peter Ramsey, Debates in Economic History series (London, 1971), 117-46; Christopher Challis, *The Tudor Coinage* (Manchester, 1978), 150-98; and J.D. Gould, ‘The Price Revolution Reconsidered,’ *Economic History Review*, 2nd ser., 17 (1964-65), reprinted in *The Price Revolution in Sixteenth-Century England*, ed. Peter Ramsey, Debates in Economic History series (London, 1971), 91-116; J. D. Gould, *The Great Debasement: Currency and the Economy in Mid-Tudor England* (Oxford, 1970), 71-86.

<sup>6</sup> Herman Van der Wee, *Growth of the Antwerp Market and the European Economy, 14th to 16th Centuries*, 3 Vols. (The Hague, 1963). 1: *Statistics*, 126-30; John Munro, ‘Money and Coinage of the Age of Erasmus’: Appendix A: ‘The Coinage of the Burgundian-Hapsburg Netherlands, Before and After 1521,’ and Appendix B: ‘Official Coinage Rates: February and August 1521,’ in *The Collected Works of Erasmus: Correspondence*, 8: *Letters 1122 to 1251, A.D. 1520 to 1521*, ed. Sir Roger Mynors and Pieter Bietenholz (Toronto: University of Toronto, 1988), 347-50; Louis Deschamps de Pas, *Essai sur l'histoire monétaire des comtes de Flandre de la maison d'Autriche et classement de leurs monnaies, 1482-1556* (Paris, 1874);

1519. In that latter year the silver coinage underwent a modest debasement of 11.7 percent, thereafter remaining perfectly stable until 1541, when it underwent another 11.0 percent debasement, which was followed by another three decades of perfect monetary stability (to 1572).<sup>7</sup> In Spain itself, the silver *real* coinage retained perfect stability from 1497 throughout the entire Price Revolution era, while the gold *excelente* and *escudo* coinages were revalued in 1537 by 5.13 percent and then in 1566 by another 12.5 percent, to accord with rising gold: silver ratios.<sup>8</sup> Clearly, therefore, Malestroit was quite incorrect. Coinage debasements had nothing to do with the onset of the Price Revolution; and those few that did occur in the first half of the sixteenth century, except for the English ‘Henrician’ aberration, were exceptionally mild compared to those of the fourteenth and fifteenth centuries.<sup>9</sup>

Nevertheless, by the early sixteenth century, western Europe had been undergoing two momentous changes in its precious metal stocks that have been largely neglected by most historians of the Price Revolution. First, from about the 1460s or early 1470s, from their Gold Coast fortress of the São Jorge, the Portuguese were exporting considerable amounts of ‘Sudanese’ gold, which West Africans were extracting from the Senegal, Niger, and Volta river basins. According to estimates of Wilks, mean annual shipments had risen to 170 kg by 1480 and peaked at 680 kg in the late 1490s; according to estimates of Ward Barrett and other scholars, the Portuguese delivered a total of about 17,000 kg gold between 1470 and 1500 (annual

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originally published as articles in *Revue numismatique*, nouvelle série, 14 (1866): 86-114, 15 (1874): 243-66, 319-34; and in *Revue belge de numismatique*, 32 (1876): 49-122; H.E. Van Gelder and Marcel Hoc, *Les monnaies des Pays-Bas bourguignons et espagnols, 1434-1713: Répertoire générale* (Amsterdam, 1960),

<sup>7</sup> A. Blanchet and A. Dieudonné, *Manuel de numismatique française*, 2 vols. (Paris, 1916), 2: chapters 17-22; Edouard Fournial, *Histoire monétaire de l'occident médiéval* (Paris, 1970), 134-39.

<sup>8</sup> Modesto Ulloa, ‘Castilian Seignorage and Coinage in the Reign of Philip II,’ *Journal of European Economic History*, 4 (1975): 459-80; Akira Motomura, ‘The Best and Worst of Currencies: Seignorage and Currency Policy in Spain, 1597 - 1650,’ *The Journal of Economic History*, 54:1 (March 1994): 104 - 27; Akira Motomura, ‘New Data on Minting, Seignorage, and the Money Supply in Spain (Castile), 1597 - 1643,’ *Explorations in Economic History*, 34:3 (July 1997): 331-67; Hamilton, *Price Revolution*, 46-72.

<sup>9</sup> See the various studies of John H. Munro, *Bullion Flows and Monetary Policies in England and the Low Countries, 1350 - 1500*, Variorum Collected Studies series CS 355 (Aldershot, 1992).

mean of 567 kg) and another 19,000 kg between 1500 and 1550 (annual mean of 380 kg).<sup>10</sup> Then, from the early sixteenth century, the Spanish and Portuguese began furnishing gold from their new American colonies. As Table 2 indicates, the estimated annual mean imports of gold into Seville alone were: 621 kg in 1503-10 (8 yr mean), 915 kg in 1511-20; 490 kg in 1521-30; 1,447 kg in 1531-40; and 2,498 kg in 1541-50. By 1550, Seville had received a total import of about 58,431 kg of gold, or the current value-equivalent of about 642,741 kg of silver (if we use a 11:1 bimetallic ratio for this era).

The monetary consequences of these gold inflows are, however, quite problematic. In the first place, the Portuguese gold imports from West Africa were, to some immeasurable extent, merely a diversion of gold that had earlier been exported from the very same 'Sudanese' sources, principally via Timbuktu, across the Sahara to various Mediterranean ports. Secondly, from 1500, the Portuguese were using some of this gold, along with silver, in conducting their newly established seaborne trade with India and Indonesia. Thirdly, most West European economies conducted their domestic commerce with silver coinages, using silver-based moneys-of-account. In theory, a large gold influx should have had deflationary consequences for silver-based pricing systems – unless the new gold stocks released or diverted some silver from regional or international commerce into domestic commerce. In any event, the continued and inexorable rise of the bimetallic ratio --

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<sup>10</sup> See Ivor Wilks, 'Wangara, Akan, and the Portuguese in the Fifteenth and Sixteenth Centuries,' in *Forests of Gold: Essays on the Akan and the Kingdom of Asante*, ed. Ivor Wilks (Athens, Ohio, 1993), 1-39, reprinted in *Mines of Silver and Gold in the Americas*, ed. Peter Bakewell, Variorum Series: An Expanding World: The European Impact on World History, 1450 - 1800 (London, 1997); John Day, 'The Great Bullion Famine of the Fifteenth Century', *Past and Present*, no. 79 (May 1978): 36-9; reprinted in John Day, *The Medieval Market Economy* (Oxford, 1987); Peter Spufford, *Money and Its Use in Medieval Europe* (Cambridge, 1988), 368-70; E.W. Bovill, *The Golden Trade of the Moors*, 2nd edn. (London, 1968), 13-44, 98-206; Marian Malowist, 'Quelques observations sur le commerce de l'or dans le Soudan occidentale au moyen âge', *Annales: E.S.C.*, 25 (1970): 1630-36; Ivana Elbl, 'Cross-Cultural Trade and Diplomacy: Portuguese Relations with West Africa, 1441 - 1521,' *Cahiers d'histoire mondiale/Journal of World History*, 3 (1992): 165 - 204; Ralph Austen, 'Marginalization, Stagnation, and Growth: the Trans-Saharan Caravan Trade in the Era of European Expansion, 1500-1900,' and Ward Barrett, 'World Bullion Flows, 1450 - 1800,' in *The Rise of Merchant Empires: Long-Distance Trade in the Early Modern World, 1350 - 1750*, ed. James Tracy (Cambridge, 1990), 311-41; 224 - 254, Table 7.5; 247; Vitorino Magalhães Godhino, *L'économie de l'empire portugais aux XVe et XVIe siècles* (Paris, 1969); Braudel, *The Mediterranean and the Mediterranean World*, 1: 464-75. He does not believe that the trans-Saharan flow was diminished.

in Spain from 10.11:1 in 1497 to 15.45:1 in 1643-- indicates that European supplies of silver increased by far the more of the two metals.<sup>11</sup>

Indeed, western Europe's most momentous monetary change both before and during the first phase of the Price Revolution was based upon a silver-copper mining boom in Central Europe, beginning in the 1460s and reaching its peak in the 1540s. According to Adolf Soetbeer (1879), the first of the few to comment on this phenomenon, aggregate silver production from mines in southern Germany, Austria, Bohemia, Slovakia, and Hungary had risen to about 35,000 kg silver a year in the period 1493 - 1520, and reached a maximum of about 47,000 kg silver a year in 1520-1544.<sup>12</sup> Subsequently, John Nef contended that Soetbeer had grossly underestimated the outputs from the new German/Bohemian mines, and produced new estimates for maximum outputs of mined silver, in 1526 - 1535: between 84,200 kg and 91,200 kg a year. In his view, even the lower-bound estimate represented a quintupling of Europe's mined silver outputs from those of the mid-fifteenth century, when European mining was in the doldrums.<sup>13</sup>

Since then, no one else has provided new aggregate estimates, though several recent more regionally focussed studies, especially those by Vlachovic (1963), Schenk (1967, 1968), Westermann (1971, 1972, 1981, 1991), Kellenbenz (1977, 1981), Laube (1974), Paulinyi (1981), Cirkovic (1981), and Braunstein

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<sup>11</sup> See Hamilton, *Price Revolution*, Table 4, p. 71; Table 8, p. 123. The official ratios of the two coined *marcs* were: 10.11 in 1497-1536; 10.61 in 1537-65; 12.12 in 1566-1608; 13.33 in 1609-42; and 15.45 in 1643-50. For other European bimetallic ratios over this period, see in particular Frank Spooner, *The International Economy and Monetary Movements in France, 1493-1725* (Cambridge, Mass., 1972), 20-33 (especially Table 1, p. 21). Kurti N. Chaudhuri, 'Treasure and Trade Balances: the East India Company's Export Trade, 1660-1720,' *Economic History Review*, 2nd ser. 21 (Dec. 1968): Table 1, 497-99, which indicates, for 1661-65, a bimetallic ratio of 15.08:1 in London and 16.16:1 in India; and also K. N. Chaudhuri, 'Circuits monétaires internationaux, prix comparées et spécialisation économique, 1500 - 1750,' in *Études d'histoire monétaire, XIIIe - XIXe siècles*, ed. John Day (Lille, 1984), 49-68. In general, the steepest rise in the bimetallic ratio occurred after 1600.

<sup>12</sup> Adolf Soetbeer, *Edelmetall-Produktion und Werthverhältniss zwischen Gold und Silber seit der Entdeckung Amerika's bis zur Gegenwart* (Gotha, 1879).

<sup>13</sup> John Nef, 'Silver Production in Central Europe, 1450-1618', *Journal of Political Economy*, 49 (1941): 575-91.



(1983), do permit a more precise picture of the mining boom in specific parts of Saxony (Schneeberg, Annaberg, Marienberg), Thuringia (Eisleben, Hettstedt), the Austrian Tirol (Schwaz region only), Bohemia (Joachimsthal, Kutna Hora, Kasperska Hora), Slovakia (Thurzo-Fugger Co), and Hungary (Nagybanya, and Körmöcbanya).<sup>14</sup> For the decade 1471-80, the aggregate mean annual output of the Central European silver mines can be estimated at 17,447 kg of fine metal, though data are available for only a few of the operating mines (Table 3). By 1491-1500, these mines were collectively producing a mean annual output of at least 25,450 kg of silver; in 1501-10: 32,624 kg; in 1511-20: 34,818 kg; in 1521-30: 42,371 kg; and in 1531-40: peaking with an annual mean of 52,525 kg, declining to an estimated annual mean of 42,371 kg in 1541-50.

Certainly these data must underestimate the true annual means of the Central European silver outputs, by

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<sup>14</sup> Josef Vlachovic, 'Slovak Copper Boom in World Markets of the Sixteenth and in the First Quarter of the Seventeenth Centuries,' *Studia historica slovacica*, 1 (1963): 63-95; Ekkehard Westermann, *Das Eislebener Garkupfer und seine Bedeutung für den europäischen Kupfermarkt, 1460-1560* (Vienna, 1971); Ekkehard Westermann, 'Tendencies in the European Copper Market in the 15th and 16th Centuries,' in *Precious Metals in the Age of Expansion*, ed. Hermann Kellenbenz (Stuttgart, 1981), 79-86; Ekkehard Westermann, 'Communication (with graphs)' to the 8th International Economic History Congress, Section C, Budapest (1982); Ekkehard Westermann, 'Die Bedeutung des Thüringer Saigerhandels für den mitteleuropäischen Handel an der Wende vom 15. zum 16. Jahrhundert,' *Jahrbuch für die Geschichte Mittel- und Ostdeutschlands*, 21 (1972): 68-92. [Ed. by Wilhelm Berges, Hans Herzfeld, and Henryk Skrzypczak]; Ekkehard Westermann, 'Die Unternehmungsform der Saigerhandelsgesellschaft und ihre Bedeutung für den oberdeutschen Frühkapitalismus: Forschungs-stand und - aufgeben,' in *L'impresa industria, commercio, banca seccoli XIII - XVIII*, ed. Simonetta Cavaciocchi, Istituto internazionale di storia economica 'F. Datini' Prato, series II, Atti delle 'Settimane di Studi' e altri Convegni vol. 22 (Prato, 1991), 577-86; Ekkehard Westermann, 'Über Wirkungen des europäischen Ausgriffs nach Übersee auf den europäischen Silber- und Kupfermarkt des 16. Jahrhunderts,' in *Columbus: Tradition und Neuerung*, ed. Armin Reese, Beiträge aus dem Fachbereich IV (Sozialwissenschaften) der Pädagogischen Hochschule Heidelberg, 5 (Idstein, 1992), 52-69; Hermann Kellenbenz, 'Europäisches Kupfer, Ende 15. bis Mitte 17. Jahrhundert: Ergebnisse eines Kolloquiums,' in *Schwerpunkte der Kupferproduktion und des Kupferhandels in Europa*, ed. Hermann Kellenbenz (Cologne, 1977), 290-351; Hermann Kellenbenz, 'Production and Trade of Gold, Silver, Copper, and Lead from 1450 to 1750,' in *Precious Metals in the Age of Expansion*, ed. Hermann Kellenbenz (Stuttgart, 1981), 307-61; Adolf Laube, *Studien über den erzbergischen Silberbergbau von 1470 - 1546* (Leipzig, 1974); Oszkar Paulinyi, 'The Crown Monopoly of the Refining Metallurgy of Precious Metals and the Technology of the Cameral Refineries in Hungary and Transylvania in the Period of Advanced and Late Feudalism (1325-1700),' in *Precious Metals in the Age of Expansion*, ed. Hermann Kellenbenz (Stuttgart, 1981), 27-39; Georg Schenk, 'Über die Anfänge des Silberbergbaues von St. Joachimsthal,' *Der Anschnitt*, 19 (1967) and 20 (1968); Philippe Braunstein, 'Innovations in Mining and Metal Production in Europe in the Late Middle Ages,' *The Journal of European Economic History*, 12 (1983): 573-91.

some considerable margin, because of periodic lacunae in the annual data for many of the mines so listed above, and furthermore because of the exclusion of many other important mines whose output data were too sporadic and discontinuous for calculating annual means. Nevertheless, some individual statistics of annual silver outputs can be given for the following *additional* mines in various scattered years: for Rammelsberg (South Germany): 2,105 kg in 1526; for Freiberg (South Germany): a mean of 2,100 kg in 1526-30; for Rattenberg (Austria): 1,503 kg in 1528; for Salzburg (Austria): 2,250 kg in 1520; and for Tirol other than Schwaz: 14,812 in 1486; 8,851 kg in 1505; 15,710 kg in 1523; and 10,013 kg in 1530.<sup>15</sup>

If aggregate estimates extrapolated from combining these two data sets would evidently lie between those of Soetbeer and Nef -- though perhaps closer to Nef's estimates for the 1520s, we are still quite justified in contending that the magnitude of this Central European mining boom vastly exceeded the scale of Spanish-American silver imports for the first half of the sixteenth-century. As Table 2 indicates, not until the decade 1531-40 are the first *significant* silver imports recorded at Seville, with an annual (estimated) mean of 8,619 kg. Annual mean imports rise, thereafter, to 17,757 kg in 1541-50, to 30,312 kg in 1551-60, and finally leap to an estimated mean of 94,286 kg in 1561-70, when mean annual silver outputs at Potosi (Viceroyalty of Peru) and Zacatecas (Mexico) combined had reached 83,529 kg. By that time, the Central European silver mines were experiencing diminishing returns and falling outputs; and they could not compete with the cheaper Spanish-American silver imports, whose costs had fallen sharply with the mercury amalgamation process.<sup>16</sup>

To understand the origins, nature, and true significance of this South German-Central European

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<sup>15</sup> See sources cited in n. 14 above.

<sup>16</sup> See Hamilton, *Price Revolution*, 11-45; Harry E. Cross, 'South American Bullion Production and Export, 1550-1750,' and John H. TePaske, 'New World Silver, Castile, and the Philippines, 1590-1800,' in *Precious Metals in the Later Medieval and Early Modern Worlds*, ed. John F. Richards (Durham, N.C., 1983), 397-423, 425-39; Nef, 'Silver Production,' 575-91; John Nef, 'Mining and Metallurgy in Medieval Civilisation,' in *The Cambridge Economic History of Europe, 2: Trade and Industry in the Middle Ages*, 2nd rev. edn., ed. M. M. Postan and E. E. Rich (Cambridge, 1987), 691-761 (1st edn. published in 1952); Flynn, 'Sixteenth-Century Inflation', 157 - 69.

silver *and* copper mining boom, we must go back to the very severe monetary contraction that had beset the west European economy in the mid-fifteenth century, in particular from the 1440s to the 1470s, when most mints had drastically reduced their coinage outputs and many had been forced to close.<sup>17</sup> Whether this so-called ‘bullion famine’ was the consequence of a contraction in monetary stocks or in monetary flows, the consequence, certainly for north-west Europe, was a pronounced and persistent deflation, affecting industrial and livestock prices as well as grain prices. In England, as Table 1 indicates, the Phelps Brown & Hopkins composite price index fell by 26.2 percent, from a quinquennial mean of 122.0 in 1436-40 to one of 90.0 in 1476-80, despite Edward IV’s 20 percent debasement of the silver coinage in 1464-5.<sup>18</sup> In Flanders and Brabant, the deflationary nadir was reached earlier, in the 1460s, because of the ensuing and more severe Burgundian coinage debasements (1466-92). From 1436-40 to 1461-65, the similarly-weighted Flemish

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<sup>17</sup> See Spufford, *Money and Its Use in Medieval Europe*, 339-62; Peter Spufford, *Monetary Problems and Policies in the Burgundian Netherlands, 1433-1496* (Leiden, 1970), 74-129, 173-99; John Munro, *Wool, Cloth and Gold: The Struggle for Bullion in Anglo-Burgundian Trade, ca. 1340-1478* (Brussels, 1973), 127-79; John Munro, ‘Bullion Flows and Monetary Contraction in Late-Medieval England and the Low Countries,’ in *Precious Metals in the Later Medieval and Early Modern Worlds*, ed. John F. Richards (Durham, 1983), 97-158; reprinted with other essays on this theme, in John Munro, *Bullion Flows and Monetary Policies in England and the Low Countries, 1350 - 1500* (Aldershot, 1992); Day, ‘Great Bullion Famine,’ 1-54; Harry Miskimin, ‘Monetary Movements and Market Structures: Forces for Contraction in 14th and 15th Century England’, *Journal of Economic History*, 24 (1964): 470-90; reprinted with other relevant studies in Harry A. Miskimin, *Cash, Credit, and Crisis in Europe, 1300-1600*, Variorum Reprints CS 289 (London, 1989); Harry Miskimin, *The Economy of Early Renaissance Europe, 1300-1460* (1969; reissued Cambridge, 1976), 138-50; Nicholas Mayhew, ‘The Monetary Background to the Yorkist Recoinage of 1464-1471’, *British Numismatic Journal*, 44 (1974): 62-73; Mayhew, ‘From Regional to Central Minting, 1158-1464,’ pp. 83-178. See also nn. 22, 26-27, 29 below.

<sup>18</sup> By this debasement, the fine metal content of the silver penny was reduced exactly 20.00 percent from 0.8991 g. to 0.7193 g., which reduction thereby raised the value of a Tower Pound of silver 25.00 percent : from 30s 0d. to 37s 6d. sterling (or, per kilogram of fine silver, from £4.634 to £5.793). The reciprocal relationship between a debasement and the corresponding increase in the money-of-account value of the mint-weight of fine silver or gold is expressed by the equation:  $\Delta T = [1/(1 - x)] - 1$ : in which T (*traite*) is the coined value of the mint weight (Tower Pound) in money-of-account, and *x* is the percentage reduction in the fine-metal content of the penny or other link-money for this money-of-account. In August 1464 and in March 1465, Edward IV reduced the fine gold content of the noble from 6.998 g. to 5.184 g, a reduction of 25.92 percent, which raised the value of the gold coinage (angel-noble and the new ryal or rose noble) by 35.0 percent, from £16.667 to £22.50 per Tower Pound of fine gold, the equivalent of a 25 percent debasement, by this formula. See Munro, *Bullion Flows and Monetary Policies*; and above nn. 5, 17; below nn. 23, 25.

composite price index fell by 36.7 percent : from a quinquennial mean of 140.2 to one of 88.7; and the comparable Brabantine composite index fell by 27.4 percent : from a mean of 125.4 to one of 91.1.<sup>19</sup>

Since these are all *silver-based* price indices, that deflation necessarily reflects a rise in the value of silver: each ounce or gram of fine silver commanded a greater quantity of goods represented in the composite price index. We may legitimately assume that silver had become more valuable because it had become more costly to produce and thus scarcer in supply, with the closure of so many European mines and with sharply declining outputs of those that struggled to remain open. According to Nef and Braunstein European silver-mining had experienced no significant technical improvements since the later Roman era; and, by the early fifteenth century, as silver-seams became less accessible, many mines had fallen victim to diminishing returns, severely rising marginal costs, and often drastic flooding. As a major example, silver outputs from the Bohemian mines at Kutna Hora, once the most productive in Europe, had fallen from a mean of about 30,000 kg a year in 1300-30 to one of about 10,000 kg in 1370-1420, and to just 4,500 kg in the 1460s, even after recovering from the physical disruptions of the Hussite Wars (1419-36).<sup>20</sup>

These circumstances, but in particular the rising commodity value of silver, as reflected by the mid-century deflationary trends, therefore provided the economic incentives that help to explain the dramatic technological revolutions that sparked a veritable mining boom in both silver and copper in South Germany and adjacent zones in Central Europe from the 1460s. That this region contained vast deposits of argentiferous-cupric ores had long been known; but only with the development of this twin set of technological innovations did their exploitation finally prove to be economically feasible. The first and most

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<sup>19</sup> In Table 1, the price indices are constructed with the base 100 = mean of prices in 1451-75, and the base 100 = mean of prices in 1501-10. For the construction of these indices, see John Munro, 'Mint Outputs, Money, and Prices in Late-Medieval England and the Low Countries,' in *Münzprägung, Geldumlauf, und Wechselkurse/ Minting, Monetary Circulation, and Exchange Rates: Akten des 8th International Economic History Congress*, ed. Eddy Van Cauwenberghe and Franz Irsigler, *Trierer Historische Forschungen*, vol. 7 (Trier, 1984), 31-122; and the sources of Table 1.

<sup>20</sup> See the publications of Nef, Braunstein, Westermann, and others cited in nn. 14 above.

important was the *Saigerhüttenprozess*, a chemical process that utilized lead in smelting to separate the silver from the copper ores. The other key innovations were mechanical devices to resolve the widespread problem of flooding in mountainous mines: chiefly with water-and-horse-powered drainage pumps and better designed adits or drainage tunnels, which thus permitted much deeper shafts to be constructed.

Although experimentation with these processes had begun in the early fifteenth-century, they were not applied on any significant scale until economic conditions became more propitious, by the 1450s: as indicated by the licence that the Duke of Saxony issued for the *Saiger* process in 1451, and by the inventory of a Nürnberg smelter-foundry in 1453. Shortly thereafter, evidence for the application of the *Saiger* process multiplies: at the Eisleben mines in Thuringia (Schleusingen, 1461; Gräfenthal and Hohenkirchen, 1462; Steinbach, 1464); and at Mogilà, near Cracow (1469); and at Chemnitz, in Saxony (1471). By the early 1470s, as Table 7 indicates, the first detailed evidence is recorded for newly mined silver outputs, when the Saxon mines of Schneeberg, Annaberg, and Marienberg produced a combined mean annual output of 4,360.9 kg of silver, while those of Schwaz in the Austrian Tirol produced a mean output of 4,113kg of silver (compared to an estimated mean output of about 4,500 kg at Kutna Hora). By 1486-90, the mean annual output of the Central European silver mines (those specified above and the Hungarian mines) had risen to 22,794 kg; and within just twenty years (i.e. in 1506-10), those silver-mining outputs had risen to an annual mean of 34,563 (Table 3). Surely, by that time, this Central-European silver mining boom should have resolved any 'silver-famine' that western Europe may have experienced at the close of the medieval era.

Somewhat fortuitously, a combination of monetary, fiscal, and commercial policies in England and the Burgundian Netherlands helped to attract a very sizeable proportion of those Central European silver outputs, chiefly under the control of South German merchant-financiers, to north-west Europe and to the Antwerp market in particular, i.e. in diverting a growing share of these metals from the hitherto more important re-export markets in Danzig and especially in Venice. In the first place, those policies had allowed England to become Europe's overwhelmingly dominant producer and exporter of quality woollen textiles,

virtually vanquishing competitive industries in the Low Countries, while exporting an ever increasing share of those cloth across the channel to Antwerp. While Flanders, with its major port of Bruges, had consistently banned the importation and sale of English woollens, the far less developed port of Antwerp, with no local cloth industry to protect, had offered its services, as early as the 1420s, as both a cloth finisher (dyeing and shearing) and entrepôt for the distribution of those woollens to continental markets, attracting first Rhenish and then South German merchants, who sought such finished cloths as their primary re-export product from the Brabant Fairs. Indeed, the London-based Merchants Adventurers, the overwhelmingly dominant cloth exporters, had chosen Antwerp as their overseas ‘mart’ or commercial headquarters in 1420.<sup>21</sup> Secondly, as noted earlier, in 1464-65 the English crown had devalued the silver coinage by 20 percent and gold by 26 percent, producing a fall in the exchange rate on the pound sterling, but without fuelling any inflation within the still deflated English economy (Table 1).<sup>22</sup> The consequent drop in English cloth prices on the Antwerp market thus made these woollens an even more attractive return cargo for the German merchants. Shortly after, in 1466, the Burgundian government also debased its coinages, though more modestly: silver, by 13 percent and gold by 4 percent. The consequence was a very sharp alteration in the Low Countries’ mint ratio, from one that had been strongly pro-gold to one that became even more strongly pro-silver, for the next 35 years (while England's was conversely pro-gold), more so than other rival mints in north-west Europe; and that mint-ratio alteration was undoubtedly an important factor in attracting a much

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<sup>21</sup> See Van der Wee, *Antwerp Market*, 2:37-123; and the various essays in Herman Van der Wee, *The Low Countries in the Early Modern World* (Variorum: Cambridge University Press, 1993); John Munro, *Textiles, Towns, and Trade: Essays in the Economic History of Late-Medieval England and the Low Countries*, Variorum Collected Studies series CS 442 (Aldershot, 1994); and John Munro, ‘Anglo-Flemish Competition in the International Cloth Trade, 1340 - 1520,’ in *Rencontres d'Oxford (septembre 1994): L'Angleterre et les pays bas bourguignons: relations et comparaisons, XVe - XVIe siècle*, ed. Jean-Marie Cauchies, *Publication du centre européen d'études bourguignonnes*, 35 (1995), 37-60; John Munro, ‘The Symbiosis of Towns and Textiles: Urban Institutions and the Changing Fortunes of Cloth Manufacturing in the Low Countries and England, 1270 -1570,’ *The Journal of Early Modern History: Contacts, Comparisons, Contrasts*, 3:1 (February: 1999): 1-74.

<sup>22</sup> See n. 18 above.

greater number of South German merchants with their silver, copper, fustian textiles, and banking-financial institutions to Antwerp.<sup>23</sup>

Indeed, all these developments helped to ensure Antwerp's primacy as Europe's leading commercial and financial centre, which ultimately encouraged the Portuguese to make Antwerp their official staple for Asian spices, in 1501, temporarily undermining Venetian mastery in the European spice trade. At Antwerp, the Portuguese sought commercial financing from South German merchant-bankers, German fustian textiles for their African trade, and two important commodities for their Asian trades: the Central European silver and copper, both of which commanded a much higher purchasing power in Asia than in Europe, because of their relative scarcity in the East. The consequent differential in the bimetallic ratios -- then 11.2:1 in north-western Europe, and 9:1 or 10:1 in South Asia and the Levant -- meant that normally silver was the more profitable metal to be shipped to Asia -- and as good ballast, when so few European manufactures found markets there, because of their relatively high costs (production *plus* transport) and lower quality.<sup>24</sup> To these important points we shall return almost immediately, after first posing a more fundamental question.

The central question is simply this: why did the Price Revolution occur so late, rather than so early? Why did this vast increase in western Europe's silver supplies not produce any significant inflation before ca. 1515-20, especially in the England and the Low Countries, in view of all the forces that had been attracting silver to this region from the 1460s? Surely, those two-pronged sets of technological innovations, chemical and mechanical, greatly reduced the cost of producing silver and augmented its supply quite dramatically. By the reasoning cited earlier, we should expect that cheaper and more abundant silver would

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<sup>23</sup> Van der Wee, *Antwerp Market*, 1:126-28, Table XV; 2:80-101; Munro, *Wool, Cloth and Gold*, 155-80, 198-211, Tables C-K; sources also sources cited in nn.17-20 above.

<sup>24</sup> Van der Wee, *Antwerp Market*, 2:119-42; J.A. Van Houtte, 'La genèse du grande marché international d'Anvers à la fin du moyen âge,' *Revue belge de philologie et d'histoire*, 19 (1940): 87-126; J.A. Van Houtte, 'Bruges et Anvers: marchés 'nationaux' ou 'internationaux' du XIVe au XVIe siècle?' *Revue du Nord*, 24 (1952): 89-108; J.A. Van Houtte, 'Anvers aux XVe et XVIe siècle,' *Annales: E.S.C.*, 16 (1961): 248-78.

have resulted in higher commodity prices: i.e. that a kilogram of silver would have commanded an ever smaller basket of goods by the 1490s. But in England, in 1496-1500, as Table 1 indicates, the Phelps Brown & Hopkins mean quinquennial commodity-price index was only 96.7; in 1506-10, it had risen only slightly, to one of 103.8 and then to one of 108.5 in 1511-15; but then it jumped to 120.4 in 1516-20 and to 146.1 in 1521-25 (a mean of 138.7 with the alternative base of 1501-10), i.e. *before* Henry VIII's first and minor debasement, in 1526. In the cross-Channel Low Countries, Van der Wee's mean quinquennial composite index for Brabant had much earlier, in 1486-90, risen to 174.10, but only because of Archduke Maximilian's severe debasements during the civil-war period (especially 1485-89); and with a return to a stronger coinage in 1490 (with several minor debasements in 1492-96), the mean index fell to 115.4 by 1496-1500. By 1511-15, however, it had risen back to 137.9, to 150.3 in 1515-19, and then soared to 179.9 in 1521-25. In Spain, the supposed homeland of the Price Revolution, but one that was totally free from any coinage debasements, the composite price index did not begin any sustained rise above the base 100 (for 1501-10) until about 1520, rising from a quinquennial mean of 122.1 in 1521-25 to one of 131.6 in 1526-30 and then to a mean of just 132.4 in 1531-35, rising at a consistently slower pace, from the 1520s, than in either the Low Countries or England.<sup>25</sup>

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<sup>25</sup> Indeed as Table 1 also indicates, the rate of inflation was generally greater in the Low Countries and England than it was in Spain (Castile), from the 1520s; and although accelerating in all three from the 1550s, the rate was the weakest in Spain. Using the common base of 100 for the decade 1501-10, the composite mean quinquennial price indices at the end of the Price Revolution era, in the late 1640s, were: 343.4 in Spain, if measured only in silver-based prices; but 457.1 in terms of *vellon* (copper) based coinages; 845.1 in Brabant; and 697.5 in England. Among many reasons that would explain this differential between northern and southern inflation rates, two seem to be predominant: (1) extensive coinage debasement in the Low Countries, the Henrician debasements in England (1542-51), but a complete absence of coinage debasement in Spain, until the issue of the all-copper *vellon* coinage of 1599 (with no change in the silver coinage itself before Dec. 1624); and (2) the role of Spanish foreign trade and finance: so that so much of the influx of silver into Spain left the country so quickly, particularly in financing debts and warfare abroad (in Italy, France, the Low Countries). On the Spanish monetary systems, see Hamilton, *Price Revolution*, 46-71 (for gold and silver in Castile); 72-103, 211-23 (on the '*vellon* inflation' in Castile, 1598-1650); and Table 7, p. 96, providing the annual premiums of silver over *vellon* coinage, which Hamilton used to deflate his *vellon* based price-indices of 1599-1650 into a silver-based price-index. See also: Ulloa, 'Castilian Seigniorage and Coinage', 459-80; Motomura, 'Seigniorage and Currency Policy in Spain, 1597 - 1650,' 104 - 27; Motomura, 'Money Supply in Spain (Castile),' 331-67.



One possible and certainly obvious reason why the Central European silver mining boom did not immediately produce inflationary conditions in western Europe, not before the 1520s, is that considerable if unknown amounts of those mined outputs were then being exported to the Levant. The principal conduit was Venice, which, since the later fourteenth century, had developed very close economic relations with both the Levant and South Germany; and in the latter with the Fuggers and other merchant financiers who controlled the major silver and copper mines of Central Europe. In the Levant, although Venice had certainly gained the greater share of its commercial prosperity from importing eastern spices, via both Alexandria and Beirut, it had also developed an important import trade in Syrian cotton, which it furnished as the key input for the South German fustian textile industries (Ulm, Augsburg, Nürnberg, Ravensburg, Regensburg, Constance, and Basel).<sup>26</sup> In return for that cotton the Venetians purchased more and more South German silver and copper to expand their trade with the Levant. By the later 1490s, when Venetian trade had reached its apogee, the value of Levantine-Asian goods that Venice was then importing into Europe amounted to about 1.1 million ducats per year.<sup>27</sup> To acquire those goods, Venice exported to the Levant some manufactures -- various European textiles, glasswares, soap, paper products -- but chiefly raw materials, of which the most two important were silver and copper, along with some gold, foodstuffs, iron, and timber.

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<sup>26</sup> See Hermann Kellenbenz, 'The Fustian Industry of the Ulm Region in the Fifteenth and Early Sixteenth Centuries,' in *Cloth and Clothing in Medieval Europe: Essays in Memory of Professor E. M. Carus-Wilson*, ed. Negley B. Harte and Kenneth G. Ponting, Pasold Studies in Textile History no. 8 (London, 1983), 259-78; Wolfgang von Stromer, *Die Gründung der Baumwollindustrie in Mitteleuropa: Wirtschaftspolitik in Spätmittelalter* (Stuttgart, 1978).

<sup>27</sup> Eliyahu Ashtor, *Levant Trade in the Later Middle Ages* (Princeton, 1983), 103-200, 433-512; Eliyahu Ashtor, *Les métaux précieux et la balance des paiements du Proche-Orient à la basse-époque* (Paris, 1971); Eliyahu Ashtor, *A Social and Economic History of the Near East in the Middle Ages* (London, 1976), 319-31; Eliyahu Ashtor, 'The Venetian Supremacy in Levantine Trade: Monopoly or Pre-Colonialism?' *Journal of European Economic History*, 3:1 (Spring 1974): 5 - 53; Eliyahu Ashtor, 'The Volume of Levantine Trade in the Later Middle Ages (1370 - 1498),' *Journal of European Economic History*, 4:3 (Winter 1975): 573 -6; Eliyahu Ashtor, 'Profits from Trade with the Levant in the Fifteenth Century,' *Bulletin of the School of Oriental and African Studies*, 37 (1975): 250-75; Eliyahu Ashtor, 'The Venetian Cotton Trade in Syria in the Later Middle Ages,' *Studi Medievali XVII* (Spoleto, 1976): 675-715. The last four articles cited have been reprinted in Eliyahu Ashtor, *Studies on Levantine Trade in the Middle Ages*, Variorum Reprints CS74 (London, 1978).

Ashtor has also estimated that the exports of silver and gold, but primarily silver, then averaged about 660,000 gold ducats (3.56 g.) a year in value = 2,349 kg fine gold, or the equivalent of about 26,167 kg fine silver. At this same time, in 1496-1500, as Table 8 indicates, the *mean* annual mint outputs in England, Flanders and Brabant (i.e. the major minters of the Habsburg Low Countries) combined were of a far smaller magnitude: just 7,363.9 kg of fine silver and 753.6 kg of fine gold.<sup>28</sup>

While Ashtor and other historians have treated these very large precious-metal shipments negatively, as a ‘bullion outflow’ to ‘remedy a chronic deficit in balance of payments’, the Venetians evidently viewed them positively as just another commodity export, as did the Dutch in the seventeenth and eighteenth centuries. So should we: and thus understand that South Germany’s increased sales of mined silver thereby led to increased Venetian imports of Syrian cotton for its fustian industries, which in turn allowed Venetian merchants to increase their acquisition of Levantine and other Asian goods. Unfortunately many historians have misused Ashtor’s data by unjustifiably projecting back into the later Middle Ages an equally ‘serious balance of payments deficit’ and thus a supposedly large bullion outflow to the East.<sup>29</sup> But clearly, over the course of the fifteenth century, Venice had substantially increased both the volume and value of its trade with Syria and Egypt: its pepper imports had almost doubled, from about 360,000 kg to about 675,000 kg, while ginger imports had almost tripled, from 78,750 kg to 225,000 kg per year; and imports of Syrian cotton had also more than doubled in value from about 40,000 ducats (2500 sacks) to about 100,000 ducats annually. Overall, Venetian trade with the Levant had grown by about 33 percent in value; and while some of that gain was achieved at the direct expense of Genoa and other western maritime rivals, the rest represented a net increase in aggregate European demand, despite continuing demographic stagnation or decline in many

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<sup>28</sup> Munro, ‘Bullion Flows and Monetary Contraction’, 101-02; 142-43, Table 7; see n. 17 above.

<sup>29</sup> See Miskimin, *Economy of Early Renaissance Europe*, 25-32, 132-50; Miskimin, ‘Monetary Movements and Market Structures, 470-90; Spufford, *Money and Its Use*, chapter 15: ‘The Bullion-Famines of the Later Middle Ages,’ 339-62; Day, ‘The Great Bullion Famine,’ 1-54; see also nn. 17, 27 above.

regions, a demand certainly fuelled by increasing outputs of South German silver, from the 1460s.<sup>30</sup>

Nevertheless, despite these Venetian commercial successes, growing quantities of German silver were indeed flowing to the Antwerp market, for reasons already noted. There its impact can be seen in the combined mint outputs of Flanders and Brabant: a total of 205,103 kg pure silver coined in 1471-1500, 7.24 times as much silver as was coined in the previous three decades (28,347 kg in 1441-70), though admittedly some of that increase reflected severe coinage debasements, particularly those of Archduke Maximilian (1483-89).<sup>31</sup> In England, however, the aggregate silver coinage outputs for 1476-1500 amounted to only 32,592 kg (in pure metal), less than half those for the preceding quarter-century: 69,497 kg. in 1451-75. The reason for these differences in mint outputs (apart from Edward IV's debasement-recoinage of 1464-5) has already been suggested: from 1465, an English bimetallic mint ratio more favourable to gold than the Low Countries' mint ratio, which consequently 'favoured' silver, so that the Flemish-Brabantine mints gained far more silver.

For the Low Countries at least, one may still ask why the influxes of German silver and the increased silver coinage outputs did not produce any significant inflation before c.1515 (i.e. apart from Maximilian's debasement-civil war era). There is, however, no *a priori* reason to assume, as did the strict Quantity Theorists, that any such increase in coin stocks would or should have led to a proportional rise in prices -- or indeed to any price rise at all. To illustrate this theorem of 'indeterminacy' let us employ a prime tool of the Quantity Theory in the form of a modernized version of the famed Fisher Identity:  $M.V = P.y$ , in which, on the right side of the equation,  $P$  is an index of the national economy's commodity price

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<sup>30</sup> See sources cited in n. 27 above.

<sup>31</sup> See in particular Spufford, *Monetary Problems and Policies in the Burgundian Netherlands*, 141-46, 180-93; Van der Wee, *Antwerp Market*, 1: 127-28, and 2:95-112; Munro, *Wool, Cloth, and Gold*, 65-126, 155-80; Munro, 'Bullion Flows and Monetary Contraction', 116-20, 131-55 (Tables 1-10). The debasements of Maximilian were perhaps matched in intensity by those of the Burgundian duke Philip the Good, from 1424 to the monetary unification of 1433-35. To compare quarter-century outputs: in 1426-50, 80,712.44 kg fine silver; in 1451-75 (with some debasements by Philip the Good and Charles the Bold), 59,649.79 kg fine silver; in 1476-1500, 134,349.10 kg fine silver).

level, such as Phelps Brown & Hopkins ‘consumables price index’;  $y$  represents *real net national income in constant monetary units*. Thus in Keynesian terms,  $y = Y/P$  (Net National Income in current money divided by the price index) = Consumption + Investment + Government Expenditures + [Exports - Imports];<sup>32</sup>  $M$  = the monetary stock; and  $V$  = the *income velocity* of this monetary stock. For most economists, however, the Cambridge ‘cash balances’ equation  $M = k.P.y$  provides a better variant, because  $k$ , which is mathematically the reciprocal of  $V$ , represents the more useful concept of the ‘demand for money’: i.e. that proportion of net national income ( $=P.y$ ) that the public collectively chooses to hold in real cash balances, reflecting the constituent elements of Keynesian liquidity preference (in terms of the transactions, precautionary, investment, and speculative motives for holding money). The opportunity cost of holding such real cash balances is obviously the foregone investment income. As Keynes himself observed, in opposing the Quantity Theory, an increase in  $M$  not accompanied by any change in the Liquidity Preference schedule should, *ceteris paribus*, produce a fall in interest rates, thus inducing a rise in  $k$  and a commensurate fall in  $V$ ; and such a fall in  $V$  would also be expected since increased stocks of money should have reduced the need to economise on its use. Keynesian economists also contend that such an increase in  $M$ , or in the rate of growth of money stocks, would also have been accompanied by some offsetting rise in  $y$  (i.e. in *real NNI*), whether exogenously created or endogenously induced by related forces of monetary expansion. In an economy with drastically underemployed resources, such as the one that Keynes observed in the Depression years of the early 1930s, these two changes in  $k$  ( $= 1/V$ ) and  $y$  might have fully offset any inflationary effects on prices otherwise to be expected from increases in money stocks ( $M$ ). At few other times in European history, have economic resources, and in particular land resources, been so ‘drastically underemployed’ as in the mid-fifteenth century, following the nadir of the late-medieval ‘great depression’

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<sup>32</sup> Usually expressed as:  $Y = C + I + G + [X-M]$ , in which  $X$  is total Exports and  $M$  is not the money stock but the total value of Imports; and thus  $y$  is  $Y/P$ , or  $Y$  deflated by some given price index.

or secular economic decline, after Europe had lost about half of its population.<sup>33</sup> An increase in aggregate demand, first from an expanding money supply and then from a recovering population, could have restored much good land to production and increased physical outputs, without any rise in marginal costs and thus in prices. As Keynes himself observed, however, these ‘offsetting’ conditions could not hold true for long:<sup>34</sup>

It is probable that the general level of prices will not rise very much as output increases, so long as there are available efficient unemployed resources of every type. But as soon as output has increased sufficiently to begin to reach the ‘bottle necks’, there is likely to be a sharp rise in the prices of certain commodities.

That situation can be related to the now well-known Phillips Curve:<sup>35</sup> as aggregate demand increases, investment and production increase, and unemployment falls; but eventually aggregate output does not rise proportionally with the increase in aggregate demand, as supplies in various sectors become less elastic, with rising marginal costs, so that prices rise for more and more commodities and services. This situation could also be portrayed on a graph as a series of aggregate demand curves, combining increases in population with an increased volume of money payments, moving upwards along an ‘historic’ aggregate supply schedule,

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<sup>33</sup> See in particular John Hatcher, ‘The Great Slump of the Mid-Fifteenth Century,’ in *Progress and Problems in Medieval England: Essays in Honour of Edward Miller*, ed. Richard Britnell and John Hatcher (Cambridge, 1996), 237-72; John Hatcher, *Plague, Population and the English Economy, 1348-1500* (London, 1977); Van der Wee, *Antwerp Market*, 1:545-48; 2:7-112, 289-319; John Munro, ‘Economic Depression and the Arts in the Fifteenth-Century Low Countries,’ *Renaissance and Reformation*, 19 (1983): 235-50; reprinted with other relevant essays in John Munro, *Textiles, Towns, and Trade* (London, 1994); Ferdinand Seibt and Winifried Eberhard, eds., *Europa 1400: Die Krise des Spätmittelalters* (Stuttgart, 1984); John Day, ‘Crises and Trends in the Late Middle Ages,’ in his *Medieval Market Economy* (1987), 185-224. [Translation of ‘Crisi e congiunture nei secoli XIV e XV,’ in *La Storia: I grandi problemi* (Turin, 1988).]

<sup>34</sup> John Maynard Keynes, *The General Theory of Employment, Interest, and Money* (London, 1936), 300; and in the following paragraph, he states: ‘Under this heading, however, ... the elasticity of supply will be decidedly greater eventually. thus a moderate change in effective demand, coming on a situation where there is widespread unemployment, may spend itself very little in raising prices and mainly in increasing employment; whilst a larger change, which, being unforeseen, causes some temporary ‘bottle-necks’ to be reached, will spend itself in raising prices, as distinct from employment, to a greater extent at first than subsequently.’

<sup>35</sup> A. W. Phillips, ‘The Relation Between Unemployment and the Rate of Change of Money Wage Rates in the United Kingdom, 1861 - 1957,’ *Economica*, 25 (1958): 283 - 299.

originally flat, but becoming more and more steeply sloped over time.

Consequently any such historical analysis of inflation must observe the changing behaviour of both monetary and real variables: i.e. the capacity of  $y$  to respond to increases in  $M$  and/or  $V$ , or indeed to increase independently of them. Furthermore, if we were now to join the majority of historians who consider demographic change to be the most important 'real' variable, we might argue that, by c.1520, the impact of continuing population growth on relatively inelastic resources, and a population growth that exceeded additions to capital stocks, was now leading to such conditions of diminishing returns, rising marginal costs, and thus rising prices. The historical difficulty with such a thesis, however, is the evidence that in both the southern Low Countries and England demographic recovery from the late-medieval slump had only just begun in the first two decades of the sixteenth century. In the duchy of Brabant, for example, the 1496 census lists only 75,343 households: just 81 percent of the 92,738 households recorded in 1437.<sup>36</sup> In England and Wales, the estimated population for 1523 is only 2.3 million, compared to estimates of 2.75 million for 1377 and about 4.5 million for 1300 (if not the 6 - 7 million suggested by some historians).<sup>37</sup> Such demographic data, therefore, do not fortify the belief that population growth and 'diminishing returns' could possibly have been responsible for the commencement of inflation in the decade 1511-20, by inducing supply rigidities in the face of more rapidly expanding volume of money payments -- not with a population that was probably still under half western Europe's medieval peak.

Changes in the income velocity of money also do not appear, *prima facie*, to be a likely cause of the

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<sup>36</sup> Joseph Cuvelier, *Les dénombrements de foyers en Brabant, XIVe - XVIe siècle*, 2 vols. (Brussels, 1912-13), 1:432-3, 446-7, 462-77, 484-7; and also pp. cxxxv, clxxvii-viii, ccxxiii-xviii; Van der Wee, *Antwerp Market*, 1: 545-48, Appendices 49:1-2.

<sup>37</sup> See in particular Ian Blanchard, 'Population Change, Enclosure, and the Early Tudor Economy,' *Economic History Review*, 2nd ser. 23 (1970): 427-45; Julian Cornwall, 'English Population in the Early Sixteenth Century,' *Economic History Review*, 2nd ser. 23 (1970): 32-44; E. A. Wrigley, R.S. Davies, J.E. Oeppen, and R. S. Schofield, *English Population History from Family Reconstitution*, Cambridge Studies in Population, Economy and Society in Past Time no. 32 (Cambridge, 1997); Pamela Nightingale, 'The Growth of London in the Medieval English Economy,' in *Progress and Problems in Medieval England*, ed. Richard Britnell and John Hatcher (Cambridge and New York, 1996), 89-106.

initial phase of the European Price Revolution; for, as indicated earlier, many economists would posit that, *ceteris paribus*, an increase in money stocks, if indeed they did so increase, should have led to a fall in interest rates, a rise in  $k$  and thus a commensurate fall in  $V$ . Table 3 and the subsequent analysis provides the evidence for monetary expansion, while the published data of Van der Wee's research on the Antwerp money market indicate that nominal interest rates, on short-term loans to government authorities, did fall in this era: in Bruges, from about 20 percent in 1500 to 10.5 percent in 1546; in Antwerp, similarly from 20 percent in 1511 to 11 percent in 1546. But some of this decline may reflect a reduction in the risk premium; and the greater part of the fall in interest rates took place after 1530.<sup>38</sup>

Furthermore, whatever the longer-term historical validity of the Keynesian view, most monetary historians argue that  $V$  evidently rose rather than fell during the sixteenth century, indeed to become a major factor in the inflation of the Price Revolution era. The best exponent of this viewpoint is Jack Goldstone, who skilfully combines factors of economic and demographic growth, with disproportionate urbanization, a rapid spread of a fully monetized market economy, and a commensurate growth in credit usage, to produce a complex model of 'financial/exchange networks', with the following theorem: 'in *occupationally specialized linked networks*, the potential velocity of circulation of coins grows as the square of the size of the network'.<sup>39</sup> Indeed, his Velocity- and urban-oriented explanation of the English Price Revolution, in the context of Tudor-Stuart economic development, seems most plausible, indeed quite convincing, until direct comparisons are made with the cross-Channel Low Countries. As Table 1 suggests, the rates and extents of

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<sup>38</sup> Van der Wee, *Antwerp Market*, 1: 526-27, Appendices 45:1-2.

<sup>39</sup> Jack A. Goldstone, 'Urbanization and Inflation: Lessons from the English Price Revolution of the Sixteenth and Seventeenth Centuries,' *American Journal of Sociology*, 89 (1984): 1122-60; Jack A. Goldstone, 'The Causes of Long Waves in Early Modern Economic History,' in *The Vital One: Essays in Honor of Jonathan R. T. Hughes*, ed. Joel Mokyr (*Research in Economic History*, Supplement no. 6, Greenwich, Conn., 1991), 51 - 92; Jack A. Goldstone, 'Monetary Versus Velocity Interpretations of the 'Price Revolution': A Comment,' *Journal of Economic History*, 51 (March 1991): 176 - 81. But see also Michael D. Bordo, 'Explorations in Monetary History: A Survey of the Literature,' *Explorations in Economic History*, 23 (1986), 339-415.

inflation were roughly parallel in both southern England and the southern Low Countries, despite very dissimilar histories of economic development:<sup>40</sup> especially in that the Low Countries had achieved the requisite levels of urbanization and a fuller evolution of ‘financial/exchange networks’ so much earlier than had England, though not yet the full negotiability of financial instruments, an issue to be explored later.<sup>41</sup> Amongst others who have critiqued the Goldstone model, Peter Lindert has suggested an alternative model: that population growth, by increasing the ratio of dependent children to adults, by raising relative food prices, thus diminishing real household incomes, reduced the demand for idle cash balances, induced dishoarding, and so increased the income-velocity of money<sup>42</sup>. But it is unclear that this could have been a sustained process over the longer run.

More recently, in a detailed critique of the Goldstone model, Nicholas Mayhew contends that the undisputed rise in Velocity during the sixteenth-century is an aberration that counters a longer-term declining trend in the European economy, one evident from the late thirteenth century, especially during other eras of economic expansion; and, *tout en passant*, he suggests that the reason for this aberration might lie in changes to the composition of the sixteenth-century money supply, changes readily apparent in Table 7.<sup>43</sup> As noted earlier, the combined English and Burgundian monetary changes in 1464-67 meant that, while the

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<sup>40</sup> By far the best comparison can be found in the graph of composite price indices for the two countries in Herman Van der Wee, ‘Prijzen en lonen als ontwikkelingsvariabelen: Een vergelijkend onderzoek tussen Engeland en de Zuidelijke Nederlanden, 1400-1700,’ in *Album aangeboden aan Charles Verlinden ter gelegenheid van zijn dertig jaar professoraat* (Gent, 1975), 413-47; reissued in English translation (but without the tables) as ‘Prices and Wages as Development Variables: A Comparison Between England and the Southern Netherlands, 1400-1700,’ *Acta Historiae Neerlandicae*, 10 (1978), 58-78; and reprinted in Herman Van der Wee, *The Low Countries in the Early Modern World* (1992), 223-41.

<sup>41</sup> See below pp. 00 and nn. 48 - 52.

<sup>42</sup> Peter Lindert, ‘English Population, Wages, and Prices: 1541 - 1913,’ *The Journal of Interdisciplinary History*, 15 (Spring 1985): 609 - 34. But see also a critique of in Bordo, ‘Explorations in Monetary History,’: 339-415.

<sup>43</sup> Nicholas Mayhew, ‘Population, Money Supply, and the Velocity of Circulation in England, 1300 - 1700,’ *Economic History Review*, 2nd ser., 48:2 (May 1995): 238-57.



Burgundian mint ratio favoured silver coinages (10.83:1), the English mint ratio conversely favoured gold (11.16:1). Not surprisingly, in the 80-year period 1441-70 to 1511-20, 73.5 percent of England's aggregate mint output by value (£10,198,986 sterling) was in gold (£7,496,051) and 25.9 percent was in silver (£2,702,936). Subsequently, the English bimetallic mint ratio came to be relatively more favourable to silver when the free-market gold:silver ratio began to rise in favour of gold at the Antwerp Fairs: from 10.93:1 in 1511 to 12.96:1 in 1525 (though averaging 11.47:1 from 1526 to 1540).<sup>44</sup> Indeed, as Table 7 indicates, during this very decade of the 1520s, the composition of English mint outputs changed abruptly to become more and more predominantly silver. Thus in the next 80-year period, from 1521 to 1600, 74.35 percent of the aggregate value of English mint outputs (£36,235,826) was struck in silver coinage (£26,942,892 = 2,637,233 kg fine metal); and from the 1550s, silver generally accounted for over 85 percent of such outputs. It is equally illuminating to observe the dramatic rise in the aggregate values of English silver and gold coinage struck between 1476 and 1600: from a total of £609,465 sterling in 1476-1500 (32,592.4 kg silver); to £1,622,139 in 1501-25 -- well more than doubling (almost doubling in silver, to 61,315.6 kg); to £4,988,515 in 1526-50 (in silver, almost quadrupling to 236,412.0 kg -- but including the 'Great Debasement' era); to £3,195,544 in 1551-75 (288,741.2 kg silver -- including the Elizabethan recoinage of 1560); and £2,905,556 in 1576-1600 (with 283,241.3 kg silver: 8.7 times that of 1476-1500, both encompassing eras of complete mint stability).<sup>45</sup>

The significance of this change in the composition of the money-stock -- owing just as much to the increased supplies and availability of silver -- lies in the obvious fact that individual silver coins have a much

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<sup>44</sup> Van der Wee, *Antwerp Market*, 1: 128-9, Table XV.

<sup>45</sup> In the second half of the 16<sup>th</sup> century, from 62 percent to 81 percent of that silver was Spanish in origin; and most of the rest came from the Spanish-Habsburg Low Countries. See Christopher Challis, 'Spanish Bullion and Monetary Inflation in England in the Later Sixteenth Century,' *Journal of European Economic History*, 4 (1975): 381-92; Challis, 'Lord Hastings to the Great Silver Recoinage, 1464 - 1699,' 179-397; and in the same volume, Challis, 'Appendix 1. Mint Output, 1220-1985,' 673-698; G.C. Brooke and E. Stokes, 'Tables of Bullion Coined from 1337 to 1550,' *The Numismatic Chronicle*, 5th ser., 9 (1929): 27-69.

greater circulation velocity than do gold coins: as may be deduced from the fact that in 1510 one sterling silver penny could purchase 0.57 litres of Bordeaux claret or 7 smoked herrings or 1 tallow candle, while one English angel-noble (6s 8d sterling) could purchase 45.5 litres of Bordeaux claret or 558 smoked herrings, or 80 candles.<sup>46</sup> Nevertheless, while this major change in the composition of money stocks was undoubtedly a factor increasing coin Velocity, it also began rather too late to explain the onset of England's inflation.<sup>47</sup>

The other major factor, and indeed major change, that probably affected both the supply of money and its income velocity was innovations in the use of financial instruments (credit). In the view of many historians, the major role that widespread credit had earlier played, in the medieval economy, was to increase Velocity (i.e. to reduce the need for active cash balances) rather than to augment the money supply itself, on the grounds that for various legal reasons, including the universal ban on usury, credit instruments, such as the bill of exchange, were not negotiable -- i.e. could not be sold at discount and transferred to third parties -- but had to be held to maturity. For late-medieval England, however, Postan has furnished very many examples of short-term informal bills that did 'pass from hand to hand', as merchants used debt claims to offset other debts, though without legal protection for third parties (except at very high transaction costs).<sup>48</sup> For a somewhat contrary view, Spufford contends that the use of credit in the medieval economy was much more restricted than Postan suggests, arguing that even in the two financially most advanced centres, Venice and Bruges, only 10 percent of adult males had access to bank credit; and that 'the vast majority of

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<sup>46</sup> John Munro, 'The Purchasing Power of Coins and of Wages in the Low Countries and England, 1500 - 1514,' in *The Correspondence of Erasmus*, Vol. 2: *Letters 142 to 297, A.D. 1501 - 1514*, ed. Sir Roger Mynors, Douglas Thomson, and Wallace Ferguson (Toronto: University of Toronto Press, 1975), 307-45.

<sup>47</sup> For the precious-metals based Monetary Approach to the Balance of Payments, for a deeper view of the monetary aspects of long-term inflation, see n. 4 above.

<sup>48</sup> Michael Postan, 'Credit in Medieval Trade,' *Economic History Review*, 1st. ser. 1 (1928): 234-61, reprinted in Michael Postan, *Medieval Trade and Finance* (Cambridge, 1983), 1-27; Michael Postan, 'Private Financial Instruments in Medieval England,' *Vierteljahrschrift für Sozial- und Wirtschaftsgeschichte*, 23 (1930), reprinted in his *Medieval Trade and Finance*, 28-64.

transactions' still took place with coin.<sup>49</sup>

The first decisive legal steps to make credit instruments, beginning with bills of exchange and bills obligatory, more fully negotiable and transferable (i.e. guaranteeing the rights of 'bearers', as third parties) was established by London's law merchant court in 1436; and that precedent was followed by mercantile courts in Lübeck in 1499 and Antwerp in 1507. Subsequently, in 1537 and 1541, the central government of the Habsburg Netherlands established far more definitive legal terms for negotiability, protecting the financial rights of third parties, as 'bearers', in transferable bills, while also legalizing interest payments on loans up to 12 percent (hence removing another major impediment to negotiability, i.e. to discounting).<sup>50</sup>

An even more important financial development was the establishment of the Antwerp Bourse in 1531, at the very time that South German merchant-bankers and the Habsburg governments in the Netherlands and Spain were engaged in what James Tracy has called a 'financial revolution', in raising vast sums from sales of *rentes*: perpetual, heritable, but redeemable annuities, yielding from 3 percent to 7 percent, which were or became fully negotiable and transferable for any European purchaser. Undoubtedly the major but generally overlooked reason why *rentes* were now becoming universally the major vehicle of public finances was that papal bulls (1425, 1455) had declared them to be free from any taint of usury,

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<sup>49</sup> Peter Spufford, *Handbook of Medieval Exchange* (London, 1986), pp. xvi; see also Spufford, *Money and Its Use*, 339-62.

<sup>50</sup> See Herman Van der Wee, 'Anvers et les innovations de la technique financière aux XVIe et XVIIe siècles,' *Annales: E.S.C.*, 22 (1967): 1067-89; republished as 'Antwerp and the New Financial Methods of the 16th and 17th Centuries,' in Herman Van der Wee, *The Low Countries in the Early Modern World*, (1993), 145-66; Herman Van der Wee, 'European Banking in the Middle Ages and Early Modern Period (476-1789)', in Herman Van der Wee and G. Kurgan-Van Hentenrijk, eds., *A History of European Banking*, 2<sup>nd</sup> edn. (Antwerp, 2000), pp. 152-80; Herman Van der Wee, 'Monetary, Credit, and Banking Systems,' in *Cambridge Economic History of Europe, 5: The Economic Organization of Early Modern Europe*, ed. E.E. Rich and Charles Wilson (Cambridge, 1977), 322-32; Van der Wee, *Antwerp Market*, 2: 333-68; John Munro, 'The International Law Merchant and the Evolution of Negotiable Credit in Late-Medieval England and the Low Countries,' in *Banchi pubblici, banchi privati e monti di pietà nell'Europa preindustriale: amministrazione, tecniche operative e ruoli economici*, ed. Dino Puncuh, *Atti della Società Ligure di Storia Patria*, Nuova Serie, Vol. XXXI (Genoa: Società Ligure di Storia Patria, 1991), 49 - 80; reprinted in John Munro, *Textiles, Towns, and Trade: Essays in the Economic History of Late-Medieval England and the Low Countries* (1994).

because the purchaser of the annuity, in return for acquiring one or more lifetime's stream of annual income, did not require any repayment of the principal; thus no 'loan' was involved, and thus *rentiers*, unlike holders of other securities, had no fear of prosecution in marketing them at discount.<sup>51</sup> For the Low Countries, trading in such *rentes (juros)* became a very major activity of the Antwerp Bourse and of South German merchant-banking houses: led by the Fuggers, Welsers, Höchstetters, Herwarts, Imhofs, and Tuchers. In Spain, the aggregate volume of such *rentes* or *juros* rose from 3.536 million ducats (*escudos* of 375 maravedís) in 1515 to 80.039 million ducats in 1598 – representing a momentous potential expansion in the money supply. As Van der Wee has so justly commented, this sixteenth-century 'age of the Fuggers and [subsequently of] the Genoese was one of spectacular growth in public finances'.<sup>52</sup> Furthermore, credit expansion was certainly related to increasing stocks of precious metals; and as Spooner has observed, even news or rumours of the arrival of bullion fleets at Seville often led to very large and elastic issues of negotiable credit.<sup>53</sup> Yet we must again observe that these important developments in credit, public and private, with an exponential growth in the sixteenth century, again came too late to explain the initial onset of inflation in England and the Low Countries.

We return, finally, to precious metals and the Central European mining boom to seek two possible other explanations. The first may have been a relatively greater diversion of German silver from Venice to Antwerp in the early sixteenth century: not just because of Portugal's success in establishing a direct sea route to India (1499-1500), and the aforementioned establishment of her official spice staple at Antwerp in

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<sup>51</sup> James D. Tracy, *A Financial Revolution in the Habsburg Netherlands: Renten and Renteniers in the County of Holland, 1515-1565* (Los Angeles, 1985); James Tracy, 'Taxation and State Debt,' in *Handbook of European History, 1400 - 1600: Late Middle Ages, Renaissance and Reformation*, ed. by Thomas Brady, Heiko Oberman, and James Tracy, 2 vols. (Leiden and New York, 1994-5), 1: *Structures and Assertions*, 563-88; Van der Wee, 'Monetary, Credit, and Banking Systems', 303-07; John Munro, 'Patterns of Trade, Money, and Credit,' in *Handbook of European History*, 1: 147-95.

<sup>52</sup> Van der Wee, 'Monetary, Credit, and Banking Systems', 376-78, Table 28 (based on researches of F. Ruiz-Martin). See also Braudel, *Mediterranean World*, 1:500-15, 528-32.

<sup>53</sup> Spooner, *Monetary Movements in France*, 9-86.

1501, but also because of the Venice's wars with the now rapidly expanding Ottoman Empire. Sultan Bayezid II (1481-1512) struck the first disastrous blow, by inflicting a decisive defeat on the Venetian navy at the Battle of Zonchio in 1499, which led to the Turkish conquest of most of the Venetian strongholds in southern Greece and incursions along the Dalmatian coast. By 1503, those losses had forced Venice to sign a humiliating peace treaty that ceded more of Greece and Albania to the Ottoman Empire, events that Frederic Lane views as the 'turning point of Venetian history.' Worse was to come, for Venetian commerce, under the next Ottoman Sultan, Selim I (1512-20). In 1514, he launched a destructive assault on Safavid Persia; and over the next three years (1515-17) he conquered Mamluk Egypt and Syria (i.e. the Levant), in which Venice had long enjoyed such enviable mercantile privileges; at the same time, the Turks were attacking shipping in the Indian Ocean, disrupting trade via the Persian Gulf and the Red Sea to the Levantine ports. Finally, in 1522 the Turks seized Rhodes and, in 1529, Algiers, which thus allowed the Ottoman Empire to encircle 'the whole Mediterranean Sea from Albania to Morocco'.<sup>54</sup>

In the absence of direct evidence on silver flows, we can cite statistics on Fugger exports of Hungarian copper, provided in Table 4: the share going to Venice fell from 32.1 percent in 1499-1501 to just 0.29 percent in 1516-17 (5.16 percent in 1526-30), while the share going to Antwerp rose from 5.22 percent in 1496-1500 to 62.5 percent in 1514-15 (58.4 percent in 1511-15; 58.85 percent in 1526-30).<sup>55</sup> Whether or not the Portuguese were shipping as much silver from Antwerp during this period, as Venice had done earlier, seems doubtful.

Secondly, and finally, as Table 3 indicates, the decade 1516-1525 marks a significant expansion in Central European silver mining. The great silver mines of Joachimsthal in Bohemia began their production only in 1516, reaching annual mean outputs of 13,795 kg of fine silver in 1526-30; and if mean quinquennial

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<sup>54</sup> See Frederic C. Lane, *Venice: A Maritime Republic* (Baltimore and London, 1973), 241-49; Halil Inalcik, *An Economic and Social History of the Ottoman Empire*, 2 vols. (Cambridge, 1994), 1: 1300-1600, 193-94, 319-25; Braudel, *The Mediterranean and the Mediterranean World*, 2: 661-69.

<sup>55</sup> Van der Wee, *Antwerp Market*, 1: 522-23, Appendix 44:1.

silver outputs of Eisleben-Hettstedt in Thuringia were only 3,425 kg in 1526-30 (compared to 4,642 in 1496-1500), they then suddenly escalated to reach a mean peak of 14,973 kg in 1536-50. In the Austrian Tyrol, Schwaz was producing an estimated annual mean of 10,125 kg silver in 1526-30, while perhaps as much as 15,710 kg of fine silver was being mined in the rest of the Tyrol (estimated for 1523: not in Table 3), and about 5,433 kg at Kőrmöcbánya, in Hungary.<sup>56</sup> Nevertheless, as this exposition has sought to reveal, the origins and mechanics of European inflation are much too complex to rest upon one single factor, monetary or 'real', though clearly, *au fond*, they had strong monetary components, especially in precious metals.

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<sup>56</sup> See sources in Table 3, and n. 14; and see also Michael North, *Geldumlauf und Wirtschaftskonjunktur im südlichen Ostseeraum an der Wende zur Neuzeit (1440-1570)*, Kieler Historische Studien vol. 35 (Sigmaringen: Jan Thorbecke Verlag, 1990); Spufford, *Money and Its Use*, 349-55, 365.

**The Monetary Origins of the ‘Price Revolution’ Before the Influx of Spanish-American Treasure: the South German Silver-Copper Trades, Merchant Banking, and Venetian Commerce, 1470-1540.**

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**Table 1**      **Composite Price Indices for Flanders, Brabant, England, & Spain**  
**in quinquennial means: 1401-05 to 1596-1600**  
**Price Indices: mean of 1451-75 = 100; and mean of 1501-10 = 100**

<b>Years</b>	<b>Flanders</b>	<b>Brabant</b>	<b>England</b>	<b>Spain I: Silver</b>	<b>Spain II: Vellon</b>	<b>Brabant</b>	<b>England</b>
<b>5 yr mean</b>	<b>1451-75=100</b>	<b>1451-75=100</b>	<b>1451-75=100</b>	<b>1501-10=100</b>	<b>1501-10=100</b>	<b>1501-10=100</b>	<b>1501-10=100</b>
<b>1401-05</b>	88.53	64.27	114.84			53.50	109.08
<b>1406-10</b>	105.26	68.55	111.23			57.07	105.65
<b>1411-15</b>	95.31	73.97	108.11			61.58	102.68
<b>1416-20</b>	107.38	80.54	113.40			67.05	107.71
<b>1421-25</b>	112.18	90.19	101.48			75.08	96.38
<b>1426-30</b>	117.77	100.15	112.27			83.37	106.63
<b>1431-35</b>	123.51	102.76	108.48			85.54	103.03
<b>1436-40</b>	140.17	125.43	122.01			104.42	115.89
<b>1441-45</b>	113.50	105.48	92.53			87.81	87.88
<b>1446-50</b>	109.98	99.58	100.90			82.89	95.84
<b>1451-55</b>	100.90	98.54	100.25			82.03	95.22
<b>1456-60</b>	117.86	114.58	97.06			95.38	92.19
<b>1461-65</b>	88.71	91.07	102.73			75.81	97.58
<b>1466-70</b>	96.52	96.95	106.75			80.71	101.39
<b>1471-75</b>	96.02	98.85	97.76			82.29	92.85
<b>1476-80</b>	117.21	120.69	90.06			100.47	85.54
<b>1481-85</b>	156.85	155.75	127.38			129.66	120.99
<b>1486-90</b>	184.51	174.10	102.77			144.93	97.61
<b>1491-95</b>	144.98	133.22	106.80			110.90	101.44
<b>1496-00</b>	100.26	115.35	96.70			96.03	91.85
<b>1501-05</b>		125.45	106.79	92.43		104.43	101.43
<b>1506-10</b>		114.80	103.77	107.57		95.57	98.57
<b>1511-15</b>		137.90	108.52	98.98		114.80	103.08
<b>1516-20</b>		150.26	120.44	104.28		125.09	114.39
<b>1521-25</b>		179.94	146.05	122.14		149.79	138.72
<b>1526-30</b>		178.52	157.35	131.57		148.61	149.45

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<b>5 yr mean</b>	<b>1451-75=100</b>	<b>1451-75=100</b>	<b>1451-75=100</b>	<b>1501-10=100</b>	<b>1501-10=100</b>	<b>1501-10=100</b>	<b>1501-10=100</b>
1531-35		173.99	155.64	132.44		144.84	147.83
1536-40		185.64	152.33	138.73		154.54	144.69
1541-45		208.34	176.55	147.90		173.44	167.69
1546-50		199.42	229.64	165.89		166.01	218.12
1551-55		260.52	275.45	176.02		216.87	261.63
1556-60		300.72	315.85	194.00		250.34	300.00
1561-65		313.94	289.31	223.43		261.34	274.79
1566-70		318.29	292.29	227.73		264.96	277.63
1571-75		423.43	296.10	246.76		352.49	281.24
1576-80		480.72	336.50	247.81		400.18	319.61
1581-85		617.42	337.52	269.07		513.98	320.58
1586-90		799.75	387.17	274.97		665.77	367.74
1591-95		688.33	416.01	284.42		573.01	395.14
1596-00		752.95	540.54	320.97	320.98	626.80	513.42
1601-05		612.32	461.27	349.92	352.43	509.74	438.12
1606-10		615.89	497.00	330.11	335.31	512.71	472.06
1611-15		636.13	532.84	316.81	322.67	529.56	506.11
1616-20		626.96	520.39	328.56	335.64	521.92	494.28
1621-25		815.75	529.72	317.85	344.72	679.08	503.14
1626-30		919.65	525.06	328.04	410.81	765.57	498.72
1631-35		908.53	608.38	329.91	395.12	756.32	577.86
1636-40		967.67	615.13	323.47	409.66	805.55	584.26
1641-45		987.17	560.50	313.49	432.48	821.78	532.37
1646-50		1015.14	734.39	343.36	457.09	845.07	697.54

<b>Five Year Period</b>	<b>Potosi: Silver Outputs in kg.</b>	<b>Zacatecas: Silver Outputs in kg.</b>	<b>Total Known Silver Mining Outputs in kg</b>	<b>Mean Fine Gold Imports in kg</b>	<b>Mean Fine Silver Imports in kg</b>	<b>Index of Silver Imports: Seville 1591-1600=100</b>	<b>Index of Mined Outputs 1591-1600=100</b>
1501-05				517.24	0.00	0.00	
1506-10				682.69	0.00	0.00	
1511-15				999.95	0.00	0.00	
1516-20				830.70	0.00	0.00	
1521-25				111.88	3.40	0.00	
1526-30				865.93	26.34	0.01	
1531-35				854.41	5,090.79	1.88	
1536-40				2,038.86	12,147.99	4.49	
1541-45				2,363.40	16,815.87	6.21	
1546-50				2,628.03	18,698.76	6.91	
1551-55	64,848.88		64,848.88	4,707.31	33,479.21	12.36	31.39
1556-60	54,335.74	21,294.68	75,630.42	3,816.70	27,145.03	10.03	36.61
1561-65	56,080.38	27,761.40	83,841.77	1,019.64	83,373.92	30.79	40.59
1566-70	51,717.86	31,498.08	83,215.94	1,286.54	105,197.84	38.85	40.29
1571-75	36,439.01	35,925.21	72,364.22	770.06	91,353.22	33.74	35.03
1576-80	111,607.53	30,389.38	141,996.90	1,115.77	132,365.17	48.89	68.74
1581-85	168,398.46	27,613.05	196,011.51	1,336.21	232,207.57	85.76	94.89
1586-90	176,839.51	28,413.40	205,252.91	1,084.12	188,397.97	69.58	99.36
1591-95	192,454.49	27,002.87	219,457.36	1,966.28	273,704.54	101.09	106.24
1596-00	169,671.92	24,005.40	193,677.32	1,924.01	267,820.77	98.91	93.76
1601-05	183,470.02	29,736.38	213,206.40	1,028.81	193,590.35	71.50	103.21
1606-10	158,273.46	34,121.27	192,394.73	1,324.00	249,135.90	92.01	93.14
1611-15	161,108.67	47,517.24	208,625.91	795.09	196,820.45	72.69	101.00
1616-20	139,403.78	48,213.16	187,616.94	976.10	241,630.75	89.24	90.83
1621-25	134,795.30	55,609.74	190,405.04	404.37	223,022.55	82.37	92.18
1626-30	130,628.28	47,861.74	178,490.02	373.59	206,045.26	76.10	86.41

**Table 2 Mined Outputs of Gold and Silver from Spanish America and Exports of Gold and Silver Bullion to Seville: in Kilograms of fine metal, in quinquennial means, 1501-1505 to 1656-61**

<b>Five Year Period</b>	<b>Potosi: Silver Outputs in kg.</b>	<b>Zacatecas: Silver Outputs in kg.</b>	<b>Total Known Silver Mining Outputs in kg</b>	<b>Mean Fine Gold Imports in kg</b>	<b>Mean Fine Silver Imports in kg</b>	<b>Index of Silver Imports: Seville 1591-1600=100</b>	<b>Index of Mined Outputs 1591-1600=100</b>
<b>1631-35</b>	124,267.78	47,934.53	172,202.31	126.99	143,003.28	52.82	83.36
<b>1636-40</b>	147,647.32	31,044.38	178,691.70	121.09	136,348.64	50.36	86.51
<b>1641-45</b>	113,646.36	28,101.07	141,747.43	167.03	113,889.78	42.06	68.62
<b>1646-50</b>	121,192.60	30,215.72	151,408.32	142.84	97,396.41	35.97	73.30
<b>1651-55</b>	99,371.13	31,046.27	130,417.40	64.27	60,685.98	22.41	63.14
<b>1656-60</b>	103,710.82	26,373.41	130,084.23	29.62	27,965.33	10.33	62.97

<b>Years</b>	<b>SAXONY</b> <b>Est. Total</b>	<b>THURINGIA</b> <b>Est. Total</b>	<b>BOHEMIA</b> <b>Joachimsthal</b>	<b>BOHEMIA</b> <b>Kutna Hora</b> <b>Kasperska Hora</b>	<b>SLOVAKIA</b> <b>Fugger-</b> <b>Thurzo kg</b>	<b>HUNGARY</b> <b>Nagybanya</b> <b>Körmöcbanya</b>	<b>TYROL:</b> <b>Schwaz</b>	<b>TOTAL</b> <b>Estimated</b>
	<b>in kg.</b>	<b>in kg.</b>	<b>in kg.</b>	<b>in kg.</b>	<b>in kg.</b>	<b>in kg.</b>	<b>in kg.</b>	<b>in kg.</b>
<b>1471-75</b>	4,360.94			4,500.00			4,112.50	12,973.44
<b>1476-80</b>	10,317.46			4,250.00			7,354.00	21,921.46
<b>1481-85</b>	3,743.30			4,000.00		1,800.00	9,745.80	19,289.10
<b>1486-90</b>	2,770.04			3,750.00		3,523.00	12,751.00	22,794.04
<b>1491-95</b>	3,757.33			3,500.00	1,957.12	3,523.00	12,422.75	25,160.21
<b>1496-00</b>	4,641.69			3,250.00	1,957.12	3,795.86	12,094.50	25,739.17
<b>1501-05</b>	8,979.23			3,000.00	2,870.47	4,068.70	11,766.25	30,684.65
<b>1506-10</b>	7,416.41	4,626.19		2,750.00	3,990.76	4,341.57	11,438.00	34,562.92
<b>1511-15</b>	6,925.10	5,713.42		2,500.00	3,632.11	4,614.43	11,109.75	34,494.81
<b>1516-20</b>	5,189.14	6,079.43	3,970.00	2,250.00	1,983.07	4,887.29	10,781.50	35,140.43
<b>1521-25</b>	3,701.18	6,301.73	9,703.24	2,000.00	2,486.46	5,160.14	10,453.25	39,806.00
<b>1526-30</b>	3,425.12	7,889.16	13,795.32	2,000.00	2,269.15	5,433.00	10,125.00	44,936.74
<b>1531-35</b>	6,663.07	6,300.90	16,554.81	2,000.00	2,269.15	5,433.00	10,125.00	49,345.92
<b>1536-40</b>	14,973.18	5,734.07	13,248.01	3,947.00	2,243.58	5,433.00	10,125.00	55,703.84
<b>1541-45</b>	7,739.26	6,144.00	10,936.85	3,997.00	2,141.55	5,433.00	9,963.49	46,355.16
<b>1546-50</b>	4,131.66	6,576.20	10,936.85	700.00	2,141.55	5,433.00	9,963.49	39,882.76

**Table 4: Central European Copper Production and Exports: in Kilograms of Fine Copper****with exports to Venice and Antwerp, in quinquennial means: 1491-95 to 1536-40**

	<b>Total Outputs Estimated in kg</b>	<b>Exports: Total kg</b>	<b>To Venice kg</b>	<b>To Venice Percent</b>	<b>To Antwerp kg</b>	<b>To Antwerp Percent</b>
<b>1491-95</b>	1,980,746					
<b>1496-00</b>	2,704,948	1,390,392.34	446,742.23	32.13%	72,545.07	5.22%
<b>1501-05</b>	3,041,820	1,403,347.49	409,357.78	29.17%	453,686.44	32.33%
<b>1506-10</b>	4,770,333	1,627,846.98	184,642.02	11.34%	819,753.42	50.36%
<b>1511-15</b>	5,654,047	1,659,584.86	60,358.63	3.64%	968,521.36	58.36%
<b>1516-20</b>	5,203,097	1,388,953.66	29,544.60	2.13%	606,520.05	43.67%
<b>1521-25</b>	5,341,702	1,434,963.13	66,809.17	4.66%	488,633.13	34.05%
<b>1526-30</b>	5,275,248	1,062,740.62	54,876.61	5.16%	625,457.93	58.85%
<b>1531-35</b>	4,628,886	1,008,644.47	111,652.65	11.07%	543,443.92	53.88%
<b>1536-40</b>	4,336,708	1,207,783.75	150,543.95	12.46%	593,242.84	49.12%

<b>Years Michaelmas</b>	<b>Total Exports</b>	<b>London Exports</b>	<b>London as % of Total</b>
1406-10	31,746	14,251	44.89%
1411-15	27,183	14,493	53.31%
1416-20	27,977	12,698	45.39%
1421-25	40,275	16,812	41.74%
1426-30	40,406	17,498	43.30%
1431-35	40,027	17,069	42.64%
1436-40	47,072	18,124	38.50%
1441-45	56,456	23,938	42.40%
1446-50	45,847	14,229	31.04%
1451-55	36,700	16,419	44.74%
1456-60	36,489	16,162	44.29%
1460-65	29,002	16,041	55.31%
1466-70	37,447	20,788	55.51%
1471-75	36,537	23,328	63.85%
1476-80	50,441	34,444	68.29%
1481-85	54,198	36,293	66.96%
1486-90	50,005	35,122	70.24%
1491-95	56,945	35,893	63.03%
1496-00	62,583	42,746	68.30%
1501-05	77,271	46,611	60.32%
1506-10	84,803	52,390	61.78%
1511-15	86,592	62,257	71.90%
1516-20	90,099	63,084	70.02%
1521-25	82,269	61,854	75.19%
1526-30	93,534	72,350	77.35%
1531-35	94,087	75,503	80.25%
1536-40	109,278	91,731	83.94%
1541-45	118,056	101,550	86.02%

<b>Table 5</b>		<b>Exports of English Broadcloths, in Quinquennial Means: 1406-10 to 1546-50 *</b>		
<b>Years</b>	<b>Total</b>	<b>London</b>	<b>London as</b>	
<b>Michaelmas</b>	<b>Exports</b>	<b>Exports</b>	<b>% of Total</b>	
<b>1546-50</b>	135,190	123,780	91.56%	

\* English Broadcloth = 24 yds by 1.75 yds, for cloths of assise  
4 straits and dozens = 1 broadcloth; and 3 kerseys = 1 broadcloth  
From one sack of wool, 4.333 broadcloths could be manufactured



**Table 6:**  
**Outputs of the Burgundian Mints in Flanders and Brabant, In Kilograms of Fine Metal,**  
**With Values in Flemish Pounds Groot: Quinquennial Means, 1426-30 to 1596-1600**

<b>Year</b>	<b>Silver: Flanders kilograms</b>	<b>Silver: Flanders £ groot</b>	<b>Silver: Brabant kilograms</b>	<b>Silver: Brabant £ groot</b>	<b>Silver: Flanders &amp; Brabant kg</b>	<b>Silver: Flanders &amp; Brabant £ gr</b>
<b>1426-30</b>	5,724.64	30,932.97	906.53	4,963.72	6,631.17	35,896.68
<b>1431-35</b>	4,568.74	23,495.93	459.15	2,401.13	5,027.89	25,897.06
<b>1436-40</b>	3,505.13	17,981.66	869.70	4,460.39	4,374.83	22,442.05
<b>1441-45</b>	102.68	527.55	0.00	0.00	102.68	527.55
<b>1446-50</b>	5.91	40.79	0.00	0.00	5.91	40.79
<b>1451-55</b>	53.16	283.98	48.65	267.27	101.82	551.25
<b>1456-60</b>	51.30	336.65	11.21	62.35	62.51	399.00
<b>1461-65</b>	0.00	0.00	0.00	0.00	0.00	0.00
<b>1466-70</b>	2,975.69	17,957.10	1,475.96	8,860.69	4,451.65	26,817.79
<b>1471-75</b>	4,619.35	28,258.17	2,694.64	16,933.56	7,313.98	45,191.72
<b>1476-80</b>	4,078.52	28,866.25	5,262.97	38,770.00	9,341.49	67,636.25
<b>1481-85</b>	1,997.52	16,669.17	3,579.95	31,757.51	5,577.47	48,426.68
<b>1486-90</b>	940.93	9,235.61	3,612.13	44,214.17	4,553.06	53,449.79
<b>1491-95</b>	1,039.27	7,332.37	1,485.56	10,663.79	2,524.83	17,996.16
<b>1496-00</b>	2,071.91	17,066.91	2,801.05	23,676.88	4,872.96	40,743.79
<b>1501-05</b>	910.33	7,810.79	2,247.51	19,092.12	3,157.84	26,902.91
<b>1506-10</b>	243.98	2,188.31	1,139.75	9,703.89	1,383.73	11,892.20
<b>1511-15</b>	153.54	1,389.56	1,486.85	12,684.57	1,640.38	14,074.13
<b>1516-20</b>	76.58	679.28	628.54	5,473.34	705.12	6,152.62
<b>1521-25</b>	468.57	4,137.14	1,435.62	12,649.98	1,904.20	16,787.12
<b>1526-30</b>	561.76	4,997.96	2,418.12	21,200.52	2,979.88	26,198.48
<b>1531-35</b>	249.98	2,223.71	2,646.30	23,211.72	2,896.28	25,435.43
<b>1536-40</b>	546.45	4,832.12	4,818.53	42,465.77	5,364.99	47,297.89
<b>1541-45</b>	521.07	4,608.51	1,796.38	15,819.92	2,317.45	20,428.43
<b>1546-50</b>	196.05	1,752.55	1,262.23	11,135.12	1,458.28	12,887.66

Table 6:

**Outputs of the Burgundian Mints in Flanders and Brabant, In Kilograms of Fine Metal,  
With Values in Flemish Pounds Groot: Quinquennial Means, 1426-30 to 1596-1600**

<b>Year</b>	<b>Silver: Flanders kilograms</b>	<b>Silver: Flanders £ groot</b>	<b>Silver: Brabant kilograms</b>	<b>Silver: Brabant £ groot</b>	<b>Silver: Flanders &amp; Brabant kg</b>	<b>Silver: Flanders &amp; Brabant £ gr</b>
<b>1551-55</b>	752.16	6,622.70	5,201.85	46,549.00	5,954.01	53,171.70
<b>1556-60</b>	4,067.69	39,193.71	8,078.38	78,979.12	12,146.07	118,172.83
<b>1561-65</b>	1,558.39	15,888.70	6,819.34	69,590.64	8,377.74	85,479.34
<b>1566-70</b>	3,388.04	34,591.35	14,806.06	153,173.32	18,194.10	187,764.68
<b>1571-75</b>	916.07	9,879.30	11,431.52	119,719.21	12,347.59	129,598.50
<b>1576-80</b>	1,805.16	20,965.50	4,785.83	58,061.61	6,590.98	79,027.10
<b>1581-85</b>	329.76	5,231.48	1,066.34	14,881.84	1,396.10	20,113.32
<b>1586-90</b>	273.46	4,292.49	9,850.93	143,697.57	10,124.39	147,990.07
<b>1591-95</b>	31.52	460.70	10,641.97	163,876.05	10,673.49	164,336.74
<b>1596-00</b>	26.22	377.39	2,261.76	32,833.30	2,287.97	33,210.69

**Table 6. Outputs of the Burgundian Mints in Flanders and Brabant, In Kilograms of Fine Metal, With Values in Flemish Pounds Groot: Quinquennial Means, 1426-30 to 1596-1600**

<b>Year</b>	<b>Gold: Flanders kilograms</b>	<b>Gold: Flanders £ groot</b>	<b>Gold: Brabant kilograms</b>	<b>Gold: Brabant £ groot</b>	<b>Gold: Flanders &amp; Brabant kg</b>	<b>Gold: TOTAL £ groot Flanders &amp; Brabant</b>	<b>Gold: TOTAL £ groot Flanders &amp; Brabant</b>	<b>Percent of Total in Gold</b>	<b>Percent of Total in Silver</b>
<b>1426-30</b>	372.372	22,373.694	161.136	10,424.924	533.508	32,798.618	68,695.300	47.75	52.25
<b>1431-35</b>	313.963	17,491.002	399.648	24,822.692	713.610	42,313.694	68,210.754	62.03	37.97
<b>1436-40</b>	241.904	13,483.328	220.777	12,305.710	462.681	25,789.038	48,231.090	53.47	46.53
<b>1441-45</b>	111.931	6,466.290	0.000	0.000	111.931	6,466.290	6,993.842	92.46	7.54
<b>1446-50</b>	2.550	148.084	0.000	0.000	2.550	148.084	188.870	78.41	21.59
<b>1451-55</b>	322.409	19,759.234	258.667	15,852.734	581.075	35,611.968	36,163.218	98.48	1.52
<b>1456-60</b>	160.791	9,854.308	65.268	4,000.050	226.060	13,854.358	14,253.362	97.20	2.80
<b>1461-65</b>	6.596	404.224	0.000	0.000	6.596	404.224	404.224	100.00	0.00
<b>1466-70</b>	186.880	12,116.676	56.288	3,622.242	243.168	15,738.918	42,556.710	36.98	63.02
<b>1471-75</b>	140.215	10,042.534	120.987	8,884.980	261.202	18,927.514	64,119.238	29.52	70.48
<b>1476-80</b>	186.598	14,335.372	193.453	14,873.126	380.051	29,208.498	96,844.749	30.16	69.84
<b>1481-85</b>	27.255	2,470.546	25.563	2,265.146	52.818	4,735.692	53,162.370	8.91	91.09
<b>1486-90</b>	0.000	0.000	112.938	20,319.780	112.938	20,319.780	73,769.568	27.54	72.46
<b>1491-95</b>	9.272	623.804	10.035	649.857	19.308	1,273.661	19,269.819	6.61	93.39
<b>1496-00</b>	293.421	27,548.326	181.212	16,915.954	474.633	44,464.280	85,208.071	52.18	47.82
<b>1501-05</b>	154.371	14,639.133	384.500	36,473.397	538.871	51,112.530	78,015.442	65.52	34.48
<b>1506-10</b>	47.850	4,544.799	263.629	25,030.810	311.480	29,575.609	41,467.805	71.32	28.68
<b>1511-15</b>	48.875	4,640.077	208.824	19,819.723	257.699	24,459.800	38,533.927	63.48	36.52
<b>1516-20</b>	9.302	883.470	135.792	12,896.402	145.094	13,779.872	19,932.492	69.13	30.87
<b>1521-25</b>	422.191	40,697.208	884.397	86,866.249	1,306.588	127,563.456	144,350.575	88.37	11.63
<b>1526-30</b>	46.009	4,455.388	194.981	20,107.277	240.990	24,562.665	50,761.144	48.39	51.61
<b>1531-35</b>	16.642	1,578.296	119.590	11,925.290	136.232	13,503.586	38,939.013	34.68	65.32
<b>1536-40</b>	28.529	2,750.162	110.134	10,693.539	138.663	13,443.702	60,741.595	22.13	77.87
<b>1541-45</b>	43.117	4,141.567	500.783	45,196.492	543.900	49,338.059	69,766.493	70.72	29.28
<b>1546-50</b>	33.034	3,156.632	698.597	57,500.833	731.630	60,657.466	73,545.128	82.48	17.52
<b>1551-55</b>	30.124	2,874.396	727.572	68,944.613	757.697	71,819.009	124,990.713	57.46	42.54
<b>1556-60</b>	36.718	3,902.567	615.361	62,052.435	652.080	65,955.002	184,127.833	35.82	64.18
<b>1581-85</b>	273.331	30,379.709	307.176	33,863.727	580.507	64,243.436	149,722.777	42.91	57.09
<b>1566-70</b>	166.441	18,492.398	100.417	11,014.003	266.858	29,506.401	217,271.079	13.58	86.42
<b>1571-75</b>	7.244	898.538	69.787	7,688.906	77.032	8,587.444	138,185.946	6.21	93.79
<b>1576-80</b>	6.986	890.548	31.375	4,347.075	38.361	5,237.623	84,264.728	6.22	93.78
<b>1581-85</b>	60.777	12,306.744	93.743	15,651.211	154.520	27,957.956	48,071.276	58.16	41.84
<b>1586-90</b>	10.456	1,655.564	41.652	6,590.401	52.108	8,245.965	156,236.030	5.28	94.72
<b>1591-95</b>	1.906	321.317	7.460	1,256.178	9.366	1,577.495	165,914.240	0.95	99.05

<b>Year</b>	<b>Gold: Flanders kilograms</b>	<b>Gold: Flanders £ groot</b>	<b>Gold: Brabant kilograms</b>	<b>Gold: Brabant £ groot</b>	<b>Gold: Flanders &amp; Brabant kg</b>	<b>Gold: Flanders &amp; Brabant £ gr</b>	<b>TOTAL £ groot Flanders &amp; Brabant</b>	<b>Percent of Total in Gold</b>	<b>Percent of Total in Silver</b>
<b>1596-00</b>	4.779	863.289	390.081	70,443.398	394.860	71,306.687	104,517.382	68.22	31.78

<b>Year</b>	<b>Silver Coinage: Total in kilograms</b>	<b>Silver Coinage: Value in £ sterling</b>	<b>Gold Coinage: Total in kilograms</b>	<b>Gold Coinage: Value in £ sterling</b>	<b>Total Percent Values: Silver in £ sterling</b>	<b>Percent Gold</b>
<b>1426-30</b>	6,858.608	31,785.107	599.478	28,703.069	60,488.176	52.55% 47.45%
<b>1431-35</b>	8,059.545	37,350.656	220.785	10,571.183	47,921.839	77.94% 22.06%
<b>1436-40</b>	977.025	4,527.863	132.274	6,333.298	10,861.161	41.69% 58.31%
<b>1441-45</b>	130.700	605.707	90.778	4,346.467	4,952.174	12.23% 87.77%
<b>1446-50</b>	517.373	2,397.681	64.336	3,080.422	5,478.103	43.77% 56.23%
<b>1451-55</b>	1,460.637	6,769.085	63.526	3,041.629	9,810.714	69.00% 31.00%
<b>1456-60</b>	1,415.094	6,558.024	26.719	1,279.288	7,837.312	83.68% 16.32%
<b>1461-65</b>	3,432.915	18,067.349	488.118	29,731.331	47,798.679	37.80% 62.20%
<b>1466-70</b>	5,168.090	29,938.348	1,288.157	83,263.992	113,202.339	26.45% 73.55%
<b>1471-75</b>	2,422.654	14,034.247	538.669	34,818.552	48,852.799	28.73% 71.27%
<b>1476-80</b>	834.683	4,835.252	404.477	26,144.624	30,979.875	15.61% 84.39%
<b>1481-85</b>	995.231	5,765.296	219.449	14,184.753	19,950.049	28.90% 71.10%
<b>1486-90</b>	926.785	5,368.794	129.749	8,386.730	13,755.524	39.03% 60.97%
<b>1491-95</b>	1,270.840	7,361.876	268.983	17,386.525	24,748.402	29.75% 70.25%
<b>1496-00</b>	2,490.940	14,429.823	278.926	18,029.238	32,459.060	44.46% 55.54%
<b>1501-05</b>	4,313.544	24,988.026	516.604	33,392.271	58,380.297	42.80% 57.20%
<b>1506-10</b>	3,633.212	21,046.916	1,523.115	98,451.267	119,498.183	17.61% 82.39%
<b>1511-15</b>	1,089.012	6,308.562	694.599	44,897.564	51,206.126	12.32% 87.68%
<b>1516-20</b>	79.145	458.481	589.841	48,068.530	48,527.011	0.94% 99.06%
<b>1521-25</b>	3,148.207	18,237.317	442.136	28,578.780	46,816.096	38.96% 61.04%
<b>1526-30</b>	9,244.701	60,248.025	736.422	54,079.255	114,327.280	52.70% 47.30%
<b>1531-35</b>	4,616.832	30,088.071	189.160	13,890.972	43,979.043	68.41% 31.59%
<b>1536-40</b>	5,684.094	37,043.459	406.719	29,826.052	66,869.511	55.40% 44.60%
<b>1541-45</b>	5,707.032	100,776.324	963.792	79,997.508	180,773.832	55.75% 44.25%

<b>Year</b>	<b>Silver Coinage: Total in kilograms</b>	<b>Silver Coinage: Value in £ sterling</b>	<b>Gold Coinage: Total in kilograms</b>	<b>Gold Coinage: Value in £ sterling</b>	<b>Total Percent Values: Silver in £ sterling</b>	<b>Percent Gold</b>	
<b>1546-50</b>	22,029.731	402,892.436	1,992.083	188,860.922	591,753.358	68.08%	31.92%
<b>1551-55</b>	9,428.855	121,874.569	136.583	16,023.336	137,897.905	88.38%	11.62%
<b>1556-60</b>	4,152.478	36,023.663	137.533	23,955.867	59,979.529	60.06%	39.94%
<b>1561-65</b>	24,263.303	210,873.247	255.828	24,682.712	235,555.960	89.52%	10.48%
<b>1566-70</b>	11,097.432	96,429.852	236.160	22,790.897	119,220.749	80.88%	19.12%
<b>1571-75</b>	8,806.166	76,520.164	102.633	9,934.572	86,454.736	88.51%	11.49%
<b>1576-80</b>	8,071.535	70,489.334	76.197	7,416.226	77,905.560	90.48%	9.52%
<b>1581-85</b>	16,056.314	139,852.039	337.318	32,770.995	172,623.034	81.02%	18.98%
<b>1586-90</b>	6,405.349	55,658.544	185.206	17,957.031	73,615.575	75.61%	24.39%
<b>1591-95</b>	18,653.363	162,086.240	178.498	17,306.684	179,392.924	90.35%	9.65%
<b>1596-00</b>	7,461.690	64,837.491	131.637	12,736.568	77,574.058	83.58%	16.42%

<b>Year</b>	<b>England Silver Coinage in kilograms</b>	<b>Low Countries Silver Coinage in kilograms</b>	<b>Combined Total: Silver Coinage in kilograms</b>	<b>England Gold Coinage in kilograms</b>	<b>Low Countries Gold Coinage in kilograms</b>	<b>Combined Total: Gold Coinage in kilograms</b>
1426-30	6,858.61	6,631.17	13,489.78	599.48	533.51	1,132.99
1431-35	8,059.55	5,027.89	13,087.44	220.78	713.61	934.40
1436-40	977.02	4,374.83	5,351.86	132.27	462.68	594.96
1441-45	130.70	102.68	233.38	90.78	111.93	202.71
1446-50	517.37	5.91	523.28	64.34	2.55	66.89
1451-55	1,460.64	101.82	1,562.45	63.53	581.08	644.60
1456-60	1,415.09	62.51	1,477.60	26.72	226.06	252.78
1461-65	3,432.92	0.00	3,432.92	488.12	6.60	494.71
1466-70	5,168.09	4,451.65	9,619.74	1,288.16	243.17	1,531.33
1471-75	2,422.65	7,313.98	9,736.64	538.67	261.20	799.87
1476-80	834.68	9,341.49	10,176.18	404.48	380.05	784.53
1481-85	995.23	5,577.47	6,572.70	219.45	52.82	272.27
1486-90	926.79	4,553.06	5,479.85	129.75	112.94	242.69
1491-95	1,270.84	2,524.83	3,795.67	268.98	19.31	288.29
1496-00	2,490.94	4,872.96	7,363.90	278.93	474.63	753.56
1501-05	4,313.54	3,157.84	7,471.38	516.60	538.87	1,055.47
1506-10	3,633.21	1,383.73	5,016.94	1,523.12	311.48	1,834.59
1511-15	1,089.01	1,640.38	2,729.39	694.60	257.70	952.30
1516-20	79.15	705.12	784.27	589.84	145.09	734.94
1521-25	3,148.21	1,904.20	5,052.40	442.14	1,306.59	1,748.72
1526-30	9,244.70	2,979.88	12,224.58	736.42	240.99	977.41
1531-35	4,616.83	2,896.28	7,513.11	189.16	136.23	325.39
1536-40	5,684.09	5,364.99	11,049.08	406.72	138.66	545.38
1541-45	5,707.03	2,317.45	8,024.48	963.79	543.90	1,507.69
1546-50	22,029.73	1,458.28	23,488.01	1,992.08	731.63	2,723.71

<b>Year</b>	<b>England Silver Coinage in kilograms</b>	<b>Low Countries Silver Coinage in kilograms</b>	<b>Combined Total: Silver Coinage in kilograms</b>	<b>England Gold Coinage in kilograms</b>	<b>Low Countries Gold Coinage in kilograms</b>	<b>Combined Total: Gold Coinage in kilograms</b>
<b>1551-55</b>	9,428.86	5,954.01	15,382.86	136.58	757.70	894.28
<b>1556-60</b>	4,152.48	12,146.07	16,298.55	137.53	652.08	789.61
<b>1561-65</b>	24,263.30	8,377.74	32,641.04	255.83	580.51	836.33
<b>1566-70</b>	11,097.43	18,194.10	29,291.53	236.16	266.86	503.02
<b>1571-75</b>	8,806.17	12,347.59	21,153.76	102.63	77.03	179.66
<b>1576-80</b>	8,071.54	6,590.98	14,662.52	76.20	38.36	114.56
<b>1581-85</b>	16,056.31	1,396.10	17,452.41	337.32	154.52	491.84
<b>1586-90</b>	6,405.35	10,124.39	16,529.74	185.21	52.11	237.31
<b>1591-95</b>	18,653.36	10,673.49	29,326.86	178.50	9.37	187.86
<b>1596-00</b>	7,461.69	2,287.97	9,749.66	131.64	394.86	526.50



## SOURCES FOR THE TABLES:

### Table 1:

**England:** E. Henry Phelps Brown and Sheila V. Hopkins, 'Seven Centuries of the Prices of Consumables Compared with Builders' Wage-Rates,' *Economica*, 23:92 (Nov. 1956), reprinted in E.H. Phelps Brown and Sheila V. Hopkins, *A Perspective of Wages and Prices* (London, 1981), 13-59, containing additional statistical appendices not provided in the original publication, or in earlier reprints.

**Flanders:** Stadsarchief Gent, Reeks 400:7-334, Stadsrekeningen 1350- 1500 [for cloth prices] Charles E. Verlinden, E. Scholliers, H. Coppejans-Desmedt, Jan Craeybecks, et al, eds., *Dokumenten voor de geschiedenis van prijzen en lonen in Vlaanderen en Brabant/Documents pour servir à l'histoire des prix et des salaires en Flandre et en Brabant*, 4 vols. (Bruges), 1965); M.J. Tits-Dieuaide, *La formation des prix céréaliers en Brabant et en Flandre au XVe siècle* (Brussels, 1975); John H. Munro, 'Mint Outputs, Money, and Prices in Late-Medieval England and the Low Countries,' in *Münzprägung, Geldumlauf, und Wechselkurse/ Minting, Monetary Circulation, and Exchange Rates: Akten des 8th International Economic History Congress*, ed. Eddy Van Cauwenberghe and Franz Irsigler, *Trierer Historische Forschungen*, vol. 7 (Trier, 1984), 31-122.

**Brabant:** Herman Van der Wee, 'Prijzen en lonen als ontwikkelingsvariabelen: Een vergelijkend onderzoek tussen Engeland en de Zuidelijke Nederlanden, 1400-1700,' in *Album aangeboden aan Charles Verlinden ter gelegenheid van zijn dertig jaar professoraat* (Gent, 1975), 413-47; reissued in English translation (but without the tables) as 'Prices and Wages as Development Variables: A Comparison Between England and the Southern Netherlands, 1400-1700,' *Acta Historiae Neerlandicae*, 10 (1978), 58-78; and reprinted in Herman Van der Wee, *The Low Countries in the Early Modern World* (1992), 223-41; Herman Van der Wee, *Growth of the Antwerp Market and the European Economy, 14th to 16th Centuries*, 3 Vols. (The Hague, 1963).

**Spain:** Earl Hamilton, *American Treasure and the Price Revolution in Spain, 1501-1650* (Cambridge, Mass., 1934; reissued 1965), Appendix VIII, p. 403, for silver-based commodity prices; Tables 27 & 29, pp. 271, 278, for vellon-based commodity price indices (real wages divided by money wages); see also Table 21, p. 189 (commodity prices 1501-50), Table 23, p. 198 (commodity prices 1551-1600), Table 25, p. 215 (commodity prices, 1601-50).

### Table 2:

**Potosi and Zacatecas silver outputs:** Peter Bakewell, 'Registered Silver Production in the Potosi District, 1550 - 1735,' *Jahrbuch für Geschichte von Staat, Wirtschaft und Gesellschaft Lateinamerikas*, 12 (1975), 68-103; Peter Bakewell, 'Mining in Colonial Spanish America,' in *The Cambridge History of Latin America, 2: Colonial Latin America*, ed. Leslie Bethell (Cambridge and New York: Cambridge University Press, 1984), 105-51; Peter Bakewell, *Silver Mining and Society in Colonial Mexico: Zacatecas, 1546 - 1700* (Cambridge, 1971); Harry E. Cross, 'South American Bullion Production and Export, 1550-1750,' in *Precious Metals in the Later Medieval and Early Modern Worlds*, ed. John F. Richards (Durham, N.C., 1983), 425-39; Richard L. Garner, 'Long-term Silver Mining Trends in Spanish America: A Comparative Analysis of Peru and Mexico,' *American Historical Review*, 67:3 (1987), 405-30; D.A. Brading, 'Mexican Silver Mining in the Eighteenth Century: the Revival of Zacatecas,' *Hispanic American Historical Review*, 50:4 (1970), 665-81.

**Spanish-American Gold and Silver Imports into Seville:** Earl Hamilton, 'Imports of American Gold and Silver into Spain, 1503-1660,' *Quarterly Journal of Economics*, 43 (1929): 436-72; Earl Hamilton, *American Treasure and the Price Revolution in Spain, 1501-1650* (Cambridge, Mass., 1934; reissued 1965), Table 1, p. 34; Table 2, p. 40; Table 3, p. 42; John H. TePaske, 'New World Silver, Castile, and

the Philippines, 1590-1800,' in John F. Richards, ed., *Precious Metals in the Later Medieval and Early Modern Worlds* (Durham, N.C., 1983), pp. 425-45; Table 1, p. 441.

Conversion ratios employed:

1 mark = 8 ounces = 230.0475 grams of alloyed silver = 226.90 grams of fine silver = 8.75 pesos = 2380 maravedís; and silver pesos of 8 reales or 272 maravedís= 25.931 grams

Hamilton, in both his original article of 1929 and his subsequent monograph provided no annual data on treasure imports. In that monograph, *American Treasure and the Price Revolution in Spain, 1501-1650* (1934), his Table 1 (p. 34) supplied the quinquennial (five-year) means of the aggregate values of gold and silver imports combined in terms of pesos of 450 maravedís (Table 1, p. 34); his Table 2 (p. 40) provided the decennial mean percentages of total values of those imports in terms of fine gold and silver; and his Table 3 (p. 42) provided the decennial mean imports of both gold and silver in grams of fine metal. I have therefore used his Tables 1 and 2 to estimate the quinquennial means of both silver and gold imports in kilograms of fine metal from the decennial mean data supplied in his Table 3.

### **Table 3: South-German and Central European silver mining:**

S. Ćirković, 'The Production of Gold, Silver, and Copper in the Central Parts of the Balkans from the 13<sup>th</sup> to the 16<sup>th</sup> Century,' in *Precious Metals in the Age of Expansion*, ed. Hermann Kellenbenz (Stuttgart, 1981), 41-69; J. Janáček, 'L'argent tchègue et la Méditerranée, XIVe-XVe siècles', in *Mélanges en l'honneur de Fernand Braudel: Histoire économique du monde méditerranéen, 1450 -1650*, ed. E. Labrousse (Toulouse, 1973), 245-61; Hermann Kellenbenz, 'Europäisches Kupfer, Ende 15. bis Mitte 17. Jahrhundert: Ergebnisse eines Kolloquiums,' in *Schwerpunkte der Kupferproduktion und des Kupferhandels in Europa*, ed. Hermann Kellenbenz (Cologne, 1977), 290-351; Hermann Kellenbenz, 'Production and Trade of Gold, Silver, Copper, and Lead from 1450 to 1750,' in *Precious Metals in the Age of Expansion*, ed. Hermann Kellenbenz (Stuttgart, 1981), 307-61; Adolf Laube, *Studien über den erzbergischen Silberbergbau von 1470 - 1546* (Leipzig, 1974); John Nef, 'Silver Production in Central Europe, 1450-1618', *Journal of Political Economy*, 49 (1941): 575-9; Paulinyi, Oszkar, 'The Crown Monopoly of the Refining Metallurgy of Precious Metals and the Technology of the Cameral Refineries in Hungary and Transylvania in the Period of Advanced and Late Feudalism (1325-1700),' in *Precious Metals in the Age of Expansion*, ed. Hermann Kellenbenz (Stuttgart, 1981), 27-39; Georg Schenk, 'Über die Anfänge des Silberbergbaues von St. Joachimsthal,' *Der Anschnitt*, 19 (1967) and 20 (1968); Josef Vlachovic, 'Slovak Copper Boom in World Markets of the Sixteenth and in the First Quarter of the Seventeenth Centuries,' *Studia historica slovacica*, 1 (1963), 63-95; Westermann, Ekkehard, *Das Eislebener Garkupfer und seine Bedeutung für den europäischen Kupfermarkt, 1460-1560* (Vienna, 1971); Ekkehard Westermann, 'Die Bedeutung des Thüringer Saigerhandels für den mitteleuropäischen Handel an der Wende vom 15. zum 16. Jahrhundert,' *Jahrbuch für die Geschichte Mittel- und Ostdeutschlands*, 21 (1972): 68-92. [Ed. by Wilhelm Berges, Hans Herzfeld, and Henryk Skrzypczak]; Ekkehard Westermann, 'Tendencies in the European Copper Market in the 15th and 16th Centuries,' in *Precious Metals in the Age of Expansion*, ed. Hermann Kellenbenz (Stuttgart, 1981), 79-86; Ekkehard Westermann, 'Communication (with graphs)' to the 8th International Economic History Congress, Section C, Budapest (1982); Ekkehard Westermann, 'Die Unternehmungsform der Saigerhandelsgesellschaft und ihre Bedeutung für den oberdeutschen Frühkapitalismus: Forschungsstand und - aufgeben,' in *L'impresa industria, commercio, banca seccoli XIII - XVIII*, ed. Simonetta Cavaciocchi, Istituto internazionale di storia economic 'F. Datini' Prato, series II, Atti delle 'Settimane di Studi' e altri Convegni vol. 22 (Prato, 1991), 577-86; Ekkehard Westermann, 'Über Wirkungen des europäischen Ausgriffs nach Übersee auf den europäischen Silber- und Kupfermarkt des 16. Jahrhunderts,' in *Columbus: Tradition und Neuerung*, ed. Armin Reese, Beiträge aus dem Fachbereich IV (Sozialwissenschaften) der Pädagogischen Hochschule Heidelberg, 5 (Idstein, 1992), 52-69.

**Table 4: Central European Copper Production**

See sources in Table 3; and Herman Van der Wee, *Growth of the Antwerp Market and the European Economy, 14th to 16th Centuries*, 3 Vols. (The Hague, 1963), 1: *Statistics*, Appendix 44, pp. 522-23.

**Table 5: English Broadcloth Exports**

Eleanora M. Carus-Wilson and Olive Coleman, *England's Export Trade, 1275 - 1547* (Oxford, 1963), 89-119; Anthony R. Bridbury, *Medieval English Clothmaking: An Economic Survey*, Pasold Studies in Textile History (London, 1982), Appendix F, pp. 118-22.

**Table 6: Burgundian-Habsburg Mint Outputs: Flanders and Brabant**

For a detailed list and analysis of the archival sources for the mint accounts used for this table from 1426 - 1500, see: Munro, John, *Wool, Cloth and Gold: The Struggle for Bullion in Anglo-Burgundian Trade, ca. 1340-1478* (Brussels, 1973), Appendix I, Tables A-B, pp. 187-97; Munro, John, 'Bullion Flows and Monetary Contraction in Late-Medieval England and the Low Countries,' in *Precious Metals in the Later Medieval and Early Modern Worlds*, ed. John F. Richards (Durham, 1983), 97-158; reprinted in John Munro, *Bullion Flows and Monetary Policies in England and the Low Countries, 1350 - 1500*, Variorum Collected Studies series CS 355 (Aldershot, 1992): see Tables 1-10, pp. 131-55; Munro, John, 'Mint Outputs, Money, and Prices in Late-Medieval England and the Low Countries,' in *Münzprägung, Geldumlauf, und Wechselkurse/ Minting, Monetary Circulation, and Exchange Rates: Akten des 8th International Economic History Congress*, ed. Eddy Van Cauwenberghe and Franz Irsigler, *Trierer Historische Forschungen*, vol. 7 (Trier, 1984), 31-122; John Munro, 'The Central European Mining Boom, Mint Outputs, and Prices in the Low Countries and England, 1450 - 1550,' in *Money, Coins, and Commerce: Essays in the Monetary History of Asia and Europe from Antiquity to Modern Times*, ed. Eddy Van Cauwenberghe, Studies in Social and Economic History, Katholieke Universiteit Leuven, no. 22 (Leuven, 1991), 119-83. The computation of these quinquennial means were based, however, on the actual short-term data (usually for periods of one year or less) recorded from the archival mint accounts.

For the period 1501-1600: unpublished computer data, in annual series of gold and silver mint-outputs in fine metal, prepared by Prof. Dr. (Eddy Van Cauwenberghe, from the Volkswagen-Universität Trier-Katholieke Universiteit Leuven Project on *The Coinage and Mint-Outputs of the Low Countries, 1334 - 1789*.

**Table 7:**

G.C. Brooke and E. Stokes, 'Tables of Bullion Coined, 1337-1550,' *The Numismatic Chronicle*, 5<sup>th</sup> ser., 9 (1929): 27-69; C.E. Blunt and C.A. Whitton, 'The Coinages of Edward IV and Henry VI (Restored),' *the Numismatic Chronicle*, 5<sup>th</sup> ser. 25 (1948): 53-57; Mayhew, Nicholas J., 'From Regional to Central Minting, 1158-1464,' in *A New History of the Royal Mint*, ed. Christopher Challis (Cambridge, 1992), pp. 83-178; Christopher E. Challis, 'Lord Hastings to the Great Silver Recoinage, 1464 - 1699,' and 'Appendix I: Mint Output, 1220-1985', in *A New History of the Royal Mint*, ed. Christopher Challis (Cambridge, 1992), pp. 179-397, 673-98; Christopher Challis, *The Tudor Coinage* (Manchester, 1978), pp. 150-98. For Calais, up to 1439, see Public Record Office, King's Remembrance Exchequer, KR. E. 101/190-98; and Lord Treasurer's Remembrancer, LTR. E. 364/59-104; *Calendar of Patent Rolls, 1422-1439*; and see also sources for table 6.

**Table 8: Silver and Gold Coinage Outputs in England and the Low Countries.**

See the sources for Tables 6 and 7.