

# Global Connections and Monetary History, 1470–1800

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## Contents

List of Figures and Tables	vii.
Preface	ix
<i>Dennis O. Flynn, Arturo Giráldez and Richard von Glahn</i>	
1 The Monetary Origins of the 'Price Revolution': South German Silver Mining, Merchant Banking, and Venetian Commerce, 1470–1540	1
<i>John H. Munro</i>	
2 Connecting Europe and Asia: A Quantitative Analysis of the Cape-route Trade, 1497–1795	35
<i>Ian de Vries</i>	
3 American Gold and Silver in the Eighteenth Century: From Fascination to Accounting	107
<i>A. García-Baquero González</i>	
4 Mining and Imperial Trade in Eighteenth-Century Spanish America	123
<i>John R. Fisher</i>	
5 Crisis and Recovery: The Ottoman Monetary System in the Early Modern Era, 1550–1789	133
<i>Şevket Pamuk</i>	
6 Precious-metal flows into India in the Early Modern Period	149
<i>Om Prakash</i>	
7 The Inflow of Silver to Bengal in Global Perspective, c. 1650–1757	159
<i>Sushil Chaudhury</i>	
8 The Emergence of the Tokugawa Monetary System in East Asian International Perspective	169
<i>Matteo Miyamoto and Yoshitaki Shikano</i>	
9 Money Use in China and Changing Patterns of Global Trade in Monetary Metals, 1500–1800	187
<i>Richard von Glahn</i>	
Index	207

# List of Figures and Tables

## Figures

2.1	Share of outbound shipping	42
2.2	Average tonnage of East Indiaman, 1733-67	45
2.3a	Flows of silver equivalent, in kg per annum, 1600-50	80
2.3b	Flows of silver equivalent, in kg per annum, 1725-50	81
8.1	Indices of rice prices: Japan and China	182

## Tables

1.1	Composite price indices for Flanders, Brabant, England, and Spain	2
1.2	Mined outputs of gold and silver from Spanish America and exports of gold and silver bullion to Seville	4
1.3	Silver outputs from the major South German-Central European mines	8
1.4	Outputs of the Burgundian mints in Flanders and Brabant	12
1.5	Silver and gold coinage outputs in England and the Low Countries	16
1.6	Gold and silver coinage outputs of the English mints	22
1.7	Central European copper production and exports	26
2.1	Ships departing for Asia	40
2.2	Outbound tonnage	46
2.3	Ships departing Europe for Asia and returning	51
2.4	Ships and tonnage returned to Europe from Asia	56
2.5	Personnel departing for Asia	69
2.6	Personnel losses in the Asia trade	73
2.7	Estimate of personnel losses in the Asia trade	74
2.8	Sources of precious metals available to the VOC in Asia, 1602-1730	76
2.9	Intercontinental specie flows, 1581-1795	78
2.10	Revenue from the sale of Asian goods in Europe, 1581-1640	86
2.11	Revenue from (a) sale of Asian goods in Europe, and (b) per ton returned, 1721-70	87
2.12	Gross margins of the Dutch and English East India Companies, 1640-1770	88
2.13	Model of Cape-route company revenues and expenses	89

## Chapter 1

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

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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 1.1). 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 Malesroit, in the *Response de maistre Jean Bodin au paradoxe de Monsieur de Malesroit touchant l'enchérissement de toutes choses et le moyen d'y remédier*.<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, 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-twentieth 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 begun about thirty or so years before Europe had received any large quantities of Spanish-American silver, as early as c.1516–20 in Northwest Europe, and by 1521–25 in Spain itself (Table 1.1). 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, Jean Cherruyt de Malesroit, who believed that coinage debasements were primarily responsible. Certainly in the two prior,

Table 1.1 Composite price indices for Flanders, Brabant, England, and Spain (in quinquennial means: 1401–05 to 1596–1600; Price Indices: mean of 1451–75 = 100; and mean of 1501–10 = 100)

Years 5 yr mean	Flanders 1451–75=100	Brabant 1451–75=100	England 1451–75=100	Spain I: Silver 1501–10=100	Spain II: Vellon 1501–10=100	Brabant 1501–10=100	England 1501–10=100
1401–05	88.53	64.27	114.84			53.50	109.08
1406–10	105.26	68.55	111.23			57.07	105.65
1411–15	95.31	73.97	108.11			61.58	102.68
1416–20	107.38	80.54	113.40			67.05	107.71
1421–25	112.18	90.19	101.48			75.08	96.38
1426–30	117.77	100.15	112.27			83.37	106.63
1431–35	123.51	102.76	108.48			85.54	103.03
1436–40	140.17	125.43	122.01			104.42	115.89
1441–45	113.50	105.48	92.53			87.81	87.88
1446–50	109.98	99.58	100.90			82.89	95.84
1451–55	100.90	98.54	100.25			82.03	95.22
1456–60	117.86	114.58	97.06			95.38	92.19
1461–65	88.71	91.07	102.73			75.81	97.58
1466–70	96.52	96.95	106.75			80.71	101.39
1471–75	96.02	98.85	97.76			82.29	92.85
1476–80	117.21	120.69	90.06			100.47	85.54
1481–85	156.85	155.75	127.38			129.66	120.99
1486–90	184.51	174.10	102.77			144.93	97.61
1491–95	144.98	133.22	106.80			110.90	101.44
1496–00	100.26	115.35	96.70			96.03	91.85
1501–05		125.45	106.79	92.43		104.43	101.43
1506–10		114.80	103.77	107.57		95.57	98.57
1511–15		137.90	108.52	98.98		114.80	103.08
1516–20		150.26	120.44	104.28		125.09	114.39
1521–25		179.94	146.05	122.14		149.79	138.72
1526–30		178.52	157.35	131.57		148.61	149.45
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	1,015.14	734.39	343.36	457.09	845.07	697.54

Sources:

**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) in: Charles E. Verlinden, E. Scholliers, H. Coppejans-Desmedt, Jan Craeybeek, 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 Iršigler (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*, 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 J. Hamilton, *American Treasure and the Price Revolution in Spain, 1501–1650* (Cambridge MA 1934; reissued 1965), 403, Appendix VIII for silver-based commodity prices; 271, 278. Tables 27 & 29, for vellon-based commodity price indices (real wages divided by money wages); see also 189, Table 21 (commodity prices 1501–50). 198. Table 23 (commodity prices 1551–1600); 215, Table 25 (commodity prices 1601–50).

**Table 1.2 Mined outputs of gold and silver from Spanish America and exports of gold and silver bullion to Seville (in kg of fine metal, in quinquennial means, 1501–05 to 1656–61)**

Years	Potosi: silver outputs (kg)	Zacatecas: silver outputs (kg)	Total known silver mining outputs (kg)	Mean fine gold imports (kg)	Mean fine silver imports (kg)	Index of silver imports: Seville, 1591–1600=100	Index of mined outputs, 1591–1600=100
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	139,403.77	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
1631–35	124,267.78	47,934.53	172,202.31	126.99	143,003.28	52.82	83.36
1636–40	147,647.32	31,044.38	178,691.70	121.09	136,348.64	50.36	86.51
1641–45	113,646.36	28,101.07	141,747.43	167.03	113,889.78	42.06	68.62
1646–50	121,192.60	30,215.72	151,408.32	142.84	97,396.41	35.97	73.30
1651–55	99,371.13	31,046.27	130,417.40	64.27	60,685.98	22.41	63.14
1656–60	103,710.82	26,373.41	130,084.23	29.62	27,965.33	10.33	62.97

**Notes:**

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, both in his original article of 1929 and 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 in terms of pesos of 450 maravedís; his Table 2 (p. 40) provided the decennial mean percentages of total values of those imports in 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 from the decennial mean data supplied in his Table 3.

**Sources:**

**Potosí and Zacatecas silver outputs:** Peter Bakewell, 'Registered Silver Production in the Potosí 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, 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 NC 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*, Table 1, p. 34; Table 2, p. 40; John H. TePaske, 'New World Silver, Castile, and the Philippines 1590–1800', in: Richards, ed. *Precious Metals in the Later Medieval and Early Modern Worlds*, 425–45; Table 1, p. 441.

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 began 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. Before that, from 1464-65 to 1542, England had enjoyed almost perfect monetary stability, briefly interrupted in 1526 by one relatively minor 'defensive' debasement (11.25 per cent weight reduction), when the bulk of the coinage was underweight.<sup>5</sup> England's commercial partner, in the cross-channel Burgundian Netherlands, 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 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 *escudete* 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, Malesfort 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 of gold between 1470 and 1500 (annual 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 1.2 indicates, the estimated annual mean imports of gold into Seville alone were: 621 kg in 1503-10 (8-year 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 gold:silver bimetallic ratio of 1:11 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 money-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 – in Spain from 1:10.11 in 1497 to 1:15.45 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, 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 per year in the period 1493-1520, and reached a maximum of about 47,000 kg silver per year in 1520-44.<sup>12</sup> Subsequently, John Nef, contending that Soetbeer had grossly underestimated the outputs from the new German/Bohemian mines, produced a new estimate for maximum output of mined silver in 1526-35 of between 84,200 kg and 91,200 kg per 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 focused studies do permit a more precise picture of the mining boom in specific parts of Saxony (Schneeberg, Annaberg, Marienberg), Thuringia (Eisleben, Hettstedt), the Austrian Tirol (Schwarz region only), Bohemia (Joachimsthal, Kutna Hora, Kasperska Hora), Slovakia (Tluruzo-Fugger Co.), and Hungary (Nagybanya, Körmöcbánya).<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 1.3). 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; peaking in 1531-40 with an annual mean of 52,525 kg; and 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 some considerable margin, because of periodic lacunae in the annual data for many of the mines listed above, and furthermore because of the exclusion of many other important mines whose output data were too sporadic

Table 13 Silver outputs from the major South German–Central European mines (in kg of fine metal in quinquennial means: 1471–75 to 1546–50)

Years	Saxony, est. total	Thuringia est. total	Bohemia – Joachimsthal	Bohemia – Kutna Hora Kasperska Hora	Slovakia – Fugger– Thurzo	Hungary – Nagybanya Körmöcbanya	Tyrol – Schwarz	Total, estimates
	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)
1471–75	4,360 94			4,500 0			4,112 50	12,973 44
1476–80	10,317 46			4,250 0			7,354 00	21,921 46
1481–85	3,743 30			4,000 0		1,800 0	9,745 80	19,289 10
1486–90	2 770 04			3,750 0		3,523 0	12,751 00	22,794 04
1491–95	3,757 33			3,500 0	1,957 12	3 523 0	12,422 75	25,160 21
1496–00	4,641 69			3,250 0	1,957 12	3,795 9	12,094 50	25,739 17
1501–05	8,979 23			3,000 0	2,870 47	4,068 7	11,766 25	30,684 65
1506–10	7,416 41	4,626 19		2,750 0	3,990 76	4,341 6	11,438 00	34,562 92
1511–15	6,925 10	5,713 42		2,500 0	3,632 11	4,614 4	11,109 75	34,494 81
1516–20	5,189 14	6,079 43	3,970 00	2,250 0	1,983 07	4,887 3	10,781 50	35,140 43
1521–25	3,701 18	6,301 73	9,703 24	2,000 0	2,486 46	5,160 1	10,453 25	39,806 00
1526–30	3,425 12	7,889 16	13,795 32	2 000 0	2,269 15	5,433 0	10,125 00	44,936 74
1531–35	6,663 07	6,300 90	16,554 81	2,000 0	2,269 15	5,433 0	10,125 00	49,345 92
1536–40	14,973 18	5,734 07	13,248 01	3,947 0	2,243 58	5,433 0	10,125 00	55,703 84
1541–45	7,739 26	6,144 00	10,936 85	3,997 0	2,141 55	5,433 0	9,963 49	46,355 16
1546–50	4,131.66	6,576.20	10,936.85	700.0	2,141.55	5,433.0	9,963.49	39,882.76

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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 Ratzenberg (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 1.2 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 rose, 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 introduction of the mercury amalgamation process.<sup>16</sup>

To understand the origins, nature, and true significance of this South German-Central European 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 Northwest Europe, was a pronounced and persistent deflation, affecting industrial and livestock prices as well as grain prices. In England, as Table 1.1 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 1464–65.<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 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. 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 output from the Bohemian mines at Kutna Hora, once the most productive in Europe, had fallen from a mean of about 30,000 kg per 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 important was the *Säugerhüttenprozess*, 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 in the 1450s, as indicated by the licence that the Duke of Saxony issued for the *Säuger* process in 1451, and by the inventory of a Nürnberg smelter-foundry in 1453. Shortly thereafter, evidence for the application of the *Säuger* process multiplies: at the Eisleben mines in Thuringia (Schleusingen, 1461; Gräfenhain and Hohenkirchen, 1462; Steinbach, 1464); at Mogila, near Cracow (1469); and at Chemnitz, in Saxony (1471). By the early 1470s, as Table 1.3 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 4,112.5 kg 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 (that is, in 1506–10), those silver-mining outputs had risen to an annual mean of 34,563 kg. 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.

Table 1.4 Outputs of the Burgundian mints in Flanders and Brabant (in kg of fine

Year	Silver: Flanders (kg)	Silver: Flanders (£ gr.)	Silver: Brabant (kg)	Silver: Brabant (£ gr.)	Silver: Flanders & Brabant (kg)	Silver: Flanders & Brabant (£ gr.)	Gold: Flanders (kg)	Gold: Flanders (£ gr.)	Gold: Brabant (kg)	Gold: Brabant (£ gr.)	Gold: Flanders & Brabant (kg)	Gold: Flanders & Brabant (£ gr.)	Total: Flanders & Brabant (£ gr.)	% of total in gold	% of total in silver
1426-30	5,724.635	30,932.966	906.533	4,963.716	6,631.168	35,896.682	372.372	22,373.694	161.136	10,424.924	533.508	32,798.618	68,695.300	47.75	52.25
1431-35	4,568.739	23,495.926	459.154	2,401.134	5,027.894	25,897.060	313.963	17,491.002	399.648	24,822.692	713.610	42,313.694	68,210.754	62.03	37.97
1436-40	3,505.132	17,981.664	869.701	4,460.388	4,374.833	22,442.052	241.904	13,483.338	220.777	12,305.710	462.681	25,789.038	48,231.090	53.47	46.53
1441-45	102.683	527.552	0.000	0.000	102.683	527.552	111.931	6,466.290	0.000	0.000	111.931	6,466.290	6,993.842	92.46	7.54
1446-50	5.911	40.786	0.000	0.000	5.911	40.786	2.550	148.084	0.000	0.000	148.084	148.084	188.870	78.41	21.59
1451-55	53.164	283.980	48.651	267.270	101.816	551.250	322.409	19,759.234	258.667	15,852.734	581.075	35,611.968	36,163.218	98.48	1.52
1456-60	51.302	336.654	11.207	62.350	62.509	399.004	160.791	9,854.308	65.268	4,000.050	226.060	13,854.358	14,253.362	97.20	2.80
1461-65	0.000	0.000	0.000	0.000	0.000	0.000	6.596	404.224	0.000	0.000	404.224	404.224	404.224	100.00	0.00
1466-70	2,975.690	17,957.102	1,475.960	8,860.690	4,451.650	26,817.792	186.880	12,116.676	56.288	3,622.242	243.168	15,738.918	42,556.710	36.98	63.02
1471-75	4,619.347	28,258.168	2,694.637	16,933.556	7,313.984	45,191.724	140.215	10,042.534	120.987	8,884.980	261.202	18,927.514	64,119.238	29.52	70.48
1476-80	4,078.520	28,866.250	5,262.975	38,770.001	9,341.495	67,636.251	186.598	14,335.372	193.453	14,873.126	380.051	29,208.498	96,844.749	30.16	69.84
1481-85	1,997.516	16,669.166	3,579.950	31,757.512	5,577.466	48,426.678	27.255	2,470.546	25.563	2,265.146	52.818	4,735.692	53,162.370	8.91	91.09
1486-90	940.931	9,235.614	3,612.131	44,214.174	4,553.062	53,449.158	0.000	0.000	112.938	20,319.780	112.938	20,319.780	73,769.568	27.54	72.46
1491-95	1,039.270	7,332.372	1,485.563	10,663.786	2,524.833	17,996.158	9.272	623.804	10.035	649.857	19.308	1,273.661	19,269.819	6.61	93.39
1496-00	2,071.913	17,066.911	2,801.051	23,676.880	4,872.964	40,744.791	293.421	27,548.326	181.212	16,915.954	474.633	44,464.280	85,208.071	52.18	47.82
1501-05	910.327	7,810.794	2,247.509	19,092.118	3,157.836	26,902.913	154.371	14,639.133	384.500	36,473.397	538.871	51,112.506	78,015.442	65.52	34.48
1506-10	243.983	2,188.306	1,139.746	9,703.890	1,383.730	11,892.196	47.850	4,544.799	263.629	25,030.810	311.480	29,575.609	41,467.805	71.32	28.68
1511-15	153.535	1,389.558	1,486.847	12,684.569	1,640.383	14,074.127	48.875	4,640.077	208.824	19,819.723	257.699	24,459.800	38,533.927	63.48	36.52
1516-20	76.582	679.285	628.540	5,473.336	705.122	6,152.620	9.302	883.470	135.792	12,896.402	145.094	13,779.878	19,932.492	69.13	30.87
1521-25	468.573	4,137.139	1,435.624	12,649.980	1,904.198	16,787.119	422.191	40,697.208	884.397	86,866.249	1,306.588	127,563.456	144,350.575	88.37	11.63
1526-30	561.757	4,997.960	2,418.118	21,200.520	2,979.875	26,199.479	46.009	4,455.388	194.981	20,107.277	240.990	24,562.665	50,761.144	48.39	51.61
1531-35	249.933	2,223.706	2,646.297	23,211.721	2,896.280	25,435.427	16.642	1,578.296	119.590	11,925.290	136.232	13,503.586	38,939.013	34.68	65.32
1536-40	546.463	4,832.122	4,818.534	42,465.771	5,364.987	47,297.893	28.529	2,750.162	110.134	10,693.539	138.663	13,443.702	60,741.595	22.13	77.87
1541-45	521.065	4,608.512	1,796.380	15,819.922	2,317.446	20,428.434	43.117	4,141.567	500.783	45,196.492	543.900	49,338.059	69,766.493	70.72	29.28
1546-50	196.049	1,752.545	1,262.233	11,135.117	1,458.283	12,887.662	33.034	3,156.632	698.597	57,500.833	731.630	60,657.466	73,545.128	82.48	17.52
1551-55	752.158	6,622.701	5,201.849	46,549.003	5,954.007	53,171.703	30.124	2,874.396	727.572	68,944.613	757.697	71,819.090	124,990.713	57.46	42.54
1556-60	4,067.687	39,193.713	8,078.382	78,979.118	12,146.069	118,172.831	36.718	3,902.567	615.361	62,052.435	652.080	65,955.002	184,127.833	35.82	64.18
1561-65	1,558.394	15,888.705	6,819.345	69,590.637	8,377.738	85,479.342	273.331	30,379.709	307.176	33,863.727	580.507	64,243.436	149,722.777	42.91	57.09
1566-70	3,388.042	34,591.355	14,806.057	153,173.323	18,194.099	187,764.677	166.441	18,492.398	100.417	11,014.003	266.858	29,506.401	217,271.079	13.58	86.42
1571-75	916.071	9,879.295	11,431.522	119,719.206	12,347.593	129,598.501	7.244	898.538	69.787	7,688.906	77.032	8,587.444	138,185.946	6.21	93.79
1576-80	1,805.157	20,965.497	4,785.828	58,061.608	6,590.985	79,021.105	6.986	890.548	31.375	4,347.075	38.361	5,237.623	84,264.728	6.22	93.78
1581-85	329.759	5,231.483	1,066.340	14,881.837	1,396.099	20,113.320	60.777	12,306.744	93.743	15,651.211	154.520	27,957.956	48,071.276	58.16	41.84
1586-90	273.461	4,292.492	9,850.927	143,697.574	10,124.388	147,990.065	10.456	1,655.564	41.652	6,590.401	52.108	8,245.965	156,236.030	5.28	94.72
1591-95	31.523	460.698	10,641.971	163,876.047	10,673.974	164,336.744	1.906	321.317	7.460	1,256.178	9.366	1,577.495	165,914.240	0.95	99.05
1596-00	26.217	377.390	2,261.755	32,833.305	2,287.972	33,210.695	4.779	863.289	390.081	70,443.398	394.860	71,306.687	104,517.382	68.22	31.78

## Sources:

For a detailed list and analysis of the archival sources for the mint accounts used for this table from 1426 to 1500, see John Munro, *Wool, Cloth and Gold: The Struggle for Bullion in Anglo-Burgundian Trade, ca. 1340-1478* (Brussels, 1973), 187-197, Appendix I, Tables A-B, Munro, 'Bullion Flows and Monetary Contraction in Late-Medieval England and the Low Countries', in: Richards, ed., *Precious Metals in the Later Medieval and Early Modern Worlds*, 97-158, reprinted in John Munro, *Bullion Flows and Monetary Policies in England and the Low Countries, 1350-1500* (Aldershot, 1992), 141-55, Tables 1-10; John Munro, 'Mint Outputs, Money, and Prices in Late-Medieval England and the Low Countries', in: *Münzprägung, Geldumlauf und Wechselkurs/Minting, Monetary Circulation, and Exchange Rates: Akten des 8th International Economic History Congress*, ed. Eddy Van

metal, with values in Flemish Pounds Groot; quinquennial means, 1426-30 to 1596-1600

Cauwenbergh and Franz Issigier (Trier, 1984), 31-122; 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 Cauwenbergh (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. Eddy Van Cauwenbergh, from the Volkswagen-Universität Trier-Katholieke Universiteit Leuven Project on *The Coinage and Mint-Outputs of the Low Countries, 1334-1789*.

Somewhat fortuitously, a combination of monetary, fiscal, and commercial policies in England and the Burgundian Netherlands helped to attract a very sizeable proportion of this Central European silver output, chiefly under the control of South German merchant financiers, to northwest Europe and to the Antwerp market in particular, 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 cloths 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 Rhensish 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 fueling any inflation within the still-deflated English economy (Table 1.1).<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 (Table 1.4), for the next thirty-five years (while England's was conversely pro-gold), more so than other rival mints in Northwest Europe. That mint-ratio alteration was undoubtedly an important factor in attracting to Antwerp a much greater number of South German merchants with their silver, copper, fustian textiles, and banking-financial institutions.<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 in 1501 to make Antwerp their official staple for Asian spices, 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 1:11.2 in northwestern Europe, and 1:9 or 1:10 in

South Asia and the Levant – meant that normally silver was the more profitable metal to be shipped to Asia (and as good ballast, too), 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 c. 1515-20, especially in 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 while augmenting its supply quite dramatically. By the reasoning cited earlier, we should expect that cheaper and more abundant silver would have resulted in higher commodity prices: that is, 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 1.1 indicates, the Pheips Brown & Hopkins mean quinquennial commodity price index was only 96.7; in 1506-10, it had risen only slightly, to 103.8, and then to 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) – all *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). 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 a country 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>

One possible and certainly obvious reason why the Central European silver-mining boom did not immediately produce inflationary conditions in Western Europe, at least 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. 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

Table 1.5 Silver and gold coinage outputs in England and the Low Countries (in kg of fine metal, in quinquennial means: 1426–30 to 1596–1600)

Years	England: silver coinage (kg)	Low Countries – Flanders & Brabant: silver coinage (kg)	Combined Total: silver coinage (kg)	England gold coinage (kg)	Low Countries: Flanders & Brabant gold coinage (kg)	Combined total: gold coinage (kg)
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	934.39
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	1,531.32
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

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

Sources:

See the sources for Tables 1.4 and 1.6

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 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 two most important were silver and copper, along with some gold, foodstuffs, iron, and timber. Ashor has also estimated that the exports of silver and gold, but primarily silver, then averaged about 660,000 gold ducats (3.56 g) per year in value, equivalent to 2,349 kg fine gold, or about 26,167 kg fine silver. At this same time, in 1496–1500, as Table 1.5 indicates, the *mean* annual mint outputs in England, Flanders and Brabant (that is, 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 Ashor 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 Ashor'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 (2,500 sacks) to about 100,000 ducats annually. Overall, Venetian trade with the Levant had grown by about 33 per cent in value. 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 regions), a demand certainly fueled by increasing output 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 output for 1476–1500 amounted to only 32,592 kg (in pure metal), less than half that for the preceding quarter-century (69,497 kg in 1451–75). The reason for these differences in mint output (apart from Edward IV's debasement–recoinage of 1464–65) 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 (that is, 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:  $MV = PY$ , in which, on the right-hand side of the equation,  $P$  is an index of the national economy's commodity price level, such as Phelps Brown & Hopkins's 'consumables price index', and  $Y$  represents real net national income in constant monetary units; while on the left-hand side,  $M$  = the monetary stock; and  $V$  = the income velocity of this monetary stock. 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> For most economists, however, the Cambridge 'cash balances' equation  $M = kPY$  provides a better variant, because  $k$ , which is mathematically the reciprocal of  $V$ , represents the more useful concept of the 'demand for money': that is, that proportion of net national income ( $PY$ ) 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 economize 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  $y$  (that is, in *real* NN), 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, at the nadir of the late-medieval 'great depression' 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 observed, however, these 'offsetting' conditions could not hold true for long: '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.'<sup>34</sup> That situation can be related to the now well-known Phillips Curve: 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.<sup>35</sup> 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 a 'historic' aggregate supply schedule, 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, that is, 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 and rising marginal costs, and thus to 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 beginning of inflation in the decade 1511–20 by inducing supply rigidities in the face of a more rapidly expanding volume of money payments – not with a population that was probably still less than half of 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 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 1.3 and the subsequent analysis provide the evidence for monetary expansion, while the published data of Van der Wee's research on the Antwerp money market (*rentes*, and so on) 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, and indeed became 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 1.1 suggests, despite very dissimilar histories of economic development in southern England and the southern Low Countries – 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<sup>40</sup> – the rates and extents of inflation were roughly parallel in both.<sup>41</sup> Among others who have critiqued the Goldstone model, Peter Lindert has suggested an alternative: that population growth, by increasing the ratio of dependent children to adults and 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. *Tout en passant*, Mayhew 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 1.6.<sup>43</sup> As noted earlier, the combined English and Burgundian monetary changes in 1464–67 meant that, while the Burgundian mint ratio favoured silver coinages (1:10.83), the English mint ratio

**Table 1.6 Gold and silver coinage outputs of the English mints (in kg of fine metal with values in pounds sterling: in quinquennial means, 1426–30 to 1596–1600)**

Years	Silver coinage: total (kg)	Silver coinage: value (£ sterling)	Gold coinage: total (kg)	Gold coinage: value (£ sterling)	Total values (£ sterling)	% silver	% gold
1426–30	6,858 608	31,785 107	599 478	28,703 069	60,488 176	52 55	47 45
1431–35	8,059 545	37,350 656	220 785	10,571 183	47,921 839	77 94	22 06
1436–40	977 025	4,527 863	132 274	6,333 298	10,861 161	41 69	58 31
1441–45	130 700	605 707	90 778	4,346 467	4,952 174	12 23	87 77
1446–50	517 373	2,397 681	64 336	3,080 422	5,478 103	43 77	56 23
1451–55	1,460 637	6,769 085	63 526	3,041 629	9,810 714	69 00	31 00
1456–60	1,415 094	6,558 024	26 719	1,279 288	7,837 312	83 68	16 32
1461–65	3,432 915	18,067 349	488 118	29,731 331	47,798 679	37 80	62 20
1466–70	5 168 090	29,938 348	1,288 157	83,263 992	113,202 339	26 45	73 55
1471–75	2 422 654	14,034 247	538 669	34,818 552	48,852 799	28 73	71 27
1476–80	834 683	4,835 252	404 477	26,144 624	30,979 875	15 61	84 39
1481–85	995 231	5,765 296	219 449	14,184 753	19,950 049	28 90	71 10
1486–90	926 785	5,368 794	129 749	8,386 730	13,755 524	39 03	60 97
1491–95	1,270 840	7,361 876	268 983	17 386 525	24,748 402	29 75	70 25
1496–00	2,490 940	14,429 823	278 926	18 029 238	32,459 060	44 46	55 54
1501–05	4 313 544	24,988 026	516 604	33,392 271	58,380 297	42 80	57 20
1506–10	3,633 212	21,046 916	1,523 115	98,451 267	119,498 183	17 61	82 39
1511–15	1,089 012	6,308 562	694 599	44,897 564	51,206 126	12 32	87 68
1516–20	79 145	458 481	589 841	48,068 530	48,527 011	0 94	99 06
1521–25	3,148 207	18,237 317	442 136	28,578 780	46,816 096	38 96	61 04
1526–30	9,244 701	60,248 025	736 422	54,079 255	114,327 280	52 70	47 30
1531–35	4,616 832	30,088 071	189 160	13,890 972	43,979 043	68 41	31 59
1536–40	5,684 094	37,043 459	406 719	29 826 052	66,869 511	55 40	44 60
1541–45	5 707 032	100,776 324	963 792	79,997 508	180,773 832	55 75	44 25
1546–50	22,029 731	402,892 436	1,992 083	188,860 922	591,753 358	68 08	31 92
1551–55	9,428 855	121,874 569	136 583	16,023 336	137,897 905	88 38	11 62
1556–60	4,152 478	36,023 663	137 533	23,955 867	59,979 529	60 06	39 94
1561–65	24 263 303	210,873 247	255 828	24,682 712	235,555 960	89 52	10 48
1566–70	11 097 432	96,429 852	236 160	22,790 897	119,220 749	80 88	19 12
1571–75	8 806 166	76,520 164	102 633	9,934 572	86,454 736	88 51	11 49
1576–80	8 071 535	70,489 334	76 197	7,416 226	77,905 560	90 48	9 52
1581–85	16,056 314	139,852 039	337 318	32,770 995	172,623 034	81 02	18 98
1586–90	6 405 349	55,658 544	185 206	17,957 031	73,615 575	75 61	24 39
1591–95	18,653 363	162,086 240	178 498	17,306 684	179,392 924	90 35	9 65
1596–00	7,461 690	64,837 491	131 637	12,736 568	77,574 058	83 58	16 42

*Sources:*

G.C. Brooke and E. Stokes, 'Tables of Bullion Coined 1337–1550', *The Numismatic Chronicle* 5th ser. 9 (1929): 27–69; C.E. Blunt and C.A. Whitton 'The Coinages of Edward IV and Henry VI (Restored)', *The Numismatic Chronicle*, 5th ser. 25 (1948): 53–57; Nicholas J. Mayhew, 'From Regional to Central Minting 1158–1464', in: *A New History of the Royal Mint* ed. Christopher Challis (Cambridge, 1992): 83–178; Christopher E. Challis, 'Lord Hastings to the Great Silver Recoinage 1464–1699', and 'Appendix I: Mint Output 1220–1985', in: Challis, ed. *A New History of the Royal Mint*, 179–397, 673–98 respectively; Challis *The Tudor Coinage* (Manchester, 1978), 150–98. For Calais up to 1439, see Public Record Office King's Remembrance Exchequer, K.R.E. 101/190–98; and Lord Treasurer's Remembrancer, L.T.R. E. 364/59–104; *Calendar of Patent Rolls 1422–1439*. See also the sources for Table 1.4



conversely favoured gold (1:11.16). 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 ratio began to rise in favour of gold at the Antwerp Fairs: from 1:10.93 in 1511 to 1:12.96 in 1525 (though averaging 1:11.47 from 1526 to 1540).<sup>44</sup> Indeed, as Table 1.6 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, 74.4 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, or 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 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 seven smoked herrings or one 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 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 (that is, 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 – that is, 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 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 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 (that is, guaranteeing the rights of 'bearers', as third parties) was established by London's law merchant court in 1436. 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, that is, 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 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 main vehicle of public finances was that papal bulls (1425, 1455) had declared them to be free from any taint of usury, 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 consequently *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 widespread activity of the Antwerp Bourse and of South German merchant-banking houses, led by the Fuggers, Welsers, Höchstetters, Herrwarts, Imhofs, and Tüchers. 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 Genesee was one of spectacular growth in public finances'.<sup>52</sup> Furthermore, credit expansion was certainly related to increasing stocks of precious metals. 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 other possible explanations. The first may have been a relatively greater



**Table 1.7 Central European copper production and exports** (in kg of fine copper with exports to Venice and Antwerp, in quinquennial means: 1491-95 to 1536-40)

Years	Total Outputs (estimated in kg)	Exports: Total (kg)	To Venice (kg)	To Venice (%)	To Antwerp (kg)	To Antwerp (%)
1491-95	1,980,746					
1496-00	2,704,948	1,390,392.3	446,742.2	32.13	72,545.1	5.22
1501-05	3,041,820	1,403,347.5	409,357.8	29.17	453,686.4	32.33
1506-10	4,770,333	1,627,847.0	184,642.0	11.34	819,753.4	50.36
1511-15	5,654,047	1,659,584.9	60,358.6	3.64	968,521.4	58.36
1516-20	5,203,097	1,388,953.7	29,544.6	2.13	606,520.0	43.67
1521-25	5,341,702	1,434,963.1	66,809.2	4.66	488,633.1	34.05
1526-30	5,275,248	1,062,740.6	54,876.6	5.16	625,457.9	58.85
1531-35	4,628,886	1,008,644.5	111,652.6	11.07	543,443.9	53.88
1536-40	4,336,708	1,207,783.7	150,544.0	12.46	593,242.8	49.12

*Sources:*

See sources in Table 1.3 and Herman Van der Wee *Growth of the Antwerp Market and the European Economy, 14th to 16th Centuries* (The Hague, 1963), I: 522-23, Appendix 44

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 its official spice staple at Antwerp in 1501, but also because of 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'.<sup>54</sup> 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 (that is, the Levant), in which Venice had long enjoyed 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 1.7. 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 1.3 indicates, the decade 1516-25 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 silver outputs of Eisleben-Hetstedt 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, Schwarz 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 1.3), and about 5,433 kg at Körmöcbánya, 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.

## Notes

- 1 Margote Grace-Hutchinson, *The School of Salamanca: Readings in Spanish Monetary Theory, 1544-1605* (Oxford, 1952); Appendix III: 95. 'And even in Spain, in times when money was scarce, 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.'
- 2 George A. Moore, ed., *The Response of Jean Bodin to the Paradoxes of Malesherou and The Paradoxes, translated from the French Second Edition, Paris 1578* (Washington, 1946). See also Jean-Yves Le Branchu, ed., *Écrits notables sur la monnaie, XVI<sup>e</sup> siècle: De Copernic à Davanzati reproduits, traduits, d'après les éditions originales et les manuscrits, avec une introduction, des notices et des notes* (Paris, 1934); *Les paradoxes du Seigneur de Malesherou, conseiller du Roy, et Maître ordinaire de ses comptes, sur le fait des monnoyes, presentés à sa Majesté, au mois de mars MDLXVI* (Paris, 1566); *La response de maistre Jean Bodin advocat en la cour au paradoxe des monseurs de Malesherou touchant l'enchérissement de toutes choses et le moyen d'y remédier* (Paris, 1568).
- 3 Earl J. Hamilton, 'American Treasure and the Rise of Capitalism (1500-1700)', *Economica: A Journal of the Social Sciences*, 27 (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, MA, 1934, reissued 1965); Fernand Braudel, *La Méditerranée et le monde méditerranéen à l'époque de Philippe II* (Paris, 1949; 2nd revised ed., Paris, 1966); republished as *The Mediterranean and the Mediterranean World in the Age of Philip II*, 2 vols (London and New York, 1972-73), especially I: 476-510.
- 4 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 ed., 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 Annals* (London, 1972). For the most recent study emphasizing 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 *EJHNet Review* <chevrev@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 to inflation; and their publications (Goldstone, Lindert, Mayhew) are discussed below on p. 21 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; Winifred Slater, 'Meaning and Function of New Methods of Time Series Analysis for Economic History', in: Eddy Van Cauwenberghe, ed., *Precious Metals, Coinage and the Changes of Monetary Structures in Latin-American, Europe, and Asia (Late Middle Ages-Early Modern Times)* (Leuven, 1989), 209-22. See also the related studies of Dennis Flynn, 'Sixteenth-Century Inflation From a Production Point of View', in: E. Marcus and N. Smukler, eds., *Inflation Through the Ages: Economic, Social, Psychological, and Historical Aspects* (New York, 1983), 157-69; Dennis O. Flynn, 'The Microeconomics of Silver and East-West Trade in the Early Modern Period', in: Wolfram Fischer and R. Marvyn McInnis, eds., *The Emergence of a World Economy, 1500-1914* (Wiesbaden, 1986), I: 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), especially Donald N. McCloskey and J. Richard Zeckner, 'How the Gold Standard Worked, 1880-1913', in: ibid., 357-85; John E. Floyd, *World Monetary Equilibrium: International Monetary Theory in an*

- 5 *Historical-Institutional Context* (Philadelphia, 1983); 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 sixteenth-century Price Revolution, see John Munro, 'The Central European Mining Boom, Mint Outputs, and Prices in the Low Countries and England, 1450-1550', in: Eddy Van Cauwenberghe, ed., *Money, Coins, and Commerce: Essays in the Monetary History of Asia and Europe from Antiquity to Modern Times* (Leuven, 1991), 150-53.
- 6 See Nicholas J. Mayhew, 'From Regional to Central Minting, 1158-1464', and Christopher Challis, 'Lord Hastings to the Great Silver Reconquest, 1464-1699', in: Christopher Challis, ed., *A New History of the Royal Mint* (Cambridge, 1992), 83-178 and 179-397 respectively; Christopher Challis, 'The Circulating Medium and the Movement of Prices in Mid-Tudor England', in: Peter Ramsey, ed., *The Price Revolution in Sixteenth-Century England* (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), n.p. in Ramsey, ed., *Price Revolution*, 91-116; J.D. Gould, *The Great Debasement: Currency and the Economy in Mid-Tudor England* (Oxford, 1970), 71-86.
- 7 Herman Van der Wee, *Growth of the Antwerp Market and the European Economy, 14th to 16th Centuries* (The Hague, 1963), I: Statistics, 126-30; John Munro, 'Money and Coinage of the Age of Erasmus', Appendix A: 'The Coinage of the Burgundian-Habsburg Netherlands, Before and After 1521'; and Appendix B: 'Official Coinage Rates: February and August 1521', in: Sir Roger Mynors and Pieter Bietenholz, eds., *The Collected Works of Erasmus: Correspondence. VIII: Letters 1122 to 1251, A.D. 1520 to 1521* (Toronto, 1988), 347-50; Louis Deschamps de Pas, *Essai sur l'histoire monétaire des comtes de Flandre de la maison d'Arricelle et classement de leurs monnaies, 1482-1556* (Paris, 1874); 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).
- 8 A. Blanchet and A. Dieudonné, *Manuel de numismatique française* (Paris, 1916). It cites 17-22; Édouard Fournial, *Histoire monétaire de l'occident médiéval* (Paris, 1970), 134-39.
- 9 Modesto Ulloa, 'Castilian Seigneurage 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: Seigneurage and Currency Policy in Spain, 1597-1650', *The Journal of Economic History*, 54:1 (1994): 104-27; Akira Motomura, 'New Data on Mining, Seigneurage, and the Money Supply in Spain (Castile), 1597-1643', *Explorations in Economic History*, 34:3 (1997): 331-67; Hamilton, *Price Revolution*, 46-72.
- 10 See the various studies in John H. Munro, *Bullion Flows and Monetary Policies in England and the Low Countries, 1350-1500* (Aldershot, 1992).
- 11 See Ivor Wilks, 'Wangara, Akan, and the Portuguese in the Fifteenth and Sixteenth Centuries', in: Ivor Wilks, ed., *Forays of Gold: Essays on the Akan and the Kingdom of Asante* (Athens, OH, 1993), 1-39, n.p. in: Peter Bakewell, ed., *Mines of Silver and Gold in the Americas* (London, 1997); John Day, 'The Great Bullion Famine of the Fifteenth Century', *Past and Present*, 79 (1978): 36-9, n.p. 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 ed., London, 1968), 13-44, 98-206; Marian Malowist, 'Quelques observations sur le commerce de l'or dans le Soudan occidental au moyen âge', *Annuaire E.S.C.*, 25 (1970): 1630-36; Ivana Eibl, '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, Segregation, and Growth: the Trans-Saharan Caravan Trade in the Era of European Expansion, 1500-1900', in: James Tracy, ed., *The Rise of Merchant Empires: Long-Distance Trade in the Early Modern World, 1350-1750* (Cambridge, 1990), 311-41; Ward Barrett, 'World Bullion Flows, 1450-1800', in Tracy, ed., *Rise of Merchant Empires*, 224-54, and Table 7.5 (p. 247); Vittorio Magalhães Godinho, *L'économie de l'empire portugais aux X<sup>e</sup> et X<sup>e</sup> siècles* (Paris, 1969); Braudel, *The Mediterranean and the*

*Mediterranean World*, I: 464–75. Braudel does not believe that the trans-Saharan flow was diminished by the trans-Atlantic trade.

- 11 See Hamilton, *Price Revolution*, 71, Table 4; 123, Table 8. The official ratios of the two coined marts were: 1:10.11 in 1497–1536; 1:10.61 in 1537–65; 1:12.12 in 1566–1608; 1:13.33 in 1609–42; and 1:15.45 in 1643–50. For other European bimetallic ratios over this period, see in particular Frank Spooner, *The International Economy and Monetary Movements in France, 1493–1723* (Cambridge, MA, 1972), 20–33 (especially Table 1, p. 21). K.N. Chaudhri, 'Treasure and Trade Balances: the East India Company's Export Trade, 1660–1720', *Economic History Review*, 2nd ser., 21 (1968): 497–99, Table 1, which indicates, for 1661–65, a bimetallic ratio of 1:15.08 in London and 1:16.16 in India; and also K.N. Chaudhri, 'Circuits monétaires internationaux, prix comparés et spécialisation économique, 1500–1750', in: John Day, ed., *Études d'histoire monétaire, XIIe–XIXe siècles* (Lille, 1984), 49–68. In general, the steepest rise in the bimetallic ratio occurred after 1600.

- 12 Adolf Soetbeer, *Edelmetall-Produktion und Werthverhältnisse zwischen Gold und Silber seit der Entdeckung Amerikas bis zur Gegenwart* (Gotha, 1879).

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

- 14 Josef Vlachovic, 'Slovak Copper Boom in World Markets of the Sixteenth and in the First Quarter of the Seventeenth Centuries', *Studia historica slovacca*, 1 (1963): 63–95; Ekkehard Westermann, *Das Eisleberer 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: Hermann Kellenbenz, ed., *Precious Metals in the Age of Expansion* (Stuttgart, 1981), 79–86; Ekkehard Westermann, 'Communication (with graphs)' to the Eighth International Economic History Congress, Section C, Budapest (1982); Ekkehard Westermann, 'Die Bedeutung des Thüringer Sagerhandels für den mitteleuropäischen Handel an der Wende vom 15. zum 16. Jahrhundert', *Jahrbuch für die Geschichte Mittel- und Ostdeutschlands*, 21 (1972): 68–92; Ekkehard Westermann, 'Die Unternehmensform der Sagerhandels-gesellschaft und ihre Bedeutung für den oberdeutschen Frühlkapitalismus: Forschungsstand und -aufgaben', in: Simonetta Cavalcocci, ed., *L'imprea industriale, commercio, banca secoli XIII–XVIII* (Prato, 1991), 577–86; Ekkehard Westermann, 'Über Wirkungen des europäischen Ausgriffs nach Übersee auf den europäischen Silber- und Kupfermarkt des 16. Jahrhunderts', in: Armin Reese, ed., *Columbus: Tradition und Neuerung* (Jüster, 1992), 52–69; Hermann Kellenbenz, 'Europäisches Kupfer, Ende 15. bis Mitte 17. Jahrhundert: Ergebnisse eines Kolloquiums', in Hermann Kellenbenz, ed., *Schwerpunkte der Kupferproduktion und des Kupferhandels in Europa* (Cologne, 1977), 290–351; Hermann Kellenbenz, 'Production and Trade of Gold, Silver, Copper, and Lead from 1450 to 1750', in Kellenbenz, ed., *Precious Metals in the Age of Expansion*, 307–61; Adolf Laube, *Studien über den erzbergischen Silberbergbau von 1470–1546* (Leipzig, 1974); Oskar Pantany, '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 Kellenbenz, ed., *Precious Metals in the Age of Expansion*, 27–39; Georg Schenk, 'Über die Anfänge des Silberbergbaues von St. Joachimsthal', *Der Ausschutt*, 19 (1967) and 20 (1968); Philippe Braustein, 'Innovations in Mining and Metal Production in Europe in the Late Middle Ages', *The Journal of European Economic History*, 12 (1983): 573–91.

15 See sources cited in n. 14 above.

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

- 17 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: Richards, ed., *Precious Metals in the Later Medieval and Early Modern Worlds*, 97–158 (ppl. with other essays on this theme in Munro, *Bullion Flows and Monetary Policies*); 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 (ppl. with other relevant studies in Harry A. Miskimin, *Cash, Credit, and Crisis in Europe, 1300–1600* [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 Reconquest of 1464–1471', *British Numismatic Journal*, 44 (1974): 62–73; Mayhew, 'From Regional to Central Minting, 1158–1464', 83–178. See also nn. 22, 26–27, 29 below.

- 18 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 kg 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:  $T = 11/(1 - x)$  – 1, in which  $T$  (*truite*) 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 nn. 5, 17 above and nn. 23, 25 below.

- 19 In Table 1.1, 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 Output, Money, and Prices in Late-Medieval England and the Low Countries', in: Eddy Van Cauwenberghe and Franz Issigier, eds., *Münzprägung, Geldmarkt, und Wechselkurs/Minting, Monetary Circulation, and Exchange Rates: Actes des 8th International Economic History Congress* (Trier, 1984), 31–122; and the sources for Table 1.1.

- 20 See Van der Wee, *Antwerp Market*, II: 37–123; and the various essays in Herman Van der Wee, *The Low Countries in the Early Modern World* (Cambridge, 1993); John Munro, *Textiles, Towns, and Trade: Essays in the Economic History of Late-Medieval England and the Low Countries* (Aldershot, 1994); and John Munro, 'Anglo-Flemish Competition in the International Cloth Trade, 1340–1520', in: Jean-Marie Cauchies, ed., *Rencontres d'Oxford (septembre 1994): L'Angleterre et les pays bas bourguignons: relations et comparaisons, XVe–XVIIe siècle* (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', *Journal of Early Modern History: Contacts, Comparisons, Contrasts*, 3:1 (1999): 1–74.

- 21 See n. 18 above.
- 22 Van der Wee, *Antwerp Market*, I: 126–28, Table XV; 2: 80–101; Munro, *Wool, Cloth and Gold*, 135–80, 198–211, Tables C–K; sources also cited in nn. 17–20 above.

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

- 24 Indeed, as Table 1.1 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 Hentrican 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 December, 1624); and (2) the foreign trade and fiscal policies of the Spanish Crown, which quickly dispersed abroad much of the silver imported into Spain in order to finance debts and war in Italy, France, and 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 96, Table 7, 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 Seigneurage and Coinage', 459-80; Motomura, 'Seigneurage and Currency Policy in Spain, 1597-1650', 104-27; Motomura, 'Money Supply in Spain (Castile)', 331-67.
- 26 See Hartmann Kellenbenz, 'The Fasten Industry of the Ulm Region in the Fifteenth and Early Sixteenth Centuries', in: Negley B. Harte and Kenneth G. Ponting, eds, *Cloth and Clothing in Medieval Europe: Essays in Memory of Professor E. M. Carnus-Wilson* (London, 1983), 259-78; Wolfgang von Stronem, *Die Gründung der Baumwollindustrie in Mitteleuropa. Wirtschaftspolitik in Spätmittelalter* (Stuttgart, 1978).
- 27 Eliyahu Ashor, *Levant Trade in the Later Middle Ages* (Princeton, 1983), 103-200, 433-512; Eliyahu Ashor, *Les métaux précieux et la balance des paiements du Proche-Orient à la basse époque* (Paris, 1971); Eliyahu Ashor, *A Social and Economic History of the Near East in the Middle Ages* (London, 1976), 319-31; Eliyahu Ashor, 'The Venetian Supremacy in Levantine Trade: Monopoly or Pre-Colonialism?' *Journal of European Economic History* 3:1 (1974): 5-53; Eliyahu Ashor, 'The Volume of Levantine Trade in the Later Middle Ages (1370-1498)', *Journal of European Economic History* 4:3 (1975): 573-6; Eliyahu Ashor, 'Profits from Trade with the Levant in the Fifteenth Century', *Bulletin of the School of Oriental and African Studies*, 37 (1975): 250-75; Eliyahu Ashor, '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 Ashor, *Studies on Levantine Trade in the Middle Ages* (London, 1978).
- 28 Munro, *Bullion Flows and Monetary Contraction*, 101-2; 142-43, Table 7; see n. 17 above.
- 29 See Miskimin, *Economy of Early Renaissance Europe*, 25-32, 132-50; Miskimin, 'Monetary Movements and Market Structures', 470-90; Spufford, *Money and Its Use*, 339-62; Day, 'The Great Bullion Famine', see also nn. 17, 27 above.
- 30 See sources cited in n. 27 above.
- 31 See, in particular, Spufford, *Monetary Problems and Policies in the Burgundian Netherlands*, 141-46, 180-93; Van der Wee, *Antwerp Market*, I: 127-28, and II: 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 1433-53. 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).
- 32 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.
- 33 See, in particular, John Hatcher, 'The Great Slump of the Mid-Fifteenth Century', in: Richard Britnell and John Hatcher, eds, *Progress and Problems in Medieval England: Essays in Honour of Edward Miller* (Cambridge, 1996), 237-72; John Hatcher, *Plague, Population and the English Economy, 1348-1500* (London, 1977); Van der Wee, *Antwerp Market*, I: 545-48, II: 7-112, 289-319; John Munro, 'Economic Depression and the Arts in the Fifteenth-Century Low Countries', *Renaissance and Reformation*, 19 (1983): 235-50, rpt. in John Munro, *Textiles, Towns, Ferdinand Seibt and Winifred 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 congiuntura nei secoli XIV e XV', in *La Storia. I grandi problemi* [Turin, 1983]).

- 34 John Maynard Keynes, *The General Theory of Employment, Interest, and Money* (London, 1936), 300. 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.'
- 35 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): 283-99.
- 36 Joseph Cuvelier, *Les dénombrements de foyers en Brabant, XIVe-XVIe siècle* (Brussels, 1912-13), I: 432-33, 446-47, 462-77, 484-87; and also pp. cxxxv, cxxxvii-cxxxviii, cxxxix-cxxviii; Van der Wee, *Antwerp Market*, I: 545-48, Appendices 49: 1-2.
- 37 See, in particular, Jan 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. Osppen and R.S. Schofield, *English Population History from Family Reconstitution* (Cambridge, 1997); Pamela Nightingale, 'The Growth of London in the Medieval English Economy', in: Richard Britnell and John Hatcher, eds, *Progress and Problems in Medieval England* (Cambridge and New York, 1996), 89-106.
- 38 Van der Wee, *Antwerp Market*, I: 526-27, Appendices 45: 1-2.
- 39 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: Joel Mokyr, ed., *The Vital One: Essays in Honor of Jonathan R.T. Hughes* (Research in Economic History, Supplement no. 6; Greenwich, CT, 1991), 51-92; Jack A. Goldstone, 'Monetary Versus Velocity Interpretations of the "Price Revolution": A Comment', *Journal of Economic History* 51 (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.
- 40 See below p. 25 and 48-52.
- 41 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 ontwikkelingsvariabele: Een vergelijkend onderzoek tussen Engeland en de Zuidelijke Nederlanden, 1400-1700', in: *Album aangeboden aan Charles Verhulst ter gelegenheid van zijn dertig jaar professorat* (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 rpt. in Van der Wee, *The Low Countries in the Early Modern World*, 223-41.
- 42 Peter Lindert, 'English Population, Wages, and Prices, 1541-1913', *Journal of Interdisciplinary History*, 15 (1985): 609-34. But see also the critique in Bordo, 'Explorations in Monetary History'.
- 43 Nicholas Maynew, 'Population, Money Supply, and the Velocity of Circulation in England, 1300-1700', *Economic History Review*, 2nd ser., 48:2 (1995): 238-57.
- 44 Van der Wee, *Antwerp Market*, I: 128-29, Table XV.
- 45 In the second half of the sixteenth century, from 62 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 the Later Sixteenth Century', *Journal of European Economic History*, 4 (1975): 381-92; Challis, 'Lord Hastings to the Great Silver Recoupage', Appendix 1, Mint Output, 1220-1985', in Challis, ed., *A New History of the Royal Mint*, 673-98; G.C. Brooke and E. Stokes, 'Tables of Bullion Coined from 1337 to 1550', *The Numismatic Chronicle*, 5th ser., 9 (1929): 27-69.
- 46 John Munro, 'The Purchasing Power of Coins and of Wages in the Low Countries and England, 1500-1514', in: Sir Roger Myrns, Douglas Thomson and Wallace Ferguson, eds, *The Correspondence of Erasmus*, vol. 2: *Letters 142 to 297, A.D. 1501-1514* (Toronto, 1975), 307-45.

- 47 On the precious-metals-based monetary approach to the balance of payments (and for a deeper view of the monetary aspects of long-term inflation), see n. 4 above.
- 48 Michael Postan, 'Credit in Medieval Trade', *Economic History Review*, 1st ser., 1 (1928): 234-61, rpt. in Michael Postan, *Medieval Trade and Finance* (Cambridge, 1983), 1-27; Michael Postan, 'Private Financial Instruments in Medieval England', *Veröffentlichungen für Sozial- und Wirtschaftsgeschichte*, 23 (1930), rpt. in his *Medieval Trade and Finance*, 28-64.
- 49 Peter Spufford, *Handbook of Medieval Exchange* (London, 1986), xvi; see also Spufford, *Money and Its Use*, 339-67.
- 50 See Herman Van der Wee, 'Anvers et les innovations de la technique financière aux XVI<sup>e</sup> et XVII<sup>e</sup> siècles', *Annales: E.S.C.*, 22 (1967): 1067-89; transl. as 'Antwerp and the New Financial Methods of the 16th and 17th Centuries', in Van der Wee, *The Low Countries in the Early Modern World*, 145-66; Herman Van der Wee, 'Monetary, Credit, and Banking Systems', in: E.E. Rich and Charles Wilson, eds, *Cambridge Economic History of Europe*, vol. 5: *The Economic Organization of Early Modern Europe* (Cambridge, 1977), 322-32; Van der Wee, *Antwerp Market*, II: 333-68; John Munro, 'The International Law Merchant and the Evolution of Negotiable Credit in Late-Medieval England and the Low Countries', in: Dino Puncuh, ed., *Banchi pubblici, banchi privati e monti di pietà nell'Europa preindustriale: amministrazioni, tecniche operative e ruoli economici* (Genoa, 1991), 49-80, rpt. in John Munro, *Textiles, Towns, and Trade*.
- 51 James D. Tracy, *A Financial Revolution in the Habsburg Netherlands: Renten and Renteniers in the County of Holland, 1515-1565* (Los Angeles, 1985); Tracy, 'Taxation and State Debt', in: Thomas Brady, Heiko Oberman and James Tracy, eds, *Handbook of European History, 1400-1600: Late Middle Ages, Renaissance and Reformation* (Leiden and New York, 1994-95), I: 563-88; Van der Wee, 'Monetary, Credit, and Banking Systems'; John Munro, 'Patterns of Trade, Money, and Credit', in: *Handbook of European History*, I: 147-95.
- 52 Van der Wee, 'Monetary, Credit, and Banking Systems', Table 28 (based on researches of F. Ruiz-Martín). See also Braudel, *Mediterranean World*, I: 500-15, 528-32.
- 53 Spooner, *Monetary Movements in France*, 9-86.
- 54 See Frédéric C. Lane, *Venice: A Maritime Republic* (Baltimore and London, 1973), 241-49; Hail Inalcik, *An Economic and Social History of the Ottoman Empire* (Cambridge, 1994), I: 193-94, 319-25; Braudel, *The Mediterranean and the Mediterranean World*, II: 661-69.
- 55 Van der Wee, *Antwerp Market*, I: 522-23, Appendix 44.1.
- 56 See sources in Table I.3, and n. 14.