

international transmission of inflation and deflation. The concept of an international transmission mechanism, the process whereby economic disturbances are spread from one country to another, is an old one. Sophisticated discussions of such a mechanism appear in the work of David Hume (1752) in the eighteenth century and even earlier in that of the Spanish scholastic philosophers of the School of Salamanca in the sixteenth (see Grice-Hutchinson 1952). Under the 19th- and earlier 20th-century gold standard, the question of international transmission arose repeatedly. In some instances, the spur was inflation; in others, most notably the Great Depression of the 1930s, it was deflation. (Examples of contemporary analyses include Fisher 1912 and 1935.)

During the past two-and-a-half decades, concern about the international transmission of economic disturbances resurfaced. The initial impetus was provided by the acceleration of inflation rates throughout the industrialized world that began in the mid-1960s under Bretton Woods. To many observers, Europeans particularly, this inflation had its roots in overly expansive US monetary policy and owed its spread to the fixed exchange rate system then in place. The apparent continuation of transmission under the floating rate regime that followed has served to maintain this interest in international transmission.

CHANNELS OF TRANSMISSION. To illustrate the various channels of international transmission, we will first consider a fixed exchange rate system in which there is a reserve-currency country and a group of other (non-reserve-currency) countries that peg their exchange rates in terms of the reserve currency. This was the relationship between the United States and most other industrialized countries under Bretton Woods. Since the issues are inflation and deflation – continuous changes in price levels, as opposed to one-time shifts – we will analyse the international transmission mechanism in an explicitly dynamic context, focusing in particular on the adjustment process following a monetary shock in the reserve-currency country.

In the initial fixed-exchange-rate equilibrium, real incomes in the countries comprising the system grow at steady-state rates determined by growth in labour forces and changes in technology. Inflation rates, but not necessarily price levels, along purchasing power parity lines are equal across countries. Rates of growth of money supplies, in general, are not. The rate at which money supply in any one country is growing equals the system-wide rate of inflation plus the rate at which the real quantity of money demanded in that country is growing. The latter, in turn, is determined by real forces – the rate of real-income growth, changes in the opportunity cost of holding money due to real variables, and changes in the 'quality' or usefulness of money.

Suppose now that the steady-state rate of growth of the reserve-currency country's money supply undergoes an unanticipated increase. Assume further that, like the United States under Bretton Woods, the reserve-currency country conducts its policies independently, ignoring the effects on other countries in the system.

In theory, there is a variety of channels through which equilibrium will be re-established and the monetary disturbance transmitted to other countries in the system. The immediate result of the monetary acceleration in the reserve-currency country is an excess of actual over steady-

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state desired real money holdings. This excess supply of money translates into excess demands for both goods and securities. The pace of nominal spending in the reserve-currency country increases, the growth rates of real spending and real income temporarily rise, nominal and real interest rates temporarily fall, and inflation gradually begins to move higher. This faster real income growth in the reserve-currency country spills over directly to other countries via the *absorption* channel of transmission, stimulating exports and thus real income growth abroad. Additionally, there may be direct effects on foreign prices and interest rates as incipient cross-country differences in prices and interest rates are eliminated via *interest-rate* and *price-arbitrage* channels according to the Law of One Price.

Very likely transmission will also take less direct routes, operating through reserve flows and, hence, money supplies. The surpluses above the line in the non-reserve-currency countries' balance of payments that are induced by the monetary expansion in the reserve-currency country are matched by increases in foreign reserves below the line. In the Humean analysis, such reserve flows (the analogue of specie flows in the gold-standard world) are the driving force in the transmission process. The result is increased monetary growth abroad, faster nominal-income growth and eventually faster inflation. These reserve flows may follow *price-reserve-flow* channels, the initial inflation acceleration in the reserve-currency country leading to relative increases in the prices of its exports and thus a deficit on current account. Or they may operate through *portfolio-balance* channels and gradual adjustment in capital markets, with the initial declines in interest rates in the reserve-currency country giving rise to capital outflows to the other countries in the system.

Economists who view the process from the perspective of the quantity theory have generally stressed the reserve-flow mechanisms of transmission and to a lesser extent the price-arbitrage channel. Keynesians, in contrast, have typically viewed the absorption channel and interest-rate adjustment operating through the portfolio-balance channel as being of primary importance. In fact, all are likely to play some role, the relative strength of each being an empirical matter. (See here Branson 1975, Bordo and Schwartz 1988 and Kimbrough 1987.)

In the new steady-state equilibrium, inflation in all countries in the system increases, nominal interest rates and the rate of money-supply growth rise by the magnitude of the inflation increase, while real variables return to their original paths (see Johnson 1976 for an algebraic statement). A decrease in steady-state money growth in the reserve-currency country produces an analogous series of effects, ending in deflation, or a decline in inflation, throughout the system rather than a rise.

With floating exchange rates, the equilibrium position will be very different than with fixed. The counterpart under floating rates to the cross-country equality of steady-state

rates of inflation in equilibrium under fixed rates is equality of exchange-rate-adjusted rates of inflation, or long-run relative purchasing power parity. In the floating-rate case, an increase in the steady-state rate of money-supply growth in any country in the system leads to equal increases in the steady-state rate of inflation in that country, in the level of the nominal rate of interest and in the rate of depreciation of the nominal exchange rate. In the long run, other countries are insulated: inflation is a domestic monetary phenomenon and the transmission of monetary disturbances nonexistent.

Less settled are the details of adjustment following a monetary shock under floating, and the adjustment process and equilibrium properties of the system following real shocks under both floating and fixed rates. In theory, the exchange rate is apt to overshoot following a shock, rising above or falling below its steady-state-equilibrium level. In practice, some short-run transmission of monetary disturbances also appears to occur under floating rates, if only because of central banks' attempts to limit fluctuations in exchange rates and interest rates.

Real shocks can have spill-over effects on other countries under either regime. The general presumption has been that the permanent effects of such shocks will be confined to levels and, hence, that any effects on rates of growth, including rates of inflation, will be transitory. The mechanism whereby real shocks are transmitted is largely an open question, with the answer depending upon the nature of the shock. In the simplest case under floating rates, transmission will take place via the absorption channel; under fixed rates, temporary alterations in reserve flows induced by changes in real quantities of money demanded also will play a role. (See Stockman 1990 for an alternative view of the transmission of real shocks.)

EMPIRICAL EVIDENCE. Empirical analysis of international transmission has centred around two episodes in particular, the Great Depression of the 1930s and the inflation of the 1960s and 1970s. The focus of this research has been both on observed equilibria under alternative exchange-rate systems, and thus whether transmission has taken place, as well as the actual workings of the transmission process. The one caveat that needs to be kept in mind in interpreting all these results is that the stark contrast between fixed and floating rate regimes that exists in theory has seldom been observed in practice. Intervention of one sort or another generally has been of at least some importance under most exchange rate arrangements.

For the Great Depression, differences among countries with different exchange rate regimes (China on silver and Spain with floating rates versus the gold-standard world) and over time (the United Kingdom and the countries that followed her departure from gold in May 1931) have been major sources of inferences. Both sets of comparisons demonstrate to varying degrees the insulation properties of floating rates and thus the importance of the monetary mechanism in transmitting shocks (see Fisher 1935; Friedman and Schwartz 1963, ch. 7; Choudhri and Kochin 1980; Lothian 1981; Huffman and Lothian 1984).

Comparisons of long-run behaviour in the Bretton Woods period with that of the floating rate period tell a similar story. Under the current float, the insulation properties of floating

Table 1
Cross-country variations in rates of growth of nominal and real variables under alternative exchange rate regimes: 23 OECD countries, 1956-90^a

Variable	Regime ^b	
	Fixed	Floating
Nominal money	3.77	7.63
Price level	1.76	8.22
Nominal exchange rate	3.13	8.69
Real exchange rate	1.71	0.93
Real money	3.06	2.48
Real income	1.35	1.26

Source: International Monetary Fund, *International Financial Statistics*, various issues.

Notes: ^a Figures are cross-country standard deviations of continuously compounded average annual rates of growth expressed in percent per annum terms. Money is the IMF's definition, the price level is the cost of living index, the nominal exchange rate is foreign currency per US dollar and real income is real GNP or GDP depending upon the country.

^b The fixed- and floating-rate periods are defined as 1956-73 and 1974-90, respectively.

rates have held up remarkably well over the long run (Lothian 1985; Darby and Lothian 1989). We can see this in the updated and otherwise revised version of Table 5.1 from the latter study that is shown here as Table 1.

Three items in this table stand out: the dramatic increases under floating rates in the variability of average rates of inflation and money-supply growth across these 23 countries; the near constancy of average exchange-rate-adjusted inflation rates (real exchange rates); and the slight declines in variability of real money growth and real income growth. In order, these three sets of findings support the hypotheses of long-run policy independence and inflation insulation under floating, long-run relative purchasing power parity, and long-run monetary neutrality.

Other studies of this period – both the Bretton Woods and floating rate portions – have analysed the causes of inflation and the actual mechanics of inflation transmission. Darby and Lothian (1983), in summarizing the empirical evidence on the transmission process, point to the central role of the United States as the reserve-currency country under Bretton Woods in generating inflation in other industrial countries and to the Humean reserve-flow mechanisms operating in both goods and capital markets as the principal channel of inflation transmission. Non-reserve-currency countries did have some degree of monetary-policy independence in the short run. By the same token, the 1974-5 oil price shock was a contributing factor to the subsequent surge in inflation. That policy independence, however, did not survive over the long run, while oil prices according to the Darby and Lothian (1983) estimates accounted for no more than a third of the inflation acceleration between 1966-70 and 1971-5.

Under the float, short-run transmission from the United States to other countries appears to have continued to take place. (Batten and Ott 1985; Burdekin 1989; Darby and Lothian 1989; Lastrapes and Koray 1990). Central bank, including Federal Reserve, behaviour under the float and increased capital-market integration due to the gradual freeing of those markets from controls have been singled out as the major channels through which this transmission has taken place.

See also BRETTON WOODS SYSTEM; FIXED EXCHANGE RATES; FLOATING EXCHANGE RATES; INFLATION; INTERNATIONAL FINANCE; MONETARY APPROACH TO THE BALANCE OF PAYMENTS.

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