The Price Revolution: A Monetary Interpretation

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This article presents tests of the role of money in the price revolution (1525–1618). The hypothesis is that American specie drove European prices, and that the mechanism was the quantity theory of money buttressed by the specie-flow mechanism. Specie entered Spain, increasing Spanish prices, and then spread over Western Europe as a result of the Spanish balance-of-payments deficit, enlarging European monetary bases and price levels. Empirical verification is achieved through Granger-causality tests.

A major event in the transformation of Western Europe from an agricultural to an industrial economy is the so-called price revolution of the sixteenth and early seventeenth centuries. While not everyone would agree as to the relative extent of the influence of the long inflation, it is clear that one important input was the considerable inflow of specie (mostly silver) from the American colonies. This flow was at its strongest from the early sixteenth century until the Thirty Years War and thus coincides with a particularly long upward drift in prices. What is particularly striking about this event—recognizing that the point of impact of the inflow of specie from the Americas was, for the most part, Spain—is the roughly parallel rise of Spanish and other European price levels. The exact date when this begins varies somewhat from country to country, but in the period of the most rapid inflow of New World specie, say from 1525 to 1600 or so, most countries in Europe experienced a roughly parallel rise in their price levels punctuated at times by sharp spikes and dips in the price data. This is certainly true for the five countries—Spain, England, France, Germany, and Austria—studied here. At the same time, and complicating the situation enormously, there are persistent reports that specie inflows into many of these same countries were ill-timed (from the point of view of the actual behavior of the inflation rate) or, even, that specie merely flowed through European markets on its way to settle the balance-of-payments deficits these countries had (mostly) with the East.

The standard explanation of the price rise, ignoring many of the complications for the moment, is the classical quantity theory of money, buttressed by the international specie-flow mechanism. When specie

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entered Spain (in the first instance) it drove up the Spanish price level and produced a balance-of-payments deficit as the Spanish demand for foreign products exceeded their own supplies to foreign markets. This deficit was financed, the story goes, with specie that then entered the monetary "bases" of the foreign countries (that is, those with surpluses with Spain), increasing their money supplies and (in the end) driving up their price levels in this period. In the event, Western Europe shows a growing average level of prices and a growing money stock, and New World specie is the alleged driving force behind all this.

The most widely accepted contrasting theory argues that prices are not driven by specie (which, at most, sets a floor to prices) but by the actions of monopolists (or governments) whose positions in this period were enhanced by the steady population growth in Western Europe. Proponents of this theory point to evidence that agricultural prices grew faster than nonagricultural prices, that the velocity of money appears to have risen (perhaps because of the population-driven urbanization that was also going on), and that the episodes of poor timing (and of the specie outflow to the East) are all tangible evidence of the failure of the quantity approach. They also point to *substantial* (really overwhelming!) contemporary opinion that favored monopolistic and other noncompetitive techniques as the typical pricing behavior in European product and factor markets.

This article focuses initially on the links among Spanish and European prices, but some especially fine French monetary data also allows me to look at the interaction between money and prices for France in this period. A series of empirical tests explore possible causal links among the variables so far mentioned. The principal method employed is the Granger-causality test.[1] This procedure, which employs the lags of potential causal variables as independent variables in ordinary least squares regressions, is used to attempt to identify causal links among national price levels and between money and prices in France. These tests indicate that Spanish prices drove European prices during this period, with essentially no suggestion of feedback. This provides a firm empirical setting for an important part of the quantity theory involving linkages among national price levels. Furthermore, the French money supply Granger-causes the French price level, again as the quantity theory would predict. One should note, however, that some anomalies in the tests suggest that greater insight may be gained by drawing also on the theory of the "monetary approach" to the balance of payments.

[1] See Clive W. J. Granger, "Investigating Causal Relations by Econometric Models and Cross Spectral Methods," *Econometrica*, 37 (July 1969), pp. 424–38; Christopher A. Sims, "Money, Income, and Causality," *American Economic Review*, 62 (Sept. 1972), pp. 540–52; and Edgar L. Feige and Douglas K. Pearce, "The Casual Causal Relationship between Money and Income: Some Caveats for Time Series Analysis," *Review of Economics and Statistics*, 61 (Nov. 1979), pp. 521–33, for the evolution of the test into the form employed here.

THEORETICAL INTERPRETATIONS OF THE PRICE REVOLUTION

The price revolution evidently began in Spain and the discussion of that case produces a great part of our cast of characters. Monetary explanations do not appear until the seventeenth century, but the list of early cost-push explanations is considerable, led by the infamous activities of the middlemen—of engrossing, forestalling, and regrating.[2] Usury is often mentioned; so are the activities of foreign capitalists, depopulation, vagrancy, luxury, the flagrant idleness of women, and even the effect of shortages of goods caused by shipping so many supplies to America.[3] Speaking of engrossment, but of Belgian prices, Charles Verlinden, Jan Craeybeckx, and E. Scholliers dismiss the quantity theory of money (in the short run) in favor of numerous local disruptions traceable to the activities of monopolists.[4] They point out that "in the eyes of contemporaries, including the government, monopolies were . . . the main if not the only cause of high prices."[5] In England, bad harvests, speculation, middlemen, government spending, and monopolies were often-heard complaints, and product-related cost-push explanations were also put forward frequently.[6] This was not exactly the case in France, however, on account of the Malestroit-Bodin controversy in 1566–68, from which emerged Bodin's crude quantity theory of money.[7] Malestroit favored civil unrest, bad harvests, the loss of labor after famines, and bullion *exports* as inducers of inflation; in the French case "by general acclaim Bodin emerged the winner in the dispute."[8] Actually, the quantity theory had been put forward in Spain by Azpilcueta de Navarro some twelve years earlier; indeed, it was well established in Spain by the end of the century.[9]

[2] See Earl J. Hamilton, *American Treasure and the Price Revolution in Spain, 1501–1650* (Cambridge, MA, 1934), p. 428.

[3] See the more comprehensive lists in Hamilton, *American Treasure and the Price Revolution in Spain*, and Dennis O. Flynn, "A New Perspective on the Spanish Price Revolution: The Monetary Approach to the Balance of Payments," *Explorations in Economic History*, 15 (Oct. 1978), pp. 388–406.

[4] Charles Verlinden, Jan Craeybeckx, and E. Scholliers, "Price and Wage Movements in Belgium in the Sixteenth Century," in Peter Burke, ed., *Economy and Society in Early Modern Europe* (New York, 1972), pp. 55–84.

[5] Ibid., p. 68.

[6] See R. B. Outhwaite, *Inflation in Tudor and Early Stuart England* (London, 1982).

[7] The documents are: Sieur de Malestroit, *Les Paradoxes du Seigneur de Malestroit, conseillor du Roi et Maistre ordinaire de ses comptes, sur le faict des Monnoyes presentez à Sa Majesté au mois de Mars MDLXVI* (Paris, 1566) and Jean Bodin, *La Response de Maistre Jean Bodin, advocat en la Cour, au Paradoxe de Monsieur de Malestroit touchant l'encherissement de toutes choses et le moyen d'y remedier* (Paris, 1568).

[8] Frank C. Spooner, *The International Economy and Monetary Movements in France, 1493–1725* (Cambridge, MA, 1972), p. 90.

[9] See the references and discussion in Flynn, "A New Perspective on the Price Revolution" and in Marjorie Grice-Hutchinson, *The School of Salamanca: Readings in Spanish Monetary Theory, 1544–1605* (Oxford, 1952). The de Navarro reference is Martin de Azpilcueta Navarro, *Commentario resolutorio de usuras* (Salamanca, 1556).

Bodin's influence was felt in England, too, in the work of the mercantilist Gerard de Malynes in 1601 and 1603.[10] Even so, it seems that outside France neither layman nor politician seems to have been much taken with the quantity idea at the time.

The first problem concerns whether Spanish specie reached European markets in sufficient volume to do the job on prices. That it entered the channels of European trade is clear, as Artur Attman attests, "the precious metals imported from America via Seville, Cadiz and Lisbon were largely distributed from the Iberian peninsula to the main arteries of world trade."[11] But Attman then adds, "the precious metals which went via France, Holland, England and other trading nations then became an indispensable asset in the solution of the deficit problem in relation to the important markets of the Baltic area, the Levant, and Asia."[12] As to whether the flow spilled over into domestic European markets, Attman is not very precise, although he does say that "the surplus periods probably occurred towards the end of the 16th Century and up to around 1620. . . ."[13] Taken together, these statements certainly do imply that in his view there was no obvious surplus earlier than the end of the sixteenth century. The problem is, simply, that his study produces only two matched observations (in millions of rix-dollars): 1550, when the inflow was 3.0 and the outflow 2.0–3.0, and 1600, when the inflow was 10.0 and the outflow 4.4.[14] This is not much to go on. Furthermore, a study by M. Morineau suggests that the inflows of specie into Western Europe are even larger than those estimated by Attman.[15] On net, then, there clearly is room for the quantity propositions to operate in the present state of the data.

Other scraps of evidence bear on this issue. For example, for England, Y. S. Brenner argues that specie flows were not adequate to produce the observed inflation; so does Peter Ramsey.[16] More recently, Christopher Challis concludes that the inflow actually was sufficient during both the Elizabethan period and Mary's reign—the latter buttressed by the lively English mercantile business (and the activities of

[10] Gerard de Malynes, *A Treatise of the Canker of England's Commonwealth* (London, 1601) and *England's View, in the unmasking of two paradoxes; with a replication unto the answer of Maister Jean Bodine* (London, 1603).

[11] Artur Attman, "American Bullion in the European World Trade, 1600–1800," *Acta*, Regiae Societatis Scientiarum et Literarum Gothoburgensis, Humaniora 26 (Gothenburg, 1986), p. 7.

[12] Ibid.

[13] Ibid., p. 33.

[14] Ibid., p. 34.

[15] According to M. Morineau in *Incroyables gazettes et fabuleux métaux: Les retours des trésors americains d'après les gazettes hollandaises (XVI^{e}–XVIII^{e} siècles)* (Cambridge-Paris, 1985) the yearly inflow into Western Europe (in millions of rix-dollars) is 6 in the 1550s and 1560s, 7 in the 1570s, 10 in the 1580s, and 13 in the 1590s.

[16] See Y. S. Brenner, "The Inflation of Prices in England, 1551–1560," *Economic History Review*, 15 (Dec. 1962), pp. 266–84, and Peter H. Ramsey, *Tudor Economic Problems* (London, 1963).

Drake and others) and the former because of the particularly close ties with the Spanish throne.[17] This covers an important part of the period studied here. For France, too, the flow seems sufficient, at least as judged by the behavior of the money stock (which is, after all, based on mint records).

With regard to the poor timing, one of the most frequent observations is that of the apparent nonsynchronization of specie inflows with significant inflationary episodes in many countries. Earl Hamilton remarks on significant inflation in Spain before the price revolution; Robert Doughty makes the same point with respect to England; and Donald McCloskey makes a similar statement.[18] Carlo Cipolla locates the Italian price crest in 1551–60, but the inflow of specie apparently is significant only after 1570 (at which time inflation had subsided). He suggests the existence of a downward "resilience" of prices.

> This is where the role of American gold and silver becomes apparent. It created a limit below which prices could not fall during the long periods of depression: and it acted as a stimulus to even greater activity during the long periods of development.[19]

Cipolla explains the Italian price rise of 1552–60 in terms of the rebuilding after "the war that had reigned there throughout the first half of the century."[20] The stimulus is apparently by some kind of profit inflation that might be supported by a "wage lag" behind price changes.[21] Finally, Ingrid Hammarstrom argues that Swedish prices do not share the broad European experience (as this is described above), although her period only runs to 1560 and her data are a little on the skimpy side; in any case her conclusions about specie inflows are not based on mint records but on Swedish price levels.[22]

[17] Christopher E. Challis, "Spanish Bullion and Monetary Inflation in England in the Later Sixteenth Century," *Journal of European Economic History*, 4 (Fall 1975), pp. 381–92.

[18] See Hamilton, *American Treasure and the Price Revolution*; Robert A. Doughty, "Industrial Prices and Inflation in Southern England, 1401–1640," *Explorations in Economic History*, 12 (Apr. 1975), pp. 177–92; and Donald N. McCloskey, "Review," *Journal of Political Economy*, 80 (Dec. 1972), pp. 1332–35.

[19] Carlo M. Cipolla, "The So-Called 'Price Revolution': Reflections on the Italian Situation," in Peter Burke, ed., *Economy and Society in Early Modern Europe* (New York, 1972), p. 45.

[20] Ibid.

[21] The profit inflation argument (with reference to the period of the price revolution) occurs in John Maynard Keynes, *A Treatise on Money*. Vol. 2: *The Applied Theory of Money* (London, 1930), pp. 152–63; John U. Nef in "Prices and Industrial Capital in France and England: 1540–1640," *Economic History Review*, 7 (May 1937), pp. 155–85, considers its relevance to English and French experience during the same period. See also Outhwaite, *Inflation in Tudor and Early Stuart England*.

[22] Ingrid Hammarstrom in "The 'Price Revolution' of the Sixteenth Century: Some Swedish Evidence," *Scandinavian Economic History Review* (No. 2, 1957), says, "The Swedish price figures give no ground for inferring any influx of foreign silver . . . into Sweden before 1560" (p. 147). This is a modest claim and surely cannot be taken (as it has been) as hard evidence of an absence of specie inflows into Sweden. In contrast, Attman, in "American Bullion in the European

If one were to accept the evidence that specie flows were not timed well enough to support inflation in particular cases, a version of the international quantity theory of money is still available to lean on. This is known as the monetary approach to the balance of payments. The theory is actually a variant of the international quantity theory of money and thus can be applied to a specie standard world, but it is a variant that does not require specie actually to move from the deflating to the inflating country. An explanation of this proposition appears in a paper by Dennis Flynn, specifically referring to the price revolution.[23] Assuming that a country's *real* income is determined by *real* factors, then "world prices, in conjunction with a country's real income, determine the domestic demand for money. The monetary authority controls only the local source of the supply of domestic money, but not its demand."[24] Domestic prices are determined by international prices, while the domestic money stock (jointly determined by money supply and money demand) is, in effect, determined by (that is, caused by) the price level and anything that explains the domestic *demand* for money.

A simple formal explanation could run as follows. Suppose that the balance of payments of a country is defined in terms of the following *flow* constraint, where X denotes exports and M imports of goods (g), capital (c), and money (m).

$$(X_g - M_g) + (X_c - M_c) + (X_m - M_m) \equiv 0 \qquad (1)$$

Then, ignoring capital, if domestic prices are lower than international so that X_g is greater than M_g, equilibrium in the balance of payments requires that M_m be greater than X_m—that is, there is a specie inflow. This is the usual explanation. In the domestic country, however, the *stock* of money must also be in equilibrium, and nothing we have said so far implies that this is necessarily so. A standard form of the stock demand for nominal money balances is

$$M^d = \mathrm{f}(y, P)$$

where y denotes real income. If this function is a *stable* function of its arguments (this would imply that *velocity* is also stable), and ignoring changes in real income, then with the price level (P) determined exogenously, P would drive money demand. For stock equilibrium to hold under these conditions, money supply would have to accommodate itself to money demand (that is, to the exogenously determined price level).

This might work as follows in the period of the price revolution.

World Trade," is of the opinion that there was a general flow of specie (mostly silver) to the Baltic area; he mentions Sweden in particular (although he has little data for the pre-1600 period).

[23] Flynn, "A New Perspective on the Spanish Price Revolution."

[24] Ibid., p. 393.

Spanish prices rise on account of the flow of specie into that country; this is a direct "specie-flow mechanism" effect. In France, for example, the equivalent of equation 1 would be out of balance in the direction indicated (X_g greater than M_g and M_m greater than X_m). At the same time, the French demand for money, which depends on world prices to some extent, will exceed the French supply. Under the assumptions of the monetary approach, the French money stock will expand to close the gap between French money demand and money supply, before the specie inflow occurs. French prices will then rise, which will *by itself* tend to close the gap between exports and imports of goods. It is clearly important to recognize in this mechanism an alternative to the specie inflow (M_m); in the limit, no specie need flow into France. As McCloskey and Richard Zecher point out, "a flow of gold is by no means a necessary part of this process of arbitrage. In fact, the mere *threat* of arbitrage may be sufficient to bring a nation's prices and interest rates into line with the world's, without flows of anything. . . . other commodities could and did serve this function as well."[25] This deals specifically with the oft-mentioned observation that many countries at this time were seen to share price experiences with Spain but not to share the spoils of the conquest of America.

Turning the coin over, then, let us consider several important nonmonetary explanations appropriate to this period. I have already mentioned a number of cost-push factors (such as monopolies) and will say no more about these. Of the remaining propositions, the main position is basically a "demand-pull" explanation of the price revolution that sometimes is tied up with a related concern over the possibility of a sustained rise in the velocity of money in this period. The demand-pull theory (expounded, for example, by Shepard Clough and Richard Rapp), argues that an increase in the demand for money accompanying the expansion of European economic activity produced the rise in prices *and* a simultaneous pressure for exploration (in order to increase the stock of money).[26] Population growth is sometimes linked to this particular proposition as an additional source of pressure on prices.

The first modern proponent of the more general population thesis is Moritz John Elsas, and a key finding is that agricultural prices rose more than the prices of manufactured products.[27] This change in relative

[25] Donald N. McCloskey and J. Richard Zecher, "How the Gold Standard Worked, 1880–1913," in Jacob A. Frenkel and Harry G. Johnson, eds., *The Monetary Approach to the Balance of Payments* (Toronto, 1976), p. 365.

[26] Shepard B. Clough and Richard T. Rapp, *European Economic History* (3rd edn., New York, 1975).

[27] Moritz John Elsas, "Price Data from Munich, 1500–1700," *Economic History* (Supplement to *Economic Journal*), 3 (Feb. 1935), pp. 63–78. This also appears in E. H. Phelps Brown and Sheila V. Hopkins, "Wage-Rates and Prices: Evidence for Population Pressure in the Sixteenth Century," *Economica*, 24 (Nov. 1957), pp. 289–306, and "Builders' Wage-Rates, Prices and Population: Some Further Evidence," *Economica*, 26 (Feb. 1959), pp. 18–38, who are actually a

prices is generally attributed to population increases exceeding the ability of the agricultural sector to produce. Ramsey also puts the matter this way, allowing, however, that specie inflows had something to do with inflation.[28] Doughty, who, as mentioned above, plays down the price revolution in England outside the period of the debasement, notes that after removing that episode, industrial prices grew 0.58 of 1 percent per year and agricultural prices 1.12 percent.[29] He also favors a population-pressure view, again with an emphasis on increases in the demand for food (frustrated by an inelastic supply). I should note, though, that the population growth rate during this period was roughly half the inflation rate at about 0.6 of 1 percent per year.[30]

A straightforward counterargument to the population theory is simply that whether or not the inflation is evenly spaced in all sectors, the general causal agent for the level of prices can still be money. Relative prices can and do alter during periods of inflation; indeed, as Flynn notes, "advocates of the orthodox quantity-theory position, on the other hand, protest that they make no claim to explain relative price movements for each category of products (especially over a period that spans more than a century of structural change)."[31] The effect of population, that is to say, would likely be on *relative* prices without necessarily having anything to do with the *absolute* price level; this is mostly a matter of constructing effective measures of inflation.[32]

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little hard to pin down on these questions. See also Michael M. Postan, "Money, Population and Economic Change in Late Medieval Europe: Note," *Economic History Review*, 12 (Aug. 1959), pp. 77–82.

[28] Ramsey, *Tudor Economic Problems*, p. 117.

[29] Doughty, "Industrial Prices and Inflation in Southern England."

[30] Using the annual numbers in E. A. Wrigley and R. S. Schofield, *The Population History of England, 1541–1871: A Reconsideration* (Cambridge, MA, 1981), a regression of ln(Pop) on trend for 1541–85 yields a compound growth rate of 0.60 percent (when inflation was 1.30 percent). For the 1586 to 1618 period population growth continued at 0.60 while inflation was 1.06 percent.

[31] Flynn, "A New Perspective on the Spanish Price Revolution," p. 389.

[32] Also see Dennis O. Flynn, "The Microeconomics of Silver and East-West Trade in the Early Modern Period," in Wolfram Fisher, et al., eds., *The Emergence of a World Economy, 1500–1914* (Wiesbaden, 1986), pp. 37–60. If the price index actually employed is not a Divisia index, then it is conceivable that it will incorrectly capture the changes in relative prices. A fixed-weight index such as the commonly used Laspeyres is subject to this problem (it is only absolutely correct when relative prices do not change at all (see John R. Hicks, *Value and Capital* [Oxford, 1946]). The indices employed in this paper are all fixed-weight Laspeyres indices (rather than Divisia) and hence could give credence to relative-price effects that would not turn up in a Divisia index. Actually, the proponents of this view have not got so far as really to prove their arguments, so this must stand as a counterconjecture under the circumstances.

Note that in a paper by D. Loschky, "Seven Centuries of Real Income per Wage Earner Reconsidered," *Economica*, 47 (Nov. 1970), pp. 459–66, the Phelps Brown-Hopkins series for England is recalculated using a Paasche index (to account for the changes in the weights produced by the change in relative prices). Inflation from 1521–30 to 1581–90 is 140 percent by the Laspeyres index and 127 percent by the Paasche, suggesting that there is no real reason to recompute for the present article. Also interesting is Loschky's argument that the Malthusian crisis of the sixteenth century (in terms of the behavior of the real wage) disappears if a Paasche-based real-wage index

McCloskey, more sharply, points out that "the central flaw in the revisionist argument is that it repeatedly uses the theory of relative prices as a theory of absolute prices."[33] This is a slightly different matter and is related to the ever-popular cost-push explanations of inflation. In any case, a monetary explanation of inflation clearly can encompass changes in relative prices, and that is all that needs to be established at this point.

The velocity argument also mentioned above comes into play from time to time, although its strongest recent supporter is Peter Lindert.[34] Harry Miskimin ties an alleged rise in velocity in the period to increased urbanization.[35] He suggests that the frequency of transactions increases as the urban structure grows relative to the rural. J. D. Gould also takes this view.[36] The effect is certainly likely, although a secular rise in velocity of this sort is also consistent with a growing national income; it could net out the effect of the rising velocity on the price level.[37] Indeed, apparently a central problem in this literature arises because of the apparent misconception that the quantity theory of money requires a *constant* velocity. As Milton Friedman points out, all that is actually required is that the demand for money be stable (or, equivalently, that the velocity function be stable) for the main propositions of the quantity theory to go through.[38] More specifically, a rise in velocity will not by itself do the job if there is, simultaneously, general economic growth. Indeed, urban growth certainly is suggestive of general growth, although without further documentation the problem here is just that the velocity hypothesis is not demonstrable without further data (for example, on velocity itself, or on real income).

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is used. The details of these calculations are disputed by H. F. Lydall and E. H. Phelps Brown, "Seven Centuries of Real Income per Wage-Earner Reconsidered: A Note," *Economica*, 49 (Mar. 1982), pp. 201–5.

[33] McCloskey, "Note," p. 1333.

[34] Peter Lindert, "English Population, Wages and Prices, 1541–1913," *Journal of Interdisciplinary History*, 4 (Spring 1985), pp. 609–34. The velocity argument appears in Clough and Rapp, *European Economic History*, and Verlinden, et al., "Price and Wage Movements in Belgium." Counterarguments are provided by Cipolla in "The So-Called 'Price Revolution,' " whose reference is to the behavior of Italian interest rates, and, as I shall discuss in a moment, in Michael D. Bordo, "Explorations in Monetary History: A Survey of the Literature," NBER *Working Paper*, 1821 (Jan. 1986), p. 102.

[35] Harry A. Miskimin, "Population Growth and the Price Revolution in England," *Journal of European Economic History*, 4 (Spring 1975), pp. 179–86.

[36] J. D. Gould, "The Price Revolution Reconsidered," *Economic History Review*, 17 (Dec. 1964), pp. 249–66.

[37] This is not the place to consider in detail the view that this period was, indeed, one of expansion in Western European economies. It does, though, bear mentioning, particularly for the English case, as in John U. Nef, "A Comparison of Industrial Growth in France and England from 1540 to 1640," *Journal of Political Economy*, 44 (June, Aug., Oct., 1936), pp. 289–317, 505–33, 643–66, and Sybil M. Jack, *Trade and Industry in Tudor and Stuart England* (London, 1977).

[38] Milton Friedman, "The Quantity Theory of Money—A Restatement," in Milton Friedman, ed., *Studies in the Quantity Theory of Money* (Chicago, 1956), pp. 3–24.

As noted, the strongest recent proponent of the velocity story is Lindert.[39] Lindert estimates the velocity of money in England for this period and suggests that velocity rose at a rate much higher than might reasonably be anticipated in view of the moderate rise in expected inflation (since actual inflation was itself moderate). Lindert proposes, in effect, a population explanation involving the need to spread slowly growing money supplies around to a growing population. But, as Michael Bordo points out, the dynamics of the process are not entirely clear (why would velocity go on changing in the absence of an *acceleration* of population growth?).[40] Further, paraphrasing Bordo's argument to some extent, there may well have been an adequate response in the development of competing monies (of intermediation, that is to say) in the face of pressure from the population-induced increase in the demand for money. In this case the velocity calculation is plainly misleading. In conclusion, we seem a long way from being able to consider the causal aspects of these velocity propositions in the current state of the sixteenth-century data (especially for real income).

What I will do in the remainder of this article, then, is employ causal tests to probe for the interrelationships among money and prices in Europe of the sixteenth century. I first look at the price data for the five countries in the sample to try to see if Spanish prices led other prices and then I consider the additional detail that is possible because of the excellent French monetary data. Annual series on both money and prices make it possible to search out the specific role of money in the determination of French prices.

INTERACTIONS AMONG EUROPEAN PRICE LEVELS

The times I am considering were hard money days primarily, and economic agents held their liquid reserves in silver (and gold) when possible, and otherwise in coins struck from other metals or in inventories of (other) readily marketable commodities. To simplify, the monetary bases of European countries in this period consisted of silver-dominated metallic coinages, whether in the hands of individuals or dealers in financial instruments (that is, in early "banks").[41] The coinage was often legitimized by the government (or other agents) through minting operations that earned "seignorage" profits. These imposed a fairly uniform standard on any particular coinage, at least in the short run. In view of the absence of any really firm governmental control over the volume of the coinage, the market effectively deter-

[39] Lindert, "English Population, Wages and Prices."

[40] Bordo, "Explorations in Monetary History."

[41] See the discussion in Debra Glassman and Angela Redish, "New Estimates of the Money Stock in France, 1493–1680," this JOURNAL, 45 (Mar. 1985), pp. 31–46, and "Currency Depreciation in Early Modern England and France," *Explorations in Economic History* (Jan. 1988).

mined its value. That is, different legal units had different coinages at different times (varying in content, quality, reliability, and so forth), and pounds, livres, florins, ducats, and such all circulated side by side at rates determined by market forces (in effect by the market value of the silver content of the minted money).

In this hard-money world, the relatively large flow of precious metals from the New World into Spain was a significant event, at least in strictly monetary terms. The institutional nature of the process is documented in an extensive literature that begins with Hamilton.[42] Certainly, Spanish prices rose steadily during this period. More important for the purposes of this study is that other European price levels also generally rose throughout the period, at differently varying rates to be sure, as the three series plotted in Figure 1 bear out.[43] This covers the entire period from 1525 to 1618.[44] It is abundantly clear that these price series (and Austrian and German prices, as we shall see) all show a similar upward drift. The unusual episodes (the "spikes") differ quite a bit—with the British and French price levels showing the greater volatility—but at any rate the common drift is unmistakable.

The relatively slow and erratic nature of the century-long price increase has produced doubt as to whether there was sufficient drift to be dubbed a "revolution," and concern over whether the short episodes could be said to dominate the figures in some sense. Among the many doubters are Gould, Cipolla, and Doughty.[45] The last-named argues that the main episode in England really belongs to the short period that encompasses the great debasement and the Elizabethan recoinage. On behalf of his position, Doughty says, "the tremendous influx of American bullion into Europe did not even result in a doubling of an already mild inflation and . . . the inflation of the 'price revolution' in southern

[42] Hamilton's data (in *American Treasure and the Price Revolution*) have been questioned from time to time (for example, by Phelps Brown and Hopkins in "Builders' Wage-Rates, Prices and Population," by M. Morineau in *Incroyables gazettes et fabuleux métaux*, and by Flynn in "The Microeconomics of Silver and East-West Trade"). In any event the data are not available on an annual basis, so little can be gleaned from them (at least in terms of the tests in this paper, which employ only annual data).

[43] The data, other than the Spanish, are taken from E. H. Phelps Brown and Sheila V. Hopkins in "Seven Centuries of the Prices of Consumables, Compared with Builders' Wage-Rates," *Economica*, 23 (Nov. 1956), pp. 296–314, and "Builders' Wage-Rates, Prices and Population"; they are annual. Generally the data refer to the prices of consumables, and they are certainly narrowly based in terms of referring only to particular areas (or even cities) and products. The Spanish data are from Hamilton, as already noted. See the discussion of the quality of the English index in Peter H. Ramsey, "Editor's Introduction" to *The Price Revolution in Sixteenth Century England* (London, 1971), pp. 1–17, and D. Loschky, "Seven Centuries of Real Income per Wage Earner."

[44] During the period from 1501 to 1525 there was a very slight upward drift in the price levels of most European countries. I concentrate on the most likely period for the quantity theory, between 1525 and 1585, based on both price and money stock behavior (taken separately).

[45] Gould, "The Price Revolution Reconsidered," Cipolla, "The So-Called 'Price Revolution,' " and Doughty, "Industrial Prices and Inflation in Southern England."

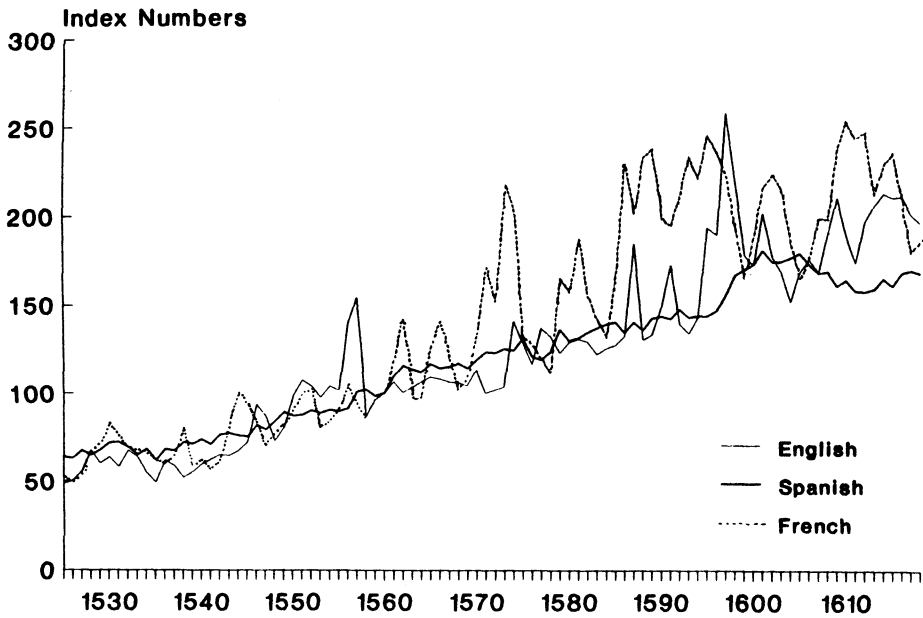

FIGURE 1

ENGLISH, FRENCH, AND SPANISH PRICES, 1525–1618
(1560 = 100)

Sources: The English data are from E. H. Phelps Brown and Sheila V. Hopkins, "Seven Centuries of the Prices of Consumables, Compared with Builders' Wage Rates," *Economica*, 23 (Nov. 1956), pp. 296–314; the French data are from E. H. Phelps Brown and Sheila V. Hopkins, "Builders' Wage-Rates, Prices and Population: Some Further Evidence," *Economica*, 26 (Feb. 1959), pp. 18–38; and the Spanish data are from Earl J. Hamilton, *American Treasure and the Price Revolution in Spain, 1501–1614* (Cambridge, MA, 1934), p. 428.

England existed before the incoming gold and silver could have had any significant effect."[46] In fact, as a glance at Figure 1 bears out, there is a significant price "spike" in the 1550–60 period, but there are also spikes at other times and there is an unmistakable upward drift to prices over the entire period.[47]

Some of the argument is probably semantic, the result of reluctance to label a gradual price increase, itself possibly easily foreseen and counteracted by economic agents, as "revolutionary." This is certainly reasonable. On the other hand, it is also apparent in Figure 1 that the upward drift is not affected by the spikes and that all countries seem to

[46] The Great Debasement covered the period from 1544 to 1551 and the recoinage was in 1560; Doughty credits Gould with this interpretation. Doughty, in "Industrial Prices and Inflation in southern England," specifically says, "if there were such a phenomenon as a 'price revolution' in England, it occurred between 1540 and 1560, during the period of the Great Debasement and the Elizabethan recoinage. In this short 20-year period, prices more than doubled for both industrial and agricultural products . . ." (p. 183).

[47] Ramsey, in "Editor's Introduction," p. 4, attributes the price rises in 1556 and 1557 to "the catastrophic harvests of the preceding years." He lists oversensitivity to agricultural crises as one of the problems with the Phelps Brown-Hopkins data.

TABLE 1
COMPOUND GROWTH RATES IN THE PRICE LEVELS OF FIVE EUROPEAN COUNTRIES

	1525–1618	1525–1585	1586–1618
England	1.51	1.64	1.06
Excluding 1541–60	1.96	2.10	
Excluding 1551–60	2.10	1.94	
France	1.64	1.84	−0.10
Spain	1.19	1.44	0.64
Germany	1.20	1.36	0.67
Austria	1.31	1.24	1.64

Notes: The entries in the table were obtained by regressing ln$P$ on trend and are, accordingly, compound annual growth rates.
Sources: The English data are from E. H. Phelps Brown and Sheila V. Hopkins, "Seven Centuries of the Prices of Consumables, Compared with Builders' Wage-Rates," *Economica*, 23 (Nov. 1956), pp. 296–314; the French, German, and Austrian data are from E. H. Phelps Brown and Sheila V. Hopkins, "Builders' Wage-Rates, Prices and Population: Some Further Evidence," *Economica*, 26 (Feb. 1959), pp. 18–38; and the Spanish data are from Earl J. Hamilton, *American Treasure and the Price Revolution in Spain, 1501–1650* (Cambridge, MA, 1934), p. 428.

have similar rates of drift (and similar incidents). Extending the comparisons to the five countries for which annual data exist, we see in Table 1 that all five countries had similar inflationary experiences overall. What is especially important here is the upward drift over the period from 1525 to 1585, a drift that is consistent across countries and, episodes aside, fairly consistent over time; the period from 1586 to 1618 is clearly another matter. With regard to Doughty's contention, the fact is that if either the 1541–60 or the 1551–60 period is dropped, the latter just to eliminate the prominent spike in the price series, the trend rate is not much affected (it is actually *higher* in both cases).

The possible monetary interactions among nations in this period can be illustrated with a set of correlation coefficients across the price level data of the five European countries studied here. These are presented in Table 2 for the three periods of the data featured in Table 1. The correlations here are strongly positive over the whole period (as well as over the 1525 to 1585 subperiod), with the Spanish price index particularly consistent in its relation with the prices of the other four countries in the sample. On the other hand, it is again apparent that the period from 1585 to 1618 is quite different, a result that will be echoed in the causal tests discussed below. The price "revolution" may well be concentrated in the period from 1525 to 1585, it seems.

Another way to proceed is to employ a test of Granger-causality to look for signs of one-way or bidirectional causation among the European price levels. The test actually considers the influence of lagged values of the independent variable (the proposed causal variable) and so it is, strictly speaking, a test of what is called "predeterminateness." The procedure is to regress a variable in which we are interested—let us

TABLE 2
CORRELATIONS AMONG THE PRICE LEVELS OF FIVE EUROPEAN COUNTRIES

	Spain	France	England	Austria	Germany
			1525–1618		
Spain	1.00	.89	.91	.89	.93
France		1.00	.85	.90	.82
England			1.00	.82	.88
Austria				1.00	.89
Germany					1.00
			1525–1585		
Spain	1.00	.87	.86	.78	.84
France		1.00	.74	.83	.81
England			1.00	.63	.71
Germany				1.00	.89
Austria					1.00
			1585–1618		
Spain	1.00	−.36	.46	.34	.86
France		1.00	.10	.30	−.16
England			1.00	.35	.56
Germany				1.00	.51
Austria					1.00

Sources: See Table 1.

say the French price level—on its own lags and on the lags of another potential causal variable. If the other variable adds significantly to the explanation of the dependent variable, then it is said to "Granger-cause" that variable. The model used in this exercise is

$$\ln y_t = \alpha + \sum_{i=1}^{n} \beta_i \ln y_{t-i} + \sum_{i=1}^{n} \delta_i \ln x_{t-i} \qquad (2)$$

where n is the (arbitrary) length of the lag. It is assumed to be the same for each variable in these tests, although procedures exist for searching for "optimal" lags.[48] It is advisable to vary n sufficiently in such tests to pick up the net influence of x on y, and in the following tables this is done for periods up to ten years (although only five are reported here).[49] The statistical test, an F-test, is used to see whether the exclusion of all of the x terms in equation 2 would significantly reduce the explanatory power of the regression. In effect, I run a restricted regression (δ_i equals 0 for all i) and then employ the F-test to

[48] See Hirotugu Akaike, "Statistical Predictor Identification," *Annals of the Institute of Statistical Mathematics*, 22 (1970), pp. 203–17.

[49] Many of the tests were carried out further, up to ten years, so as to identify much longer lags, if they exist. The reason for this was the suspicion, occasionally voiced in the literature, that the lags in this period were very long. These tests were unproductive.

test for the significance of the restrictions.[50] Conventionally, I assert that causation has been established if the probability that the proposed causal agent is *not* influential is 0.05 or less.[51]

The quantity theory predicts that money leads prices in a causal sense, at least when economic agents require time to respond to the stimulus. This would imply, in the specific circumstances at hand, that Spanish money would affect Spanish prices but with a lag. The law of one price, then, implies that Spanish prices, being too high relative to those of the rest of the world, would provide the stimulus for a balance-of-payments surplus for the rest of the world, possibly taking the form of a specie inflow into the monetary bases of these other countries. This, too, would be expected to operate with a lag. Furthermore, the specie inflow would, again with a lag, produce a rise in the price levels of these other countries. We would expect, then, to find evidence of causation running from (the lags of) Spanish prices to the price levels of the other European countries.

The Granger-causal interactions among European price levels during the period from 1525 to 1585 are shown in Table 3, oriented around the Spanish price level, which might reasonably be expected to be the dominant influence on European prices.[52] Note that the results are expressed in terms of the probabilities just referred to and that the significant cases are marked with an asterisk. Here we see very strong *and positive* causal pressure from Spanish prices to European prices, with the only sign of reverse pressure running from English to Spanish prices (at one lag). As things stand, then, not only are prices highly correlated, but also there is a highly significant Granger-causal influence running from Spain to the rest of Europe.[53] This finding is consistent

[50] The use of the F-test requires that the residuals from each of the regressions be "white noise." In addition, there is a problem of potential "nonstationarity" that arises in data (such as these) dominated by a time trend. Typically, as in Charles R. Nelson and Charles I. Plosser, "Trends and Random Walks in Macroeconomic Time Series," *Journal of Monetary Economics*, 10 (Sept. 1982), pp. 139–62, one might wish to "difference" the data to be assured of stationarity, but in the case of the sixteenth-century data, the logs of the index numbers are used. This generally appears to produce satisfactory results, as judged both by scatter-plots of the (logged) series and by the Q-statistics calculated both before and after the causal restriction is applied. I return to this topic below, when I consider results for some detrended (but not differenced) data.

[51] The Granger test is certainly not foolproof. For one thing, it is a test only of predeterminateness and not of contemporary (t) causation; for annual data this may well be a serious concern. Then, it may seem that a lagged variable is affecting a current variable when in fact the lagged variable is merely adjusting to the expectation (of economic agents) of the current variable. In this case the current variable is really "causing" the lagged variable. Finally, as with all regression models, causal variables may have been omitted from these equations; in this case one would expect inconsistent estimates of the coefficients.

[52] Results for the period from 1586 to 1618 show no causal influence among these prices except for one running from English to Spanish prices.

[53] Speaking of the English result, one would not expect a reverse flow of specie from England to Spain, but there were times when there were substantial direct flows from the New World to England. Drake brought back a considerable amount of specie, for example. The reverse causation

TABLE 3
THE INFLUENCE OF SPANISH PRICES ON EUROPEAN PRICES, 1525–1585

Variables		Probability that the Causal Variable is NOT a significant influence (for lags of:)					
Dependent	Causal	n = 1	n = 2	n = 3	n = 4	n = 5	Sign
French *P*	Spanish *P*	.000*	.000*	.000*	.000*	.001*	+
English *P*	Spanish *P*	.001*	.001*	.19	.41	.52	+
German *P*	Spanish *P*	.001*	.003*	.04*	.03*	.06	+
Austrian *P*	Spanish *P*	.000*	.001*	.03*	.07	.14	+
Spanish *P*	French *P*	.75	.82	.14	.12	.21	
Spanish *P*	English *P*	.04*	.11	.18	.27	.38	+
Spanish *P*	German *P*	.78	.32	.51	.24	.31	
Spanish *P*	Austrian *P*	.07	.16	.29	.40	.25	

* Indicates significance at the .05 level.
Notes: The entries in the table are the probabilities associated with the hypothesis that the excluded variables (the proposed "causal" variables) are significant as a group. The sign in the last column reflects the value of the sum of the lag coefficients when this sum is statistically significant (as judged by a *t*-test).
Sources: See Table 1.

with the specie-flow mechanism, of course, although we must still recall the apparently poor synchronization of specie flows with inflationary episodes. It is also consistent with the monetary approach without such a qualification. It is consistent with both, really, because it is a demonstration of a causal link behind the operation of the law of one price during the period of the price revolution.

FRENCH MONEY AND PRICES

Monetary data for France provide a rare opportunity to investigate specific "quantity-theoretic" propositions prior to the nineteenth century. The data are recalculations by Debra Glassman and Angela Redish of a set of data originally produced by Frank Spooner.[54] The Glassman-Redish data provide what is undoubtedly a significant improvement over the older Spooner estimates, but the reader should be warned that the later data have been smoothed by a regression technique. Spooner uses 30-year and 60-year moving averages over his raw mint data, but Glassman and Redish propose using the predictions from a regression of mint output on a number of its determinants. They also assume two different deterioration rates (0.25 and 1 percent per year) for loss due to clipping and wearing out, and so forth. The two estimates are referred to here as *M*(a) and *M*(b). The smoothing, however it is done, somewhat

with Spain could be interpreted in terms of the monetary approach in the sense that English prices influenced Spanish prices without the need of accommodating specie flows from England to Spain.

[54] Glassman and Redish "New Estimates of the Money Stock in France," and Spooner, *The International Economy and Monetary Movements in France*.

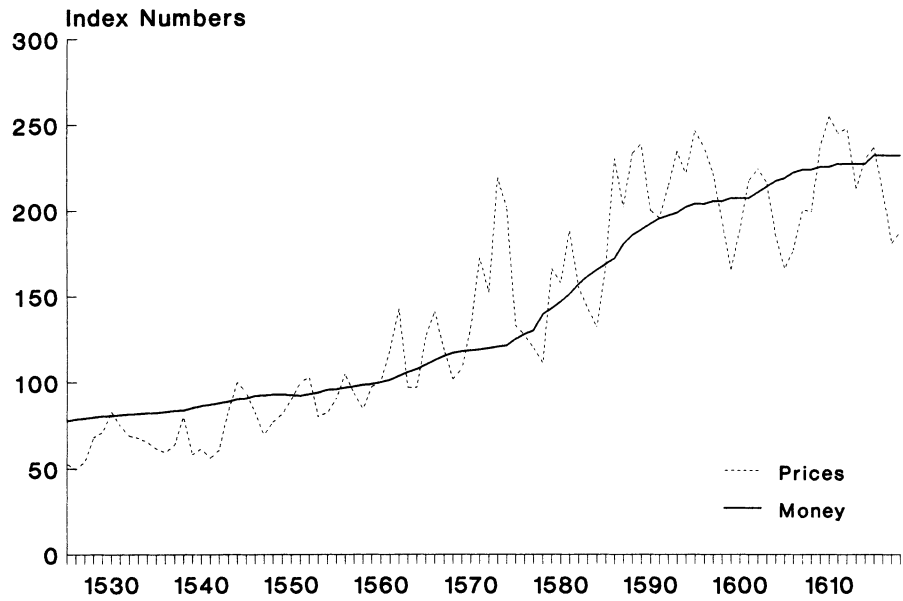

FIGURE 2

FRENCH MONEY AND PRICES, 1525–1618
(1560 = 100)

Notes: The French money supply is $M(a)$, which assumes a 0.25 percent annual rate of deterioration.

Sources: The French money supply is taken from Debra Glassman and Angela Redish, "New Estimates of the Money Stock in France, 1493–1680," this JOURNAL, 45 (Mar. 1985), pp. 31–46, while the French price level is from E. H. Phelps Brown and Sheila V. Hopkins, "Builders' Wage-Rates, Prices and Population: Some Further Evidence," *Economica*, 26 (Feb. 1959), pp. 18–38.

inhibits the application of time-series methods, although it does leave a series that has a constant variance of trend.

Figure 2 shows comparisons between one of the two French money-stock series of Glassman and Redish and the French price level of E. H. Phelps Brown and Sheila Hopkins. Here, again, the common drift in the two series is apparent. Indeed, there seems to be a strong relation between French money and French prices, as the set of correlation coefficients in Table 4 suggests; here both measures of money are employed. Furthermore, it is evident that the strong relation between French money and prices from 1525 to 1585 disappears in the period from 1585 to 1618. As already noted, the latter is a time of considerable volatility in prices but, in fact, not in the measure of the money stock.

Table 5 sets out the causal relation among French money and prices and Spanish prices over two subperiods of the period from 1525 to 1618.[55] Note the repetition of some results involving Spanish prices

[55] Debra Glassman and Angela Redish, in "An Empirical Analysis of Depreciation and Price Change in Early Modern France," mimeo, University of British Columbia (June 1986), p. 20, have studied the entire period from 1522 to 1647 using monthly data on French grain prices and found prices Granger-causing money and not the converse. From my point of view, which regards the

TABLE 4
CORRELATIONS AMONG FRENCH MONEY AND PRICES

	1525–1585			1585–1618		
	M(a)	*M*(b)	Prices	*M*(a)	*M*(b)	Prices
French *M*(a)	1.00	.99	.80	1.00	.96	.06
French *M*(b)		1.00	.74		1.00	.07
French Prices			1.00			1.00

Notes: *M*(a) is the money supply assuming a 0.25 of 1 percent per year rate of deterioration through clipping and so forth; *M*(b) assumes a 1 percent rate of deterioration.
Sources: The French money supply is taken from Debra Glassman and Angela Redish, "New Estimates of the Money Stock in France, 1493–1680," this JOURNAL, 45 (Mar. 1985), pp. 31–46. The French price level is drawn from E. H. Phelps Brown and Sheila V. Hopkins, "Builders' Wage-Rates, Prices and Population: Some Further Evidence," *Economica*, 26 (Feb. 1959), pp. 18–38.

from Table 3. A strong positive causation runs from French money to French prices over the period from 1525 to 1585, while there are no Granger-causal links in the turbulent period from 1586 to 1618. Pretty clearly, then, the main predictions of the quantity theory of money are upheld in this test, practically without qualification.

TABLE 5
SPANISH PRICES AND FRENCH MONEY AND PRICES, 1525–1618

Variables		Probability that the Causal Variable is NOT a significant influence (for lags of:)					
Dependent	Causal	n = 1	n = 2	n = 3	n = 4	n = 5	Sign
		1525–1585					
French *P*	French *M*(a)	.001*	.001*	.000*	.006*	.08	+
	French *M*(b)	.01*	.01*	.02*	.10	.42	+
	Spanish *P*	.000*	.000*	.000*	.000*	.001*	+
French *M*(a)	French *P*	.81	.80	.38	.08	.16	
	Spanish *P*	.49	.83	.14	.23	.33	
French *M*(b)	French *P*	.53	.43	.25	.05*	.12	+
	Spanish *P*	.47	.57	.06	.11	.18	
		1586–1618					
French *P*	French *M*(a)	.35	.77	.46	.32	.38	
	French *M*(b)	.30	.78	.53	.59	.10	
	Spanish *P*	.39	.14	.37	.41	.53	
French *M*(a)	French *P*	.48	.34	.64	.89	.96	
	Spanish *P*	.27	.28	.51	.47	.22	
French *M*(b)	French *P*	.48	.29	.92	.93	.78	
	Spanish *P*	.09	.17	.30	.17	.03*	+

Notes and Sources: See Tables 1 and 4.

periods from 1525 to 1585, 1586 to 1618, and, perforce, from 1618 to 1648 as potentially dissimilar in monetary/price regimes, this result may well not hold up after it is subjected to stability checks. When the entire period from 1525 to 1618 is tested in the manner of Table 4, there is indeed evidence of "reverse" causation (as well as of direct causation). As the results in Table 4 make clear, however, the reverse causation disappears when the period is broken in two. A serious possibility of heteroscedasticity affects regressions running over such long periods as that between 1522 and 1647.

TABLE 6
SPANISH PRICES AND FRENCH MONEY AND PRICES, 1525–1585
(Detrended data)

Variables		Probability that the Causal Variable is NOT a significant influence (for lags of:)					
Dependent	Causal	n = 3	n = 4	n = 5	n = 6	n = 7	Sign
French *P*	French *M*(a)	.29	.34	.54	.42	.48	
French *P*	French *M*(b)	.34	.34	.54	.42	.48	
French *P*	Spanish *P*	.30	.30	.44	.45	.62	
French *M*(a)	French *P*	.16	.01*	.002*	.002*	.001*	+
	Spanish *P*	.02*	.04*	.08	.09	.17	
French *M*(b)	French *P*	.21	.01*	.001*	.001*	.001*	+
	Spanish *P*	.02*	.04*	.07	.10	.19	

Notes: None of the shorter lags were significant and so they were omitted. See Table 4 for further notes.
Sources: See Tables 1 and 4.

The main problem with the foregoing concerns the data, but in a way that is not exactly obvious. In particular, both the monetary and the price data exhibit strong trends, the consequence of which is nonstationarity, in the sense that the numbers do not oscillate around a stable value, but tend to drift (in this case) upward. What is worrisome is that in such a case the Granger test can give misleading results, especially for shorter lags. A reasonable way to induce stationarity in the data is to detrend the raw data.[56] When this is done, as Table 6 reveals, there is an unexpected result: *prices appear to cause money* at fairly long lags. This is not a marginal finding but a strong example of what is often called "reverse causation" in the literature; it applies equally to the two Glassman-Redish measures of the money stock.

Putting aside concerns about the stationarity of the data, we appear to have a typical "trend-cycle" (or "long-run/short-run") division in the interaction between French money and prices. In the *long run*, the simplest monetary hypothesis that could be offered is that Spanish specie drove European monetary bases and, hence, European prices, both in the same direction. The trend-dominated causal tests in Table 5 indicate this is so. During this period Western Europe was on a specie standard, *in effect*, in which Spain was the principal "reserve-creating" country and all other countries had money supplies that were driven *partly* by movements in specie.

In the *short run*, however, a different monetary mechanism may well hold; this is the monetary approach outlined above. Over the cycle, fluctuations in Spanish prices drove European prices directly, shown in Table 3, while domestic money supplies bore the brunt of the adjustment (with or without specie flows). To an extent, then, domestic

[56] I also differenced the data, but the differences of such highly smoothed data as I have here prove to contain no causal information on these tests.

money supplies would actually be endogenous to their own price levels, since the price levels are, themselves, determined exogenously by the influence of the international law of one price. Put simply, Spanish specie drives international prices, whereas domestic monetary bases accommodate themselves to some extent to domestic (and international) prices as the underlying mechanism that validates the law of one price. In a causal test, then, we would expect all European countries except Spain to show causation running from domestic prices to domestic money stocks if the monetary approach is valid.[57] This, indeed, is what Table 6 shows for the detrended, short-run French data. The suggestion is that domestic money supplies responded more quickly to the international pressure than did flows of goods and specie. But, and this is important, only in the short run, as one might expect in a hard-money world such as sixteenth-century Europe.

CONCLUSIONS

I have argued that the price revolution may well have been a monetary phenomenon after all. Early demonstrations of the monetary hypothesis, usually in the form of the classical specie-flow mechanism tied to the basic quantity theory of money, rely on the close synchronization of European price levels—which clearly exists. The monetary hypothesis also depends on evidence that specie drove the monetary bases of the countries involved and that the individual monetary bases in turn drove their respective price levels. But many writers, as it turns out, are adamant in denying the latter two links and so the classical theory, although widely espoused, has had many detractors. An alternative monetary paradigm—suggested in this context by Flynn—invokes the monetary approach to the balance of payments, a proposition that dispenses logically with specie flows. The monetary approach also explains an anomaly in my empirical tests. When these pieces are fitted together, they are broadly consistent with a monetary interpretation of the price revolution.

[57] The reserve-creating country (Spain) would show the traditional money-causes-prices relation; see Bluford H. Putnam and D. Sykes Wilford, "Money, Income and Causality in the United States and the United Kingdom: A Theoretical Explanation of Different Findings," *American Economic Review*, 68 (June 1978), pp. 423–28. This is a testable implication of the theory that cannot be appraised in the present state of the Spanish data.