# Financial Liberalization and the Aid-Growth Relationship in India

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# FINANCIAL LIBERALIZATION AND THE AID-GROWTH RELATIONSHIP IN INDIA


## Abstract

This paper examines the impact of foreign aid in the process of economic development in India by controlling for the degree of financial liberalization. A composite index is constructed using the method of principal component analysis to capture the joint influence of various policies imposed on the Indian financial system. The results show that while foreign aid exerts a direct negative influence on output expansion, its indirect effect via financial liberalization is positive. Therefore, an important implication of the findings in this paper is that greater openness in the financial system of the host country is a crucial prerequisite to realize the effectiveness of foreign aid. Our results are robust to a number of control variables and estimation techniques.


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*Keywords:* Aid; financial liberalization; India.

*JEL classification*: E44; O16; O53

## 1. Introduction

Although many developing countries have received a substantial amount of foreign aid over the last few decades, there is no consensus regarding its impact on growth (Morrissey, 2001; Radelet, 2006). Several recent studies, typified by the work of Burnside and Dollar (2000, 2004) and Collier and Dollar (2001, 2002), argue that aid assists growth but only in good policy environments. Others suggest that there is a non-linear effect in the aid-growth relationship due to diminishing returns to aid (see Dalgaard and Hansen, 2001; Hansen and Tarp, 2001; Lensink and White, 2001, Gomanee *et al.*, 2003; Dalgaard *et al.*, 2004, among others). Although the current debate is focused on these two leading views (Alvi *et al.*, 2008), there is also a growing literature showing that the aid-growth nexus can at best be characterized as fragile and ambiguous (see, e.g., Easterly *et al.*, 2004; Clemens *et al.*, 2004; Easterly, 2006).

Amidst animated debate on the effectiveness of aid, the present study seeks to examine a different but related issue: the role of financial liberalization in the aid-growth relationship. This issue is examined in the context of India, a large and rapidly growing developing economy that has undergone significant financial sector reforms. From the 1950s to the 1980s, India was the largest recipient of foreign aid. However, its economic growth rates were virtually stagnant during this period (Becker, 2007). The financial sector reforms initiated since the 1990s along with the rapid economic growth experienced by India since then suggest that there may be a close association between financial liberalization and the aid-growth nexus. This interesting observation forms the basis for further analysis.

The early literature initiated by McKinnon (1973) and Shaw (1973) suggests that financial liberalization encourages investment and therefore exerts a positive effect on long-term growth. Following the seminal empirical work of King and Levine (1993), the relationship between finance and growth has been a subject of considerable academic interest and intense policy debate (see, e.g., Bell and Rousseau, 2001; Rousseau and Wachtel, 2002; Beck and Levine, 2004; Levine, 2005). The bulk of cross-country evidence appears to suggest that financial development has a positive impact on economic growth (see Ang, 2008c, 2009a for a survey of literature), although case studies indicate that the direction of causality is less unambiguous (see, e.g., Ang and McKibbin, 2007).

These two strands of literature, i.e., the aid-growth and finance-growth links, have recently been combined under an integrated framework by Nkusu and Sayek (2004). They argue that financial development may exert an indirect positive effect on the aid-growth relationship through the conduct interest rate and exchange rate management, where the effectiveness of these policies depend on the absorptive capacity of the local financial markets. Significant inflows of foreign aid will put upward pressure on the real exchange rate that can be translated into higher prices. The presence of a broad and deep financial system provides the necessary instruments that could

effectively sterilize these undesirable impacts. In other words, foreign aid functions effectively when aid flows are better managed in the context of deeper and more efficient financial systems. Therefore, it appears plausible that one of the underlying reasons that aid is less effective in spurring development than is expected may be due to the failure of financial systems in ensuring an efficient allocation of aid resources.

However, in contrast to Nkusu and Sayek (2004), the focus of the present study is on financial liberalization rather than financial development. We emphasize the former since the depth of a financial system is directly shaped by financial sector policies. The presence of a more liberalized financial system also effectively reduces barriers and restrictions on interest rate and exchange rate controls, providing the monetary authorities with greater flexibility to conduct monetary and exchange rate management (Caporale and Williams, 2001; Kletzer and Kohli, 2001). The main contributions of this study include: 1) empirically testing the relationship between aid and growth by providing further evidence from a large and fast growing developing country. Not only could this enhance our understanding of the aid-growth relationship, but also fill the gap in the extant literature, which is dominated by cross-country analysis; 2) contributing to the debate on the effectiveness of foreign aid on the Indian economy. There are very few studies on the aid-growth relationship for India, despite her status as one of the largest recipient of foreign assistance; and 3) complementing the literature on the effectiveness of foreign aid by assessing the impact of financial liberalization on GDP growth. This policy factor has been neglected somewhat in the analysis of the aid-growth nexus.

We organize the rest of the paper as follows. Section 2 briefly reviews the financial repression and liberalization experience of India. A composite index for financial liberalization is constructed to measure the joint influence of a number of policies implemented in the Indian financial system. The econometric techniques employed in this study are explained in Section 3. The results are presented and analyzed in Section 4. The next section provides a sensitivity analysis of the results by considering alternative estimators and the inclusion of several control variables. The last section summarizes and concludes the paper.

## 2. Financial Sector Reforms in India

There was little financial repression imposed on the Indian financial system in the 1950s. However, the Reserve Bank of India gradually imposed more controls over the financial system by introducing interest rate controls in the 1960s. The statutory liquidity ratio was raised from 25 percent in 1966 to 38 percent in 1989. The cash reserve rate increased considerably from 3 to 15 percent during the same period. These high liquidity and reserve requirements enabled the Bank to purchase government securities at low cost. The extent of directed credit programs has also

increased significantly since the nationalization of the fourteen largest private banks in 1969. A number of priority lending rates were set at levels well below those that would prevail in the free market. This process culminated in the late 1980s when directed lending was more than 40 percent of total lending.

The major phase of financial liberalization was undertaken in 1991 as part of the broader economic reform in response to the balance of payments crisis of 1990-91. The objective was to provide a greater role for markets in price determination and resource allocation. Consequently, interest rates were gradually liberalized, and the reserve and liquidity ratios were reduced significantly. However, despite this liberalization, the Indian financial system has continued to operate within the context of repressionist policies through the provision of subsidized credit to certain priority sectors. Liberalization of the directed credit programs is only limited to deregulation of priority lending rates, whilst significant controls on the volume of directed lending remain in place. Furthermore, the Bank has tightened supervision and regulation in recent years to ensure that these priority sector requirements are met.

**Table 1**: Principal component analysis for the financial liberalization index

| | Principal component | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| Eigenvalue | 4.247 | 1.943 | 1.101 | 0.600 | 0.463 | 0.338 | 0.182 | 0.089 | 0.035 |
| % of variance | 0.472 | 0.216 | 0.122 | 0.067 | 0.051 | 0.038 | 0.020 | 0.010 | 0.004 |
| Cumulative % | 0.472 | 0.688 | 0.810 | 0.877 | 0.928 | 0.966 | 0.986 | 0.996 | 1.000 |
| Policy Variable | Eigenvector | | | | | | | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| $FDR_t$ | 0.397 | 0.140 | 0.422 | 0.165 | 0.221 | 0.232 | 0.084 | 0.626 | 0.341 |
| $DRC_t$ | 0.398 | 0.223 | 0.206 | 0.370 | 0.234 | 0.110 | 0.603 | 0.033 | 0.426 |
| $DRF_t$ | 0.223 | 0.522 | 0.195 | 0.473 | 0.155 | 0.187 | 0.569 | 0.109 | 0.148 |
| $FLR_t$ | 0.172 | 0.277 | 0.699 | 0.218 | 0.581 | 0.043 | 0.118 | 0.000 | 0.068 |
| $LRC_t$ | 0.098 | 0.577 | 0.206 | 0.563 | 0.257 | 0.296 | 0.129 | 0.357 | 0.002 |
| $LRF_t$ | 0.318 | 0.353 | 0.345 | 0.103 | 0.302 | 0.621 | 0.221 | 0.294 | 0.180 |
| $CRR_t$ | 0.356 | 0.319 | 0.228 | 0.163 | 0.514 | 0.241 | 0.435 | 0.356 | 0.234 |
| $SLR_t$ | 0.449 | 0.146 | 0.154 | 0.052 | 0.296 | 0.075 | 0.049 | 0.394 | 0.707 |
| $DCP_t$ | 0.407 | 0.005 | 0.129 | 0.456 | 0.161 | 0.600 | 0.187 | 0.317 | 0.297 |

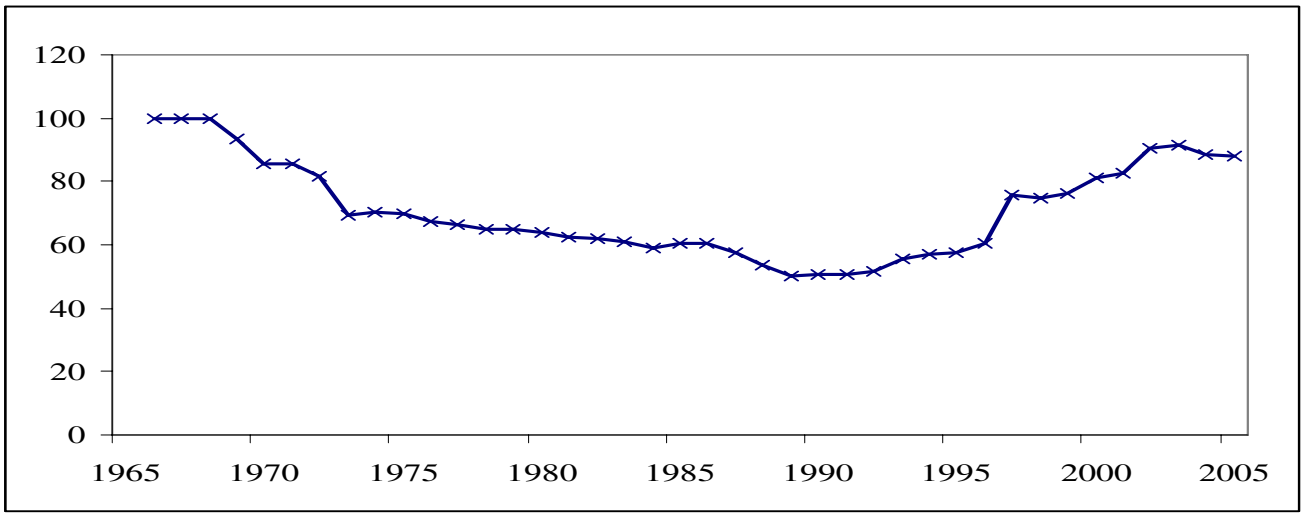
**Notes**: $FDR_t$ = fixed deposit dummy, $DRC_t$ = deposit rate ceiling dummy, $DRF_t$ = deposit rate floor dummy, $FLR_t$ = fixed lending dummy, $LRC_t$ = lending rate ceiling, $LRF_t$ = lending rate floor, $CRR_t$ = the cash reserve ratio on time deposits, $SLR_t$ = the statutory liquidity ratio and $DCP_t$ = directed credit program.

Measuring the extent of financial liberalization is not an easy task. To do this, we follow the approach of Demetriades and Luintel (1997) and Ang (2008b, 2009b) by constructing a composite index. In particular, nine series for these repressionist policies are collected. Six of them are interest rate controls, including a fixed lending dummy, a minimum lending rate, a maximum lending rate, a fixed deposit dummy, a minimum deposit rate and a maximum deposit rate. These policy controls are translated into dummy variables which take the value of 1 if a control is present and 0 otherwise. The remaining three policies are the cash (statutory) reserve ratio, the statutory liquidity ratio and directed credit programs.

Using these nine policy variables, a summary measure of financial repression, which represents the joint impact of the various financial policies, is developed using the method of principal component analysis. In principle, this composite measure is able to capture most of the information from the original dataset that consists of nine policy variables. Given its conciseness, this approach sufficiently deals with the problems of multicollinearity and over-parameterization. The inverse of this measure can be interpreted as the extent of financial liberalization (see, e.g., Ang and McKibbin, 2007; Ang, 2008d).

Table 1 presents the results for the financial liberalization index obtained from principal component analysis. The eigenvalues indicate that the first principal component explains about 47.2 percent of the standardized variance, the second principal component explains another 21.6 percent and so on. The first principal component is computed as a linear combination of the nine policy measures with weights given by the first eigenvector.

**Figure 1**: Financial Liberalization Index (1966-2005)




**Notes**: the first observation is normalized to take the value of 100.

The six largest principal components are extracted, and they are able to capture 96.6 percent of the information from the original data set. The remaining principal components are not considered since their marginal information content is relatively small. The percentages of variance are adjusted to make sure that their absolute values sum to one. These adjusted values are then used as the weights to compute the index. In this connection, the first principal component, which accounts for 47.2 percent of the total variation of the policy variables, has a weight of 47.2/96.6, and so on. The resulting index is presented in Figure 1. It is evident that the trend towards financial repression has been reversed since the early 1990s. The leveling-off observed in the series coincides with the increase in the extent of directed credit programs in recent years.

## 3. Empirical Approach

The importance of financial liberalization as a precondition for the growth-enhancing effects of aid can be illustrated with the AK model of Rebelo (1991) in which total factor productivity ($A$) is a function of aid, financial liberalization and their interaction. This simple endogenous growth setting can be used to guide our empirical formulation so that economic development ($ED_t$) depends on the capital stock ($KAP_t$), financial liberalization ($FL_t$), foreign aid ($AID_t$), and the interaction term between financial liberalization and foreign aid ($FL_t$ x $AID_t$), as given in Eq. (1).

$$\ln ED_t = \beta_0 + \beta_1 \ln KAP_t + \beta_2 \ln FL_t + \beta_3 \ln AID_t + \beta_4 \ln FL_t \text{x} \ln AID_t + \varepsilon_t \qquad (1)$$

In the above equation, $\beta_1$ is expected to carry a positive sign whereas the signs expected for $\beta_2$ and $\beta_3$ cannot be determined a priori. $\beta_4$ is expected to be positive due to the hypothesis that the impact of foreign aid on per capita real GDP is enhanced through the degree of liberalization in the financial system. The model will be estimated using annual data for India over the period 1966-2005. Data sources and construction of variables are explained in the Appendix.

The main econometric procedure used to test for the existence of the long-run equilibrium relationship and to provide estimates of this long-run relationship is the ARDL procedure of Pesaran *et al.* (2001). The approach has several desirable statistical properties, such as precise estimates of long-run parameters and valid *t*-statistics, even in the presence of endogenous explanatory variables. Pesaran and Shin (1998) have shown that the OLS estimators of the short-run parameters are consistent and the ARDL based estimators of the long-run coefficients are super-consistent in small sample sizes. Hence, valid inferences on the long-run parameters can be made using standard normal asymptotic theory.

The ARDL procedure involves two stages. In the first stage, the existence of the long-run relationship between the variables is tested. The ARDL model for the dynamic output equation can be formulated as:

$$\Delta \ln ED_t = a_0 + b_0 \ln ED_{t-1} + \sum_{j=1}^{k} b_j \ln DET_{j,t-1} + \sum_{i=1}^{p} c_{0i} \Delta \ln ED_{t-i} + \sum_{i=0}^{p} \sum_{j=1}^{k} c_{ji} \Delta \ln DET_{j,t-i} + \varepsilon_t \quad (2)$$

where $p$ is the lag length and $DET_t$ is a vector of $k$ determinants of $\ln ED_t$. The null hypothesis of no long-run relationship between $\ln ED_t$ and its determinants is $H_0 : b_0 = b_1 = ... = b_k = 0$. We first estimate Eq. (2) by the OLS estimator and then calculate the $F$-statistic. The test for cointegration is provided by two asymptotic critical value bounds when the independent variables are either $I(0)$ or $I(1)$. The lower bound assumes all the independent variables are $I(0)$, and the upper bound assumes they are $I(1)$. If the test statistics exceed their respective upper critical values, the null is rejected and we can conclude that a long-run relationship exists. The second stage of the procedure is to derive the long-run and short-run estimates using the underlying ARDL model.

## 4. Empirical Findings

We begin our empirical analysis by assessing the integration properties of the underlying variables. Two standard unit root tests were used to assess the order of integration of the underlying variables - the Augmented Dickey-Fuller (ADF) test and Phillips-Perron (PP) test. The results reported in Table 2 show that all variables appear to be integrated at order one, or $I(1)$, at 1% level of significance. This allows legitimate use of the ARDL bounds test since the procedure requires all underlying variables to be integrated at an order less than two.

**Table 2**: Results for unit root tests

| | *ADF* | | *PP* | |
|---|---|---|---|---|
| | Levels | 1st-differenced | Levels | 1st-differenced |
| $\ln ED_t$ | -1.481 | -6.061*** | -0.079 | -6.105*** |
| $\ln KAP_t$ | 2.381 | -2.786* | 3.101 | -3.021** |
| $\ln FL_t$ | -0.785 | -3.285** | -0.774 | -4.748*** |
| $\ln AID_t$ | -2.840 | -5.277*** | -2.724 | -6.164*** |
| $\ln FL_t$ x $\ln AID_t$ | -1.641 | -6.006*** | -1.916 | -6.027*** |

**Notes**: For ADF, AIC is used to select the lag length and the maximum number of lags is set to be five. For PP, Barlett-Kernel is used as the spectral estimation method. The bandwidth is selected using the Newey-West method. *, ** and *** indicate 10%, 5% and 1% levels of significance respectively.

Next, to perform the ARDL bounds test, we estimate Eq. (2) with one and two lags for the model. We do not consider a lag length greater than two in order to conserve the degrees of freedom, given the small sample used in this study. Table 3 gives the *F*-statistics for the ARDL bounds tests, as well as the Akaike's and Schwarz's Bayesian Information Criteria (denoted by AIC and SBC, respectively).

**Table 3**: ARDL bounds tests

| | $p=1$ | $p=2$ |
|---|---|---|
| I. *F*-statistic | 3.415 | 7.481*** |
| II. Model section criteria: *AIC* | -4.469 | -4.858 |
| *SBC* | -3.822 | -3.988 |
| III. Diagnostic checks: $\chi^2_{NORMAL}$ | 6.681** | 0.151 |
| | (0.035) | (0.927) |
| $\chi^2_{SERIAL}$ | 3.675* | 1.827 |
| | (0.055) | (0.176) |
| $\chi^2_{WHITE}$ | 11.858 | 20.439 |
| | (0.617) | (0.368) |
| $\chi^2_{ARCH}$ | 0.018 | 1.562 |
| | (0.892) | (0.211) |

**Notes**: $p$ is the optimal lag length for the ARDL model. $p$ is the lag length. The test statistics are compared against the critical values reported in Pesaran et al. (2001). For the case with five variables, an intercept and no trend, the 10%, 5% and 1% critical value bounds for the ARDL bounds test are (2.450, 3.520), (2.860, 4.010) and (3.740, 5.060), respectively. $\chi^2_{NORMAL}$ refers to the Jarque-Bera statistic of the test for normal residuals, $\chi^2_{SERIAL}$ is the Breusch-Godfrey LM test statistic for no first order serial correlation, $\chi^2_{WHITE}$ denotes the White's test statistic to test for homoskedastic errors, and $\chi^2_{ARCH}$ is the Engle's test statistic for no autoregressive conditional heteroskedasticity. Figures in parentheses indicate *p*-values. *, ** and *** indicate 10%, 5%, and 1% levels of significance, respectively.

The test for the presence of a long-run relationship results in an *F*-statistic of 3.415 when one lag is chosen. This statistic is lower than the 10 percent upper bound value of 3.520, suggesting that no evidence of cointegration is found when one lag is considered. However, the results indicate the null hypothesis that there exists no per capita output equation is rejected at the one percent significance level for the model when two lags are chosen. The null of no relationship between the variables cannot be rejected when $\ln KAP_t$, $\ln FL_t$, $\ln AID_t$ or $\ln FL_t \text{x} \ln AID_t$ are chosen to be the dependent variables. Hence, the results suggest these variables can be interpreted as long-run forcing variables explaining $\ln ED_t$.

In line with the results of the bounds test, both AIC and SBC prefer a richer dynamic specification of two lags. Furthermore, the choice of two lags is not subject to any econometric problems, based on the results of the diagnostics checks reported in panel III. Thus, we find that using two lags is more appropriate in this case and have chosen to follow this lag structure in the remaining analyses.

**Table 4**: ARDL estimates of the long-run relationship and the short-run dynamics

| I. The long-run relationship (Dep. = $\ln ED_t$) | Coefficient | Std. Error | *p*-value |
|---|---|---|---|
| *Intercept* | -14.623** | 6.848 | 0.043 |
| $\ln KAP_t$ | 0.634*** | 0.044 | 0.000 |
| $\ln FL_t$ | 4.145** | 1.549 | 0.013 |
| $\ln AID_t$ | -2.539** | 0.974 | 0.015 |
| $\ln FL_t$ x $\ln AID_t$ | 0.595** | 0.231 | 0.016 |
| II. The short-run dynamics (Dep. = $\Delta\ln ED_t$) | Coefficient | Std. Error | *p*-value |
| *Intercept* | -0.022 | 0.020 | 0.288 |
| $ECT_{t-1}$ | -0.381*** | 0.090 | 0.000 |
| $\Delta\ln KAP_t$ | 1.525*** | 0.408 | 0.001 |
| $\Delta\ln FL_t$ | 0.631* | 0.342 | 0.076 |
| $\Delta\ln AID_t$ | -0.457** | 0.217 | 0.045 |
| $\Delta(\ln FL_t$ x $\ln AID_t)$ | 0.108** | 0.050 | 0.039 |
| $\Delta\ln GDP_{t-1}$ | -0.276* | 0.155 | 0.086 |
| $\Delta\ln GDP_{t-2}$ | -0.098 | 0.144 | 0.502 |
| $\Delta\ln AID_{t-2}$ | -0.051 | 0.045 | 0.268 |
| $\Delta(\ln FL_{t-2}$ x $\ln AID_{t-2})$ | 0.014 | 0.010 | 0.178 |
| III. Diagnostic checks | Test-statistic | | *p*-value |
| $\chi^2_{NORMAL}$ | 5.704* | | 0.058 |
| $\chi^2_{SERIAL}$ | 0.011 | | 0.919 |
| $\chi^2_{WHITE}$ | 5.627 | | 0.776 |
| $\chi^2_{ARCH}$ | 0.046 | | 0.831 |

**Notes**: The resulting lag structure chosen using AIC for the underlying ARDL model is (2, 1, 2, 2, 2).

Panel I of Table 4 provides estimates of the long-run relationship whereas panel II gives the results of the short-run dynamics. Capital stock enters the long-run equation significantly at the one percent level with the expected positive sign. Specifically, the long-run elasticity of per capita real output with respect to capital stock is found to be 0.634. The results suggest that capital stock has played a vital role in the process of economic development in India, a finding consistent with the growth literature.

Every one percent increase in the composite index of financial liberalization is associated with a 4.145 percent increase in per capita real GDP. The results imply that liberalization of the financial system in India has a favorable effect on economic development. The finding of a positive influence of financial liberalization provides some support for the financial liberalization thesis of McKinnon (1973) and Shaw (1973), which argues in favor of removing all financial restraints in order to foster economic growth. Our results are also consistent with the cross-country findings of Bekaert *et al.* (2005).

Our model conjectures that foreign aid has both direct and indirect effects on output expansion. Holding the indirect effect constant, the results show that foreign aid is found to have a direct negative effect on economic development in India, with a negative long-run elasticity of 2.539. Thus, our results do not lend any support to the view that aid will promote growth. The results seem to suggest that resources from foreign aid have been misused and misallocated and therefore were unlikely to exert any positive impact on growth in India. Our results corroborate the cross-country findings of Knack (2001) and Nkusu and Sayek (2004), who have shown that foreign aid has a dampening effect on economic growth. However, the results stand in sharp contrast to the earlier findings of Chenery and Strout (1966) and Papanek (1973). Our finding is also consistent with the theoretical models developed by Kimbrough (1986) and Gong and Zou (2001), which predict that both investment and output growth rates will move in opposite directions in response to an increase in foreign aid receipts.

As regard to the indirect effect, the interaction term is found to be statistically significant and has the expected sign (positive). Therefore, it can be inferred that the impact of foreign aid on the Indian economy is strengthened by the level of financial liberalization. This is obvious when we obtain the derivative of $\ln ED_t$ with respect to $\ln AID_t$. The results suggest that aid will have a detrimental effect on growth unless the financial system in India is liberalized beyond a certain level so that efficient allocation of aid resources can take place. In this case, the threshold from which the effect of aid on growth becomes beneficial is 71.307 (or 4.267 in natural logarithms), a level which has been achieved since 1997 (see Figure 1). Hence, both the direct and indirect effects of financial liberalization on economic development are found to be positive.

Turning to the short-run dynamics, the regression results for the short-run model reported in panel II of Table 4 show several salient features. In first-differenced form, financial liberalization, aid and their interaction have signs consistent with those reported in the long-run model, although these effects are much smaller than their long-run counterparts. The coefficient on $ECT_{t-1}$, which measures the speed of adjustment back to the long-run equilibrium value, are statistically significant at the one percent level and correctly signed, i.e., negative. This implies that an error-correction mechanism exists in the per capita output function so that the deviation from long-run equilibrium

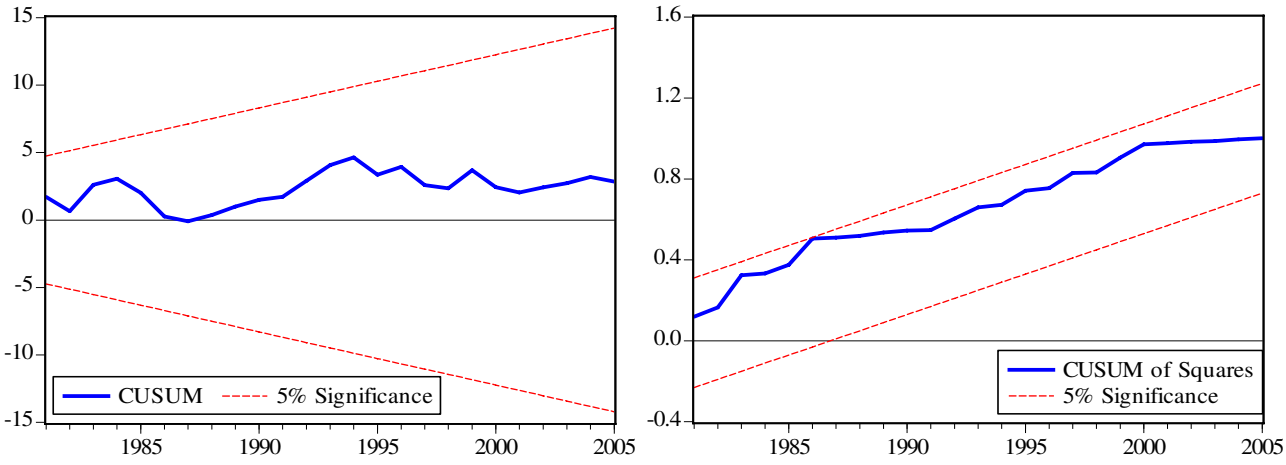
has a significant impact on the growth rate of per capita output. The equation adjusts at about 38 percent every year to restore equilibrium when there is a shock to the steady-state relationship. In order to assess the sensitivity of the results, we subject the estimation to a number of robustness checks in the next section.

## 5. Robustness checks

*5.1. Diagnostic tests*

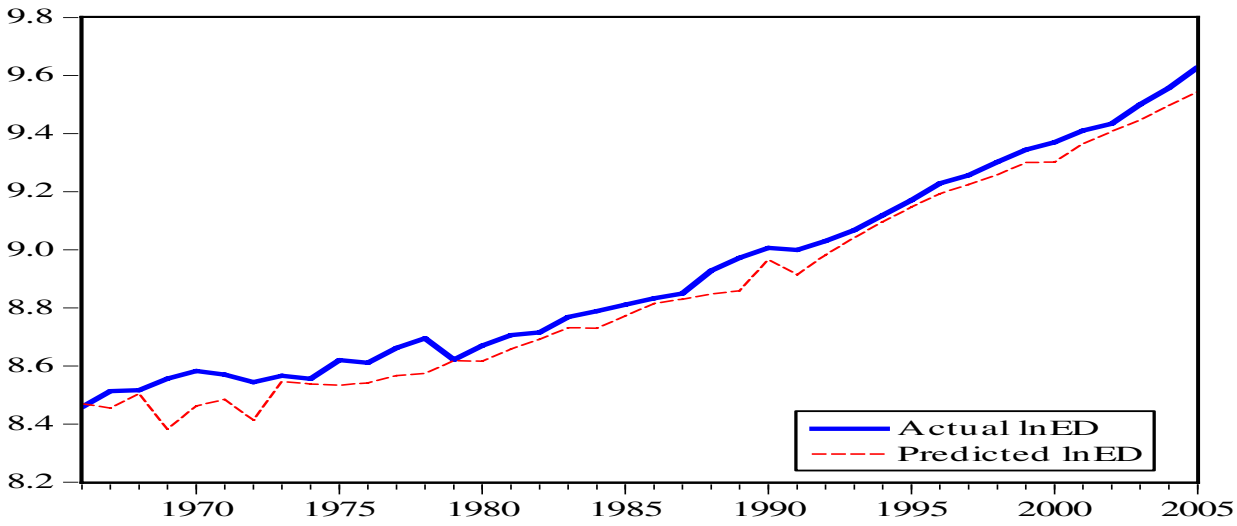
The results reported in panel III of Table 4 show that the regression specification fits remarkably well and passes the diagnostic tests against non-normal residuals, serial correlation, heteroskedasticity and autoregressive conditional heteroskedasticity at the five percent level of significance. Structural stability of the equations is examined using the cumulative sum (CUSUM) and CUSUM of squares tests on the recursive residuals. The former is able to detect systematic changes in the regression coefficients whereas the latter is able to detect sudden changes from the constancy of the regression coefficients.

**Figure 2**: Plots of CUSUM and CUSUM of squares recursive residuals




The results in Figure 2 show that the test statistics are within the five percent confidence interval band, suggesting the estimated model is rather stable over time. The actual and predicted series of the per capita real GDP series are also compared in Figure 3, which reveals that the predicted series tracks the actual series very closely over time, providing some support that the model is well-fitted.

**Figure 3**: Actual and predicted ln$ED_t$ series




*5.2. Alternative estimators*

While the ARDL approach is used for the main results of this paper, to provide a sensitivity check of the results we also consider three other estimators, namely the FM-UECM estimator Inder (1993), the DOLS procedure of Stock and Watson (1993) and the FM-OLS procedure of Phillips and Hansen (1990). Since our focus is on the long-run results, the short-run dynamics generated by each estimator are not reported here for brevity. In general, these approaches give very similar results compared to those estimated using the ARDL approach. All variables enter the long-run equation significantly at the conventional levels. The main theme is that the interaction term continues to be highly significant, highlighting the importance of the complementary role of financial sector reforms in order to absorb the benefits of foreign aid.

**Table 5**: Alternative estimators

| | *FM-UECM* | | *DOLS* | | *FM-OLS* | |
|---|---|---|---|---|---|---|
| | coefficient | *p*-value | coefficient | *p*-value | coefficient | *p*-value |
| *Intercept* | -5.897** | 0.014 | -30.381*** | 0.006 | -6.303*** | 0.007 |
| ln$KAP_t$ | 0.584*** | 0.000 | 0.679*** | 0.000 | 0.577*** | 0.000 |
| ln$FL_t$ | 2.185*** | 0.000 | 7.783*** | 0.004 | 2.286*** | 0.000 |
| ln$AID_t$ | -1.293*** | 0.000 | -4.782*** | 0.004 | -1.367*** | 0.000 |
| ln$FL_t$ x ln$AID_t$ | 0.298*** | 0.001 | 1.121*** | 0.004 | 0.314*** | 0.000 |

**Notes**: the dependent variable is ln$ED_t$. *, ** and *** indicate 10%, 5%, and 1% level of significance, respectively.

*5.3. Controlling for other effects*

Having examined the robustness of the econometric results, we now turn to presenting the results with additional control variables. We derive the results using the ARDL estimator. Since we are mainly interested in the long-run relationship, only the long-run results are reported to conserve space. Specifically, we control for the presence of a non-linear effect ($AID_t$ x $AID_t$) due to diminishing returns to aid (Dalgaard and Hansen, 2001; Lensink and White, 2001; Gomanee *et al.*, 2003), the interaction between aid and other financial or institutional factors, including quality of institutions ($INS_t$), banking sector development ($BANK_t$), stock market development ($STOCK_t$) and share market volatility ($VOL_t$). The results are reported as columns (1) – (5) in Table 6. The construction of these variables is explained in the Appendix.

It is evident that there is no support for the presence of a non-linear effect, implying that a threshold effect does not exist in the relationship between aid and per capita real GDP for India. Apart from the measure of stock market volatility, all other control variables and their interaction terms are found to be statistically insignificant. For instance, the effectiveness of aid on growth in India does not depend on the presence of a good institutional framework such as strong intellectual property rights protection – a finding consistent with Easterly *et al.* (2004) and (Alvi *et al.*, 2008). Moreover, the measures of financial development are found to have no effect on per capita GDP. This is probably due to the inclusion of the financial liberalization index in the specification as studies have shown that financial liberalization is an important determinant of financial development (e.g., see Ang and McKibbin, 2007; Ang, 2008a).

Importantly, the inclusion of additional controls does not alter our main findings. In other words, financial liberalization and its interaction with aid continue to have a positive influence whereas aid continues to have a direct negative effect on output expansion. These effects are found to be statistically significant at the conventional levels. It should also be highlighted that the evidence of cointegration remains robust to the inclusion of these control variables.

**Table 6**: Controlling for nonlinear and other interaction effects

| | Dependent variable: ln$ED_t$ | | | | |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| ln$KAP_t$ | 0.583*** (0.000) | 0.642*** (0.000) | 0.691*** (0.000) | 0.491*** (0.000) | 0.532*** (0.000) |
| ln$FL_t$ | 2.513** (0.024) | 2.623** (0.025) | 0.463*** (0.003) | 1.057*** (0.000) | 1.218*** (0.000) |
| ln$AID_t$ | -1.847*** (0.006) | -1.512** (0.042) | -0.272*** (0.004) | -0.558*** (0.000) | -0.457*** (0.000) |
| ln$FL_t$x ln$AID_t$ | 0.348** (0.034) | 0.351** (0.046) | 0.055*** (0.004) | 0.131*** (0.000) | 0.154*** (0.000) |
| ln$AID_t$ x ln$AID_t$ | -0.025 (0.155) | | | | |
| ln$INS_t$ | | 0.135 (0.918) | | | |
| ln$INS_t$ x ln$AID_t$ | | 0.036 (0.853) | | | |
| ln$BANK_t$ | | | -0.415 (0.251) | | |
| ln$BANK_t$ x ln$AID_t$ | | | -0.033 (0.556) | | |
| ln$STOCK_t$ | | | | 0.018 (0.839) | |
| ln$STOCK_t$ x ln$AID_t$ | | | | -0.006 (0.661) | |
| ln$VOL_t$ | | | | | -0.542* (0.061) |
| ln$VOL_t$ x ln$AID_t$ | | | | | -0.087* (0.051) |
| *F*-statistic (ARDL bounds test) | 6.315*** | 4.515*** | 5.193*** | 5.162*** | 4.519*** |

**Notes**: These additional interaction terms are found to be either *I*(0) or *I*(1), allowing legitimate use of the ARDL bounds tests. For the case with six variables (column 1), an intercept and no trend, the 10%, 5% and 1% critical value bounds for the ARDL bounds test are (2.26, 3.35), (2.62, 3.79) and (3.41, 4.68), respectively. For the case with seven variables (columns 2 to 5), an intercept and no trend, the 10%, 5% and 1% critical value bounds for the ARDL bounds test are (2.12, 3.23), (2.45, 3.61) and (3.15, 4.43), respectively. Figures in parentheses indicate *p*-values. *, ** and *** indicate 10%, 5%, and 1% level of significance, respectively.

## 6. Conclusions

Notwithstanding the growing concern over the importance of foreign aid in India, few studies have attempted to assess the impact of aid on the country's growth. The paper empirically investigates this relationship by focusing on the complementary role of financial sector reforms. Specifically, we tested the hypothesis that financial liberalization enhances recipient countries' ability to effectively absorb foreign aid, drawing on the experience of a large and rapidly growing developing economy.

Using the ARDL bounds test, the empirical evidence shows a significant long-run relationship between per capita real GDP and all its determinants. The results also reveal that financial liberalization is an important factor determining output growth for India both in the short run and long run, indicating the financial liberalization thesis of McKinnon (1973) and Shaw (1973) is firmly supported by the Indian data. We found that aid inflows *per se* may retard output expansion. However, India is able to gain significantly more from aid flows with a more liberalized financial system. Our empirical results are robust to several sensitivity checks, including model stability, the use of different estimators, and the inclusion of a number of control variables.

The results have some policy implications. Firstly, any impediments to financial sector reforms are likely to harm India's economic prosperity. Secondly, foreign aid has a direct detrimental effect on the economic performance of India. However, the benefit of aid can be realized through liberalizing the financial sector. Thus, liberalizing the financial system can enhance the effectiveness of aid on growth. Thirdly, the presence of a good policy environment in the form of a stronger intellectual property rights protection framework has no implication on the aid-growth nexus in India. Finally, there is no evidence to support the presence of a non-linear effect in the relationship, suggesting that diminishing returns to aid does not occur in India.

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## Appendix: Construction of variables and data sources

| *Variable* | *Description* | *Sources* |
|---|---|---|
| $ED_t$ | Economic development is measured per capita GDP at 1993 constant prices. | National Accounts Statistics, Government of India. |
| $KAP_t$ | The initial capital stock is computed by taking the initial gross capital formation at constant prices divided by the sum of depreciation rate (assumed to be 10 percent) and the average growth rate of gross capital formation at constant prices over the period 1966-2005. Capital stocks are then computed using the standard perpetual inventory model. | National Accounts Statistics, Government of India. |
| $AID_t$ | Foreign aid is measured by the ratio of utilization of external assistance to nominal GDP. | National Accounts Statistics, Government of India. |
| $FL_t$ | The composite index of financial liberalization consists of six interest rate control dummies, cash reserve ratio, statutory liquidity ratio and directed credit programs. The reserve and liquidity ratios are direct measures expressed in percentages. The extent of directed credit program is measured by 0, 1, 2 and 3 when the programs cover zero, up to 20 percent, 21 to 40 percent, and more than 40 percent, respectively, of total bank loan. The index is constructed using the method of principal component analysis, following the approach of Demetriades and Luintel (1997). Details of index construction are described in Section 2. | Annual Reports and Report on Currency and Finance, Reserve Bank of India. |
| $INS_t$ | Quality of institutions in this study is measured by the protection of intellectual property rights. The intellectual property rights index covers five dimensions: 1) patentability of various kinds of inventions, 2) membership in international patent arrangements, 3) provisions for loss protection, 4) enforcement mechanisms, and 5) duration of the patent term. Each dimension is assigned a value ranging from zero to one. The unweighted sum of these five values provides an indication of the overall level of intellectual property rights protection, with higher values reflecting greater level of protection. Missing years are interpolated. | Ginarte and Park (1997). |
| $BANK_t$ | Following the established practice, banking sector development is measured by bank credit to commercial sector divided by nominal GDP. | Annual Reports and Report on Currency and Finance, Reserve Bank of India. |
| $STOCK_t$ | Stock market development is measured by the ratio of share market capitalization to nominal GDP. Data for stock market capitalization before 1976 are constructed using the share price index. | International Financial Statistics CD Rom and Beck *et al.* (2000). |
| $VOL_t$ | Stock market volatility is measured by the 5-year rolling standard deviation of the growth rate of share price index. | International Financial Statistics CD Rom. |