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LIBERALIZATION POLICY: 'FITS & STARTS' OR GRADUAL CHANGE IN INDIA

by

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Abstract

In this paper we assess the impact of external economic liberalization in India on the transmission of aggregate shocks. We examine the relative importance of domestic and external shocks and capture their feedback effects by estimating an eight variable vector autoregression (VAR) model. We also test two propositions regarding the nature of India's liberalization policy: 1) under *intermittency (or 'fits and starts')* the transmission of aggregate shocks in the post-reform period is compared with two pre-reform periods; and 2) under *gradualism* the transmission of aggregate shocks over three consecutive episodes of economic reform are compared. Our test first consists of a simple regression analysis using output, interest rates, and prices for India and its world counterparts. The analysis is extended to include dummy variables and distributed lags method. Finally, we apply the recursive regression method and Chow-tests to uncover breaks in the estimated parameters. The preponderance of evidence suggests that India's liberalization policy has followed a continuous and smooth path, at least since the mid 1970s.

JEL Classifications: C22, C50, E65, F36, F41, O11

Keywords: reform policy, transmission, shocks, liberalization, India

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LIBERALIZATION POLICY: 'FITS & STARTS' OR GRADUAL CHANGE IN INDIA**I. Introduction**

India's economic liberalization has drawn a great deal of attention. India began relaxing government controls on a selective basis, in the mid 1970s.¹ However, beginning in July 1991, the policy appeared to be more broad-based and coherent. The shift from an inward-looking trade policy to a more outward-looking trade policy, from a policy of a tightly controlled exchange rate to a more market-determined exchange rate, and from a policy of outright hostility toward foreign investment to a more open-door policy suggests deeper commitment by the policy makers to a liberalized economy. In addition, the policy has survived several changes in government.

Has India's recent liberalization policy succeeded?² Does it represent a break from the past implementation of economic policy? By definition, liberalization means a systematic release of market forces from statal, para-statal and other institutional interferences in the day-to-day working of the economy. India's liberalization strategy is two pronged -- internal and external. Here we are primarily interested in external liberalization. Generally, any move toward a more open economy is considered efficiency-enhancing because it exposes the economy to greater competitiveness.

We shed light on the transmission of aggregate shocks in the Indian economy since the mid 1970s and analyze changes in the pattern of this transmission, especially since July 1991. How rapidly and thoroughly external shocks are transmitted to the Indian economy is a measure of how well India is

¹Bhagwati and Srinivasan (1975) have chronicled and analyzed India's earlier attempts to liberalize. See Gang (1995) for an hypothesis explaining India's apparent "stop and go" policy of liberalization. See Chand and Sen (1999) for a summary of trade policy in India.

²See Chopra et al. (1995) for an attempt to measure the economic impact of India's liberalization policy. On balance, the evidence appears to be positive.

integrated into the world economy.

We first estimate an eight variable vector autoregressive model (VAR) to test the transmission of external shocks to the Indian economy from July 1975 to June 1996.³ We then analyze the transmission of external shocks under two alternate propositions regarding policy regimes. Under the proposition of *'fits and starts' or intermittency* we assume that history of India's liberalization policy is characterized by a series of policy changes and retrenchments. Under the proposition of *gradualism*, increased liberalization is a continuous process not noticeably affected by announced policy change. We test the *intermittency* and *gradualism* propositions by dividing the time from July 1975 to June 1996 into several periods. We employ simple regression analysis, using domestic variables as the dependent variables and corresponding foreign variables as the independent variables. The analysis is extended to include dummy variables and distributed lags. We also use the recursive regression method and Chow-tests to further confirm our results. The paper is organized as follows: section II describes India's economic liberalization policy, section III presents the empirical results and analyzes them, and section IV contains a summary and conclusions.

II. Economic Liberalization Policy

The current phase of India's liberalization policy began in mid 1991, although limited efforts were made earlier (see Chand and Sen, 1996). For instance, in the 1980s there was a partial lifting of import restrictions and exporters were given greater access to imports. To streamline the tariff

³Studies doing similar analysis include Burdekin, 1989; Darby and Lothian, 1989; de Brouwer, 1995a and 1995b; Feasel, Kim and Smith, 1999; Genberg and Salemi, 1987; Genberg, Salemi and Swaboda, 1987; Kuszczak and Murray, 1986; Lastrapes and Koray, 1990; Moon and Jain, 1995; and McCarthy, Neary and Zanalda, 1994.

structure, some quantitative restrictions were replaced by tariffs. As part of the financial liberalization, the Indian currency was devalued by 45%. Other minor changes were also introduced in the financial sector.

The 1980s also saw a period of rapidly expanding government expenditure. The central government deficit rose from 4.9% of the GDP in 1975-80 to 8.4% in 1985-90. Fiscal expansion contributed to a healthy rate of economic growth: the rising central government deficit and continued monetization of government expenditure led to higher inflation. The Middle East crisis of 1990 brought two adverse and unexpected results. First, the price of oil was pushed up significantly, adding to rising prices. Second, substantial workers' remittances from abroad were lost. India's international reserves (excluding gold) fell from 5.23 billions SDRs in 1986 to 1.07 SDRs in 1990. This severe external imbalance manifested itself in a drastic fall in the reserves to imports ratio. The country's ratio of non-gold reserves to imports fell from 41.5% in 1986 to 6.4% in 1990. In addition, India was facing considerable political instability. These and other developments led to a downgrading of India's credit rating in the international money market. India's access to foreign credit was severely curtailed. By early 1991 India was on the brink of defaulting on its international obligations.

Thus, at least in part, the current phase of liberalization policy that began in July 1991 was made necessary by external circumstances. The current phase began with a 19% currency devaluation. The interest rate was increased significantly to curb the flight of short term capital. Efforts were made to reduce the central government fiscal deficit, in part by mobilizing financing from IMF, the World Bank and other sources.

The following brief account serves to summarize the comprehensiveness of the reforms made in

the 1990's. Concerning taxation, the maximum excise duty was reduced from 105% in 1990/91 to 70% in 1994/95. The personal income tax rate came down from 54% to 40%. The corporate income tax was also reduced, albeit marginally. Reforms in international trade were even more significant. As a result, maximum import duties came down from 400% in 1990/91 to 65% in 1994/95. More importantly, import-weighted average rates fell from 87% to 33%. The effective rate of protection declined from 148% in 1990/91 to 71% in 1994/95. Quantitative restrictions were also significantly reduced for all tradeables. Instead of import licensing based on 26 separate lists, in 1994 there was a single list. Of the 55 goods restricted to import by state agencies, most have now been taken off this list. The number of items that were subject to controls were reduced from 439 to 210 over this period. Some mineral and agricultural exports that were subject to export taxes are now free from export tax. Many specific sectors enjoyed export subsidies that are gradually being phased out. Besides these, many changes have been made in industrial deregulation, foreign investment, and banking.

India's economic reform may be producing some results, although there are some initial set backs.⁴ Fiscal retrenchment in response to the 1991 crises meant reducing domestic demand. Similarly, monetary tightening and the consequent rise in the interest rate pushed up borrowing costs. Coupled with the withdrawal of external financing and restrictions on imports, this led to a slowdown in economic growth in 1991. Since then there has been a gradual improvement in India's overall economic performance. The economy has picked up, the rate of growth in real terms reaching 5.3% in 1994, 7.8% in 1995/96 and 6.8% in 1996/97. The inflation rate has improved, although some

⁴For an analysis of the effect of Indian liberalization on total factor productivity growth, see Chand and Sen, 1999.

gains achieved earlier seem to have been lost in more recent years.

Trade liberalization has meant a significant increase in the total volume of trade. The ratio of trade to gross domestic product increased from 12.1% in 1975-80 to 16% in 1990-94. This indicates a clear shift away from an inward-looking trade policy based on import-substitution to a more outward-looking trade policy. The deficit on the current account has come down from 7.15 billion US dollars in 1988 to about 4.11 billion US dollars in 1992. The country's international reserves position has improved remarkably: the reserve to import ratio rose from a low of 6.4% in 1990 to 73.4% in 1994. Industrial deregulation and financial sector reform have given some boost to private sector investment, and an increase in foreign direct investment.

Yet India's liberalization policy has encountered some serious problems. The move toward privatization has been painfully slow. Subsidies, especially fertilizer and food subsidies, are pervasive. The reform has failed to address the acute shortage of power and other infrastructural bottlenecks. The public sector salary and wage negotiations are continuing in complete disregard of the labor market conditions. A comprehensive labor market reform in the private sector is long overdue.

Our proposition of *intermittency or 'fits and starts'* assumes that the period from July 1991, when the current policy is known to have come into effect, to June 1996, can be labeled as the post-reform period in India's policy making history. The transmission of external shocks in this post-reform period is compared with two pre-reform periods. The first pre-reform period runs from July 1986 to June 1991. This is labeled as the equal sample case and is designed to match the length of our data series on the current reform period. The second pre-reform period, which is labeled the full sample case, runs from July 1975 to June 1991. The proposition of *gradualism* does not use the

dichotomy of pre/post-reform. Instead, it assumes three broad episodes of liberalization. The first episode runs from January 1977 to December 1984 and broadly covers the later part of Indira Gandhi's regime. The second episode runs from January 1985 to December 1990 and covers the regime of Prime Minister Rajiv Gandhi. The third episode runs from January 1991 to June 1996 to cover the rest of the period. This mostly covers the regime of Prime Minister Narasimha Rao. Under the *intermittency* hypothesis the responsiveness of domestic variables to foreign variables is expected to show a sharp jump in the post-reform period compared with the pre-reform periods. Under the proposition of *gradualism*, we would expect the transmission of external shocks to show a gradual increase from one period to the next.

III. Empirical Analysis

A. Data

The period considered in this study is from July 1975 to June 1996. Data limitations have prevented us from using a larger sample period. We have decided against both annual and quarterly data, in favor of using monthly data. Due to the unavailability of longer time series, annual data would have created a serious degree of freedom problem. Quarterly series may be a good compromise, but lack of sufficient observations, especially for the post-reform period, prevent us from using quarterly data. The study uses the following domestic and foreign variables. For India: the industrial production index (IPI), wholesale price index (WPI), nominal interest rates (IRI), nominal money supply M1 (NMI), and the share price index (SPI). For the Rest of the World: the industrial production index (IPW), the wholesale price index (WPW), and the nominal interest rate (IRW). It should be pointed out that we have used call money rate for domestic interest rate

variable (IRI).⁵ Til August 1989 there was a ceiling on the call money interest rate, and the rate was at this ceiling for significant periods. Furthermore, the call money rate has shown extreme volatility since 1989. Because of this, we considered using 182-day T-bill rate, which appears to be a better measure of domestic interest rate. However, since 182-day T-bill was introduced in November 1986, using this series would not have given us a complete series for the entire sample period. Hence, we decided to work with call money rate. A detailed description of the data with their sources is given in Appendix Table A1. We have constructed the three world variables using India's exports to four major trading partners (U. S., U. K., Germany, and Japan).

B. Transmission of aggregate shocks: a VAR analysis

Following Moon and Jain (1995) and others, we use vector autoregression (VAR) to examine the transmission of external shocks to the Indian economy.⁶ A typical VAR model takes the following form,

$$C(L)Y_t = C + V_t \text{ and } \dots \dots, \quad (1)$$

with,

$$C(L) = I - C_1L - C_2L^2 - \dots - C_mL^m \dots, \quad (2)$$

where Y_t is an $n \times 1$ vector of variables, C is an $n \times 1$ vector of constants, and V_t is an $n \times 1$ vector of random variables, each of which is serially uncorrelated with constant variance and zero mean. In this model the current innovations contained in V_t are unanticipated. Equation (2) represents an $n \times n$ matrix of normalized polynomials with the lag operator $L(L^k Y_t = Y_{t-k})$.

⁵We thank the referee for raising this issue.

⁶See footnote 4 in Ansari (1996) for discussion on the use of VAR and the controversy surrounding its use. Also see Backus (1986), and Ambler (1987) in defense of VAR methodology.

Since the stationarity condition of the data is crucial in determining the specification of the model, we first carry out Dicky-Fuller (DF) and Augmented Dicky-Fuller (ADF) tests with and without a time trend, to test the presence of unit root(s) in the data.⁷ All variables have been used in their natural log forms except interest rates. Based on these tests we have concluded that three of the five domestic variables, namely, output (l_{ip}i), prices (l_wpi), and interest rates (IRI) and one of the three foreign variables, namely, prices (l_wpw), are integrated of order zero or I(0). The remaining four variables are stationary in their first differences, so they are integrated of order one, or I(1).

Our variables have a mixed order of integration. One of the conditions for testing for cointegration is that all variables should have a common order of integration, hence we did not test these variables for the existence of a long run relationship using cointegration techniques.. This is also the reason why we could not use vector error-correction modeling (VECM). Interpreting the results when variables with different degrees of integration are mixed in a VAR system can be also be problematic. Besides, estimating a VAR model in the level forms is not only common in empirical literature, many practitioners actually consider it superior to the differencing strategy (See, e.g., Eichenbaum and Singleton (1986); Fuller, (1976); Spencer, (1989); Doan, (1989); and Todd, 1990). Therefore, we have estimated an eight variable unrestricted vector autoregression in level, which includes a time trend and a dummy variable defined to take the value zero for the pre-reform period and one for the post-reform period. Since VAR results are sensitive to lag lengths, we have employed the Akaike Information Criterion (AIC) for determining optimum lags (Akaike (1969)). On the basis of a maximum of 24 lags, the Akaike criterion produced an eight period lag length as

⁷Since the use of these tests and their variations has become a routine practice in empirical literature, we have refrained from their detailed explanation. Similarly, to conserve space we have not provided any table containing these results.

the optimal lag length. Since our main task is to examine the transmission of foreign shocks, we first include the three foreign variables in our ordering followed by domestic money supply and the other four domestic variables.⁸

In view of the difficulty in interpreting the estimated coefficients from VAR, it is a common practice to rely on variance decompositions (VDCs) and impulse response functions (IRFs). The variance decompositions suggest the proportion of the forecast error variance accounted for a given variable and by each of the other variables in the system. The results of the variance decompositions are presented in Table 1. To get a sense of the relative importance of foreign vs. domestic variables, we present two additional statistics. The statistic labeled r1 is the ratio of variance explained by all foreign variables to variance explained by all other variables, excluding its own (Genberg et. al., 1987). In the case of output, the total variance explained by three foreign variables for a three period time horizon is 3.88, while that explained by other seven variables is 9.17. Thus, r1 is 42% (3.88/9.17). We also report a new statistic, r2, defined as the ratio of total variance explained by all foreign variables to total variance explained by all domestic variables, excluding its own. A value of 100 means that the influence of both foreign and domestic variables is fifty-fifty. The value less than 100 means that the influence of foreign variables is less than that of domestic variables, while a value more than 100 means that the influence of foreign variables is greater than that of domestic variables. In the case of output, the total variance explained by three foreign variables for a three period time horizon is 3.88, while that explained by other four domestic variables is 5.29. Thus, r2 is 73% (3.88/5.29). In this case, the influence of the foreign variables is smaller than that of the

⁸Since VAR results are also known to vary with the ordering of variables, we have tried different orderings. These did not make substantial differences in the results, indicating robustness with regard to ordering of variables.

domestic variables.

The main points emerging from Table 1 are as follows. In the case of output (*lipi*), *r1* remains below 50% for all time horizons. Similarly, *r2* never reaches 100. This means that domestic variables have consistently dominated foreign variables in the transmission of aggregate shocks. In contrast, these two ratios suggest dominance of foreign variables in the case of prices (*lwpi*), except for three and six period time horizons. The influence of foreign variables is very small in the case of interest rates (*IRI*). It is small even compared with that for output. Foreign variables clearly dominate in the case of stock prices, especially for longer time horizons. This may show a growing integration of international capital markets. Finally, the Indian money supply is relatively free from foreign influences, as one would expect.

Besides these broad results, the table reveals several other interesting points. Prices, both foreign and domestic, and money supply, seem to account for a substantial portion of forecast error variance in output, especially for some longer time horizons. The influence of domestic money supply on domestic output may be taken as evidence of effective monetary policy. Similarly, the significant impact of an unanticipated shock in domestic prices on domestic output can also be taken as evidence in favor of the rational expectations monetarist position, which suggests a positive effect of money supply on output through a positive effect on prices. However, we have not included any variable to capture the impact of government expenditure on output, and we cannot say anything about the relative effectiveness of monetary vs. fiscal policy.⁹ Foreign prices have had the most dominant effect on domestic prices, accounting for about a quarter of the forecast error variance.

⁹In one such study, Ansari has found that fiscal policy effectiveness dominates monetary policy effectiveness in the case of India (Ansari, 1996).

Money supply is the second most dominant factor explaining the forecast error variance of domestic prices. Thus, it seems that expansionary monetary policy has contributed to inflation in the case of India. Many studies have reported what is known as the 'price puzzle', indicating a negative effect of money supply on prices. Does this finding reject such a price puzzle in the case of India? Since variance decompositions tell us about the magnitude but not the nature (negative or positive) of this relationship, we cannot answer this question without analyzing the impulse response functions. As seen by r_1 and r_2 , foreign variables together have relatively small influence on domestic interest rates. However, individually, foreign interest rates seem to have exerted quite considerable influence on the domestic interest rate. In fact, the influence of the foreign interest rates is twice as large as that of domestic money supply. An important implication of this finding is that India's capacity to institute an independent domestic stabilization policy may be severely limited. A significant positive association between money supply and interest rate is known as the 'liquidity puzzle'. A very small influence of money supply on the interest rate seems to rule out any liquidity puzzle in the case of India. However, a definitive answer has to wait until we analyze the impulse response functions. Another point worth noting is that domestic stock prices may be very sensitive to foreign interest rates. In fact, the influence of foreign interest rates exceed that of the domestic interest rate. The explanation for this apparent anomaly is not immediately clear.

Finally, a relatively large proportion of the forecast error variance in money supply explained by domestic prices seems to suggest some degree of accommodation in Indian monetary policy. To put it in perspective, less than 10% of the forecast error variance of domestic prices is explained by money supply for most of the time horizons, reaching a maximum of 18.49% in the 24th period. In contrast, the proportion of variance in money supply explained by domestic prices is more than 10%,

reaching more than 20% for most of the periods. This shows that there is a feedback effect between money supply and prices. In other words, expansionary monetary policy has contributed to inflation that, in turn, has been accommodated by expansionary monetary policy. This finding is consistent with Ansari (1996).

Important as variance decompositions are, they fail to answer some questions raised earlier. For this, we must resort to impulse response functions. The impulse response functions trace the time path of the effects of a shock in one variable upon itself and on all other variables. They are helpful in determining the sign of the response. Figure 1 shows how much domestic output (lipi) would change one to twenty-four months after a one-time one standard deviation shock (innovation) in foreign output (lipw). As the figure reveals, a one-time one standard deviation shock applied to lipw produces a positive impact on lipi in all periods. The impact gradually declines and converges to zero by the 18th month. Figure 2 shows how much domestic prices (lwpi) would change one to twenty-four months after a one-time one standard deviation shock (innovation) in foreign prices (lwpw). The figure shows a delayed but very large positive impact on lwpi of an unanticipated shock in lwpw, which gradually declines, converging to zero in 24 months. Similarly, we have plotted the impact of an unanticipated shock in foreign interest rates (IRW) on domestic interest rates (IRI) in Figure 3. An unanticipated shock in foreign interest rates seems to have produced a one-period delay, but very large positive impact on domestic interest rates in the following three months. This is followed by a large negative impact in period five and six. The impact becomes sharply positive and remains so for the remaining period. Finally, the plot of the impulse response reveals mostly a positive association between domestic money supply and interest rates for the 24-month period, suggesting some evidence of liquidity puzzle in the case of India. Similarly, the plot of the influence

of money supply on domestic prices does not show any evidence of a price puzzle up to the tenth period. However, beyond this, the impact of money supply on prices turns sharply negative, indicating strong evidence of a price puzzle. To conserve space, we have not produced these two figures here.

To summarize, the findings of the impulse response functions are largely consistent with those of the variance decompositions. The picture of the relative importance of foreign and domestic shocks on the Indian economy is mixed. Domestic prices are influenced more by foreign variables than by domestic variables, while the impact of foreign variables on output and interest rates is relatively small. There is some evidence of monetary policy effectiveness and of monetary policy accommodation. Finally, the Indian economy seems to suffer to some degree from both the liquidity puzzle and the price puzzle. These are interesting findings per se, but they do not address whether there has been any significant change in the transmission of external shocks in the post-reform period compared to pre-reform periods. This is the focus of our investigation in the next section.

C. India's Liberalization Policy: Intermittency vs. Gradualism

Due to lack of sufficient data points for the post-reform period, we do not address the issue of *intermittency vs. gradualism* in the multivariate framework of VAR. In this section we employ a bivariate approach to address this issue. As we are interested strictly in the transmission of external shocks, we use only domestic and foreign output, prices, and interest rates for this exercise. We carry out three types of estimations. First, we use the domestic variable as the dependent variable and the foreign variable as the independent variable in a simple regression. Second, we carry out estimations including both an intercept and a slope dummy. We also carry out regression analysis with both intercept and slope dummies using the Almon method of distributed lags. In each case,

we compare the pre and post-reform coefficients under the proposition of *intermittency*. Similarly, we compare the coefficients of the three policy episodes under the proposition of *gradualism*. Finally, we estimate equations with recursive least squares method and employ Chow-tests to verify the robustness of our findings regarding *intermittency* and *gradualism*.

Results of simple regression analysis to test *intermittency* are presented in Table 2. Since we have used a double log specification for output and prices, each coefficient is a measure of elasticity. The coefficient of foreign output (lipw) in full sample case, for instance, means that a 1 percent change in the foreign output would lead to a 0.31 percent change in domestic output. The coefficient of foreign output (lipw) in each case is positive, as expected. But more important, the post-reform coefficient (2.39) is larger in each case than two pre-reform periods. This may suggest *intermittency*. However, comparing the post-reform coefficient with that of the equal sample case shows an improvement in the size of the coefficient, which may suggest *gradualism*. The picture is mixed for price variables. All coefficients are positive except the equal sample case. However, the post-reform coefficient (0.270) is significantly smaller than for the full sample case (0.438). It should be noted that due to serial autocorrelation these coefficients may be suspect, making comparisons less reliable. The equation for interest does not use a double log form. So, its coefficient has a slightly different interpretation. The coefficient of 1.748 in the post-reform period, for instance, means that a one percentage point rise in foreign interest rates would lead to a 1.748 percentage point rise in the domestic interest rate. As the table shows, the interest rate variable has also produced somewhat mixed results. From being negative in the full sample case, it has turned positive in the post-reform period. However, the size of the coefficient in the post-reform period has declined sharply compared with the equal sample case. To sum, these results provide only scant evidence of *intermittency*.

Next, we have estimated equations including a dummy variable, d_2 , defined to take a value of zero up to June 1991 and one after that. The results of these estimations to test *intermittency* are presented in Table 3. In the equal sample case only the intercept dummy of the interest rate has the positive sign, indicating a positive shift in the level of external transmission, although the coefficient is statistically insignificant. Coefficients for both output and prices are negative, one being statistically significant. In contrast, the coefficients of slope dummies for both output and prices have positive signs. The coefficient of slope dummy for interest rate, on the other hand, has a negative sign, although it is not statistically significant. The mixed signs of the coefficients of intercept and slope dummies seem to give conflicting signals about *intermittency*. On the one hand, a negative shift in the intercept points to a lower level of transmission of external shocks; a positive slope dummy, on the other, points to an increased degree of responsiveness of domestic variables to a change in foreign variables. The picture remains mixed for the full sample case as well. The negative sign of the coefficients of the intercept dummy in the case of output and interest rate points to a downward shift in the level of transmission of external shocks, although none is statistically significant. In contrast, coefficients of the slope dummies of these variables are positive, indicating a rise in the degree of responsiveness. The picture is reversed in the case of a price variable, which has produced a positive intercept dummy coefficient but a negative slope dummy coefficient.

Finally, to analyze both the short and the long-run transmission of external shocks, equations with intercept and slope dummies on the foreign variables have been estimated using the Almon method of distributed lags. A second degree polynomial with a twelve period lag order produced the best results. No endpoint restrictions have been imposed on the parameters. Due to the presence of serial correlation in the error-terms, the equations have been re-estimated using the generalized least

squares method (GLS). The results for equal sample case are presented in Appendix Table A3. Very few of the short-run coefficients have the correct signs and are statistically significant. The long-run coefficients, which are of special interest, seem to present mixed pictures. The long-run coefficient of intercept dummy for output is negative, and significant, while that for prices and interest rates are positive, though not significant. In contrast, the slope dummy coefficients for output are positive, while that for prices and interest rates the slope dummy coefficients are negative. The results for the full sample case as presented in Appendix Table A4 are also mixed. The long-run coefficient of the intercept dummy for output and the interest rate are negative, while for prices it is positive. The slope dummy coefficients for output and the interest rate are positive while that for prices is negative. The mixed signs of the intercept and slope dummy coefficients make it difficult to draw any conclusion about *intermittency*. If we combine the results of both tables, we have three negative and three positive coefficients for both intercept dummy and slope dummy variables. Let us make an intuitively appealing assumption that a change in slope of a function has greater long-run implication for the transmission of external shocks than a change in its intercept. From this generalization, we notice that only three out of six slope dummy coefficients have the positive signs. Of the three positive, only one is statistically significant, while two of the three negative coefficients are statistically significant. Thus, there appears to be little evidence in favor of *intermittency*.

We repeat these exercises to test *gradualism* in the liberalization policy of India. The results of simple regression analysis are presented in Table 4. In the case of output, there is an unambiguous evidence in favor of *gradualism*. The coefficient of the foreign output variable in each period has a positive sign, as expected, two being statistically significant. But more importantly, the coefficient has increased from 0.346 in the first episode to 1.957 in the second and to 2.390 in the third,

providing a strong support for *gradualism*. The price variable has also produced all positive coefficients, but the evidence of *gradualism* is not as strong as in the case of output. The size of the coefficient has declined from 0.616 in the first episode to 0.057 in the second, increasing again to 0.270 in the third. The extent that the coefficient has shown an improvement in the third episode over the second may be taken as an indication of *gradualism*. However, the presence of serial autocorrelation may render this comparison less reliable. That there is an unambiguous support for *gradualism* in the case of interest rates is obvious from the table. The coefficient has shown a gradual improvement, increasing from negative 0.113 in the first episode, to positive 1.285 in the second and finally to positive 1.748 in the third.

The results of estimations with two intercept and slope dummies are presented in Table 5. The second dummy variable is the same as defined earlier. The first dummy variable takes a value of zero from January 1977 to December 1984 and again from January 1991 to June 1996. It takes the value one for the rest of the sample period. In the case of output, the coefficients of the intercept dummies have mixed signs, positive for the first intercept dummy and negative for the second. The net effect of the two intercept dummies is still negative, although none is statistically significant. The slope coefficient of output variable is positive as expected, though it is not statistically significant. Like the coefficients of intercept dummies, the coefficients of the slope dummies have mixed signs. The coefficient of the first slope dummy is negative, but that of the second is positive, though none is significant statistically. However, the net effect of the slope dummies is still positive and large. The coefficient of first slope dummy reduces the overall slope coefficient by 0.176 while that of the second increases it by 0.6322. The overall impact of the two slope dummies is positive and large. Thus, the overall results favor *gradualism*. In the case of prices the coefficients of two

intercept dummies are positive, suggesting an upward shift in the level of transmission of external shocks. In contrast, the two slope dummy coefficients are negative. However, due to serial autocorrelation, this interpretation is suspect. In the case of interest rate, the coefficients the two intercept dummies are large and negative, indicating a downward shift in the level of transmission. However, the coefficients of the two slope dummies are also large and positive, indicating a significant increase in the degree of responsiveness of the domestic interest rates to a change in the foreign interest rate. If the slope changes are more important than an intercept change, then one finds a strong evidence in favor of *gradualism* in the case of interest rates.

As with *intermittency*, we have estimated equations for output, prices and interest rates using the Almon method of distributed lags with no endpoint restrictions to test *gradualism*. These results are summarized in Appendix Tables A5-7. The long-run coefficients for intercept and slope dummies seem to give mixed signals. In each case, while there is a clear downward shift in the level of transmission, there is an equally clear and positive change in the degree of responsiveness. Both slope dummy coefficients for output are positive, one being statistically significant. Likewise, both slope dummy coefficients of prices are positive, though none is significant. Similarly, both slope dummy coefficients on interest rates are positive and statistically significant. Using the line of argument set forth earlier, positive slope dummy coefficients provide a strong and unambiguous evidence in favor of *gradualism* in the case of output, prices, and interest rate.

From the analysis so far, the preponderance of evidence in all cases seem to favor *gradualism* in India's policy of economic reform. Note that we have tested *gradualism* by identifying three more or less arbitrarily chosen episodes of economic liberalization. Examining the behavior of these coefficients over a continuous time path rather than comparing them with more than three ad hoc

episodes should be a more appropriate strategy to test *gradualism*. To do this we have used the recursive least square's method, which traces the evolution of a given coefficient as more of the sample data are included in the estimation. The plots of the time series behavior of the coefficient of each foreign variable are presented in Figures 4-6. The plots for output and prices show no noticeable break in the behavior of any of the slope coefficients since July 1991. Moreover, the coefficients of both output and prices have clearly increased over time. The increased transmission of external shocks over time constitutes strong evidence in favor of *gradualism*, confirming our earlier results. In the case of the interest rate, however, there seems to be a small break in the behavior of the coefficient in the post-reform period. The coefficient, which first declined a bit, has shown some improvement before leveling up. This break notwithstanding, the coefficient has shown almost no change over the entire period. Thus, this result rules out *gradualism* in the case of interest rate. Note that in each case, the initial instability in these figures is due to the limited number of observations included in the estimation. These findings are further confirmed by results from Chow-tests. The null hypothesis of no structural break was rejected at the 5 percent level only in the case of the interest rate variable.

IV. Summary and Conclusions

In this paper we set out to achieve two interrelated objectives: first, to test the transmission of external shocks in the Indian economy empirically, and second, to assess the impact of India's liberalization policy on the pattern of the transmission of aggregate shocks. To do the first, we estimated an eight variable vector autoregression (VAR) model using monthly data from July 1975 to June 1996. To do the second, we tested two alternative propositions regarding the nature of

India's liberalization policy. Under *intermittency or 'fits and starts'*, we compared the transmission of aggregate shocks in the post-reform period with pre-reform periods. Under *gradualism*, we compared the transmission of aggregate shocks over three consecutive episodes of economic reform. To carry out these comparisons we estimated simple regression equations using domestic output, prices and interest rates as the dependent variables and carefully constructed foreign variables as the independent variables. We also estimated equations applying dummy variables approach and Almon distributed lag methods. Finally, we used the recursive least squares method to trace the evolution of slope coefficients over time. To test any break in data, we applied Chow-tests.

The VAR results clearly indicated the presence of significant transmission of external shocks in the Indian economy over the period under study. Considering that India has relied on a high degree of state interference in both the domestic and external sectors of its economy, this finding is somewhat surprising. Second, there is a preponderance of evidence in favor of *gradualism*. Could it be that India has quietly been marching toward liberalization, with talk of any reversal in its policy being nothing more than rhetoric? Despite its slow speed, the results of this study leave no doubt that the policy of economic reform has been moving in the right direction.

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Table 1
Results of the variance decomposition analysis

Proportion of the forecast error variance of lipi

period	S.E.	lipw	lwpw	IRW	lml	lipi	lwpi	IRI	lspi	r1	r2
3	.007	1.31	1.81	.76	2.43	90.83	.09	2.20	.57	42	73
6	.011	1.79	5.38	1.16	2.29	82.54	2.00	3.53	1.31	48	91
9	.012	1.83	8.28	1.23	3.59	73.18	5.60	3.69	2.60	42	73
12	.013	2.32	9.16	1.95	5.18	68.05	6.58	4.24	2.52	42	73
15	.014	2.67	9.25	1.99	5.82	66.93	6.44	4.42	2.48	42	73
18	.015	2.67	9.92	2.19	7.04	63.71	6.88	5.11	2.48	41	69
21	.016	2.52	10.28	2.25	8.36	60.42	8.46	5.36	2.35	38	61
24	.017	2.45	10.30	2.23	9.32	58.37	9.00	6.05	2.28	36	56

Proportion of the forecast error variance of lwpi

3	.006	.20	1.02	.26	.74	1.22	94.75	1.12	.69	28	39
6	.010	1.49	8.18	.43	1.08	2.25	78.78	4.25	3.54	48	91
9	.013	2.37	21.01	.62	1.54	3.18	63.21	4.90	3.17	65	188
12	.017	2.33	25.46	.78	1.65	3.00	57.64	6.29	2.85	67	207
15	.020	2.05	24.94	2.12	2.83	3.12	55.58	6.36	2.99	66	190
18	.024	1.89	24.08	5.48	6.74	3.13	49.53	5.71	3.44	62	165
21	.027	1.68	22.22	7.89	13.15	2.72	43.64	4.98	3.72	56	129
24	.031	1.48	19.69	9.34	18.49	2.81	39.28	4.85	4.06	50	101

Proportion of the forecast error variance of IRI

3	.492	.64	1.02	1.80	.84	9.20	.07	83.70	2.73	21	27
6	.705	1.44	3.38	3.09	1.23	17.90	.31	70.21	2.44	27	36
9	.820	2.75	3.44	3.55	2.44	18.52	1.28	65.39	2.63	28	39
12	.903	3.40	3.44	4.35	2.63	18.86	2.30	61.24	3.78	29	41
15	.974	3.83	3.39	6.20	3.11	18.91	2.67	58.07	3.82	32	47
18	1.034	3.96	3.68	7.30	3.12	19.24	3.02	55.83	3.85	34	51
21	1.084	4.14	3.80	7.96	3.17	18.89	3.45	54.77	3.82	35	54
24	1.134	4.24	3.95	8.99	3.11	18.50	3.71	53.66	3.84	37	59

Proportion of the forecast error variance of lspi

3	.432	.74	2.87	1.50	.08	1.13	.81	7.32	85.55	35	55
6	.040	1.06	1.70	7.65	.29	.92	1.32	14.50	72.56	40	61
9	.045	1.32	1.30	11.28	.40	1.56	1.00	16.68	66.46	41	71
12	.048	1.36	1.56	15.05	.38	1.53	.95	17.34	61.83	44	79
15	.049	1.26	2.11	18.89	.39	1.55	.92	16.96	57.92	53	112
18	.051	1.57	2.82	22.13	.58	1.61	.86	16.06	54.36	58	139
21	.052	2.43	3.24	24.01	.82	1.55	.82	15.32	51.81	62	160
24	.053	3.40	3.54	24.57	.93	1.51	.80	14.89	50.36	63	174

Proportion of the forecast error variance of lml

3	.028	.55	1.08	1.26	92.34	.04	3.85	.72	.16	38	60
6	.030	.98	.87	.86	86.43	1.06	7.80	1.70	.30	20	25
9	.032	.91	.74	.69	74.69	3.95	14.83	3.62	.57	9	11
12	.034	.81	.88	1.15	67.98	5.14	18.57	4.94	.53	9	10
15	.034	.78	1.06	1.44	64.41	4.99	20.22	6.58	.52	9	10
18	.035	.75	1.38	2.02	60.82	4.73	20.99	8.61	.70	11	12
21	.036	.73	1.90	2.94	57.68	4.50	21.32	9.66	1.27	13	15
24	.037	.74	2.32	3.58	55.44	4.37	21.29	9.86	2.40	15	17

Table 2
Regression results testing *intermittency* with no dummies

dependent variable	full sample case pre-reform	equal sample case pre-reform	1991-96 post-reform

lipi:			
constant	3.22 (2.03) ²	-3.67 (-3.08) ¹	-6.27 (-2.51) ²
coeff.	.310 (1.00)	1.794 (6.84) ¹	2.390 (4.43) ¹
R ²	.99	.87	.93
DW	2.62	2.12	2.23
OB	192	60	59
method	auto(1)	auto(1)	auto(1)
lwpi:			
constant	1.28 (2.10) ²	45.54 (.02)	4.14 (1.94) ²
coeff.	.438 (2.87) ¹	-.032 (-.12)	.270 (.63)
R ²	.99	.99	.99
DW	1.10	1.31	1.23
OB	192	60	60
method	auto(1)	auto(1)	auto(1)
IRI:			
constant	12.63 (3.82) ¹	-4.33 (-.52)	2.33 (.22)
coeff.	-.243 (-.65)	2.348 (2.09) ²	1.748 (.96)
R ²	.65	.53	.34
DW	2.05	1.99	1.81
OB	191	60	60
method	auto(1)	auto(1)	auto(1)

Figures in the parentheses are the t-values. ¹Significant at the one percent, and ² five percent level.

Table 3
Regression results testing *intermittency* with dummies

equal sample case: 86.07 to 91.06 and 91.07 to 96.06

	lipi	lwpi	IRI
	-----	-----	-----
constant	-4.10 (-3.21) ¹	74.63 (.04)	-5.63 (-.56)
intercept dummy	-5.106 (-2.26) ²	-1.131 (-.48)	8.775 (.72)
coefficient	1.890 (6.74) ¹	-.071 (-.29)	2.515 (1.91) ²
slope dummy	1.131 (2.30) ²	.248 (.49)	-.917 (-.51)
R ²	.95	.99	.40
DW	2.11	1.39	1.85
OB	119	120	120
method	auto(1)	auto(1)	auto(1)

full sample case: 75.07 to 91.06 and 91.07 to 96.06

constant	-379.05 (-.00)	.96 (1.32)	13.47 (3.96) ¹
intercept dummy	-2.910 (-.75)	1.956 (.67)	-5.015 (-.66)
coefficient	.270 (.89)	.420 (3.00) ¹	-.371 (-.96)
slope dummy	.635 (.76)	-.421 (-.67)	.972 (.82)
R ²	.99	.99	.49
DW	2.56	1.13	1.87
OB	251	252	251
method	auto(1)	auto(1)	auto(1)

Numbers in the parentheses are the t-values. ¹Significant at the one percent, and ² five percent level.

Table 4
Regression results testing *gradualism* with no dummies

dependent variable	1977-84	1985-90	1991-96
-----	-----	-----	-----
lipi:			
constant	2.64 (2.04) ²	-4.42 (-4.53) ¹	-6.27 (-2.51) ²
coeff.	.346 (1.28)	1.957 (9.05) ¹	2.390 (4.43) ¹
R ²	.95	.94	.93
DW	2.67	2.31	2.23
OB	96	72	59
method	auto(1)	auto(1)	auto(1)
Lwpi:			
constant	-1.10 (-.07)	26.97 (.03)	4.14 (1.94) ³
coeff.	.616 (2.93) ¹	.057 (.23)	.270 (.63)
R ²	.99	.99	.99
DW	1.18	1.38	1.23
OB	96	72	60
method	auto(1)	auto(1)	auto(1)
IRI:			
constant	9.47 (4.62) ¹	1.70 (.45)	2.33 (.22)
coeff.	-.113 (-.54)	1.285 (2.49) ¹	1.748 (.96)
R ²	.69	.44	.34
DW	1.51	1.99	1.81
OB	96	72	60
method	auto(1)	auto(1)	auto(1)

 Numbers in the parentheses are the t-values. ¹Significant at the one percent, ² five percent, and ³ ten percent level.

Table 5
Regression results testing *gradualism* with dummies

	lipi	lwpi	IRI
constant	4.45 (1.33)	-.36 (-.18)	16.14 (3.34) ¹
intercept dummy 1	.792 (.70)	.996 (1.25)	-12.032 (-1.39)
intercept dummy 2	-2.892 (-.75)	.966 (.35)	-8.474 (-.99)
coefficient	.263 (.82)	.493 (3.57) ¹	-.680 (-.99)
slope dummy 1	-.176 (-.70)	-.218 (-1.26)	1.593 (1.48)
slope dummy 2	.632 (.75)	-.206 (-.35)	1.431 (1.14)
R ²	.99	.99	.49
DW	2.59	1.24	1.86
OB	233	234	234
method	auto(1)	auto(1)	auto(1)

Numbers in the parentheses are the t-values. ¹Significant at the one percent level

APPENDIX TABLE A1
Original data series and their sources

series	period		base	sa/na	source
-----	-----		-----	-----	-----
India:					
wholesale prices	57.01	96.06	90=100	na	IFS
share price	57.01	96.06	90=100	na	CBB
industrial production	60.01	96.01	90=100	na	---
interest rate, call	57.01	96.06	--	--	CBB
money supply, M1, bill. Rs.	57.01	96.06	--	sa	IFS
Foreign:					
US wholesale	57.01	96.06	90=100	na	IFS
UK wholesale	57.01	96.06	90=100	na	IFS
German wholesale	57.01	96.06	91=100	na	IFS
Japan wholesale	57.01	96.06	90=100	na	IFS
US ind. product.	57.01	96.06	90=100	sa	IFS
UK ind. product.	57.01	96.06	90=100	sa	IFS
German ind. prod.	58.01	96.06	90=100	sa	IFS
Japan ind. prod.	57.01	96.06	90=100	sa	IFS
US interest rate, bond	58.01	96.06	3-year	---	IFS
UK interest rate bond	66.01	96.06	short	---	CBB
German int. rate TB	75.07	96.06	---	---	CBB
Japan int. rate bond	57.01	96.06	govt.	---	CBB

na=not seasonally adjusted, sa= seasonally adjusted.
CBB=Central Bank Bulletin, TB=treasury bills IFS=International
Financial Statistics

APPENDIX TABLE A2
Results of unit root tests

variable	DF		ADF		outcome
	no trend	with trend	no trend	with trend	
lipi	I(1)	I(0)	I(1)	I(0)	I(0)
lwpi	I(1)	I(1)	I(1)	I(0)	I(0)
lspi	I(1)	I(1)	I(1)	I(1)	I(1)
lm1	I(1)	I(1)	I(1)	I(1)	I(1)
IRI	I(0)	I(0)	I(0)	I(0)	I(0)
lipw	I(1)	I(1)	I(1)	I(1)	I(1)
lwpw	I(0)	I(1)	I(0)	I(1)	I(0)
IRW	I(1)	I(1)	I(1)	I(1)	I(1)

APPENDIX TABLE A3

Regression results testing *intermittency* using Almon distributed lagsequal sample case: 86.07 to 91.06 and 91.07 to 96.06

t	lipi			lwpi			IRI		
	d2	lipw	lipwd2	d2	lwpw	lwpwd2	d2	IRW	IRWd2
0	-6.246 (-1.77)	.337 (.69)	1.353 (1.76) ³	-2.911 (-1.91) ²	-.023 (-.16)	.634 (1.91) ³	-4.730 (-.42)	.444 (.52)	.325 (.22)
1	-4.051 (-2.12) ²	.192 (.72)	.879 (2.12) ²	-1.991 (-1.72) ³	.007 (.07)	.434 (1.72) ³	-2.037 (-.30)	.307 (.58)	.139 (.15)
2	-2.200 -2.88) ¹	.078 (.66)	.479 (2.89) ¹	-1.175 (-1.26)	.032 (.43)	.256 (1.27)	.167 (.05)	.202 (.68)	-.014 (-.29)
3	-.697 (-.77)	-.005 (-.04)	.154 (.78)	-.459 (-.55)	.051 (.82)	.100 (.56)	1.884 (.64)	.130 (.55)	-.133 (-.35)
4	.473 (.31)	-.058 (-.27)	-.098 (-.29)	.153 (.19)	.064 (1.03)	-.033 (-.18)	3.113 (.77)	.091 (.29)	-.220 (-.42)
5	1.295 (.66)	-.081 (-.30)	-.276 (-.65)	.662 (.79)	.071 (1.09)	-.143 (-.79)	3.855 (.75)	.085 (.22)	-.272 (-.41)
6	1.773 (.85)	-.072 (-.25)	-.380 (-.83)	1.069 (1.27)	.072 (1.10)	-.232 (-1.26)	4.109 (.74)	.111 (.26)	-.292 (-.41)
7	1.909 (.98)	-.033 (-.13)	-.410 (-.97)	1.373 (1.67) ³	.068 (1.08)	-.298 (-1.67) ³	3.875 (.74)	.171 (.42)	-.278 (-.41)
8	1.701 (1.12)	.036 (.17)	-.365 (-1.11)	1.575 (2.00) ²	.057 (1.02)	-.341 (-2.00) ²	3.153 (.74)	.263 (.76)	-.231 (-.42)
9	1.150 (1.30)	.137 (1.11)	-.247 (-1.28)	1.674 (2.17) ²	.041 (.77)	-.363 (-2.17) ²	1.944 (.65)	.388 (1.42)	-.150 (-.39)
10	.256 (.31)	.268 (2.31) ²	-.055 (-.30)	1.671 (1.97) ²	.019 (.30)	-3.62 (-1.97) ²	.247 (.08)	.546 (1.89) ³	-.036 (-.08)
11	-.982 (-.49)	.429 (1.57)	.211 (.49)	1.565 (1.48)	-.009 (-.09)	-.339 (-1.47)	-1.937 (-.32)	.736 (1.56)	.111 (.14)
12	-2.562 (-.70)	.622 (1.25)	.552 (.70)	1.356 (.96)	-.043 (-.31)	-.293 (-.95)	-4.610 (-.45)	.960 (1.24)	.292 (.21)
$\Sigma\beta_{ki}$	-8.178 (-4.29) ¹	1.85 (9.77) ¹	1.798 (4.33) ¹	4.563 (.62)	.409 (.99)	-.980 (-.62)	9.034 (.55)	4.434 (3.33) ¹	-.758 (-.28)
constant	-3.88 (-4.52) ¹	R ² =.96	DW=2.06	131.1 (.99)	R ² =.99	DW=1.49	-18.99 (-1.98) ²	R ² =.43	DW=1.87

Numbers in the parentheses are the t-values. ¹Significant at the one percent, ² five percent, and ³ ten percent level.

APPENDIX TABLE A4
Regression results testing *intermittency* using Almon distributed lags

full sample case: 75.07 to 91.06 and 91.07 to 96.06

t	lipi			lwpi			IRI		
	d2	lipw	lipwd2	d2	lwpw	lwpwd2	d2	IRW	IRWd2
0	-2.370 (-.69)	.574 (2.42) ²	.515 (.69)	-.249 (-.13)	.230 (2.83) ¹	.057 (.14)	-9.673 (-1.10)	-.015 (-.05)	1.135 (.98)
1	-1.658 (-.81)	.401 (2.65) ¹	.362 (.81)	.074 (-.05)	.178 (3.28) ¹	-.014 (-.05)	-4.739 (-.89)	-.015 (-.08)	.636 (.90)
2	-1.055 (-.88)	.257 (2.74) ¹	.233 (.90)	.384 (.33)	.132 (3.71) ¹	-.082 (-.33)	-.799 (-.27)	-.016 (-.14)	.236 (.59)
3	-.559 (-.50)	.142 (1.84) ³	.127 (.52)	.681 (.66)	.094 (3.25) ¹	-.147 (-.66)	2.144 (.86)	-.018 (-.18)	-.063 (-.20)
4	-.173 (-.11)	.054 (.59)	.044 (.13)	.963 (.93)	.062 (1.97) ³	-.209 (-.93)	4.090 (1.23)	-.022 (-.16)	-.263 (-.61)
5	-.106 (-.06)	-.005 (-.04)	-.017 (-.04)	1.231 (1.16)	.037 (1.02)	-.267 (-1.56)	5.039 (1.23)	-.026 (-.16)	-.363 (-.69)
6	.276 (.14)	-.035 (-.30)	-.054 (-.13)	1.486 (1.37)	.018 (.48)	-.322 (-1.36)	4.992 (1.14)	-.031 (-.18)	-.362 (-.64)
7	.338 (.19)	-.037 (-.34)	-.068 (-.17)	1.727 (1.60)	.007 (.18)	-.375 (-1.60)	3.947 (.96)	-.037 (-.23)	-.262 (-.50)
8	.291 (.19)	-.011 (-.12)	-.060 (-.18)	1.953 (1.86) ³	.002 (.06)	-.424 (-1.86) ³	1.906 (.58)	-.045 (-.33)	-.062 (-.15)
9	.136 (.11)	.043 (.56)	-.028 (-.11)	2.166 (2.07) ²	.004 (.13)	-.470 (-2.06) ²	-1.132 (-.51)	-.053 (-.51)	.239 (.83)
10	-.127 (-.09)	.126 (1.50)	.027 (.09)	2.365 (2.07) ²	.013 (.38)	-.512 (-2.06) ²	-5.167 (-2.14) ²	-.062 (-.54)	.639 (1.93) ²
11	-.499 (-.22)	.237 (1.77) ³	.104 (.21)	2.551 (1.82) ³	.028 (.59)	-.552 (-1.82) ³	-10.198 (-2.14) ²	-.072 (-.37)	1.140 (1.78) ³
12	-.978 (-.27)	.377 (1.76) ³	.205 (.26)	2.722 (1.49)	.050 (.70)	-.588 (-1.49)	-16.227 (-1.98) ²	-.083 (-.26)	1.740 (1.60)
$\Sigma\beta_{ki}$	-6.271 (-1.39)	2.123 (12.92) ¹	1.391 (1.42)	18.057 (1.89) ²	.856 (4.40) ¹	-3.905 (-1.89) ³	-25.819 (-1.88) ³	-.496 (-1.12)	4.388 (1.86) ³
constant	-5.19 (-7.15) ¹	R ² =.99	DW=2.36	.05 (.94)	R ² =.99	DW=1.20	14.46 (3.73) ¹	R ² =.50	DW=1.94

Numbers in the parentheses are the t-values. ¹Significant at the one percent, ² five percent, and ³ ten percent level.

APPENDIX TABLE A5
Results of lipi testing *gradualism* using Almon distributed lags

t	d1	d2	lipw	lipwd1	lipwd2	change			
						intercept	slope		
0	1.45 (1.86) ³	-2.82 (-.85)	.53 (2.22) ²	-.32 (-1.88) ³	.63 (.87)	+	-	-	+
1	.81 (1.61)	-2.02 (-1.04)	.35 (2.35) ²	-.18 (-1.62)	.45 (1.06)	+	-	-	+
2	.28 (.84)	-1.34 (-1.26)	.20 (2.20) ²	-.06 (-.82)	.30 (1.30)	+	-	-	+
3	-.15 (-.50)	-.78 (-.75)	.08 (1.03)	.04 (.55)	.18 (.80)	-	-	+	+
4	-.48 (-1.36)	-.33 (-.23)	-.01 (-.06)	.11 (1.42)	.08 (.26)	-	-	+	+
5	-.71 (-1.74) ³	-.01 (-.01)	-.06 (-.54)	.16 (1.80) ³	.01 (.03)	-	-	+	+
6	-.84 (-1.93) ³	.19 (.10)	-.09 (-.72)	.19 (1.99) ²	-.04 (-.08)	-	-	+	+
7	-.87 (-2.02) ²	.28 (.16)	-.08 (-.71)	.20 (2.08) ²	-.06 (-.14)	-	+	+	-
8	-.80 (-1.98) ²	.25 (.17)	-.05 (-.48)	.18 (2.03) ²	-.05 (-.16)	-	+	+	-
9	-.63 (-1.60)	.09 (.08)	.02 (.20)	.14 (1.64) ³	-.02 (-.08)	-	+	+	-
10	-.35 (-.78)	-.18 (-.15)	.11 (1.24)	.08 (.80)	.04 (.14)	-	+	+	-
11	.02 (.03)	-.57 (-.27)	.24 (1.69) ³	-.00 (-.01)	.12 (.26)	+	-	-	+
12	.50 (.56)	-1.08 (-.31)	.40 (1.76) ³	-.11 (-.57)	.23 (.30)	+	-	-	+
$\Sigma\beta_{ki}$	-1.77 (-.72)	-8.33 (-2.09) ²	1.66 (4.42) ¹	.43 (.78)	1.88 (2.15) ²	-	-	+	+
constant	= -3.22 (-1.99) ²		R ² =.99		DW=2.45	Rho1=.85			

Numbers in the parentheses are the t-values. ¹Significant at the one percent, ² five percent, and ³ ten percent level.

APPENDIX TABLE A6
Results of lwpi testing *gradualism* using Almon distributed lags

t	d1	d2	lwpw	lwpwd1	lwpwd2	change			
						intercept	slope		
0	1.05 (1.65) ³	-1.31 (-.61)	.38 (3.50) ¹	-.23 (-1.66) ³	.29 (.63)	+	-	-	+
1	.36 (.81)	-.67 (-.43)	.28 (3.85) ¹	-.08 (-.81)	.15 (.45)	+	-	-	+
2	-.20 (-.62)	-.18 (-.15)	.19 (3.88) ¹	.04 (.62)	.04 (.17)	-	-	+	+
3	-.62 (-2.02) ²	.17 (.16)	.11 (2.66) ¹	.14 (2.02) ²	-.03 (-.15)	-	+	+	-
4	-.91 (-2.67) ¹	.37 (.35)	.06 (1.01)	.20 (2.67) ¹	-.08 (-.35)	-	+	+	-
5	-1.06 (-2.83) ¹	.42 (.39)	-.00 (-.06)	.23 (2.83) ¹	-.09 (-.39)	-	+	+	-
6	-1.07 (-2.77) ¹	.33 (.30)	-.04 (-.71)	.23 (2.77) ¹	-.07 (-.30)	-	+	+	-
7	-.94 (-2.52) ²	.09 (.09)	-.06 (-1.17)	.21 (2.52) ¹	-.02 (-.09)	-	+	+	-
8	-.68 (-1.96) ³	-.29 (-.27)	-.07 (-1.52)	.15 (1.96) ³	.06 (.26)	-	-	+	+
9	-.27 (-.84)	-.81 (-.75)	-.07 (-1.60)	.06 (.84)	.18 (.74)	-	-	+	+
10	.26 (.72)	-1.49 (-1.20)	-.05 (-.99)	-.06 (-.72)	.32 (1.20)	+	-	-	+
11	.93 (1.91) ³	-2.30 (-1.44)	-.02 (-.21)	-.21 (-1.91) ³	.50 (1.44)	+	-	-	+
12	1.75 (2.50) ²	-3.27 (-1.52)	.03 (.28)	-.38 (-2.50) ²	.71 (1.53)	+	-	-	+
$\Sigma\beta_{ki}$	-1.39 (-.51)	-8.93 (-1.01)	.73 (2.45) ²	.30 (.51)	1.96 (1.02)	-	-	+	+
constant =	-3.91 (-.01)		R ² =.99		DW=1.04	Rho1=1.0			

¹Significant at the one percent, ² five percent and the ³ ten percent level. T-values are in the parentheses.

APPENDIX TABLE A7
Results of IRI testing *gradualism* using Almon distributed lags

t	d1	d2	IRW	IRWd1	IRWd2	change			
						intercept		slope	
0	-6.44 (-1.17)	-8.61 (-1.19)	-.06 (-.21)	.71 (1.15)	.65 (.68)	-	-	+	+
1	-5.84 (-1.78) ³	-4.43 (-1.02)	-.05 (-.31)	.61 (1.66) ³	.39 (.68)	-	-	+	+
2	-5.20 (-2.85) ¹	-1.08 (-.46)	-.05 (-.49)	.52 (2.48) ¹	.18 (.60)	-	-	+	+
3	-4.51 (-2.67) ¹	1.46 (.77)	-.04 (-.47)	.44 (2.32) ²	.03 (.14)	-	+	+	+
4	-3.78 (-1.60)	3.19 (1.21)	-.04 (-.29)	.36 (1.43)	-.06 (-.19)	-	+	+	+
5	-3.00 (-1.04)	4.10 (1.24)	-.03 (-.20)	.30 (.96)	-.10 (-.25)	-	+	+	+
6	-2.18 (-.71)	4.20 (1.18)	-.02 (-.14)	.24 (.71)	-.10 (-.21)	-	+	+	+
7	-1.32 (.46)	3.47 (1.04)	-.02 (-.11)	.18 (.59)	-.03 (-.07)	-	+	+	+
8	-.41 (-.17)	1.94 (.73)	-.01 (-.07)	.14 (.53)	.08 (.25)	-	+	+	+
9	.54 (.31)	-.41 (-.24)	-.00 (-.00)	.10 (.50)	.26 (1.16)	+	-	+	+
10	1.53 (.81)	-3.58 (-1.97) ²	.01 (.05)	.07 (.32)	.48 (1.93) ²	+	-	+	+
11	2.57 (.77)	-7.57 (-2.02) ²	.01 (.07)	.05 (.12)	.77 (1.49)	+	-	+	+
12	3.66 (.65)	-12.37 (-1.89) ³	.02 (.07)	.03 (.05)	1.10 (1.24)	+	-	+	+
$\Sigma\beta_{ki}$	-24.37 (-3.00) ¹	-19.70 (-1.81) ³	-.28 (-.62)	3.75 (3.55) ¹	3.65 (2.01) ²	-	-	+	+
constant =	11.46 (2.63) ¹		R ² =.55		DW=1.91			Rho1=.51	

¹Significant at the one percent, ² five percent and the ³ ten percent level. T-values are in the parentheses.

Figure 1

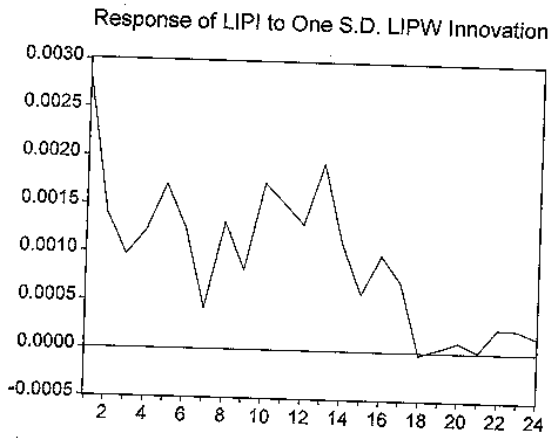


Figure 2

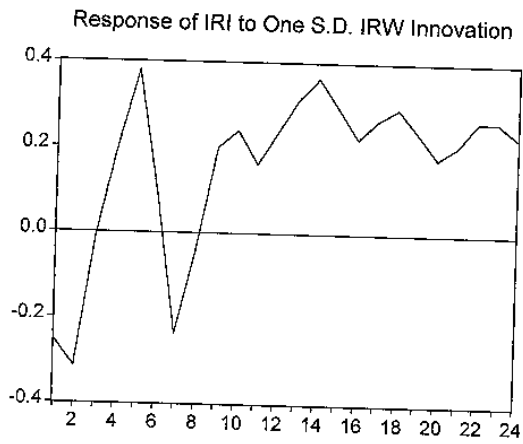
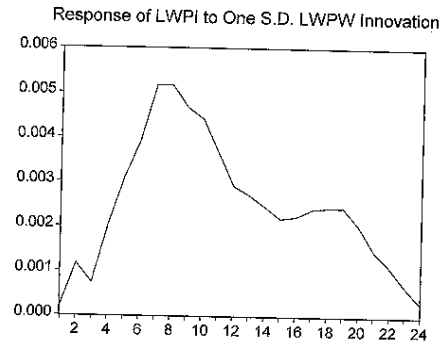


Figure 4

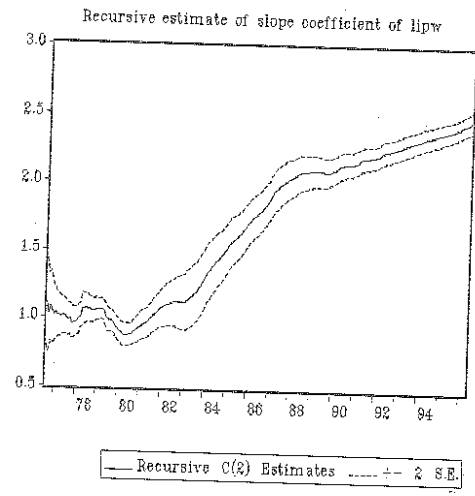


Figure 6
Recursive estimate of slope coefficient of irw

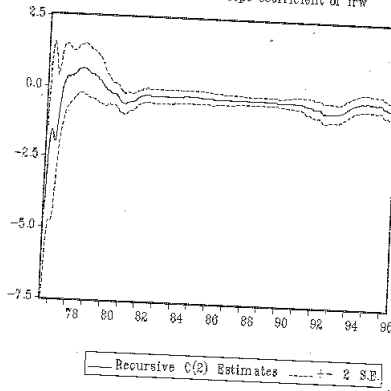


Figure 5

Recursive estimate of slope coefficient of lwpw

