FINANCE AND GROWTH: A REASSESSMENT OF THE EMPIRICAL EVIDENCE FOR THE INDIAN ECONOMY*

1. Introduction

Since the seminal contributions of Schumpeter (1911), Robinson (1952), McKinnon (1973) and Shaw (1973), the nature of causality between financial development and economic growth has been widely debated in the literature.

Following Patrick (1966), two alternative views characterize this debate, namely the 'supply-leading' and the 'demand-following' hypotheses. According to the former, the services provided by financial intermediation are essential for the smooth working of a market-economy so that financial development plays a key role in the process of economic growth (see, among others, Gurley and Shaw, 1955; Mathieson, 1980; Fry, 1988; Levine, 1997). The 'demand-following' hypothesis postulates instead that economic growth increases the demand for financial intermediation, so that financial development passively reacts to the growth of the real sector. Prominent examples of this hypothesis are Kuznets (1955), Friedman and Schwartz (1963) and Lucas (1988). As originally pointed out in Lewis (1955) and Goldsmith (1969), these alternative views may not be mutually exclusive. Recent endogenous growth models, for instance, assume that financial development and economic growth are endogenous processes, thus giving rise to a bi-directional relationship (Greenwood and Jovanovic, 1990; Berthelemy and Varoudakis, 1997).

Empirical work relying on a cross-sectional approach lends usually support to the 'supply-leading' hypothesis (see e.g., Roubini and Sala-I-Martin, 1992; King and Levine, 1993). As widely

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recognized, however, cross-country regressions suffer from various methodological problems. Time series studies provide weaker support to the 'supply-leading' hypothesis and a variegated evidence, suggesting that causality patterns are very much 'country-specific' (Demetriades and Hussein, 1996).

Focusing on developing countries, India attracted a large attention in applied research. This is hardly surprising, given the radical changes experienced by this country during the post-independence period. After the introduction of strict administrative credit controls in the early 1960's, further reinforced in the next two decades, India moved towards a progressive financial liberalization since the early 1990's. As regards the real sector, this country experienced a transition from a very low growth rate during the first three decades to a high and steady growth phase, sustained by a process of trade liberalization (Rodrick and Subramanian, 2004).

Most research on India supports bi-directional causality between finance and growth (Demetriades and Luintel, 1996; Katircioglu *et al*., 2007), while this result is confirmed in other studies including India among the set of countries examined (see, among others, Demetriades and Hussein, 1996; Luintel and Khan, 1999). A major drawback of this literature is that the analysis is seldom extended beyond the first half of the 90's, thus precluding a thorough examination of the effects induced by the financial liberalization process.

The present paper reassesses India's experience using a larger annual data set (1950-2006) and a rich set of financial development indicators. The increased sample size allows to capture the effects of recent structural changes; moreover, the use of a large span of low-frequency observations is important in order to get sensible inferences from time series tests (Campbell and Perron, 1991).

More specifically, this paper contributes to the literature in three main respects. First, differently from existing contributions which rely on standard Granger causality tests, I use a more robust framework based on a Level Var approach which does not require pre-testing for cointegration (Toda and Yamamoto, 1995). Second, whereas recent research focuses on bivariate causality tests (Bhattacharya and Sivasubramanian, 2003; Katircioglu *et al*., 2007), this paper accounts for potential mis-specification problems inside alternative multivariate frameworks. Third, this paper investigates potential subsample instability in the results from causality tests, an issue virtually ignored in the previous literature.

The outline of the paper is as follows. Section 2 describes the

data and the methodology. Section 3 contains the empirical evidence. I start inside a bivariate framework, using alternative indicators as proxies for financial development. The analysis is then extended to alternative multivariate frameworks, assessing the stability of the results through a rolling regression technique. Section 4 provides an overall evaluation of the empirical evidence and draws some policy implications. Section 5 concludes.

2. Data and methodology

2.1 Data Set

I use annual data for the Indian economy drawn from the IFS National Accounts tables. The sample size covers the period from 1950 to 2006, yielding a total of 57 observations. All series are transformed in natural logarithms. Following a standard practice, economic development is proxied with real GDP. This variable is computed through nominal GDP at current prices (expressed in billions of Rupees) and the GDP deflator. Seminal contributions have stressed the importance of using a wide array of financial variables (see, e.g., King and Levine, 1993; Bell and Rousseau, 2001). In line with this remark, I focus on four alternative financial development indicators.

The former is the ratio of the broad money stock (M2) to nominal GDP. This measure is widely used as a monetization variable and, in a theoretical perspective, is closely related to McKinnon (1973) outside money model where the accumulation of real money balances exerts a propulsive role on economic growth. A drawback associated with this indicator is that, particularly in developing countries, a large part of the money stock consists of currency held outside the banking system.

This motivates the use of two additional indicators which more accurately reflect the services provided by financial intermediaries, namely the ratio of total bank deposits to nominal GDP and the ratio of credit to the private sector to nominal GDP. From a theoretical standpoint, both these indicators are related to the debt-intermediation approach introduced in Gurley and Shaw (1955) and Shaw (1973), and more recently extended inside the endogenous growth literature. While the ratio of bank deposits to nominal GDP is a standard measure of 'financial deepening', the ratio of private

credit to nominal GDP reflects more closely the allocative role exerted by the financial system[1].

A growing body of literature has shown that, besides the banking system, the stock market may positively affect long-run growth, enhancing portfolio diversification and facilitating investment in higher-return projects (see, among others, Levine, 1991; Levine and Zervos, 1998). Following Levine (1997) and Levine and Zervos (1998), I use therefore an additional financial development indicator measuring stock market capitalization, constructed as the ratio of the Indian total share prices index to nominal GDP.

While most research on India focuses on bivariate causality tests, this paper exploits alternative multivariate frameworks in order to avoid mis-specification problems and biased results arising from the omission of relevant variables. To this purpose, I introduce additional macroeconomic variables, related either to trade or to domestic capital formation. More specifically, I consider two alternative trade variables, namely real domestic exports and the ratio of nominal exports to GDP. These variables are used in trivariate systems exploring the causal relationships between finance, trade and growth. Moreover, in order to capture potential indirect effects from financial development to economic growth occurring through capital formation, I use the ratio of gross fixed capital formation (measured at current prices) to nominal GDP.

2.2 Econometric Framework

Almost all research dealing with India performs Johansen cointegration analysis before implementing Granger causality tests in a VAR or VECM framework. As shown by various Monte Carlo experiments, however, Johansen-type tests for cointegrating ranks are highly sensitive to nuisance parameters in finite samples (Reimers, 1992; Toda, 1995). In this perspective, Toda and Phillips (1993) document that standard Granger causality tests may lead to incorrect statistical inferences.

In order to overcome this drawback, I apply a more recent

[1] This latter indicator is more strictly related to the quantity and efficiency of productive investments and should therefore exhibit a closer causal relationship with economic growth (see King and Levine (1993), p. 718, and Demetriades and Hussein (1996), section 3, for an in-depth discussion of this point).

estimator developed in Toda and Yamamoto (1995), based on a VAR model in levels, which does not require pre-testing for cointegration and can be applied irrespective of the cointegration properties of data.

Assume that some linear or nonlinear restrictions on the coefficients of a given model have to be tested. Toda and Yamamoto (1995) propose to estimate an 'augmented' VAR expressed in levels, and show that these restrictions can be tested by means of a modified Wald test. The first step in the implementation of this procedure is the selection of the true lag length (k^*) of the VAR and the determination of the maximum order of integration (d_{max}) of the variables in the system. An over-parametrized VAR in levels of order $p \geq k^* + d_{max}$ is then estimated in order to conduct statistical inferences.

Toda and Yamamoto (1995) prove that linear or nonlinear restrictions on the first k^* coefficient matrices (Π_1, ..., Π_k) can be tested using standard asymptotic theory; the coefficient matrices of the last d_{max} lagged vectors (Π_{k+1}, ..., Π_{max}) are ignored since these are regarded as zeros. Under the null hypothesis of zero restrictions on the coefficients of each variable for lags one to k^*, the Wald statistic is asymptotically distributed as a chi-square with usual degrees of freedom, and this does not depend on whether the VAR is stationary (around a linear trend), integrated, or cointegrated of any order.

Specializing the above framework to the analysis of this paper, this approach involves the estimation of the following VAR system in levels:

$$Z_t = \mu_t + \sum_{i=1}^{p} \Pi Z_{t-i} + \varepsilon_t$$

where μ_t is a vector of constant terms, Π_i is a coefficient matrix, and ε_t is a vector of Gaussian error terms with zero mean and covariance matrix Λ [$\varepsilon_t \sim$ i.i.d. (0, Λ)]. In the case of bivariate causality tests, Z_t is a 2x1 column vector including real output and one financial indicator variable. In the case of multivariate causality tests, Z_t is instead a 3x1 column vector including real output, one financial indicator, and one macroeconomic variable assumed to potentially affect the finance-growth relationship (i.e., in our context, either one trade variable or domestic capital formation). Denoting with k^* the true lag length of this VAR, estimation is first implemented including $k^* + d_{max}$ lags, while the Wald statistic is computed on the first k^* coefficient matrices (Π_1, Π_2, ..., Π_k)[2].

[2] The only requirement for the consistency of this test is that the number of 'extra' lags added to the original VAR is equal to or greater than the

3. Empirical evidence

3.1 Causality Tests in a Bivariate Framework

The first step in order to implement the Toda and Yamamoto (1995) estimator is the determination of d_{max}, i.e. the maximum order of integration of the variables in the system. To this purpose, standard unit root tests (ADF, Phillips-Perron) under alternative econometric specifications were applied to all the variables. The results (not reported in order to save space, but available upon request) show that all series are integrated of order one [I(1)], so that $d_{max} = 1$ in the present context.

A further step is the selection of the optimal lag length (k^*) for the VAR systems expressed in levels. The Akaike Information Criterion (AIC) and the Schwarz Bayesian Criterion (SBC) suggest, respectively, a value of $k^* = 2$ and of $k^* = 1$ for bivariate models incorporating the first three financial indicators described in section 2.1. Conversely, both model selection criteria support $k^* = 1$ in the bivariate system including the ratio of share prices to nominal GDP. Accordingly, I assume two alternative optimal lag structures ($k^* = 1$, 2) for most financial development indicators, whereas k^* is restricted to 1 in the bivariate system using the share prices ratio. All bivariate systems allow for a constant term while usually omitting a linear trend since this restriction is not rejected by data in most cases, at conventional significance levels[3].

Table 1 summarizes the results from bivariate causality tests.

Consistently with the preliminary data inspection, I assume two alternative optimal lag structures ($k^* = 1$, 2) in the levels VARs for most financial indicators. Moreover, empirical estimates are carried out using a comprehensive set of additional lags ranging from one to three. This flexible structure is useful to examine the sensitivity of results to the choice of the lag length, and ensures that the

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largest order of integration of the variables entering the system, i.e. $p \geq k^* + d_{max}$ (see Toda and Yamamoto, 1995, section 2, for details). As shown in Swanson *et al*. (1996), this 'surplus lag' approach has excellent finite sample size properties, particularly relative to standard Wald tests when the variables in the system are cointegrated.

[3] A deterministic trend is included only in the VAR based on the ratio of total bank deposits to nominal GDP. The appropriateness of all these VAR specifications was finally checked through conventional diagnostic tests on the residuals from estimated equations.

TABLE 1 - *India (1950 - 2006): Bivariate Levels VAR Causality Tests*

Null Hypotheses Absence of the following casual relationships:	$k^* = 1$			$k^* = 2$		
	Var (1 + 1)	Var (1 + 2)	Var (1 + 3)	Var (2 + 1)	Var (2 + 2)	Var (2 + 3)
M2 ⇒ *Y*	0.001 [0.975]	0.030 [0.861]	0.183 [0.668]	0.185 [0.911]	0.599 [0.741]	0.288 [0.866]
Y ⇒ *M2*	**10.48 [0.001]**	**10.94 [0.001]**	**9.63 [0.002]**	**12.20 [0.002]**	**10.48 [0.005]**	**7.82 [0.020]**
DR ⇒ *Y*	0.094 [0.759]	0.002 [0.962]	0.171 [0.679]	0.283 [0.868]	0.498 [0.779]	0.285 [0.867]
Y ⇒ *DR*	**6.11 [0.013]**	**7.14 [0.008]**	**6.81 [0.009]**	**7.52 [0.023]**	**7.25 [0.027]**	**6.33 [0.042]**
CR ⇒ *Y*	0.016 [0.899]	0.182 [0.669]	0.347 [0.555]	0.183 [0.912]	0.358 [0.836]	0.648 [0.723]
Y ⇒ *CR*	**9.05 [0.003]**	**9.02 [0.003]**	**7.55 [0.006]**	**9.02 [0.011]**	**7.57 [0.023]**	**6.28 [0.043]**
SR ⇒ *Y*	0.642 [0.423]	1.074 [0.300]	1.011 [0.315]	-	-	-
Y ⇒ *SR*	1.419 [0.234]	1.319 [0.251]	1.031 [0.310]	-	-	-

The entries in this table are modified Wald statistics obtained applying the Toda and Yamamoto (1995) estimator to bivariate systems including Real Income and alternative financial indicators. $k^* = 1, 2$ indicate the optimal lags assumed in the VAR to perform the causality test. P values are in square brackets beside test statistics. Boldface types indicate significant values. Y: *Real GDP*; M2: Financial Indicator based on the *M2/GDP* ratio; DR: Financial Indicator based on *Deposit/GDP* ratio; CR: Financial Indicator based on *Private Credit/GDP* ratio; SR: Financial Indicator based on *Share Prices/ GDP ratio*. All ratios relative to financial indicators are expressed in logs.

asymptotical critical values can be used when performing causality tests between integrated variables.

The most relevant finding is the existence of a significant causal effect from economic growth to financial development. As documented in table 1, this result holds for almost all financial indicators (the only exception being the *Share Price/GDP* ratio), and is highly robust to different optimal lag structures as well as to alternative 'surplus lags' in the estimated VARs. A further important result is the absence of any significant causal relationship in the reverse direction. As shown in table 1, the modified Wald statistics are never able to reject the null hypothesis of absence of a causal effect from financial variables to real growth, at conventional significance levels.

On the whole, this empirical evidence provides strong support to the 'demand-following' hypothesis, while rejecting the existence of a bi-directional causal relationship between finance and growth.

These results differ from those typically obtained in the literature. Actually, most earlier work supports either a causal effect from financial variables to economic growth (Ahmed and Ansari, 1998; Bell and Rousseau, 2001; Bhattacharya and Sivasubramanian, 2003), or a bi-directional relationship (Demetriades and Luintel, 1996; Demetriades and Hussein, 1996; Luintel and Khan, 1999; Sinha and Macri, 2001).

The different conclusions achieved in this section call for further econometric investigation to explore the robustness of our results. This issue is addressed in the next two sections, where I extend the analysis in a multivariate framework (§ 3.2) and discuss the stability of the results over time (§ 3.3).

3.2 Causality Tests in a Multivariate Framework

The main shortcoming of previous causality tests is that they suffer from the so-called 'omitted variables problem'. This means that econometric inferences about the causal links between financial indicators and economic growth may be biased, due to the absence of other relevant macroeconomic variables (potentially) affecting this relationship. This mis-specification problem has been widely recognized in the literature, both in a general perspective (Lutkepohl, 1982) and with specific reference to the applied work on finance and growth (see, among others, Darrat, 1999; Luintel and Kahn, 1999; Chang and Caudill, 2005).

In order to overcome this problem, I implement causality tests inside two alternative trivariate systems including, respectively, the following variables:

(a) Financial Development, Aggregate Investment, Real Growth;

(b) Financial Development, Trade, Real Growth.

The rationale underlying these multivariate specifications is to avoid any omitted variables bias, allowing for potential indirect effects of financial indicators on real growth, occurring either through capital formation (a) or through trade (b)[4].

I now briefly sketch out the theoretical underpinnings of these trivariate systems before discussing the results of causality tests.

Consider the former system (a). Since Schumpeter (1911) and Hicks (1969) seminal contributions, the existence of a well-functioning financial sector has been identified as a crucial factor channelling funds to most innovative firms and therefore fostering capital formation, technological advance and growth. The theoretical literature identifies some peculiar features of the financial system such as promoting risk amelioration (trading, hedging and pooling of risk), providing information about firms and market conditions, monitoring managers and exerting corporate control, and mobilize savings. These functions jointly contribute to foster long-term capital accumulation, to boost technological innovation, and to provide a better resources allocation. Assuming a standard production function where aggregate output depends on physical capital, labor, and the level of technology, these effects translate into a higher rate of economic growth[5].

Consider now the latter system (b), where the effects of financial development on growth are transmitted through trade variables. The rationale for this indirect effect is related to two different strands of literature pinpointing, respectively, a causal relationship from finance to trade and a causal relationship from trade to growth.

The former link draws on theoretical contributions incorporating a financial sector in the Heckscher-Ohlin model. As shown in

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[4] See Chang (2002), Chang and Caudill (2005) for empirical analyses focusing on indirect effects from finance to growth occurring through trade variables. Abu-Bader *et al*. (2008) follow an analogous approach emphasizing the role of aggregate investment.

[5] See Levine (1997), section 2 and the references herein, for an in-depth survey of the theoretical literature analyzing the functions of the financial system and their effects on the real economy.

Kletzer and Bardhan (1987), countries with a relatively advanced financial structure have a comparative advantage in sectors relying on external finance, and this gives rise to a positive causal effect of financial development on the trade balance. Beck (2002) extends this theoretical set up to an economy with two sectors (constant and increasing returns to scale), showing that financial development shifts incentives of the producers towards the good with increasing returns to scale, and thus reiterating the existence of a positive link from the degree of financial intermediation to the structure of trade flows.

Turning to the causal relationship from trade to growth, this is related to the well-known 'export-led growth' hypothesis. Various channels may generate a positive effect of exports on output growth. These channels include a standard demand side effect (keynesian foreign trade multiplier), a relaxation of the foreign exchange constraint which allows to increase the imports of intermediate inputs and capital goods thus boosting domestic production, and positive influences operating through the supply side (more efficient resources allocation, exploitation of economies of scale).

(a) Finance, Investment and Growth

This system includes an additional variable defined as the ratio of gross fixed capital formation (measured at current prices) to nominal GDP. Standard unit root tests point out that this variable is I(1): therefore I retain the assumption that $d_{max} = 1$ when implementing causality tests. The *Share Prices/GDP* ratio is excluded since no significant relationship with economic growth has been documented in the previous section. Since preliminary data inspection did not produce univocal evidence as regards the optimal lag structure, the VARs are estimated assuming $k^* = 1$ and $k^* = 2$[6].

Tables 2, 3 and 4 summarize the results. Each table refers to a specific financial indicator, namely the *M2/GDP* ratio (table 2), the *Deposit/GDP* ratio (table 3), and the *Private Credit/GDP* ratio (table 4). The upper section of each table contains the results relative to the direct relationships between financial indicators and economic growth. The lower section focuses instead on potential indirect effects occurring through real capital formation, i.e. it explores the existence of two unidirectional causal relationships (from finance to investment, and from investment to economic growth).

[6] Consistently with the previous section, moreover, these VARs include a constant term, whereas a linear trend is excluded since this restriction is never rejected by likelihood ratio tests.

TABLE 2 - *India (1950 - 2006): Multivariate Levels VAR Causality Tests*
Financial Indicator: *M2/GDP*
Trivariate Systems: *Y*; *M2/GDP*; *INV/GDP*

Null Hypotheses Absence of the following causal relationships:	$k^* = 1$		$k^* = 2$	
	Var (1 + 1)	Var (1 + 2)	Var (2 + 1)	Var (2 + 2)
DIRECT EFFECTS				
Finance ⇒ Growth	0.493 [0.482]	0.226 [0.634]	0.330 [0.848]	0.114 [0.944]
Growth ⇒ Finance	**11.52 [0.001]**	**13.05 [0.000]**	**15.96 [0.000]**	**13.40 [0.001]**
INDIRECT EFFECTS				
Finance ⇒ Investment	0.627 [0.428]	2.58 [0.108]	**10.84 [0.004]**	**7.243 [0.027]**
Investment ⇒ Growth	0.185 [0.667]	0.095 [0.757]	0.679 [0.712]	1.654 [0.437]

The entries in this table are modified Wald statistics obtained applying the Toda and Yamamoto (1995) estimator to the trivariate systems indicated above. See Table 1 for general explicative notes. *INV/GDP* represents the ratio of Gross Fixed Capital Formation to GDP (at current prices), expressed in logs.

TABLE 3 - *India (1950 - 2006): Multivariate Levels VAR Causality Tests*
Financial Indicator: *TOTAL DEPOSITS/GDP*
Trivariate Systems: *Y*; *TOTAL DEPOSITS/GDP*; *INV/GDP*

Null Hypotheses Absence of the following causal relationships:	$k^* = 1$		$k^* = 2$	
	Var (1 + 1)	Var (1 + 2)	Var (2 + 1)	Var (2 + 2)
DIRECT EFFECTS				
Finance ⇒ Growth	0.778 [0.374]	0.548 [0.459]	0.860 [0.650]	0.315 [0.854]
Growth ⇒ Finance	**8.80 [0.003]**	**9.54 [0.002]**	**11.03 [0.004]**	**9.25 [0.010]**
INDIRECT EFFECTS				
Finance ⇒ Investment	0.597 [0.440]	**4.061 [0.044]**	**13.13 [0.001]**	**6.46 [0.039]**
Investment ⇒ Growth	0.118 [0.730]	0.075 [0.783]	1.075 [0.584]	2.374 [0.305]

The entries in this table are modified Wald statistics obtained applying the Toda and Yamamoto (1995) estimator to the trivariate systems indicated above. See Tables 1 and 2 for general explicative notes.

TABLE 4 - *India (1950 - 2006): Multivariate Levels VAR Causality Tests*
Financial Indicator: *PRIVATE CREDIT/GDP*
Trivariate Systems: *Y*; *PRIVATE CREDIT/GDP*; *INV/GDP*

Null Hypotheses Absence of the following causal relationships:	$k^* = 1$		$k^* = 2$	
	Var (1 + 1)	Var (1 + 2)	Var (2 + 1)	Var (2 + 2)
DIRECT EFFECTS				
Finance ⇒ Growth	0.186 [0.666]	0.001 [0.970]	1.137 [0.566]	0.727 [0.695]
Growth ⇒ Finance	**8.17 [0.004]**	**7.82 [0.005]**	**7.88 [0.019]**	**6.85 [0.032]**
INDIRECT EFFECTS				
Finance ⇒ Investment	1.630 [0.202]	0.624 [0.429]	0.837 [0.658]	2.487 [0.288]
Investment ⇒ Growth	0.065 [0.798]	0.212 [0.644]	2.112 [0.347]	1.835 [0.399]

The entries in this Table are modified Wald statistics obtained applying the Toda and Yamamoto (1995) estimator to the trivariate systems indicated above. See Tables 1 and 2 for general explicative notes.

Consider the direct relationships between financial indicators and economic growth. Focusing on the upper sections of tables 2, 3 and 4, the null hypothesis of absence of a causal effect from finance to growth is never rejected, at conventional significance levels. The reverse null hypothesis, namely the absence of a causal effect from growth to financial variables, is instead strongly rejected, at all alternative lag structures and with all financial indicators.

Overall, these results are fully consistent with those reported in section 3.1, since they reject bi-directional causality and provide strong support to the 'demand-following' hypothesis.

Consider now potential indirect effects from financial development to economic growth occurring through real capital formation. Focusing on the lower sections of tables 2, 3 and 4, some financial variables display a significant effect on real capital formation. This happens in the case of the *M2/GDP* ratio (see table 2, with $k^* = 2$ as optimal lag structure), and in the case of the *Deposit/GDP* ratio (see table 3, under both optimal lag structures), whereas in the case of the *Credit/GDP* ratio the Wald tests are not statistically significant (see table 4, third row). As documented in tables 2, 3 and 4, however, the null hypothesis of absence of a causal relationship from investment to economic growth is never rejected at all lag structures.

Taken as a whole, these results reject the existence of indirect effects from financial variables to economic growth. Notwithstanding some significant effects of the financial structure on real capital formation, the empirical evidence unambiguously fails to support a significant causal relationship from aggregate investment to economic growth[7].

(b) Finance, Trade and Growth

This trivariate system relies on two alternative trade indicators: the ratio of *Nominal Exports to GDP* and *Real Domestic Exports*. Since standard unit root tests point out that these variables are I(1),

[7] These results display a close similarity with some recent applied research. As regards the significance of the finance-investment nexus, our findings are consistent with those obtained in Bell and Rousseau (2001), documenting that the financial sector was instrumental in promoting aggregate investment in India during the post-independence period. Moreover, as regards the absence of a significant causal relationship from aggregate investment to economic growth, our findings are in line with those of Sinha and Macri (2001), reporting a wrong sign for the coefficient of the investment variable in the estimation of an augmented production function for India.

I retain the assumption that $d_{max} = 1$. The standard criteria for selecting the optimal VAR length univocally support $k^* = 1$, with all trade variables and financial development indicators. Accordingly, I assume $k^* = 1$, while estimated VARs include a set of additional lags ranging from one to three in order to ensure the appropriateness of asymptotical critical values used in causality tests[8].

Tables 5, 6 and 7 summarize the results. Each table refers to a specific financial indicator. The upper section of each table refers to the direct relationships between financial indicators and economic growth, while the lower section focuses on the potential indirect effects occurring through trade variables.

The empirical evidence is highly robust across alternative trade variables and financial development indicators.

Focusing on direct effects, the upper sections of tables 5, 6 and 7 show that the null hypothesis of absence of a causal effect from growth to financial variables is consistently rejected, at conventional significance levels, under all alternative specifications. The converse result holds as regards causality from financial variables to economic growth. Overall, these findings further corroborate the 'demand-following' hypothesis.

Turning to indirect effects, the null hypothesis of absence of a causal effect from financial to trade variables is never rejected under all alternative specifications. I therefore do not find any support for the predictions of some recent theoretical trade models, outlining a possible positive influence of financial development on the structure of trade balance[9]. A further robust result is that the null hypothesis of absence of a causal effect from trade variables to economic growth is consistently rejected. This lends a major support to the 'export-led growth' hypothesis, confirming the propulsive role of exports on India's long-term growth highlighted in many recent empirical contributions (see, among others, Chandra, 2003; Love and Chandra, 2004; Tronzano, 2010).

Taken as a whole, this evidence points to the absence of indirect effects from the financial sector to economic growth occurring through trade variables.

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[8] In line with a preliminary data inspection, all VARs include a constant term and omit a linear trend.

[9] This result is broadly consistent with the findings of Katircioglu *et al*. (2007) for India, documenting very weak effects of financial variables on trade variables.

TABLE 5 - *India (1950 - 2006): Multivariate Levels VAR Causality Tests*
Financial Indicator: *M2/GDP*
Trivariate Systems: [*Y*; *M2/GDP*; *EXP/GDP*] ; [*Y*; *M2/GDP*; *REAL EXPORTS*]

Null Hypotheses Absence of the following causal relationships:	Trade Variable: Export / GDP $k^* = 1$			Trade Variable: Real Exports $k^* = 1$		
	Var (1 + 1)	Var (1 + 2)	Var (1 + 3)	Var (1 + 1)	Var (1 + 2)	Var (1 + 3)
DIRECT EFFECTS						
Finance ⇒ Growth	1.461 [0.227]	1.527 [0.216]	0.895 [0.344]	0.178 [0.672]	0.011 [0.914]	0.006 [0.937]
Growth ⇒ Finance	**7.174 [0.007]**	**8.323 [0.004]**	**5.365 [0.021]**	**9.422 [0.002]**	**9.254 [0.002]**	**5.762 [0.016]**
INDIRECT EFFECTS						
Finance ⇒ Trade	2.694 [0.101]	1.780 [0.182]	0.895 [0.344]	0.050 [0.821]	0.280 [0.596]	0.186 [0.666]
Trade ⇒ Growth	**5.656 [0.017]**	**7.010 [0.008]**	**7.062 [0.008]**	**4.424 [0.035]**	**3.818 [0.051]**	**4.313 [0.038]**

The entries in this table are modified Wald statistics obtained applying the Toda and Yamamoto (1995) estimator to the alternative trivariate systems indicated above. See Table 1 for general explicative notes. *EXP/GDP*: Ratio of Exports of Goods and Services to GDP (at current prices). *Real Exports*: Nominal Exports deflated through Export Price Deflator. Both these trade variables are expressed in logs.

TABLE 6 - *India (1950 - 2006): Multivariate Levels VAR Causality Tests*
Financial Indicator: *TOTAL DEPOSITS/GDP*
Trivariate Systems: [*Y*; *DEPOSITS/GDP*; *EXP/GDP*] ; [*Y*; *DEPOSITS/GDP*; *REAL EXPORTS*]

Null Hypotheses Absence of the following causal relationships:	Trade Variable: Export / GDP $k^* = 1$			Trade Variable: Real Exports $k^* = 1$		
	Var (1 + 1)	Var (1 + 2)	Var (1 + 3)	Var (1 + 1)	Var (1 + 2)	Var (1 + 3)
DIRECT EFFECTS						
Finance ⇒ Growth	1.252 [0.263]	1.726 [0.189]	1.026 [0.311]	0.181 [0.670]	0.075 [0.784]	0.013 [0.909]
Growth ⇒ Finance	**5.826 [0.016]**	**6.988 [0.008]**	**4.986 [0.026]**	**7.336 [0.007]**	**7.099 [0.008]**	**4.300 [0.038]**
INDIRECT EFFECTS						
Finance ⇒ Trade	1.972 [0.160]	1.190 [0.275]	0.557 [0.455]	0.128 [0.720]	0.127 [0.721]	0.151 [0.697]
Trade ⇒ Growth	**5.385 [0.020]**	**7.429 [0.006]**	**7.622 [0.006]**	**4.629 [0.031]**	**3.934 [0.047]**	**4.299 [0.038]**

The entries in this Table are modified Wald statistics obtained applying the Toda and Yamamoto (1995) estimator to the alternative trivariate systems indicated above. See Tables 1 and 5 for general explicative notes.

TABLE 7 - *India (1950 - 2006): Multivariate Levels VAR Causality Tests*
Financial Indicator: *PRIVATE CREDIT/GDP*
Trivariate Systems: [*Y*; *CREDIT/GDP*; *EXP/GDP*] ; [*Y*; *CREDIT/GDP*; *REAL EXPORTS*]

Null Hypotheses Absence of the following causal relationships:	Trade Variable: Export / GDP $k^* = 1$			Trade Variable: Real Exports $k^* = 1$		
	Var (1 + 1)	Var (1 + 2)	Var (1 + 3)	Var (1 + 1)	Var (1 + 2)	Var (1 + 3)
DIRECT EFFECTS						
Finance ⇒ Growth	2.064 [0.151]	0.864 [0.352]	0.513 [0.474]	0.209 [0.647]	0.012 [0.911]	0.0005 [0.981]
Growth ⇒ Finance	**8.825 [0.003]**	**6.696 [0.010]**	**4.053 [0.044]**	**7.680 [0.006]**	**6.048 [0.014]**	**3.768 [0.052]**
INDIRECT EFFECTS						
Finance ⇒ Trade	2.172 [0.141]	0.512 [0.474]	0.633 [0.426]	0.677 [0.411]	0.126 [0.722]	0.257 [0.612]
Trade ⇒ Growth	**6.494 [0.011]**	**7.002 [0.008]**	**4.289 [0.038]**	**4.865 [0.027]**	**3.998 [0.046]**	**3.905 [0.048]**

The entries in this table are modified Wald statistics obtained applying the Toda and Yamamoto (1995) estimator to the alternative trivariate systems indicated above. See Tables 1 and 5 for general explicative notes.

To sum up, the main findings obtained inside alternative trivariate systems corroborate the empirical evidence obtained in the previous section, providing further support to the 'demand-following' hypothesis and excluding a bi-directional relationship between finance and growth. Moreover, these trivariate systems reject indirect effects of financial variables on economic growth, operating either through real capital formation or through trade variables.

3.3 Stability Analysis

The results discussed in the previous section refer to a rather long temporal span during which India's financial system underwent significant structural changes[10]. Since the focus of this paper is on causality patterns between finance and growth, the potential effects associated with these changes must be accounted for in this research. It is therefore important to complement previous empirical findings analyzing their stability over time.

To this purpose, this section implements a stability analysis, namely it explores the robustness of the evidence from causality tests to changes in the sample period. Following a standard approach[11], besides addressing the time dependence of the empirical evidence, I also investigate its robustness to alternative specifications of the underlying econometric framework and to the inclusion of different macrovariables.

The methodology followed in this section relies on the approach most commonly used in the literature investigating subsample instability (see e.g., Thoma, 1994; Swanson, 1998).

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[10] During the 1950's the Indian financial system was fairly liberal, whereas strict regulations and controls were introduced in the next two decades. Since the early 1960's, the government significantly tightened administrative controls, raising liquidity requirements and establishing state development banks for industry and agriculture. Further administrative controls were introduced during the 1970's, namely interest rate ceilings for priority sectors and a formal system of directed credit covering a large fraction of total lending. The late 1980's mark the beginning of a new gradual process of financial liberalization, which was further intensified during the 1990's through various reforms.

[11] The literature about subsample instability in Granger causality tests mainly focuses on the money-income relationship. See, for instance, Thoma (1994) and Swanson (1998) for a discussion of available empirical methodologies.

I start carrying out Granger causality tests inside an initial subsample corresponding to the 1950-1980 period, i.e. including 31 yearly observations. The selection of the above period is dictated by the need to ensure a sufficient numbers of degrees of freedom. Subsequently, I use an increasing window technique, that is I replicate the tests adding one year to the data set at each iteration. This process is repeated until the entire data set (1950-2006) is analyzed. This procedure yields, for each causal relationship, a total of 27 time-varying observations which are plotted for the years ranging from 1980 to 2006. In order to make the results comparable across sample periods and degrees of freedom, I plot the p-values from the modified Wald tests generated through the Toda and Yamamoto (1995) estimator.

As regards model specification, I exclude the bivariate framework implemented in section 3.1 in order to avoid mis-specification problems. I focus instead on the alternative trivariate systems outlined in section 3.2 and, for each of them, I assess the robustness of empirical findings to alternative financial and macroeconomic indicators.

Figures 1 and 2 report the results of stability analysis inside two trivariate systems including financial variables, trade variables and real economic growth.

FIGURE 1 - *Stability Analysis; Trivariate System (1 + 3): [Y, DEP/GDP, EXP/GDP]*

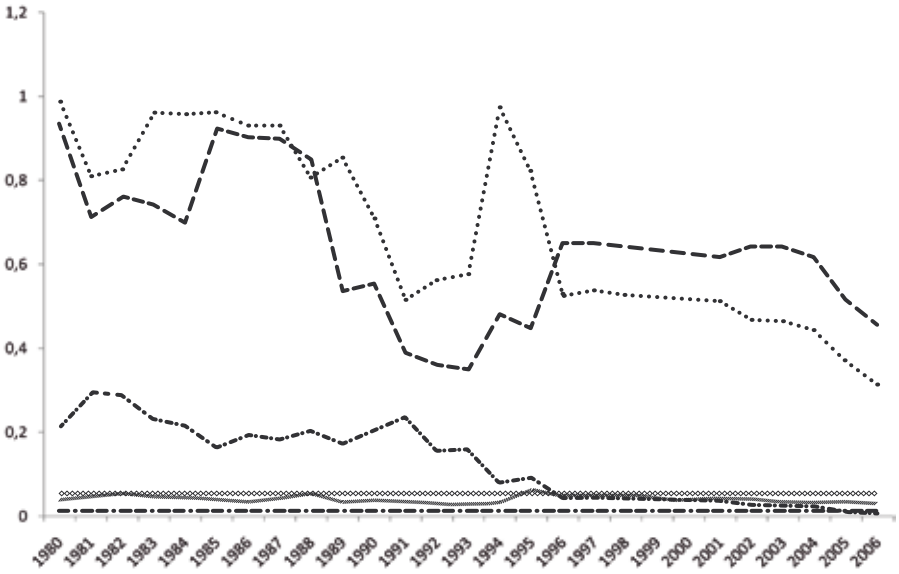
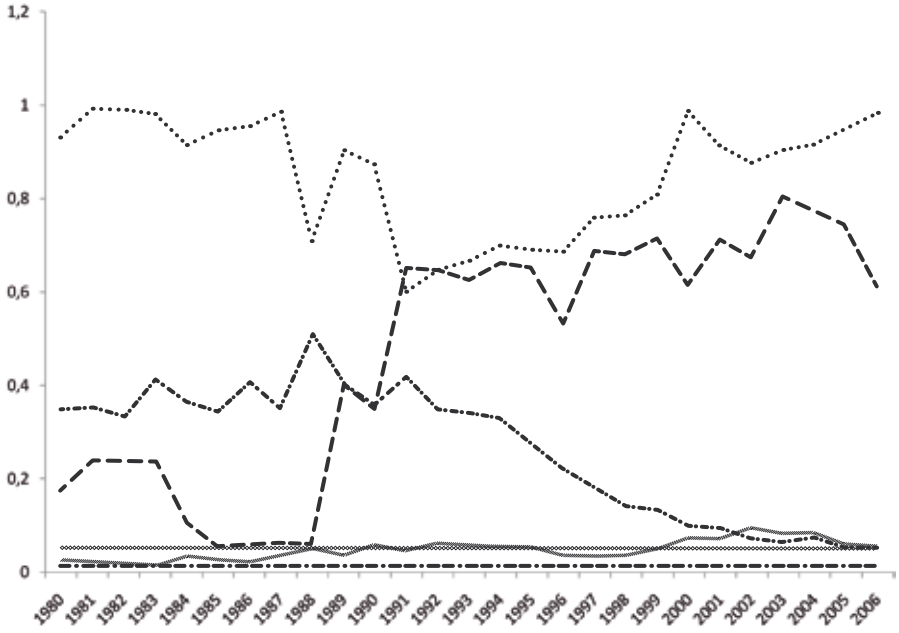


FIGURE 2 - *Stability Analysis; Trivariate System (1 + 3): [Y, CRED/GDP, REAL EXP]*



Both trivariate systems assume $k^* = 1$ as optimal lag length of the VAR and include three 'surplus lags' in order to implement the Toda and Yamamoto (1995) estimator. In the former trivariate system (figure 1), financial development is proxied with the *Deposits/GDP* ratio and the trade variable corresponds to the ratio of *Nominal Exports to GDP*. In the latter trivariate system (figure 2), financial development is proxied with the *Private Credit/GDP* ratio, while the trade variable is represented by *Real Domestic Exports*.

Let us consider, first, the direct relationships between financial and growth variables. As shown in figures 1 and 2, the p-values relative to the causal effect from finance to growth (dotted lines) consistently exceed standard critical values, whereas those relative to the reverse causal effect from growth to finance (full-grey lines) lie almost always inside the 5%-1% critical values band[12] (which corresponds to the two straight lines drawn near the horizontal axis).

[12] In the latter trivariate system, the full-grey line slightly exceeds the 5%-1% critical values band from 2000 to 2006 (see figure 2). However, during these years, the null hypothesis of absence of a causal relationship from growth to finance can always be rejected at a 10% significance level.

Therefore, progressively enlarging the sample size from 1980 to 2006, modified Wald tests never allow to reject the absence of a unidirectional relationship from financial variables to economic growth, while steadily supporting a causality effect in the reverse direction. These results document the absence of subsample instability in the finance-growth nexus and point out that the 'demand-following' hypothesis is remarkably stable over time.

Consider now the indirect relationship from financial variables to economic growth potentially occurring through trade variables. As shown in figures 1 and 2, the p-values related to the finance-trade nexus (segmented lines) exclude the existence of causality from financial to trade variables, since they largely exceed the 5%-1% critical values band[13]. Turning to the causal relationship from trade to growth, this displays a notable degree of temporal instability under both model specifications. As documented in figure 1, for instance, the 'export-led growth' hypothesis finds robust empirical support only since 1996 onwards, when the reported p-values are steadily inside the 5%-1% critical values band (see dotted-segmented line)[14].

The absence of causality from financial to trade variables, and the weak support for the 'export-led growth' hypothesis imply that there are no indirect influences of the financial system on real growth occurring through trade variables. These results are fully in line with the previous evidence for the whole sample.

This increasing window approach was replicated using the alternative trivariate system estimated in section 3.2, namely the one including financial variables, aggregate investment, and real economic growth. Overall, these results denote substantial affinities with those outlined above, further corroborating the empirical evidence obtained in section 3.2[15].

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[13] The only minor exception is in figure 2 when, albeit for a very short period, the null hypothesis of absence of a causal effect from finance to trade is rejected at a 10% significance level.

[14] Empirical support for the 'export-led growth' hypothesis, moreover, is much weaker in the alternative specification based on real exports (see figure 2, dotted-segmented line). In this case, notwithstanding a clear declining trend of p-values from the beginning of the 1990's, the null hypothesis of absence of a causal relationship from trade to growth can be rejected at a 5% level only at the very end of the sample (i.e. in 2006).

[15] As regards the direct relationships between financial and growth variables, the plots of p-values consistently exclude the existence of bi-

To sum up, this increasing window approach reveals that all major empirical findings obtained in the previous section exhibit a substantial degree of temporal stability. This conclusion holds both focusing on the direct relationships between finance and growth and considering potential indirect effects. These results, moreover, are highly robust to alternative financial development indicators.

4. Discussion and policy implications

This section provides a critical evaluation of the empirical findings and, on this basis, discusses the effectiveness of financial sector's development policies in fostering the process of economic growth in India.

The main result of this paper is a strong support for a unidirectional causal relationship from real growth to financial development. This evidence is robust to the inclusion of alternative variables in the VAR, and exhibits notable sub-sample stability.

This result differs from those achieved in past research, where the sample excluded the recent financial liberalization period. This research documents bi-directional causality between finance and growth (Demetriades and Luintel, 1996; Demetriades and Hussein, 1996; Luintel and Kahn, 1999; Sinha and Macri, 2001), while sometimes pointing out unidirectional causality in the reverse direction (Ahmed and Ansari, 1998; Bell and Rousseau, 2001). The only work consistent with my empirical evidence is Chakraborty (2008), which focuses exclusively on the post-liberalization era (1996-2005). This author documents uni-directional causality from real growth to various financial variables, and concludes that

> "economic growth has caused financial development in India" (Chakraborty, 2008, page 134)[16] .

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directional Granger causality and confirm the stability of the 'demand-following' hypothesis. Turning to indirect effects, the analysis mildly supports Granger causality from financial variables to real capital formation, but strongly rejects the existence of a causal effect from investment to economic growth. On the whole, these results confirm the absence of indirect effects from financial variables to economic growth occurring through real capital formation. The additional figures corresponding to these results are not included in the paper in order to save space. These figures are available from the author upon request.

[16] Chakraborty (2008) uses quarterly data for the Indian economy

The above discussion reveals that the empirical results are crucially affected by the inclusion of the liberalization period in the sample. The causal relationship from finance to growth tends in fact to vanish either if the analysis is limited to this specific period, or if this period is included in the sample. This suggests that the propulsive effects of financial liberalization on the real economy were hindered by some relevant structural imbalances characterizing the deregulation process.

The literature points out four main imbalances associated with financial liberalization:

1. persistence of financial repression;
2. significant financial constraints;
3. unbalanced financial development;
4. poor banking sector efficiency.

Pentecost and Moore (2006) use annual data for India (1951-1999) to test McKinnon (1973) 'complementarity hypothesis' between money and real capital. They provide strong support for the above hypothesis and, more importantly, document the absence of structural breaks in money demand and investment functions despite the financial deregulation process. The rejection of the standard assumption of substitutability between money and physical capital reveals that, even in more recent years, financial markets remained repressed and underdeveloped, inhibiting a more efficient allocation of resources and forcing firms to rely primarily on internal sources of finance.

Turning to the latter point, the existence of binding financial constraints is widely documented in the literature. Bhaduri (2005) analyzes a panel of Indian firms and documents a significant tightening up of their financial constraints in the initial years of the post reform period[17]. Further evidence in this direction is provided in Oura (2008), analyzing a large sample of firms from 1993 to 2006.

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ranging from 1996.3 to 2005.1. The empirical investigation relies on standard cointegration and Granger causality tests. The banking system development indicators considered are the ratio of private credit to GDP and the ratio of liquid liabilities to GDP.

[17] At a more disaggregated level, financial constraints are more intense for young and small firms. This is probably due to the fact that these segments of firms received a preferential treatment in the strictly regulated credit system preceding the liberalization (see Bhaduri, 2005, section 4).

Using an instrument for external funds demand introduced by Rajan and Zingales (1998), this paper shows that India's financial system is not allocating enough resources to the most finance-intensive firms, and that this generates a growth-hampering effect.

Another structural problem characterizing the liberalization process is the lack of a balanced banking sector development across Indian regions (see point 3 above). Using a disaggregated data set provided by the Reserve Bank of India, Kendall (2009) shows that although the liberalization generated a dramatic increase of financial depth in all districts, the relative distribution of financial depth among them was virtually unaffected during the 1990s. This negatively affected the growth process at the regional level, since districts at the lowest level of Net Domestic Product did not exhibit any significant tendency to catch up with higher income areas[18].

Finally, the disappointing performance of the banking sector in the post reform period created serious impediments in the efficient provision of funds for real growth (see point 4 above). Das and Gosh (2006) analyze a large sample of Indian banks during the years 1992 to 2002 and find a decrease in average technical efficiency of about 9% according to the intermediation approach[19]. On the whole, this paper documents the existence of sizable scale inefficiencies among Indian banks. This poor efficiency record is confirmed in Rezvanian *et al*. (2008) for a smaller sample of Indian banks over the period 1998 to 2003. While reiterating the existence of sub-optimal scale problems, this paper points out that foreign banks are significantly more efficient whereas domestic banks (and particularly public banks) are lagging behind.

The structural imbalances outlined above impinged negatively on real growth at a macroeconomic level (financial repression, low banking sector efficiency), at a regional level (unbalanced financial development), and at a more disaggregated level (binding financial constraints on specific segments of firms). The joint effect of these

[18] Formal econometric analysis through district-level growth regressions shows that moving from the 25th to the 75th percentile of financial depth intensity implies an average gain of 4% growth over the 1990's (see Kendall, 2009, section 3.5). This result documents that the costs associated with the absence of a more geographically diffuse banking sector development across regions have been quite large.

[19] See Das-Gosh (2006), table 4, page 204. Very similar results are obtained under the value-added approach, whereas average technical efficiency turns out to be nearly stagnating under the operating approach.

imbalances has been to remove the link from finance to growth during the post-liberalization period. This explains the results obtained in Chakraborty (2008), as opposed to earlier empirical research not including the decade of the 1990's. Additionally, this can explain the findings of the present paper, taking into account both the intensity of the negative effects on real growth, and the length of the liberalization period with respect to our total sample.

Building upon these remarks, I now turn to the policy implications of this research.

The above discussion suggests that most policy measures should focus on the need to strengthen the ongoing liberalization process. An essential feature of financial deregulation has been a gradualist approach, in line with India's democratic and pluralistic tradition, and this explains to a large extent the persistence of structural imbalances. However, only a progressive elimination of these problems can lead to a more diversified and efficient financial system, exerting a significant impact on economic growth.

Further progress towards a fully market-based financial system can be obtained through various policy actions, operating both at the macroeconomic level (reduction in the funds preempted by the government from the banking system, further interest rates liberalization) and at the microeconomic level (measures aimed at directly infusing a greater competition in the banking sector).

In the pre-liberalization phase, a large amount of credit was channeled to the government through high cash reserve requirements (CRR) and statutory liquidity requirements (SLR)[20]. Since the beginning of the reform process, the Reserve Bank of India has progressively lowered the CRR from 15% to 4.5% (the legal minimum is currently 3%), and the SLR from 38.5% to 25% (its current legal minimum level).

The persistence of huge financial distortions, however, calls for further reductions in the funds preempted by the government from the banking system. A sensible policy could therefore envisage a reduction in the CRR statutory minimum level from 3% to 2%, and a parallel reduction in the SLR minimum level from 25% to about

[20] For instance, at the start of the reform period, commercial banks were compelled to hold more than 50% of increases in their deposits in cash reserves and public debt instruments: 15% as cash reserve ratio (CRR), and 38.5% as statutory liquidity ratio (SLR) to be invested in government securities. See Das and Gosh (2006), section 3.

15-20%, with the aim of promoting a gradual convergence of current reserve requirements towards these lower floors.

This policy is motivated by the persistence of financial repression and of financial constraints for Indian firms (see points 1 and 2 above). A further motivation is related to additional evidence pointing out that a high retention of resources by the state plays a relevant role in determining a high cost of outside financing. As discussed in Aziz (2008), notwithstanding recent reforms the cost of capital in India is still notably higher than in a standard growth model without any frictions. Simulation exercises show that a lower cost of capital would increase the Investment/GDP ratio by 5 percentage points over the medium term, with a 1-2 percentage points of higher growth rate[21].

Another important macroeconomic measure is the completion of the process of interest rates deregulation. The pre-reform period was characterized by high borrowing facilities for the government and some priority sectors, which distorted the role of interest rates as a resources allocation mechanism. Additionally, deposit rates were subject to ceilings which generated negative real rates, thus limiting the provision of credit to not protected sectors. During the 1990s, this administered regime was gradually dismantled, leaving market forces a greater freedom to determine interest rates variations.

Notwithstanding these developments, the current system is not yet fully liberalized. Important segments of the interest rates structure, such as the rate on saving deposits and that on export credits, are still controlled by the Reserve Bank of India[22].

The present situation offers therefore a clear scope for further

[21] This paper relies on a conventional one-sector growth model, properly modified to incorporate various market imperfections (see Aziz, 2008, section 3). The model includes an 'investment wedge', defined as the difference between the marginal rate of intertemporal substitution in consumption and the marginal product of capital. Notwithstanding the liberalization process, the computed 'investment wedge' for India (1980-2005) turns out to be consistently positive and this mainly reflects an excessive level of CRR and SLR rates. Simulations incorporating the effects of these reserve requirements are shown to match Indian data particularly well (see Aziz, 2008, sections 6-7). The key policy implication is that India needs further financial sector reforms in order to foster its medium term growth process.

[22] Further administrative restrictions include caps on the prime rate for small loans, and limits on the amount of foreign borrowing and deposits for nonresidents.

interest rates deregulation, involving both saving deposits and export credits. A fully liberalized interest rates structure would significantly improve resources allocation, lowering financial repression and allowing constrained firms an easier access to external sources of finance. Moreover, focusing on export credits, interest rates deregulation would generate pervasive effects on the economy, given the propulsive role of exports on Indian economic growth (see, among others, Love and Chandra, 2004 and Tronzano, 2010).

Turning to policy implications at a more disaggregated level, they are mainly related to the banking system, given its current modest efficiency performance (see point 4 above).

The initial post-reforms years witnessed a series of mergers and acquisitions in the banking sector. However, this process has been insufficient since one major problem of the Indian banking system is represented by large scale inefficiencies. The government should therefore encourage, through appropriate set of incentives, a consistent increase in mergers and acquisitions, in line with current trends in the global banking industry.

The previous discussion has pointed out that foreign and private domestic banks are more efficient according to various performance indicators. A second policy guideline is therefore represented by a support to the entry of foreign banks and to the creation of new private domestic banks, in line with similar measures implemented during the mid-1990's[23]. Recent research focusing on 'peer groups' of Indian banks suggests that the incentives for the creation of private banks deserve a particular attention. New private banks tend in fact to be more technically efficient because they are equipped with a more flexible and skilled workforce, and are therefore particularly well suited to implement sophisticated risk management techniques and operational innovations in banking practices (see Das and Gosh, 2006, section 6.2.5).

A third relevant policy guideline consists in accelerating the privatization process of state-owned banks. An initial step in this direction has been taken in 1994, when the Banking Regulation Act was modified allowing public sector banks to raise private equity up to 49% of paid-up capital. However, after more than one decade,

[23] Foreign banks started their operations in 1994-1995, when the Reserve Bank of India established more liberal rules for their entry. During the same period, the government relaxed the licensing system for the creation of new private banks.

although many public banks have diversified their ownership, the government remains still the largest shareholder. A consistent stimulus to the privatization process is essential because the Indian banking system is still largely dominated by public sector banks[24]. A higher share of private capital in state-owned banks would increase their productive efficiency, facilitating cost reductions, and the introduction of better organizational forms and of more sophisticated technologies and managerial skills[25].

I now turn to the last policy implication which is related to the need to promote a more homogeneous diffusion of the banking system. A disappointing feature of the recent liberalization is an unbalanced development of the banking sector, which prevented a catch-up process of lower-income districts (see point 3 above). This problem requires urgent policy action, given the large number of under-banked districts in India, and the recent sensible decline in rural lending (see Singh, 2010, tables 1-2). A proper policy intervention could rely on progressive fiscal incentives for banks opening new branches in more underdeveloped financial districts. Broadly speaking, these incentives could be inversely related to the degree of financial depth of each district, in order to progressively correct existing imbalances. Fiscal incentives along these lines are definitely more flexible than the licensing rules used in the past[26]. Moreover, they could successfully replace the state-led social banking program implemented during the nationalization era (1969-1990),

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[24] In 2006, public sector banks accounted for 72.3% of the total assets, 74.9% of the deposits, and 72.9% of the advances of all commercial banks (see Kumar and Gulati, 2009, section 1).

[25] Recent research on Indian banks documents a positive association between technical efficiency and the capital adequacy ratio, and a negative relationship between technical efficiency and the level of non-performing loans (see Das-Gosh, 2006, section 6.2). This implies that, besides the policy interventions to improve banking sector efficiency discussed in the main text, also a tightening of some micro-prudential measures could exert a positive influence (see Kumar and Gulati, 2009, section 3, for a survey of prudential norms introduced in India during the latest liberalization phase). In this perspective, a full adaptation to international standards of prudential norms related to capital adequacy, asset classification, identification of non-performing assets and provisions for bad debts, deserves a particular attention.

[26] In 1977, the Reserve Bank of India established a 1:4 licensing rule according to which, for every branch opened in an already banked location, commercial banks were compelled to open four new branches in unbanked locations. This rule was dismissed at the onset of the liberalization process.

which determined a significant expansion of rural branches and a parallel consistent reduction in rural poverty (Burgess *et al*., 2005).

Two final observations are in order. The policy measures described above focus exclusively on the banking sector since this empirical investigation does not consider other segments of India's financial system. Although the Indian banking system currently plays a major role in providing funds to the economy, bond and equity markets will become increasingly important in the near future. A discussion of these issues, however, is outside the scope of the present paper[27].

The latter observation concerns the interactions between finance and growth. The present section outlines various policy interventions which might restore the propulsive effect of the banking sector on economic growth documented in earlier research. On the other hand, the empirical findings obtained in this paper lend strong support to the 'demand-following' hypothesis. Therefore, conditional on the implementation of these policy guidelines, the resurgence of a 'virtuous cycle' between finance and growth represents a likely scenario for the Indian economy in the years to come.

5. Concluding remarks

This paper reassesses the empirical evidence on the finance-growth nexus for India using a large annual data set (1950-2006) and a wide array of financial development indicators. The contribution to the existing literature is threefold. First, I adopt a more robust econometric approach which does not require pre-testing for cointegration. Second, I implement bivariate and multivariate causality tests in order to overcome the omitted variables problem. Third, I check the stability of the results over time through a rolling regression technique.

Overall, differently from most recent research on India, this paper provides strong support to the 'demand-following' hypothesis and rejects bi-directional causality between finance and growth. These

[27] While stock market capitalization increased substantially in recent years, other segments of India's financial system are lagging behind. The corporate bond market, for instance, is still much less developed than in other emerging market economies due to low transparency and other fiscal, regulatory and financial problems (see Oura, 2008, sections 3 and 5).

findings are robust to different econometric frameworks, alternative financial development indicators, and various lag structures in the underlying VARs. Moreover, the absence of a causal effect from finance to growth is confirmed allowing for potential indirect effects operating either through real capital formation or through trade variables. These results, finally, display a substantial stability along the sample.

The final section of the paper provides a comprehensive evaluation of this empirical evidence and outlines some policy implications.

The main point made in this section is that a strengthening of the financial sector is important to foster India's future process of economic growth. The lack of empirical support for a causal effect from finance to growth appears in fact largely driven by many structural imbalances characterizing the recent financial liberalization period (and usually disregarded in earlier research not incorporating this period in the sample). These structural imbalances include the persistence of financial repression, a significant tightening up of financial constraints for specific segments of firms, an unbalanced banking sector development across Indian regions, and a poor banking sector efficiency.

Consistently with the above remarks, this paper suggests various policy interventions to consolidate the current financial liberalization process, both at the macroeconomic and at the microeconomic level.

At the macroeconomic level, I advocate a reduction in the funds preempted by the government from the banking system, as well as further interest rates liberalization. These measures would significantly reduce financial distortions, financial constraints for Indian firms, and the average cost of capital, with powerful effects on long-term economic growth.

At the microeconomic level, I focus on interventions aimed at achieving greater competition in the banking sector, such as incentives for mergers and acquisitions, support to the entry of foreign banks and to the creation of new private banks, and the acceleration of the privatization process of state-owned banks. Overall, these measures would significantly raise the efficiency performance of the banking sector, removing the scale inefficiencies which hampered real economic growth in recent years.

A final policy guideline is related to the need of promoting a more homogeneous diffusion of the banking system across Indian regions. In this regard, I argue that a system of progressive fiscal incentives is an efficient tool to tackle the problem of under-banked districts

in India, and that these incentives might significantly contribute to trigger a catch-up process of lower-income areas.

To sum up, since the beginning of the deregulation process in the early 1990's India's financial system has gone through a difficult transitional phase, where large structural imbalances have hindered the propulsive effects of financial variables on real growth. A strong case can thus be made to strengthen the liberalization process in various directions, in order to achieve a more efficient and fully market-based financial system.

As soon as new market opportunities are reaped, and the dominance of public sector intermediation is reduced, the financial sector should recover its significant influence on economic growth. Since the empirical evidence of this paper strongly supports the 'demand-following' hypothesis, a new 'virtuous cycle' between finance and growth represents a likely scenario for the Indian economy in the years to come.

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ABSTRACT

This paper reassesses the empirical evidence on the finance-growth nexus for India through a large annual data set (1950-2006) and contributes to the current literature in many respects. Differently from most previous research, the empirical evidence supports the 'demand-following' hypothesis, namely a unidirectional relationship from real growth to financial development. Since the absence of a causal effect in the reverse direction appears largely due to some recent structural imbalances in the Indian economy, the paper makes a strong case for strengthening the current financial liberalization process. Various policy measures in this direction are outlined, both at the macroeconomic and at the microeconomic level.

Keywords: Economic Growth, Financial Development, Causality Tests, India

JEL Classification: C32, E44, O53

RIASSUNTO

Finanza e crescita: un riesame dell'evidenza empirica nel caso dell'India

Questo articolo riesamina l'evidenza empirica sul nesso finanza-crescita nel caso dell'India usando un ampio campione di dati annuali (1950-2006), e contribuisce alla letteratura esistente sotto diversi profili. Diversamente dalla maggior parte degli studi empirici precedenti, l'analisi supporta la cosiddetta ipotesi di *demand-following*, cioè l'esistenza di una relazione di causalità unidirezionale dalla crescita reale allo sviluppo del settore finanziario. Poiché l'assenza di una relazione causale in senso inverso appare largamente imputabile ad alcuni recenti squilibri strutturali dell'economia indiana, l'articolo sottolinea l'importanza di rafforzare l'attuale processo di liberalizzazione del sistema finanziario. A questo proposito, vengono individuati vari possibili interventi di politica economica e finanziaria, sia a livello macroeconomico che a livello settoriale.