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*Price movements in early twentieth-century India*¹

By TIRTHANKAR ROY

As late as the 1930s, most colonial economies in Asia and Africa possessed neither central banks nor governments explicitly concerned about domestic stabilization. With the exception of studies of the Great Depression, both economic history and the development literature seem to have overlooked the consequences of this deficiency. Many colonies were agrarian economies constantly under the threat of harvest-induced fluctuations. The interwar period witnessed price and income fluctuations more severe than the world had seen previously. In a world integrated by trade and a complex system of payments, these shocks were transmitted quickly to regions ill equipped to cope with them. It is probable that a chronically unstable environment inhibited local enterprise and was thus a constraint on growth, a possibility not well explored in the literature on colonial experience.² It is clearly important to ask how shocks originated in a colonial economy, whether policies were inadequately geared to dealing with them, how adjustment took place, and what were the effects of shocks.

A study of Indian prices between *c.* 1900, when detailed data are first available, and 1935, the inauguration of the central bank, can suggest tentative answers to the first two of these questions. Agricultural prices in this period fluctuated more compared with those in the contemporary world, and also in post-independence India³ (figure 1). Severe inflations, of the order of 20–30 per cent, were common, very often as parts of a price cycle. Neither feature is repeated in post-1950 data. Contemporary literature on India suggests an explanation for this chronic price instability. India functioned under currency regimes which meant the money supply was sensitive to the balance of payments, and perhaps as a result, more volatile than one would expect under a central bank (figure 2). But real incomes depended primarily on harvests, which were much more sensitive to weather than they are now. This points to an inherent maladjustment between money supply and transactions demand for money, which Keynes considered

¹ I wish to thank two anonymous referees for this journal, Ashima Goyal, Veena Mishra, and Kunal Sen for their comments on a draft. I have had helpful discussions with Arun Banerji and R. Krishnan on several issues dealt with in the article.

² Morris acknowledges the role of instability and uncertainty in restricting private investments in India. The instability is attributed partly to harvest-dependent domestic demand, and limited information: Morris, 'Growth of large-scale industry', pp. 555–8.

³ For international comparison of wholesale prices in 1892–1912, see Datta, *Report on the enquiry*. Indices of agricultural prices in India, US, and UK, 1860–1940, are compared in McAlpin, 'Price movements', p. 889. Numerous witnesses at the *Royal Commission*, 1926, cited these data to argue that fixed exchange had been destabilizing.

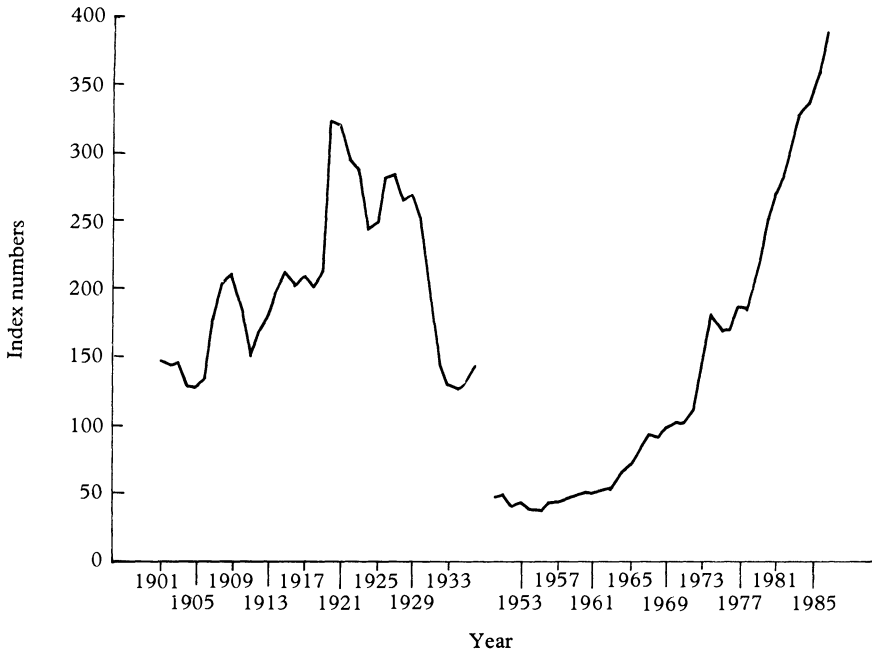


Figure 1. *Movement of prices* (weighted prices, primary commodities)

Note: The base years are 1873 for 1900-35, and 1970 for 1950-87.

Sources: McAlpin, 'Price movements'; *Statistical abstracts for India*

a major weakness of the Indian monetary system,⁴ and resultant changes in prices, asset holdings, and real balances. The article develops this suggestion of a dichotomy into a few testable propositions.

In Indian historiography and in contemporary economic writings, two basic causes of price movements—harvests and currency growth—have been discussed. However, these studies consist mainly of descriptions of specific episodes, from which neither the causes nor the consequences of price movements can be generalized.⁵ This article, in contrast, examines the dynamics of prices in terms of a model. The model confirms the role of harvests and trade shocks in generating inflations, but also extends the literature by attempting to explain why the intensity of inflations varied, how the economy adjusted to inflations, and to what extent price rises affected industry. The article concludes that the extent of price change depended on how commodity exports, gold imports, and the money multiplier responded to an initial harvest shock, and that the resultant

⁴ 'The Indian currency is internally . . . absolutely inelastic', Keynes, *Indian currency*, p. 57. That price stability should be the goal of monetary policy is a recurrent theme in much of Keynes's writings on India. It led him to advocate flexible exchange, and insofar as the choice of exchange regime was not related to the gold exchange versus gold standard question, made the latter debate somewhat redundant.

⁵ The best known of such episodes are: an inflation in the first decade of the century analysed in Datta, *Report on the enquiry*, and Keynes, *Indian currency*, and the 1920s deflation widely studied in recent scholarship. See, for example, Goldsmith, *Financial development*; Tomlinson, *Political economy*.

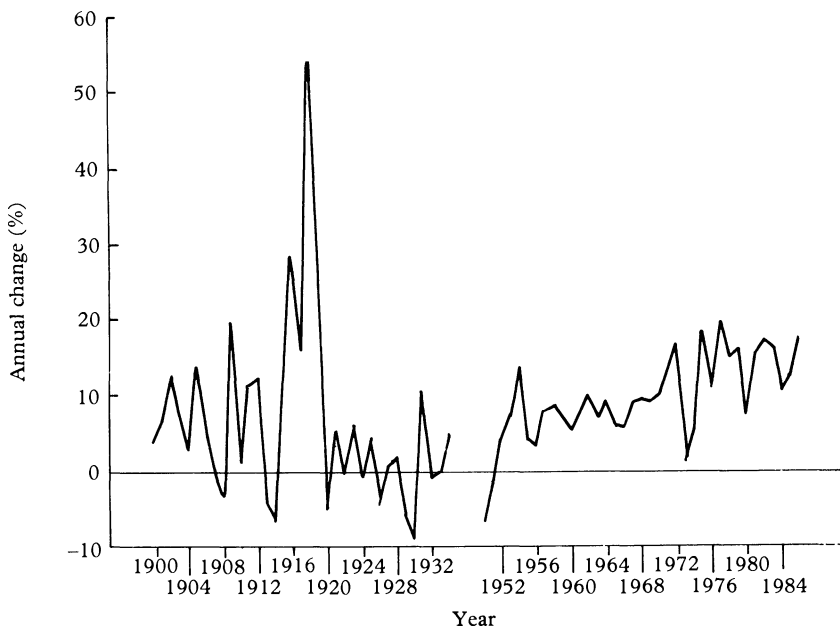


Figure 2. *Rates of currency growth*

Sources: see text

changes in real balances can explain several episodes of depression in industry.

The article has four sections. The first outlines certain general features of the economy being modelled. The second sets out the elements of the model. The third explains the database used and presents the statistical results. Section IV examines the probable real effects of price and currency movements. It is necessary to add that the results are tentative, having been derived from associations between highly aggregated time series, and would need to be tested with direct evidence on the way agents behaved and institutions changed. The article does not attempt to do this.

I

The real side of the Indian economy was characterized by its dependence on agriculture, openness to trade, and narrow asset markets. The primary sector made up about 60 per cent of national income in 1935. That apart, industry was largely the processing of agricultural output, commerce consisted of the export trade in cash crops and the movement of food and raw materials, and government expenditure depended on land revenues. Equally important, the main functions of the banking system—financing the harvest, crop movements and storage, and export trade—were also related to agriculture. Secondly, colonial India was an open economy in a sense in which independent India was not. Merchandise exports formed 7–8 per cent of net domestic product in 1915, 1925, and 1935. The proportion

was lower in the 1960s and the 1970s. Furthermore, the financial system was more exposed to trade, by virtue of the currency regime and the absence of an independent monetary policy. Net imports of gold constituted on average half of total financial savings in the prewar period, and a similar proportion in the 1920s. This, together with changes in cash holdings, explained the bulk of household savings. The holding of securities was highly concentrated, among entrepreneurs, banks, and the Treasury.

Throughout the period, the rupee was convertible to sterling, and the basic objective of the monetary authority was to stabilize the rupee-sterling exchange rate, apparently in an attempt to stabilize India's function in the imperial trade and payments system. Holding the exchange rate constant would imply, as in any market, that the market for currency cleared by quantity adjustments. In India this function could not be served by gold, for gold was neither a means to settle the balance of payments nor the main constituent of currency reserves. Reserves, like a large part of the money stock, consisted primarily of silver.⁶ Receipts and payments, all being routed through London, were effected simply by means of drafts issued by the Secretary of State, and cashed in India (for a receipt), or in London (for a payment).⁷ The major threat to the system arose from inflation in silver towards the end of the war. A depreciation of sterling against silver meant a depreciation of the rupee as well, and that could lead to a collapse since the rupee was still largely a silver coin. Under the circumstances, a managed float was introduced c. 1917. This switch in regime was not entirely deliberate, as the government took time to arrive at a rate that could be taken as the long-term equilibrium. In any case, this had the effect of making currency growth fluctuations more regular, and smaller in magnitude between 1920 and 1925.⁸ From 1926, exchange was again closely controlled to remain in the neighbourhood of 18d. per rupee, the rate prevailing for the next several decades. Finally, although gold did not perform any significant currency function, gold imports were large, but almost entirely private and non-monetary. This gold was brought to the country by Bombay's bullion merchants, and functioned as commodities or assets rather than money.

II

The model used here to characterize the dynamics of Indian prices has three components: agricultural prices, currency growth, and the trade balance. Prices are explained by harvests and currency growth, the former being an exogenous variable largely determined by the weather. Currency growth is explained by the trade balance. Clearly, if trade responds to prices

⁶ However, in 1914-5 and 1931-3, when Britain left the gold standard, Indian gold reserves substantially expanded at the cost of securities.

⁷ General references on the gold exchange standard are de Cecco, *Money and empire* on the prewar period; Tomlinson, *Political economy*; Balachandran, 'Sterling crisis' on monetary policy in the interwar period.

⁸ Coefficients of variation in notes issued fell, though there was a small increase in variability of coins.

or harvests, we have a complete model in three equations and three endogenous variables. The trade balance is decomposed into commodity and bullion, and it is suggested that both commodity and bullion responded to harvests, which thus provides a possible feedback mechanism. The other feedback is explored via the money multiplier, which seems to react to prices. The nature of these relationships, however, altered after the First World War, in ways which may provide some insights into institutional changes in interwar India. The three components of the model are set out more fully below.

The two basic explanations for the rise in agricultural prices, both well articulated before the war, were harvest shocks and speculation in food. A 1913 report on prices described the harvest failure of 1906-7 in great detail.⁹ Recently, McAlpin noted the importance of harvests in non-traded grain prices, whereas a closer correspondence between world and domestic prices seemed to be emerging in traded commodities.¹⁰ Keynes's assessment of the same episode focused on accelerated currency growth. Interestingly, the argument was not that excess liquidity raised demand for food grains, but that stock holdings were constrained by liquidity.¹¹ New money was first received as payment for exports, a large part of which were agricultural goods, so that a link between export payments and stock holding is likely. These two hypotheses are clearly not alternatives. Both explain the supply of food, whereas demand can be assumed to be provided by relatively more stable parameters such as population.

The second equation in the system should explain how currency growth changed. In the absence of open market operations by a central bank and monetized budget deficits, one would expect currency reserves to be a function of the balance of payments. Empirically, the correlation between notes issued and the balance of trade—which was consistently in surplus even when non-monetary gold imports are included—is strong, and withstands different methods of estimation.

One way to understand this association is by referring to other items in the balance of payments. The most important category in India's invisibles account was government remittance, which included the 'home charges', or net expenditure of the India Office chargeable to Indian revenues. This item was, however, substantially more stable than the balance of trade.¹² Moreover, the effect on currency of government account transactions was modified by two factors: loans contracted in Britain against capital expenditures, and the extent to which the government could meet its

⁹ Datta, *Report on an enquiry*.

¹⁰ McAlpin, 'Price movements'.

¹¹ Chandavarkar, *Keynes and India*, p. 29. In the currency reports, there are references to easy money causing stock holding, the former identified with low bank rate. See, for example, evidence of Lionel Abrahams, Assistant Under-secretary of State, *Royal Commission* (1914, evidence, I, p. 27), and that of A. Bowie, Director of Allahabad Bank, *Royal Commission* (1926, V, p. 100). Bowie conjectured that expanding currency against trade bills would have the same effect.

¹² Coefficients of variation in the balance of trade exceeded those in government remittances in the prewar period. Excluding 1931, an outlier, and the early 1920s, when remittances were large, variation in trade was higher in 1924-38. In 1924, the draft system was replaced by market transactions in sterling. The calculations include sterling purchased from the banks, the bulk of it being meant for home charges.

liabilities out of the Secretary of State's treasury balances. The latter instrument was used in some years during the war and the early 1920s.¹³ Otherwise, remittances were effected by the draft mechanism, or by shipment of gold from currency reserves, both leading to a contraction of currency. Private investments and remittances were much smaller in size, and much more stable than trade.¹⁴ Keynes conjectured that private inflow increased in 'prosperous' years, which were usually years of inflation induced by exports, and hence, foreign investment could accentuate inflations. However, the assumptions involved in the estimation of the income and capital accounts make them an unreliable basis from which to infer short-run changes.

The third set of equations completing the model relates to trade. The trade balance depends on variables such as the scale of world trade that are not easily measured. Furthermore, the trade balance is too aggregated, and needs to be decomposed into, at least, commodity exports, commodity imports, and gold imports.

India's commodity trade does not appear to have been especially price sensitive. While this can be a spurious result of the highly aggregated commodity classification available, export and import demands might in fact have been relatively price inelastic. In products such as jute or tea, India was a monopolistic seller, though competition was increasing for some of its exportables. Jute and hides, moreover, were essential intermediate products. Imports, on the other hand, did not compete with domestic manufactures. And both were known to respond to gradual rises in prices very slowly, thereby explaining the persistence of inflation caused by changes in the harvest. But episodes of major harvest shortfalls did invariably cause exports to contract, usually in the following year, whether via prices or via availability, with chain reactions on currency. Commodity imports did not necessarily respond to harvest shortfalls. A possible reason is that the bulk of Indian imports were non-consumables, consisting of government purchases of stores, defence and railway equipment, and luxuries. A smaller proportion, between 5 and 15 per cent of value, was 'machinery and millwork', the closest available index of private industrial investment. These are not likely to be especially dependent on current incomes, in particular agricultural incomes.

The largest homogeneous item of imports was non-monetary gold, which could account for as much as 20 to 40 per cent of total commodity imports including gold. The significance of gold consists not only in the sheer size of absorption which sustained a long and controversial official resistance to the gold standard for India, but in the fact that gold served as a link between household savings and currency fluctuations via the balance of trade. The literature has focused on the possibility that gold, being an asset, could draw resources away from investment, or, being a 'near-money', could smooth real income fluctuations. Its function in smoothing balance sheets

¹³ Memorandum submitted by Lionel Abrahams, *Royal Commission* (1914, appendices to interim report, I, app. 1).

¹⁴ Banerji, *Indo-British economic relations*.

was demonstrated in an episode of dehoarding in the early 1930s, attributed to the debts contracted by the peasantry during the depression. Peasants were, however, not alone in hoarding gold, and the dehoarding of those years might have released funds for industrial investment, which subsequently increased as a ratio of national income.

Gold being an asset like cash, deposits, land, or machinery, demand for it can depend on that for rival assets. Between 1901 and 1914, of the average annual net financial asset acquisition of Rs 344 million, 10 per cent was in cash, 14 per cent in deposits, 53 per cent in gold, and 22 per cent in silver. In 1921-9, the proportions were 1, -6, 66, and 39 respectively. In 1931-5, there were net sales of gold while the growth in deposits recovered.¹⁵ Within each period, annual fluctuations are not very large, and the episodes of sale or purchase are spread over several years. There are at least two examples of sustained change in relative rates of return which could explain asset substitutions. First, in the 1920s, gold prices were falling, but gold was appreciating against silver, which should explain the steady decline in the hoarding and circulation of silver coins. And second, again in the 1920s, real interest rates were falling, which should explain the contraction of deposits against gold and silver.

But these are examples of a steady change. No systematic association seems to exist between annual variation in purchases and rates of return across cash, deposits, gold, and silver. Nor is there any direct evidence of interdependence between financial assets in the short run. On the other hand, the demands for gold, land, and machinery ought to be largely independent of each other because these were probably acquired by different groups for different motives. For the rural elite, gold was a favourite mode of saving. Land was hardly a speculative investment. Machinery, on the other hand, was acquired by the urban entrepreneurs. This justifies explaining annual or seasonal changes in gold demand by an independent demand function.

Finally, as an alternative to trade, a second route to stability could be via broad money, if prices induce systematic movements in the money multiplier. There are two reasons why this route seems worth exploring. First, the model set out above works, though with somewhat reduced explanatory power, if we systematically substitute currency for deposits or M1. This is especially true of the interwar period. Secondly, that the multiplier could be an endogenous variable, and varied negatively with prices and base money changes, receives support for the interwar period, when the contemporaneous correlation between the multiplier and prices had an R^2 of 0.6, and a negative and significant coefficient. In an accounting sense, the multiplier is governed by cash preferences of the public, and statutory reserve ratios applicable to the banks. In the absence of a central bank, the statutory ratio is replaced by banks' preferences for cash reserves. It is therefore an endogenous variable rather than one dictated by policy.

¹⁵ Reserve Bank of India, *Banking and monetary statistics*.

III

Before discussing the estimated relationships, a brief introduction to the database is necessary. The corpus of official macroeconomic statistics inherited by independent India consisted of data on trade, prices, industrial production, and finance published in the *Statistical abstracts for British India*, and later in *Banking and monetary statistics of India* issued by the Reserve Bank of India. This article uses currency, exchange rates and interest rates, imports of bullion, and merchandise trade figures from these two sources. The reliability of these data is not seriously in question. The bases for building prices and incomes were, however, scattered in occasional inquiry committee reports, and in regular estimates of crop production. Since the 1960s, real incomes have been reconstructed by Mukerji, Sivasubramonian, Heston, and others.¹⁶ A standard caution regarding the use of sectoral incomes data is that they often involve blowing up dubious averages of yield or value added. It is widely agreed that this is a serious limitation, and reduces the size of national or per caput income to at best an informed conjecture. However, it has not been suggested that the data can systematically mispredict harvest shocks, and hence their use in an analysis of fluctuations is not impossible.

There are two major gaps in the database on the colonial Indian macroeconomy: balance of payments, and saving and investment. The factor income and capital transfer accounts can be constructed only under very restrictive assumptions. In the saving-investment accounts, the element missing is household physical savings, including land, and hence a reliable time-series of aggregate savings. This gap makes it difficult to infer the long-term growth effects of fluctuations. This database is also inadequate in addressing questions about certain peripheral issues: income distribution, informal money market, and the artisan sector. It is unlikely that the exclusion of the informal money market crucially affects analyses of money supply, for this sector's ability to create money was negligible given that it did not as a rule accept deposits. The artisan sector can be included separately in much the same way as large-scale industry, provided reliable estimates of income or production become available. Distribution can partly explain changes in the demand for manufactured goods, which were not yet mass consumption goods. However, even descriptive data are too weak on the nature of this demand.

The database permits the testing and hence the independent estimation of only some of the hypothesized relationships. Table 1 presents the main regression results. The equations are estimated separately for two periods. A specific periodization forms an implicit framework for studies in recent Indian economic history, and can be validated statistically with reference to the basic aggregates, some of which went through pronounced cycles. This familiar time division is based mainly on currency regimes, and distinguishes between the relatively tranquil period of the prewar gold exchange standard, the trade and exchange fluctuations that followed it, the 1920s characterized

¹⁶ Mukerji, *Levels of economic activity*; Sivasubramonian, 'National income'; Heston, 'National income'.

Table 1. *Regression results: prices and currency growth*

	Prices ^a		Currency ^b	
	1900-14 (1)	1921-35 (2)	1900-14 (3)	1921-35 (4)
Number of observations	15	15	15	15
Constant	-0.018	-0.049	0.010	-0.041
Agricultural production ^c	-0.597 (1.82)	-0.204 (0.40)		
Currency	0.943 ^d (1.61)	1.57 (2.26)		
Balance of trade ^e			0.036 (2.77)	0.075 (2.59)
\bar{R}^2	0.39	0.20	0.41	0.36
DW	1.61	1.33 ^f	2.33	2.11

Notes: *t*-ratios in parentheses, $t_{0.05, n=15} = 1.753$

a weighted agricultural price in index numbers

b notes issued

c previous year's agricultural production in index numbers

d currency lagged by 1 year

e previous year's balance of trade in value

f DW-statistic falls in inconclusive range

Sources: Reserve Bank of India, *Banking and monetary statistics*; McAlpin, 'Price movements'; *Statistical abstracts of British India*; Mukerji, *Levels of economic activity*

by deflation, and the post-depression years characterized by significant changes in household assets.

To provide sufficient data points, these periods have been broken down into the prewar (1900-14), and the interwar (1921-35). Minor adjustments have been made in the second period to avoid outliers. The year 1921 marks the end of war-induced instability which forced a quick and violent transition from fixed to floating exchange, while 1935 marks the formal start of the Reserve Bank of India, and with that, greater control of the money market. Although it is customary to presume a 'structural break' between the prewar and the interwar periods, the break is clearly visible only in financial developments. I shall try to substantiate the notion of a break by referring to prices, output, and the real money linkages, to the extent that the estimated equations shed some light on them.

The regression equations transform the variables into first difference of natural logs, so that the coefficients are ratios of change in growth rates. Since all equations use annual or half-yearly data, the number of observations is small, typically around 15. Whether a first difference makes the series stationary was checked, with five major variables and each of the two sub-periods, by one of the standard Dicky-Fuller tests. In all cases but one, the estimates showed that the hypothesis of a unit root cannot be rejected at 0.05 level. It must be mentioned, however, that the test is reliable only if the sample size is much larger, and so the results have not been reported.

Estimated price equations in table 1 show that agricultural prices responded to currency growth in both periods, apparently with a lag in the first. Harvest fluctuations were of greater magnitude and more frequent before

the war, and milder in the 1920s. This shows up in stronger supply response in the earlier period. It may be added that the two explanatory variables—current output, and current or lagged currency—are themselves poorly correlated in both periods.

The balance of trade explains about 36 per cent of the variation in paper currency in the prewar period, and 41 per cent in the interwar period (table 1). The association is weaker when silver coins are included in the money stock, but the sign does not change. The association is stronger in the 1920s, despite several other influences on money supply coming into effect: the switch to a managed float, changes in the implicit rules of monetary control,¹⁷ and in instruments of control,¹⁸ and the accelerated replacement of silver coins by notes.

The variation in gold purchases had three causes. The first is real incomes. Gold was more of a rural asset, and so more dependent on agricultural income, which had a seasonal pattern. The second is the general price index. That could alter the relative price between commodities and assets. The third is the rupee price of gold, which is a joint outcome of the exchange rate and the sterling price of gold. Of these, general commodity prices do not explain gold purchases to any significant extent. Estimated equations using the other two variables find a strong response of gold to harvests in the prewar period, but increased price sensitivity in the interwar period.¹⁹ This sensitivity can be attributed to the much larger variation in the rupee price of gold after 1920. In the 1920s the sterling price of gold was relatively stable, but sterling depreciated mildly against the rupee. In the early 1930s, after the UK went off the gold standard, the exchange rate was stable, but sterling depreciated against gold. In India, these movements in prices corresponded to a cycle in net purchases, the real quantity bought in the mid 1920s being close to the quantity sold in the early 1930s. This was also the period when Bombay's bullion exchange came into being, and speculative activity in gold increased enormously.

Coming now to the multiplier, the aggregate cash-to-deposit ratio, assumed to reflect the public's preference for liquidity, moved cyclically, falling more or less steadily in 1900-17 and again in 1927-35, but rising in 1917-27.²⁰ The cycles in prices and real interest rates were similar to the cycles in this ratio. The public's preference for liquidity increased during periods of inflation, and was reduced when the rate of change in prices was low or negative. Thus, from 1917 to 1922 currency growth increased, inflation was high, and real interest rates were falling. From the early 1920s deposit growth turned negative, raising the currency-to-money ratio and reducing the multiplier. A substitution for gold can be suggested. It is also possible that inflation raised transactions demand, and hence cash for transactions,

¹⁷ Balachandran, 'Sterling crisis' suggests an implicit dependence of monetary control on Britain's balance of payments with the US.

¹⁸ The war forced an increase in fiduciary issues, making money supply somewhat sensitive to the public debt. For changes in public finance, and its effects on reserves, see Goldsmith, *Financial development*.

¹⁹ The estimated equations are reported in Roy, 'Money supply'.

²⁰ For a more detailed discussion of the data and hypotheses on the multiplier in India, see *ibid*.

since deposits may not have been considered as liquid as cash given that cheques were seldom used.

The other component of the multiplier is the banks' preference for liquidity. Both before and after the war, a large part of the short-term movements in the banks' cash-to-deposit ratio can also be attributed to prices: a quick rise in agricultural prices usually raised the ratio. The most obvious explanation is that a bad harvest raised prices and at the same time reduced bank credit. However, several other explanations are possible: for example, reduced demand for industrial credit or remittances as a result of a sudden rise in agricultural prices. This would be testable with more detailed information on the banks' decision-making processes.

Having isolated three factors—exports, gold imports, and the money multiplier—that could play a role in stabilizing, or destabilizing, a price shock, the next step is to examine how far they clarify specific episodes of inflation. There were three major inflations during our period, in 1903-8, 1913-4, and 1919-20. In at least two of these cases, a trade and a harvest shock coincided. Real agricultural output declined by 7 per cent in 1902-4, by 15 per cent in 1906-7, by 14 per cent in 1910-3 (this last a steady fall from a record crop in 1910), and by nearly 30 per cent in 1917-8, the year of a major epidemic. There can be some dispute as to what caused prices to rise after 1902. The harvest was bad, but not disastrous. On the other hand, buoyant export demand did contribute to monetary growth. But the extent of the rise until 1904-5 was not rapid enough to restrain exports and encourage imports, which, Keynes believed, always responded sluggishly in India. The price situation worsened suddenly in the next year, when another bad harvest occurred. In 1919, also, an exceptionally strong export demand coincided with a bad crop. In each of the three cases, agricultural prices jumped, continued to rise for some time—presumably fuelled by expectations—and then began to decline. In each case, industrial prices followed these cycles, but with smaller variations.

The intensity and duration of the inflations varied considerably. Prices increased by 33 per cent in 1905-7, the average annual rates were about 6-10 per cent in 1910-3, and in 1919 prices increased by more than 50 per cent over the previous year. This variation can clearly be attributed to the extent of currency expansion. A bad harvest had two effects, pulling currency growth in opposite directions: fall in agricultural exports, and fall in net private gold imports. The first would tend to reduce currency growth, the second to increase it. In the first of these three episodes, gold imports fell much more than agricultural exports, so that the money supply expanded. In the second case, the effect of inflation on commodity trade was more pronounced than the effect on gold, dampening monetary growth. In 1919, private gold transactions were under suspension as the government desperately needed gold for currency reserves. The war demand for commodities was price inelastic. The result was a massive creation of money.

There are several major differences between the prewar and the interwar periods. First, harvest fluctuations were milder after the first war. The only comparable harvest-induced inflation occurred in the mid 1920s and was not significant. Second, as a result of the first, price and currency fluctuations

in the interwar period were wholly due to trade shocks. While the exchange rate bore the impact of trade shocks until the mid 1920s, thereafter the exchange was effectively fixed again, so that a gradual decline in export demand induced steady deflation. From 1926, currency growth, and all prices, began a seven-year downward course, the climax coming in 1931 when a sharp fall in exports caused prices to crash. The gold demand estimates would suggest that movements in the gold market contributed to cycles in currency growth from the mid 1920s. Third, short-term changes in prices seemed to generate systematic counter-inflationary movements in the money multiplier. It is possible that these patterns in cash holdings emerged because of financial instability experienced in 1917-21. However, the multiplier embodied decisions that cannot adequately be explained with the database used here.

IV

Now consider the probable effects of shocks on industry. The obvious way to connect non-agricultural income with money is via real balances. Interest rates are correlated with currency, or crude measures of excess liquidity, in the prewar period, but the relationship is weak, and disappears after the war. This is not a surprising result, for asset markets were not widely accessible, nor diversified enough to absorb money in the short run. Furthermore, industrial investment did not enter aggregate demand because machinery was by and large imported. The implications are that investment was determined by domestic incomes, or growth was constrained by savings, and interest rate movements did not affect real incomes significantly.

Real balances, however, are likely to have been an important variable. The two prewar industrial depressions were years of 'monetary stringency', a term that loosely referred to credit rationing, and sometimes increased cost of credit. Since it usually arose from a fall in exports, stringency should also mean reduced cash payments across the economy, and reduced savings with the traders, and peasants growing commercial crops. That cash was indeed a constraint on transactions is a reasonable conjecture, for while the economy was clearly monetizing, the monetary rules reflected merely short-run and not structural variables. Cash itself was one of the commonly held assets—evident in the use of silver coins—and could well have a wealth effect on purchases.

Apart from real balances, sources of demand for manufactured goods should include industrial exports, and real incomes of the non-agricultural classes, measured by services incomes, which reflect the size of government expenditure and income from commerce.

Explaining industrial incomes by aggregate demand alone implies assuming that supply was flexible, and, the market being quantity clearing, that prices were given by input costs. This explanation is attractive for two reasons. First, whether prices cleared the market is difficult to test given the level of aggregation at which both prices and output data are available. Second, the assumption of excess capacity in industry can be justified by the facts that industry was labour intensive, there was a labour surplus, and that

Table 2. *Factors explaining major industrial depressions (average annual percentage change)*

	<i>Real income in large manufacturing</i> (1)	<i>Notes issued deflated by agricultural prices</i> (2)	<i>Real income in services</i> (3)	<i>Real industrial exports</i> (4)
1905-8	-2.7	-7.3	-4.2	0.5
1912-4	-2.1	-1.5	0.4	5.8
1917-9	-7.4	12.7	-2.1	-6.2
1928	-3.9	-1.1	-1.2	-11.7
1931	-4.6	27.5	0.2	-7.2
1935-6	-2.5	-2.2	-0.1	7.3
1900-36	1.9	5.3	2.0	1.8

Sources: Heston, 'National income'; Reserve Bank of India, *Banking and monetary statistics*

prices were cost determined. This last could be justified by pointing to a strong correlation between industrial and agricultural prices.²¹ However, the exact nature of the structural model is not crucial to support the existence of a real balance effect on demand for industry.

Table 2 provides the background for the major depressions in large-scale industry. In each of these cases, real incomes actually declined, and industrial production either stagnated or fell. The first column shows the average annual change in industrial income; the three other columns show average changes in the explanatory variables: real balances, incomes in the service sector, and exports, respectively. The data in the table suggest that except in two cases of clearly export-induced depressions, a fall in real balances was sufficient to cause a fall in incomes. The two exceptions were 1917-9 when the war dislocated trade, and the great depression in 1931. The growth of income in the service sector was uniformly low in all the depressions. The two major prewar episodes were invariably years of agricultural shocks with monetary impact. In 1907-8 and 1912-4, inflation reduced real balances, and poor harvests affected government expenditure and commercial incomes. The result was a short recession, despite industrial exports remaining relatively stable. In three other years, 1901, 1909, and 1922, real industrial income increased by more than 10 per cent. Invariably, real balances and service sector income increased at rates significantly above average, whereas exports were buoyant in at least two of these years.

It was argued above that money could not affect industrial incomes via the interest rate, because capital goods were mainly imported. But did money affect investments? The association between investments, short-term interest rates in the formal money market adjusted for seasonal variations, and the exchange rate after the currency began to float, were tested, and resulted in the following equation (estimated in first difference logs, with *t*-ratios in parentheses):

²¹ First differenced weighted industrial prices (in logs) were correlated with differenced agricultural prices with *R*² of 0.19 for prewar and 0.48 for interwar periods. The *t*-ratios of coefficients are significant at the 10% level. DWs are 1.71 and 1.40, and do not indicate the presence of significant autocorrelation.

$$\text{Investment} = -2.39 - 0.16 \text{ Bank rate (peak)} + 2.27 \text{ Exchange (sterling/Re)} \\ (0.63) \quad (2.07)$$

$$\bar{R}^2 = 0.32; DW = 2.41$$

The association of machinery imports with both cost variables carried the expected signs, but only that with exchange rates was strong enough. A high sensitivity of imports to the flexible exchange rate would be a stabilizing factor, though the share of machinery in imports remained small throughout. Furthermore, it is worth observing that an appreciation of the rupee was bad for exports, but probably improved industrial growth prospects.

Finally, on what did the interest rate depend? In the interwar period, the absence of a systematic association between currency and interest rate implies that the interest rate was directed by the monetary authority. Although the currency function of a central bank was still vested in the government, the tendency towards centralization in banking had started early, and speeded up after the war. The Imperial Bank of India, established in 1921 by amalgamating three Presidency banks, was both the bankers' bank, though without statutory reserve requirements, and the government's bank. To that extent it was more liquid than private banks, could afford to treat its bank rate as an instrument to control average interest rates, and did so, much to the annoyance of the large private banks.²²

The nominal interest rate observed in 1921-32 is the bank rate charged by the Imperial Bank, which led other lending or discounting rates. The seasonal variation in this rate is quite clearly related to changes in the cash-to-deposit or cash-to-advances ratios of the bank. The peak always occurred in January or early February when the cash ratio fell, sometimes quite suddenly, and the low rate occurred in June or July when the ratio was at its highest. The evidence of bankers to the 1926 currency committee suggests that annual change in either the low or the high bank rate depended on two factors: sudden withdrawals or an increase in government deposits, and annual changes in the ratio of cash to advances or deposits.²³ These two should normally be related, since an increase in government expenditure would imply aggregate deposit expansion on a smaller cash reserve. Since both deposit and interest rate data are available by day and month, an accurate test of this association is possible. This involves recording the cash-to-deposit ratio for the day when the interest rate peaked in a particular year, and the day when it was at its lowest (table 3). Correlations between first difference in the cash-to-deposit ratio and the interest rate are then separately estimated for peak and trough. For the period 1921-32 the associations are indeed very strong and negative. After 1932 explicit controls on interest rates were introduced.

The picture that emerges is as follows. To some extent currency variations explained the major fluctuations in output or income. Interest rates were influenced by the central bank's cash-to-deposit ratio. The latter responded positively to prices, and hence, indirectly to currency growth. This would

²² Exchange between Norcott Warren, director, Imperial Bank, and A. Bowie, *Royal Commission* (1926, v).

²³ Evidence of several official witnesses, *Royal Commissions*, 1914 and 1926.

Table 3. *Bank rate and cash-deposit ratio, Imperial Bank, 1921-32*

	Bank rate (%)		Cash-deposit ratio (%)	
	high (1)	low (2)	high ^a (3)	low ^a (4)
1921	7 (28 Jan.)	5 (7 May)	32.0 (28 Jan.)	33.4 (27 May)
1922	8 (10 Feb.)	4 (30 June)	21.4 (10 Feb.)	42.6 (30 June)
1923	8 (5 Jan.)	4 (22 June)	20.5 (5 Jan.)	31.3 (22 June)
1924	9 (8 Feb.)	4 (25 July)	13.9 (8 Feb.)	29.7 (25 July)
1925	7 (22 Jan.)	4 (2 July)	21.3 (23 Jan.)	36.0 (3 July)
1926	6 (Jan.) ^b	4 (10 June)	21.5 (Jan.) ^b	35.7 (10 June)
1927	7 (10 Feb.)	4 (28 July)	16.6 (11 Feb.)	37.7 (28 July)
1928	7 (Jan.) ^b	5 (19 July)	15.2 (Jan.) ^b	25.2 (19 July)
1929	8 (14 Feb.)	5 (6 June)	11.9 (14 Feb.)	22.6 (7 July)
1930	7 (Jan.) ^b	5 (10 July)	17.6 (Jan.) ^b	19.7 (11 July)
1931	7 (15 Jan.)	6 (28 May)	12.8 (16 Jan.)	19.1 (29 May)
1932	7 (14 Jan.)	4 (7 July)	13.8 (15 Jan.)	27.4 (8 July)

Notes: *a* cash deposit on dates closest to peak and lowest interest rates
b average for the month

Source: Reserve Bank of India, *Banking and monetary statistics*

point to an interest-rate mechanism by which prices stabilized, as imports of capital goods expanded due to a fall in interest rates. However, no clear example of this process is apparent in the time series data, which is not surprising, since some of these relationships were statistically weak.

V

This article has tried to integrate the two basic hypotheses on Indian prices—bad harvests and excess currency growth—into a model that consists of three relationships. Agricultural prices are explained by harvests and monetary growth. Monetary growth is explained by fluctuations in the balance of trade. At the third stage, components of the balance of trade are related to the harvest. This link was mediated by agricultural exports and private gold imports. If exports fell relatively more in a year of bad harvest, currency growth declined, thus dampening inflation. If gold imports fell relatively more, currency growth could remain stable. The relative rates of change in these variables, and the speed of adjustment, decided the intensity and duration of inflation. The reason why relative rates of change in gold or exports varied between one bad year and another is not obvious from the database used here.

In the interwar period, the dynamics changed. Harvest shocks were rare, and most price movements arose from trade shocks, generated by cycles in world trade. A brief regime of flexible exchange rates stabilized currency and prices to some extent, but from the mid 1920s the exchange rate was almost fixed again, and depressed export demand caused a steady deflation, culminating in the crash of 1931. This analysis also suggested that, in this period, developments in the gold market contributed to the long-term trend in currency growth, and counter-inflationary movements in the money multiplier might have been a source of stability.

Real balances, and not interest rates, provide the link between currency and industrial fluctuations. Did interest rates provide the link between currency and industrial growth? Bank rate was fairly sensitive to money in the prewar period and was partially controlled after 1920. Interest rates did affect industrial investment negatively. But the correlation was weak and probably reflects the small size of the market for long-term debt.

It is likely that several features observed in this study of India can be generalized to other contemporary agrarian and exporting economies, so that the model developed here may have wider applicability. These features are: a high volatility of prices resulting from agricultural and currency fluctuations, and currency growth being determined by the external account. Given this, the extent to which trade responded to prices or harvests would determine the intensity of shocks. The speed and degree of response would perhaps depend on the specific composition of trade. It is likely that the role non-monetary gold imports played in adjustments distinguished India from most other contemporary economies. While it is important to explain the dynamics of fluctuations in economies that suffer considerable instability, it is also necessary to analyse the effects of shocks, especially on distribution, and the behavioural and institutional changes underlying changing statistical relationships. These problems cannot be dealt with adequately in this article, chiefly because they require a wholly different database.

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