Services Reform and Manufacturing Performance: Evidence from India

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Conventional explanations for the post-1991 growth of India's manufacturing sector focus on goods trade liberalization and industrial de-licensing. We demonstrate the powerful contribution of a neglected factor: India's policy reforms in services. The link between these reforms and the productivity of manufacturing firms is examined using panel data for about 4,000 Indian firms for the period 1993-2005. We find that banking, telecommunications, insurance and transport reforms all had significant positive effects on the productivity of manufacturing firms. Services reforms benefited both foreign and locally-owned manufacturing firms, but the effects on foreign firms tended to be stronger. A one-standard-deviation increase in the aggregate index of services liberalization resulted in a productivity increase of 11.7 percent for domestic firms and 13.2 percent for foreign enterprises.

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I. Introduction

A vital element of India's rapid economic growth since the early 1990s has been the improved performance of its manufacturing sector. Output in manufacturing grew by 5.7 percent per year in the period 1993-2005 (Reserve Bank of India, 2008). Previous explanations for the revival of manufacturing emphasize trade liberalization, more permissive industrial licensing policies, and the limited labor market reforms undertaken since 1991 (see review below). In focusing primarily on proximate policies, however, previous analyses have ignored what we demonstrate is a critical factor, policy reforms in services sectors.

The neglect of services is surprising, first of all, because finance, transport and telecommunications are important inputs to manufacturing, so the potential for downstream effects is large.[1] Moreover, reforms in the 1990s, allowing greater foreign and domestic competition with significantly improved regulation, visibly transformed these services sectors.[2] Indian firms were no longer at the mercy of inefficient public monopolies, but could now source from a wide range of domestic and foreign private sector providers operating in an increasingly competitive environment. Evidence, presented in Section III below, suggests that firms obtained access to better, newer and more diverse business services.

In this paper, we address three questions: Has services reform led to an increase in manufacturing productivity? Have reforms in some services had a bigger impact than in others? Have some manufacturers (e.g. foreign firms based in India) benefitted more than others? These questions matter significantly for policy; not only is services reform in India incomplete, but across the world some of the most intransigent policy restrictions today are in services.[3] Convincing evidence that these restrictions

[1] These inputs affect *inter alia* a firm's ability to invest in new business opportunities and better production technology, to exploit economies of scale by concentrating production in fewer locations, to efficiently manage inventories, and to make coordinated decisions with their suppliers and consumers. Ethier (1982) provides theoretical support for this argument, showing that access to a greater variety of inputs results in higher productivity among downstream industries. Markusen (1989) argues that many producer services are both differentiated and knowledge-intensive. Knowledge intensity in turn suggests strong scale economies in that knowledge must be acquired at an initial learning cost, after which the knowledge-based services can be provided at a very low marginal cost. His theoretical results suggest the possibility of significant gains from liberalized trade in producer services. The importance of intermediate inputs for productivity growth has also been emphasized in the theoretical contributions of Grossman and Helpman (1991). Jones (2010) draws attention to how linkages between firms through intermediate inputs result in a multiplier similar to the one associated with capital in a neoclassical growth model. This multiplier is large because of a high share of intermediates in output and thus helps account for differences in incomes across countries.

[2] India implemented significant liberalization in both goods and services between 1991 and 2005. Major liberalization reforms began in 1991 as part of an IMF structural adjustment package, designed to combat balance of payments imbalances, and continued with the government's eighth four year plan from 1992-1996. As we discuss below, the pace of reform in services was gradual and sought to balance a variety of economic and political considerations.

[3] Even in industrial countries, the supposed strategic importance of some services has led to the persistence of restrictions. For example, witness the barriers to foreign participation in air and maritime transport as well as certain types of communication services in the United States, and the difficulty in completing the single market for services in the European Union.

penalize the politically cherished manufacturing sector could provide an important impetus to reform, even though improvements in services sectors alone could already contribute to faster GDP growth and would hence be reason enough to welcome services policy reform in the first place.[4]

Services reform may affect the performance of manufacturing sectors in at least four ways. First, new services may become available thanks to the entry of new and more sophisticated services providers. Examples include new financial instruments and cash flow management tools, multi-modal transport services, or digital value-added services in telecommunications. Availability of these services may in turn lead to productivity enhancing changes in manufacturing, such as receiving production orders on line or setting up on-line bidding systems for suppliers. Second, services reform may increase availability of services through, for instance, extending internet coverage to rural areas. The improved access may lead to enhanced performance of smaller or remotely located enterprises. Third, the reliability of existing services may improve as a result of reform. These improvements will in turn limit disruptions to production and reduce operating costs in downstream manufacturing sectors. Fourth, reducing market power in services may enhance innovation incentives in downstream manufacturing if prior to the reform, part of the innovation rent was appropriated by upstream service providers (as argued by Bourlès et al. 2013).

Exploring whether there is a systematic link between liberalization in services sectors and the performance of firms in downstream manufacturing industries requires three types of information: a measure of policy reform in services, a performance measure for manufacturing firms and information on the linkages between different sectors of the economy.

In preparation for this study, a large amount of information on the state and the history of services reform was gathered by local consultants employed by the World Bank in India. The information was then condensed into a composite time-varying policy index for each sector modeled after a similar index compiled by the European Bank for Reconstruction and Development for countries in Central and Eastern Europe and reported in their flagship publication *Transition Report 2004*. The index can take on values ranging from 0 to 5 and is available for four sectors: banking, telecoms, transport and insurance for the time period 1991-2004. Constructing the index is one of the contributions of this study, as it can be used in other research on the impact of Indian policy reforms.

[4] Services liberalization is likely to lead to output growth, as well as labor and productivity growth, in the services sector itself. Examining these effects lies, however, beyond the scope of this paper.

The performance of manufacturing firms is measured on the basis of total factor productivity estimates obtained from sector-specific production functions. To take into account the possible simultaneity bias between unobserved productivity shocks and input choices, we follow the procedure outlined by Ackerberg, Caves and Frazer (2006) which builds on the earlier work by Olley and Pakes (1996) and Levinsohn and Petrin (2003). Unlike the latter method, the approach we follow allows for more plausible assumptions about the timing of the firm's decision regarding input choices and optimization errors.

To examine the link between the performance of services users and services sector reforms, our analysis relates the productivity of manufacturing firms to the state of liberalization in services sectors weighted by the respective manufacturing sector's reliance on inputs from each services sector. The reliance of manufacturing sectors on services inputs is assessed based on the national input-output matrix. Our identifying assumption is that the effect of reforms in specific services sectors should be more pronounced in manufacturing sectors relying more heavily on those services inputs. The specification also controls for the level of import tariffs on output and inputs as well as for firm and year fixed effects.

The analysis is based on firm-level data from the *Capitaline* database, a commercially available database including balance sheets, profit and loss statements, and ownership information on large private and public firms operating in India. Firms included in the database account for 62 percent of India's manufacturing output during the period covered by the analysis. Our data set forms an unbalanced panel covering 3,771 firms or 22,558 firm-year observations during the 1993-2005 period.

Our results suggest that policy reforms in services sectors had a significant impact on firms in the manufacturing sector. The aggregate effect of services liberalization was an increase in productivity of 11.7 percent for domestic firms and 13.2 percent for foreign firms for a one-standard-deviation increase in the liberalization index. When the individual services sectors are examined in the same specification, a one-standard-deviation change in the banking sector index corresponds to a 6.5 percent change in productivity for both domestic and foreign firms. A one-standard-deviation change in the telecommunications liberalization index corresponds to a 7.2 percent increase in productivity for domestic firms and a 9.8 percent increase in productivity for foreign firms. A similar change in the transport index leads to a 19 percent improvement in productivity of all firms. Only foreign firms appear to benefit from the insurance reform, enjoying a productivity boost of 3.3 percent.

Our results are confirmed by an instrumental variable approach in which we instrument for reform in India using measures of services reform in two countries, Indonesia and China. Indonesia's services

commitments were made in the context of the Uruguay Round negotiations which led to the General Agreement on Trade in Services (GATS). These commitments reflected liberalization pressure from the industrial countries on developing countries with large markets and significant services protection – attributes Indonesia shares with India. Chinese services commitments were made during that country's accession to the WTO, and were a result of tough bilateral negotiations with the key WTO members, particularly the European Union and the United States. Since India sees China as a competitor, China's market-opening commitments are likely to have influenced Indian policy reform.

The findings are also robust to focusing on structural breaks in services reform instead of using the liberalization index and to employing alternative proxies for reform based on the extent of privatization and presence of FDI in services sectors. The results also hold when we exclude manufacturing industries supplying equipment to services sectors. Moreover, the results remain unchanged if we control for delicensing and lifting of restrictions on FDI inflows in a given manufacturing sector.

Services reform could be expected to have a first order effect on increasing output of the manufacturing sector. Essentially, reduced input costs or relaxation of critical infrastructure constraints should allow firms to expand (whether or not accompanied by TFP improvements). Therefore, our final exercise focuses on the relationship between services reform and manufacturing output. We find a positive and statistically significant relationship between manufacturing output and the overall index of reform, the banking sector reform measures and the telecom reform, though this last effect is less robust.

This paper proceeds as follows. Section two discusses the related literature. Section three describes services liberalization in India between 1990 and 2005 and presents some evidence on its impact. Section four describes the data and the construction of the liberalization index and reviews our estimation procedures, while section five interprets the results. Section six examines the link between services liberalization and output growth in manufacturing. Section seven concludes.

II. Related Literature

A review of the relevant literature reveals that: India's manufacturing revival has been attributed to almost everything except its services reforms; even research on other countries tends to attribute changes in manufacturing performance to goods trade liberalization and foreign direct investment; and, in the few instances where the role of services reform is considered, the focus has been limited to specific services like banking and infrastructure.

India's liberalization in the 1990s has made it a rich environment for research on the effects of policy reform on manufacturing performance. Considering the 1991 reforms as a single event, Krishna and Mitra (1998) find both price and productivity effects at the firm level. Khandelwal and Topalova (2011) examine reductions in trade protection in individual industries and find that procompetitive forces, resulting from lower tariffs on final goods, as well as access to better inputs, due to lower input tariffs, increased firm-level productivity, with the latter having a larger impact. Sivadasan (2009) considers the liberalization of both the trade and FDI regime in manufacturing and concludes that both increased firm-level productivity. In a descriptive analysis, Goldberg et al. (2009) show that trade reform spurred imports of previously unavailable products. New imported inputs often originated from more advanced countries and new imported varieties exhibited higher unit values relative to existing imports. Goldberg et al. (2010a) find that lower input tariffs accounted on average for 31 percent of the new products introduced by Indian firms, which suggests that an important consequence of the input tariff liberalization was to relax technological constraints through firms' access to new imported inputs that were unavailable prior to the liberalization.

Other key contributions have looked beyond policy in manufacturing *per se*, but focused primarily on institutional factors affecting the distribution of benefits from reforms and liberalization across industries and states. Besley and Burgess (2004) exploit variation in labor regulations across Indian states and find that labor market reforms were a significant determinant of manufacturing output per capita. Aghion, Burgess, Redding and Zilibotti (2008) show that the effects of liberalizing the system of central controls regulating entry and production activity were stronger in areas where organized labor was relatively weak, arguing that firms were better able to adapt to the new regime in regions where regulations were more pro-industry. Harrison et al. (2011) find that market-share reallocations played an important role in aggregate productivity gains immediately following the start of India's trade reforms in 1991. However, aggregate productivity gains during the overall 20-year period from 1985 to 2004 were driven largely by improvements in average productivity, which can be attributed to India's trade liberalization and FDI reforms. Goldberg et al. (2010b) investigate the impact of liberalization on Indian firms' product choice and find little evidence of "creative destruction" in the 1990s, i.e. Indian firms infrequently discontinued product lines even during a period of trade and structural reform. They argue that remnants of industrial licensing and rigid labor market regulation in the Indian economy prevented firms from adjusting fully to reforms.

The emphasis on attributing changes in manufacturing performance to changes in trade, investment and labor market policies in goods characterizes much of the existing empirical work on liberalization in developing countries. For instance, Pavcnik (2002) uses plant level data from Chile to find that trade liberalization forces exit of the least productive firms while increasing productivity of the remaining firms in the import competing sectors. Empirical research on liberalization of foreign direct investment has produced mixed results. Aitken and Harrison (1999) find what they term 'the market stealing effect' of foreign direct investment which swamps the positive effect of technology transfer on firm productivity in Venezuela. Javorcik (2004) explicitly distinguishes between intra- and inter-industry effects of foreign direct investment using firm level data from Lithuania and finds that foreign direct investment has a positive productivity effect on supplier industries but no significant effect on local competitors in the same industry. Javorcik and Li (2013) show that entry of foreign retail chains boosts the productivity of the supplying industries in Romania.

Downstream spillovers arising from policy reform and foreign participation in the services sectors are likely to be different from those arising from foreign direct investment in manufacturing industries. Disruption in the provision of services can result in large delays in production and product delivery, high information costs and an inability to invest in potentially profitable new activities. There has not, however, been much empirical analysis of the downstream effects of services reform. One exception is Banga and Goldar (2004), which undertake a simple growth-accounting exercise using Indian industry-level data and document a positive relationship between the use of services and output growth and productivity in manufacturing industries, which is consistent with the findings in this paper. Another one is Bourlès et al. (2013), which relies on industry-level data and finds that anticompetitive upstream regulations have significantly curbed productivity growth in OECD countries. Beyond these papers, the few existing studies have focused on specific services sectors, usually banking.[5] Rajan and Zingales (1998) show that financial development increases growth. They weight industries by dependence on outside financing (as estimated from US data) and find that firms which are more dependent on external financing gain more from financial development than other firms. Bertrand, Scholar and Thesmar (2004) demonstrate that banking deregulation in France in 1985 led to improved productivity in manufacturing firms. Entry and exit rates increased following liberalization, suggesting that less productive firms had been protected by the easy access to credit allocated to large firms by the previously nationalized banking sector. Productivity effects were particularly strong in banking-dependent sectors.

[5] There is some work on the economy-wide effects of services reform. Mattoo, Rathindran and Subramanian (2006) show that services liberalization leads to higher levels of economic growth. Eschenbach and Hoekman (2006) find similar evidence for Eastern Europe.

The present paper is most closely related to Arnold, Javorcik and Mattoo (2011) which uses firm-level data to show that increased foreign participation in services provision led to improvement in manufacturing productivity in the Czech Republic in the period 1998-2003. The current paper studies the more complex and dynamic Indian context with new data on and measures of services reform. Furthermore, while the previous paper considered the services sector as a whole, in the present paper, by separating the liberalization measures into measures for banking, telecommunications, transport and insurance services, we are able to identify the impact of key reforms in individual sectors. Finally, in contrast to the previous paper, we distinguish between the implications of services liberalization for domestic and foreign manufacturers.

III. Services Reform in India

After decades of state dominance, India's economic landscape was transformed with the liberalization of manufacturing in the late 1980s and early 1990s, and the liberalization of services during the 1990s and 2000s. This section describes the key reforms in individual services sectors, their determinants and their consequences. We first provide some evidence that the pattern and pace of services reform reflected sector-specific political forces that were to an extent exogenous to the developments in the downstream manufacturing sector. We then show that the reforms had an impact on the performance of the services sectors.

The Genesis and Pattern of Reform in Services Sectors

In the 1980s, the services sectors in India were dominated by state enterprises, there were restrictions on entry by private domestic and foreign providers, and prices of services were largely fixed by the government (World Bank, 2004). The 1990s saw significant liberalization, with greater freedom of establishment to domestic and, in some cases, foreign providers, greater operational autonomy for providers, and greater reliance on market-based allocation mechanisms.

The pace of policy reform has, however, varied across sectors and been determined primarily by political considerations (Hoekman, Mattoo and Sapir, 2007). Sectors in which privatization and competition would mean restructuring and large scale lay-offs were slower to benefit from the reforms than those in which incumbents could remain profitable and employment would not decline even as foreign and local private competitors entered the market. Reforms were also slower to materialize where it

was feared that they could cause a reduction in access to services for poor or rural communities. Most political economy explanations for the pace and pattern of reforms, point to considerations in the services sectors themselves rather than in downstream industries.[6]

Services sectors in India can today be separated into three broad categories: significantly liberalized, moderately liberalized and closed. The *telecommunications sector* was operated solely by the central government prior to 1992, when the government began to issue select operating licenses to private providers. In 1994, cellular service began and the government announced the National Telecom Policy which improved the environment for private investment. In 2002, the government fully opened the long distance sector of the telecom industry to private competition and eliminated all restrictions on the number of service providers, except in areas where limits are dictated by the availability of spectrum. Foreign ownership limitations were also significantly relaxed and now range from 74 percent to 100 percent across different segments.

To those accustomed to the glacial pace of reform in India, the telecommunications experience seems highly unusual. Discussions with policy-makers suggest that technology trumped all other considerations in this sector and India sought to exploit new technological possibilities by rapidly introducing competition.[7] Public sector incumbents reincarnated as more or less successful participants with a stake in a competitive and rapidly growing market. The number of telephone subscribers has increased rapidly, with most of the increases taking place in private sector companies (OECD, 2011). The expansion in scale dwarfed any adverse effects of diminished labor intensity–employment grew by as much as a third in the six years following the first significant liberalization in 1994. It also became evident that better access to services could be achieved than what had been possible with public monopoly, attenuating concerns regarding distributional equity and weakness of regulatory capacity.

In the moderately liberalized sectors, Indian firms may remain disadvantaged by the legacies of past policies and hence ill-equipped to compete. The best example is the banking sector where nationalization in 1969 of the largest private sector banks led to a sector dominated by public sector banks

[6] Chari and Gupta (2008) provide evidence that the delicensing reforms in India in 1991 categorized certain more concentrated and less competitive industries as strategic and shielded them from foreign competition by maintaining barriers to foreign direct investment. They find that profitable state-owned enterprises were likely to be protected, particularly in capital-intensive industries. Lobbying power by state banks and other services companies in India is likely to have been a factor in delaying liberalization of the services sectors into the mid-1990s and in excluding them from the general goods liberalization during the rapid trade reforms which took place in 1991.

[7] The authors discussed the reform experience with B.K. Zutshi, the first Chairman of the Telecom Regulatory Authority of India (TRAI), and H.V. Singh, the Secretary and Director of Economy Policy at the TRAI in December 2006.

committed to directing credit to areas identified by the government as priorities.[8] Directed lending and interest rate regulations prescribed the credit portfolios which banks were required to hold, putting into question the long term solvency of many banks (Reddy, 2005). Banks were also required to hold large percentages of their portfolios in government securities bought at concessional interest rates. In 1977, the government began requiring any bank that wanted to open a branch in an area which already had a bank branch to open four branches in (rural) areas with no financial services (Burgess and Pande, 2005). The effect was to generate excessive staffing levels, unprofitable rural branches and large levels of non-performing loans. The close relationship existing between the banks, the government and central bank created the potential for moral hazard as banks expected government intervention in the event of a failure (Reddy, 2002).

Liberalization of the *banking sector* was handled by the Reserve Bank of India with a focus on maintaining the viability of existing banks while increasing competition and efficiency in the sector (Reddy, 2005). In 1994, liberalization began with increased approval of private sector banks. In 2001, the government began deregulation of the interest rate, and in 2002, foreign participation in the banking sector was allowed up to 49 percent in private banks. There was also an increase in the approval rate for the entry of new private banks. At the same time, India has made banking sector liberalization conditional on improving the competitiveness of public sector banks through measures such as mergers, voluntary worker retirement schemes, and the creation of asset management companies to deal with non-performing assets. A 2004 rule allowed foreign banks to acquire up to a 74 percent stake in branches listed by the Reserve Bank of India as having weak portfolios; foreign institutions are allowed only a 20 percent stake in branches which are performing well. Foreign banks may now operate through licensed branches and as fully owned subsidiaries, but a few key restrictions remain in the banking sector. There is a cap on the number of licenses for branches at 20 per year for both new and existing banks, and the share of foreign bank assets in total banking assets may not exceed 15 percent. Despite these limitations in the pace of reforms, banking concentration has decreased visibly and the market share of new banks has increased to around 25 percent (OECD, 2011).

The *insurance sector* has been liberalized more slowly than the other sectors. Prior to liberalization, the insurance sector was controlled by the Ministry of Finance through publicly owned companies. In 1999, the Insurance Regulatory Development Authority bill was passed which allowed

[8] The Bank Company Acquisition Act of 1969, quoted in Burgess and Pande (2003), explicitly recognizes the goal of expanding credit to priority sectors through government expansion of the banking system.

private sector companies to enter the insurance market. Foreign equity participation in the insurance sector is restricted to 26 percent and foreign firms are allowed entry only through partnerships or joint ventures. The funds of policyholders must be retained within the country and there is compulsory exposure to the rural and social sector, including crop insurance. Entry into the insurance market by private sector providers finally began in 2002 when twelve private sector insurers entered the market.

All subsectors of *transport services* were operated primarily by public sector companies prior to liberalization. Air transport was run by two publicly owned carriers, states controlled the ports for maritime industries, and a large segment of the shipping sector was heavily regulated and dominated by publicly owned companies. In 1997, foreign direct investment up to 40 percent was allowed in airlines, 74 percent foreign direct investment was allowed in port construction, and private sector companies were allowed to contract for infrastructure maintenance and construction. In air transport, for example, the remarkable increases in passenger traffic can be attributed almost entirely to private entrants (OECD, 2011). Yet transportation sectors remain subject to state level regulations which vary significantly across states, with trucking particularly susceptible to local political pressures.

Professional services including accounting, legal, and other services sectors such as *retail distribution, postal* and *rail transport* services are formally closed to foreign participation.[9] FDI is not allowed in the accounting and legal sectors. Within distribution services, FDI is not allowed in the retail segment but there are no limits in other areas, except the requirement of approval for commission agents, franchising services and wholesale trade. The closed sectors are characterized by domestic firms that are sub-optimal in size and handicapped by an inhibiting and weak regulatory environment. Many Indian services in closed sectors are highly fragmented by international standards.[10] Here adjustment and employment concerns are the dominant factor impeding liberalization.

A more detailed survey of the liberalization reforms is provided in on-line Appendix A (attached at the end of the manuscript).

The Impact of Reform

[9] As an exception to this general rule, single-brand retailers are allowed.

[10] For example, there are 100,000 chartered accountants in India and 43,000 audit firms, with an average of two chartered accountants per firm as compared to an average of between 350 and 1500 chartered accountants in the typical affiliates of the "big four" accounting firms. In retail distribution, the penetration of supermarkets in India is only 2 percent compared to 55 percent in Malaysia and 36 percent in Brazil (World Bank, 2004).

The elimination of barriers to entry in services coincided with dramatic changes both at foreign and domestic providers (Gordon and Gupta, 2004). FDI inflows into services following liberalization by far exceeded those into other sectors. Ten percent of FDI inflows during 1990-2005 went into the transport sector, 9.6 percent of the inflows were into the telecommunications sector, and 9.6 percent of the inflows were into the financial and other services sector (Ministry of Commerce and Industry, 2008). At the same time, the services sector grew by an average of 11 percent per year, with the more liberalized sectors generally growing at relatively faster rates (Chart 1, and Eichengreen and Gupta, 2010). The share of services in overall value added rose from 39 percent in 1993 to 50 percent in 2004 (National Accounts Statistics, 2005, constant 1993 Rs).

Growth has been particularly strong in the services sectors on which we focus in this paper: communication services displayed average annual growth rates of 13.6 percent in the 1990s, while banking grew by 12.7 percent on average, transport grew at an average rate of 6.9 percent and insurance grew at a rate of 6.7 percent (Gordon and Gupta, 2004). Output per worker in the services sectors in India has increased by over 7.5 percent per year during the 1990s, clearly outpacing the agricultural or industrial sectors (Bosworth and Collins, 2008, p.56). Other evidence suggests that strong total factor productivity growth was at the root of this remarkable performance, not capital deepening or higher markups (Bosworth, Collins, Virmani, 2006; Gordon and Gupta, 2004). Indeed, services prices decreased relative to manufacturing prices, as indicated by a slower pace of growth in the services deflator than the overall GDP deflator.

The reforms are likely to be responsible for striking improvements in sectoral performance. In 1990, the average turn-around time for a container at major ports in India was 8 days, and at major Mumbai ports the average was 11. This meant that manufacturing companies exporting their products or importing inputs had to factor in more than a week of transit time for their goods, which increased the cash outlays necessary for exporting and importing. By 2005, the average turn-around time at major ports in India had decreased to 3.5 days, with 4.5 days as the average time at Mumbai ports (see Charts 2 and 3).

In the 1980s, air transport providers and several of the largest shipping companies were publicly-owned companies. After liberalization, increasing competition from foreign companies put pressure on Indian carriers to improve their performance. They responded positively, and operating efficiency increased. In fact, operating revenue per employee in Indian Airlines increased over 5 times over the period 1990-2004 from 0.5 million per employee to 2.5 million per employee. The increased efficiency is likely to have led to continued growth of India carriers in the period 1990-2005, of nearly 15 percent

yearly in passenger traffic and 11 percent yearly in cargo traffic (Directorate General of Civil Aviation, 2006).

These improvements seem to have benefitted manufacturing firms as they allowed them to get their products to markets more efficiently: while 60 percent of manufacturing firms viewed transport as an obstacle to business operations in 2002, this figure declined to 35 percent in 2006 (see Table 1).[11] Better functioning transport services are likely to have improved the ability of Indian firms to compete in highly variable markets such as textiles and electronics in which the ability to respond quickly to changes in demand is crucial.

Banerjee and Duflo (2004) find that prior to liberalization even at the most efficient public sector banks, bank loan approvals in 64 percent of cases were mechanically made for the same loan amount as prior loans. The rationing of credit by the public sector reduced the ability of companies to respond to new business opportunities and finance improvements in products or production processes. Because liberalization allowed banks to set interest rates at their risk-adjusted cost of capital and choose diversified loan portfolios, by 2005 the level of investment by banks increased to 4.75 times the size of investment in 1994. The share of investment by foreign and private banks also increased during the period from 11 percent in 1994 to 24 percent in 2005. Despite the slow pace of reforms, credit provision and investment have increased across the sector, led by foreign and locally-owned private banks (Reserve Bank of India, 2008).

As illustrated in Table 1, manufacturing firms in India saw an improvement in their access to finance and cost of financing as a result of the banking sector liberalization. While 61 percent of Indian firms reported that access to finance was an obstacle to their business in 2002, only 41 did so in 2006. For the cost of financing, the corresponding figures were 68 and 45 percent, respectively.

Before the beginning of the reforms in telecommunications, the sector was controlled by MTNL, a publicly owned company which provided local telephone service, and VSNL, a publicly owned company which provided long distance service. Both companies were plagued by frequent service interruptions, which averaged 19 faults per 100 stations per month in 1991. In addition, service was poorly distributed and access to new lines was difficult.[12] Businesses were severely handicapped in their ability to communicate with their customers and suppliers and to coordinate activity across plants. Liberalization

[11] World Bank Investment Climate Surveys, India 2002 and 2006. For more details see notes to Table 1.

[12] The communications minister in the 1980s, C.M. Stephens declared in parliament that telephones were a luxury, not a right, and that anyone unsatisfied with their service was welcome to return their phone as there was an eight year waiting list of people seeking telephone service (Panagariya, 2008 p.372).

appears to have interacted powerfully with technological change to transform the telecommunications market. By 2005, the number of faults had declined to 7.5 percent and the waiting lists for telephone services had virtually disappeared in urban areas (Charts 4 and 5). Even rural customers, projected by critics of the liberalization reforms to lose from the privatization, saw increases in access to phone lines. Access to internet services, provided initially only by MTNL, increased quickly when private providers were allowed to enter the market (Chart 6).

Improvements in the telecom services, following the opening of the sector to private investment, were reflected in the results of the World Bank survey: in 2002 41 percent of manufacturing firms felt that telecoms availability was an obstacle to business operations, in 2006 only 23 percent were not satisfied with telecom services (see Table 1). The ease of receiving telephone service also increased precipitously as the median respondent's wait for a mainline phone connection decreased from 30 days to 4 days.

Until 2002, private sector competition in the insurance market was proscribed, severely limiting the range of insurance services on offer. Market penetration of insurance quickly increased following the entry of private and foreign insurers. After decades of public monopoly, premiums were equal to only 1.9 percent of GDP in 1999-2000, but they jumped to 2.86 percent of GDP by 2002-2003 (Insurance Regulatory and Development Authority, 2004). Government projections at the time of liberalization suggested that market participation by foreign firms in 2005 would reach only five percent of the market, but by November 2005, private firms with foreign shareholding had acquired a 34 percent market share. This corresponded to limited contraction by Indian public sector incumbents (Department of Public Enterprises, 2003).[13]

In sum, liberalization was associated with a metamorphosis of services in India from a narrow range of products of sub-standard quality and poor distribution, to the current environment in which service providers are highly competitive and offer their consumers, including manufacturing firms, a wide range of new and high quality services products.

IV. Empirical Strategy

[13] National Insurance Company Limited, Calcutta, New India Assurance Company Limited, Mumbai, and United India Insurance Company Limited Chennai each cut their staffs by 10 percent, while Oriental Insurance Company Limited, New Delhi cut its staff by 14 percent (India Knowledge @ Wharton, 2006).

In this paper, we investigate whether there is a systematic link between liberalization in services sectors and the performance of firms in downstream manufacturing industries. This exercise requires three pieces of information: a measure of policy reform in services, a performance measure for manufacturing firms and information on the linkages between different sectors of the economy.

Measuring services reform

In order to make the detailed information on services sector reforms in India which was gathered for this study amenable to quantitative analysis, we condense the information into a composite policy index for each sector. In doing so, we have been guided by a similar index compiled by the European Bank for Reconstruction and Development for countries in Central and Eastern Europe and reported in the flagship publication *Transition Report 2004*. This approach starts from a general template of reforms necessary to achieve a desirable policy environment, which is then adapted to the specific situation of each sector.

For each services sector *k*, the time-varying services liberalization index $reform_{kt}$ ranges from 0 to a maximum score of 5. An index value of 0 corresponds to a situation where the public sector is either the only relevant provider of services or has a strong grip on private providers, and there is extremely limited scope for the market mechanism. Note that all Indian services sectors treated here fall into this highly restrictive category before the beginning of economic reforms in the early 1990s. A level of 1 indicates at least some scope for private sector participation and some liberalization of operational decisions, combined with some very limited scope for foreign participation (limited, for example, by low FDI ceilings). To qualify for an index value of 2, there must be only a limited degree of interference with operational decisions by public authorities, substantial price liberalization, and clear scope for foreign participation even if only in narrowly defined segments and as minority shareholders. Still, the state may remain a dominant actor in the sector. An index of 3 implies significant scope for private providers, including foreign ones, clear competitive pressure on the public incumbents from new entrants, and explicit possibilities for foreign equity participation. A level of 4 is equivalent to little public intervention and the freedom of operation of private providers, the possibility of majority foreign ownership, and the dominance of private sector entities. Finally, a level of 5 (not attained in any of the sectors considered here) would reflect an equal treatment of foreign and domestic providers, a full convergence of regulation with international standards and unrestricted entry into the sector. The details of how the index was

constructed are presented in on-line Appendix B (attached at the end of the manuscript). The index is available for four sectors: banking, telecoms, transport and insurance for the time period 1991-2004.

Linkages between manufacturing industries and services sectors

The next question in our analysis is how to aggregate these sector-specific indices into a single index of services reform. Given that some services are likely to be more important for manufacturing industries than others, and that this dependence may vary across different manufacturing industries, an unweighted average of services sector indices is unlikely to be an appropriate measure of the potential impact of upstream services liberalization on the performance of manufacturing firms. Instead, we use information on the intensity with which services inputs are used in the production of a given manufacturing sector. In particular, we weight each of the reform indices for the four major services sectors (banking, telecom, transport and insurance) by the proportion α_{jk} of inputs sourced by the manufacturing sector *j* from the services sector *k* to create the index of services reform:

$$Services\_Index_{jt} = \sum_{k} \alpha_{jk} reform_{kt} \qquad (1)$$

where α_{jk} is based on the input-output matrix pertaining to 1993, the first year of our sample.[14] Data from a national input-output matrix contain information about the average inter-industry sourcing behavior of firms in a given sector of the economy. For an individual firm, the actual reliance on a given services sector may be somewhat different, but even if such information were available at the level of each individual firm (which it is not), such data would risk being endogenous to the performance of the firm, which would defeat our purpose. By using average information, we lose some precision in measuring the reliance of firms on services inputs, but we can be less concerned about the endogeneity of this measure.

[14] The input-output matrix includes 66 manufacturing sectors and 16 services sectors. The manufacturing sectors were aggregated to 38 sectors at which sector-specific price deflators were available. The services sectors include: construction, electricity, gas, water supply, railway transport services, other transport services, storage and warehousing, communication, trade, hotels and restaurants, banking, insurance, ownership of dwellings, education and research, medical and health, other services. Input shares are calculated relative to the total value of inputs sourced. Banking services constitute on average 5% of all inputs, transport 4.4%, telecommunications 1.6% and insurance 1.4%. An alternative normalization, by gross output, leads to the same conclusions.

The fact that we use sourcing information from the 1993 input-output matrix should further minimize the scope for endogeneity even at the level of the average firm in an industry.[15,16]

In our analysis, we will also distinguish between the effects of reform in individual services sectors. To do so, we will construct indices capturing the reform in a particular services sector. For instance, we will define

$$Banking\_Index_{jt} = \alpha_{j,banking} reform_{banking,t} \quad (2)$$

where $\alpha_{j,banking}$ reflects the proportion of inputs sourced by the manufacturing sector *j* from the banking sector, according to the input-output matrix, and $reform_{banking,t}$ is the state of reform in the banking industry at time *t.* We will follow the same approach to construct indices for telecom, insurance and transport sectors.

For the banking sector, an alternative measure of financial dependence will help us to test the robustness of the main measure. This alternative is based on Rajan and Zingales (1998), who compute sector averages of financial dependence based on US data and argue that this is a suitable measure for firms' technologically induced demand for external finance in an environment with well developed financial markets. The measure is based on a comparison between firms' investment outlays and own cash flow.

Measuring the performance of manufacturing firms

Our goal is to provide a more complete explanation of the remarkable improvement in the performance of the Indian manufacturing sector following the post-1991 economic reforms. We use firm-level data from the *Capitaline* database, a commercially available database including balance sheets, profit and loss statements, and ownership information on large private and public firms operating in India to measure the performance of manufacturing firms.[17] The database covers sixty-two percent of India's

[15] Putting potential endogeneity concerns aside, we also experimented with defining weights based on firm-specific use of telecommunications and transport services. Doing so does not alter the conclusions of the paper. We are unable to identify in the data expenditure on banking and insurance services.

[16] Our index varies across manufacturing sectors and years. 29 percent of the variation is due to variation over industries, while 45 percent is due to variation over time. Thus together industry fixed effect and year fixed effects explain almost three-quarters of the variation in the index.

[17] Several firm-level studies of Indian manufacturing use the *Prowess* database produced by the Centre for Monitoring the Indian Economy (CMIE). We use the *Capitaline* database because *Prowess* does not contain complete information on foreign equity ownership of firms. Both databases use as their source balance sheet-based financial data drawn from firms' annual

manufacturing output during the period considered by the analysis, and includes 11,939 firms, of which 5,236 operate in the manufacturing sector. The data set forms an unbalanced panel due to firm entry and exit covering the period 1993-2005. Firms' industry affiliations follow India's National Industry Classification (NIC) which encompasses the manufacturing sectors. After cleaning the data and discarding firms not reporting information on output or production inputs, we are left with 3,771 firms or 22,558 firm-year observations. 2,224 firms are observed in the data for at least 5 years, while 1,124 are observed for 9 years or longer.

A consistent measurement of firm performance is crucial to our analysis. We use the total factor productivity (TFP) as our outcome of interest. To control for a possible simultaneity bias arising from the endogeneity of a firm's input selection, which will exist if a firm responds to productivity shocks unobservable to the econometrician by adjusting its variable input choices, we follow the method proposed by Ackerberg, Caves and Frazer (2006). Ackerberg et al. build on the widely used estimation procedures proposed by Olley and Pakes (1996) and Levinsohn and Petrin (2003). Unlike the latter method, their approach allows for more plausible assumptions about the timing of the firm's decision regarding input choices and optimization errors.

We use the Ackerberg et al. method to estimate sector-specific production functions and obtain the TFP as the residual from this estimation.[18] We group some smaller industries together in order to facilitate the estimation.[19] Following the advice of Ackerberg et al., we use value added as the dependent variable in the production function. Value added is defined as the sales of firm *i* in year *t* less the value of material, services and energy inputs. All components of value added are expressed in real terms. Capital and labor inputs (expressed in real terms) are included as independent variables. Material and services inputs (in real terms) are used to proxy for the productivity shocks.

Nominal output is deflated by a set of wholesale price indices disaggregated at the 2-digit level, while capital inputs are calculated from detailed data on net values of land, buildings, machinery and computers, all deflated by the relevant sector deflators. In the absence of data on the number of workers employed, the labor input is calculated by normalizing the wage bill of each firm by the average wage

reports and reports filed with regulatory agencies (see e.g. Contractor et al., 2007). For unlisted firms, *Capitaline* also relies on own research of the data base provider.

[18] We are grateful to Carolina Villegas-Sanchez for sharing with us a STATA routine implementing the procedure.

[19] The industry groupings are: food and tobacco; textiles; garments and leather goods; wood, paper and printing; petroleum products and chemicals; rubber and plastics; non-metallic minerals, iron and steel; metal products; machinery, office, electrical and communication equipment; lifting, medical and industrial equipment; motor vehicles and other transport equipment.

prevailing in a given 2-digit sector in a given year.[20] Materials are deflated by input-output coefficient weighted sector deflators based on the wholesale price index. Energy inputs are deflated using National Accounts Statistics price indices for "Fuel, Power, Light and Lubricants." Services inputs are aggregated from detailed data on reported expenses on travel, transport, legal services and accounting, and non-interest banking expenses. These items are deflated using a weighted average of services sector deflators from the national accounts statistics. Given that our interest is in upstream services reform, a proper accounting for services inputs at the firm level is essential to control for changes in the intensity with which firms use services in their production, in response to increased product offerings in the service sectors. Summary statistics for all the variables are presented in Table 2.

To establish whether there exists a link between the performance of manufacturing firms and liberalization of upstream services sectors, we regress the TFP of a manufacturing firm *i* operating in industry *j* at time *t* on the aggregated $Services\_Index_{jt-1}$ lagged one period or disaggregated indices of services reform.[21] We control for foreign ownership, trade liberalization, firm fixed effects and year fixed effects. Our principal estimation equation has the following form:

$$\ln TFP_{ijt} = \gamma_1 Services\_Index_{jt-1} + \gamma_2 Tariff_{jt-1} + \gamma_3 Input\ tariff_{jt-1} + \gamma_4 Foreign_{it} + \alpha_i + \alpha_t + \varepsilon_{it} \quad (3)$$

Services sectors were not the only item on the post-1991 reform agenda in India. Continued reductions in manufactured product tariff rates occurring during the same period may also have influenced manufacturing productivity. To control for changes in tariff rates, we include lagged output tariffs in the same manufacturing sector ($Tariff_{jt-1}$) and a weighted measure of input tariffs ($Input\ tariff_{jt-1}$). The weights of the input tariffs are taken from the 1993 input-output matrix, while the aggregation of individual tariff lines to the 2-digit sector level is achieved using the 1990 import weights. The information on tariffs was obtained from the World Bank's WITS database.[22]

[20] Measuring labor input on the basis of wages implies that differences in the quality of labor are accounted for as long as wage differences reflect such quality differences. At the same time, if part of the productivity gains are appropriated by workers through higher wages, then measured TFP would be biased downward. We are grateful to an anonymous referee for pointing this out to us.

[21] As this specification does not take into account potential responses that materialize with longer lags, the productivity effects could in principle be underestimated. At the same time, the break regressions reported as a robustness check later in the paper allow for a more general timing of the productivity response to services reform.

[22] The authors are grateful to Rajesh Mehta for providing tariff data for the years in which the figures were missing from WITS.

As many studies find that foreign affiliates tend to outperform domestic producers (see for instance, Aitken and Harrison, 1999; Arnold and Javorcik, 2009), we include an indicator for foreign-owned firms, equal to one if the foreign ownership share in firm *i* is above 10% at time *t* ($Foreign_{it}$). In an expanded specification, we will allow for differential effects of services reform on domestic and foreign firms by interacting $Foreign_{it}$ with the $Services\_Index_{jt-1.}$

The dependent variable is firm-specific, but our variables of interest vary at the sector-year level, therefore, we cluster standard errors at the sector-year level.[23]

As a benchmark, we also use OLS to estimate an augmented Cobb-Douglas production function. To make it comparable to the Ackerberg et al. procedure, we regress real firm value added (defined as above) on real labor and capital inputs as well as measures of services reform and other control variables:[24]

$$\ln VA_{ijt} = \beta_{1j} \ln K_{it} + \beta_{2j} \ln L_{it} + \beta_3 Services\_Index_{jt-1} + \beta_4 Tariff_{it-1} + \beta_5 Input\ tariff_{it-1} + \beta_6 Foreign_{it} + \alpha_i + \alpha_t + \nu_{it} \quad (4)$$

where VA_{ijt} stands for the value added of firm *i* observed in year *t* (and manufacturing industry *j*), K_{it} denotes capital, and L_{it} labor. Note that we allow the coefficients on capital and labor inputs to differ across 11 manufacturing sectors. As in specification (3), we include firm and year fixed effects and cluster standard errors at the sector-year level.

Our point estimates for the production function coefficients, presented in Table 3, have reasonable values. On average, the labor coefficient is 0.73 in the OLS and 0.75 in the Ackerberg et al. specification, and the capital coefficient is equal to 0.27 in both cases. In 9 of 11 industries, the coefficient on the capital input is higher in Ackerberg et al. procedure, which is what we would expect to observe under plausible assumptions (Olley and Pakes, 1996). The average returns to scale are very close to constant (1.00 and 1.01).

V. Results

Baseline specification

[23] Clustering at the firm-level instead would not change the conclusions of the paper. As expected, we found that it produces higher significance levels of the estimated coefficients.

[24] A specification with output on the left-hand side and industry-specific coefficients on material inputs, services inputs and energy leads to very similar results.

Our baseline regression results from estimating equation (4) are presented in Table 4. We find that the aggregate services index has a positive and highly significant coefficient estimate, suggesting a strong role for services liberalization in explaining manufacturing firm productivity in India. A one-standard-deviation change in the aggregate services index improves manufacturing productivity on average by 9.1 percent. The change in the index observed between 1993 and 2004 corresponds to improvement of 23 percent.

We also enter the individual service sector reform indices into the regression one by one. We find positive and statistically significant effects of banking, telecom and transport reforms. For banking, both our standard input-output weighted index and the Rajan-Zingales weighted measure yield similarly significant results. There is no evidence that liberalization of the insurance industry led to a better performance of manufacturing firms.

When we enter the individual sector indices simultaneously (column 7 of Table 4), the banking, the telecom and the transport index maintain their positive and significant coefficients. The results from this regression suggest that telecom and transport liberalization have the strongest effects on productivity. A one-standard-deviation increase in liberalization of the telecom industry yields a 8.8 percent increase in productivity, and a one-standard-deviation change in transport improves productivity by 14 percent. Banking reform has a 4.4 percent productivity effect, while the effect for the insurance sector is not significant at the conventional levels.[25]

Alternatively, we can focus on the magnitude of the effect corresponding to a one-unit change in the value of the liberalization index. For instance, allowing firms greater operational autonomy and enhancing scope of foreign participation (change in the index from one to two) leads to a productivity increase of 1.7 percent when the banking sector is reformed, 2.7 percent when the telecom sector is liberalized and 19 percent when the change pertains to the transport industry.

Over the period of our sample, we cannot identify a significant effect from changes in tariff rates on manufacturing productivity.[26] We also find that foreign affiliates tend to exhibit higher productivity

[25] If we consider the change in the index occurring during our sample period, the corresponding effects are 5.5 percent for banking, 8.6 for telecoms and 41.5 percent for transport.

[26] In a recent paper, Bollard, Klenow and Sharma (2010) also find that productivity growth in Indian manufacturing since the 1990s is not robustly related to tariff reductions. It is also possible that we do not find significant effects because most of the tariff cuts took place prior to the time covered by our sample. Note that allowing for a different coefficient prior to 1997 (the last year of the period studied by Khandelwal and Topalova 2011) did not produce any evidence of significant effects either.

than domestic firms which is consistent with the conclusions of the existing literature (Aitken and Harrison, 1999; Arnold and Javorcik, 2009).

In Table 5, we present the results with our preferred TFP measure estimated based on the Ackerberg et al. method. We first apply this method to estimate production functions for each of the 11 sectors separately, and then we regress the TFP obtained from these regressions on services and trade liberalization variables, the foreign affiliate dummy as well as firm and year fixed effects. Using the Ackerberg et al. measure leads to three changes in the results. First, the estimated coefficients become larger while maintaining their significance levels. Second, the insurance index, which did not reach conventional significance levels in Table 4, now appears to be statistically significant at the ten percent level in one specification. Third, the transport index now appears to be statistically significant in both specifications where individual measures of services reform enter jointly.

When the individual services sectors are examined together in the last column of Table 5, a one-standard-deviation change in the banking sector index corresponds to a 6.6 percent change in productivity. A one-standard-deviation change in the telecommunications liberalization index corresponds to a 8.4 percent increase in productivity. A similar change in the transport index leads to a 18.8 percent improvement in firm performance. No statistically significant effect is found for the insurance sector reform. As before, the coefficients on tariffs do not appear to be statistically significant.[27]

In additional regressions, not presented here to save space, we split firms into quartiles based on their sales in the first year of the data. We then estimated specifications from Table 5 for each quartile separately. When using the aggregate index, we found that firms in all quartiles benefitted from services reform, though the estimated effect was the smallest in magnitude for firms in the bottom quartile. The same pattern was obtained for the financial sector reform measured using both proxies. In contrast, telecommunications and insurance liberalization did not appear to have a statistically significant impact on firms in the bottom quartile, though it did benefit larger firms. Transport reform positively affected all quartiles except for the second one.

Alternative measures of services liberalization

Next we demonstrate that using measures of services reform other than our services index leads to the same conclusions. Our index captures both policy changes and their implementation. Our alternative

[27] In regressions, not reported to save space, we also show that our conclusions are robust to using a translog production function.

proxies focus on outcomes and are based on: the share of a services industry sales made by private/privatized providers and the share of a services industry sales made by foreign providers.[28] As in formula (1), these shares are then weighted by the relevant coefficient from the input-output table.[29] Privatization as well as opening sectors to new domestic and foreign entrants are important aspects of any services reform, and thus progress in this area is a suitable proxy for the success of the reform.

The results, presented in web Appendix C Table C1, are analogous to specifications from Table 5. To save space we present only variables of interest. The top panel shows the results for the privatization-based measure. In all four specifications, we find a positive and statistically significant link between the extent of private sector participation in a given services sector and the performance of downstream manufacturing. In the upper middle panel, we repeat the same exercise for the FDI-based measure. We find a positive and statistically significant coefficient for the overall measure, for banking and for transport, but not for telecommunications. In the next panel, we include both proxies in the same specification and find that only privatization-based measure is positive and statistically significant. This is not surprising given that the two measures are highly correlated (the correlation between the foreign ownership and private ownership indices for the combined services sectors within the regression sample is 0.826). The bottom panel presents the results for specifications including the services index as well as the two additional proxies. The services index is positive and statistically significant in the telecommunications and transport regressions, though not in the other two. Again, this is most likely due to the high correlation between the three variables. (the correlation between the foreign ownership index and our standard services index is 0.657, and the correlation between the private ownership index and our standard services index is 0.8442 for the general services category in the regression sample).

Do foreign firms benefit more from services liberalization?

Our finding of a significant productivity premium for foreign owned firms is common in the literature. But does ownership also affect the ability of firms to reap the benefits of upstream services reform? Liberalization allows entry of foreign services firms which may have stronger links with foreign-

[28] More specifically, these variables represent the share of sales in the banking, telecommunications, and transport sectors made by firms with more than 10 percent foreign (or private) ownership. The sales of firms with more than 10 percent foreign (or private) ownership are weighted by the percentage of foreign (private) ownership in the firm in a given year, and the sum of these weighted sales is then divided by the total sales in the sector in the year.

[29] We did not have equity ownership data or sales data for insurance firms, so the insurance variables are left out of this analysis. Therefore, the general services sector index is the sum of the banking, transport, and telecommunications sector index.

owned manufacturing firms and whose local presence could therefore provide greater benefits to foreign-owned manufacturing firms. Moreover, accustomed to doing business in environments with well-developed services sectors, foreign firms may derive larger benefits from improvements in services industries. In order to test this hypothesis, we estimate an expanded specification which includes interaction effects between the services index and the foreign ownership indicator.

The interaction between foreign ownership and services liberalization is positive and significant for the aggregate measure (see Table 6). This is also true in all cases when services indices enter one by one, confirming our intuition that the productivity effect of services liberalization is stronger for foreign owned firms. This increased effect for foreign owned firms is consistent across services sectors when tested individually, but is not significant for the banking and the transport sector when all services indices enter the same model. This may be because multinational firms are relatively well-equipped able to procure banking and transport services internationally, and are therefore less reliant on the respective domestic sectors.

The differential impact of liberalization on foreign firms is remarkably strong in the telecommunications sector. A standard deviation increase in the telecommunications index increases productivity by 7.2 percent for domestic firms while it increases productivity by 9.8 percent for foreign owned firms. Given the greater need for coordination across national borders, one may find this result intuitive. As for the insurance reform, only foreign firms seem to be able to appropriate its benefits and see a boost in productivity of 3.3 percent.

Controlling for other reforms

While many observers have considered decreasing tariff protection to be the key explanation behind the productivity enhancements of Indian firms, recent research suggests that a comprehensive approach may be warranted, encompassing also other policy changes taking place in India (Harrison et al., 2011). Against this background, we extend the set of controls in our baseline specification to include industry-specific measures of delicensing and FDI reform.[30] We do not take into account the labor market reform, most of which occurred before the first year of our sample 1993 (Ahsan and Pagés, 2009).

[30] According to Harrison et al, by the end of 1991, nearly 85% of industries had been delicensed, with the share increasing to over 90% of industries by the end of the 1990s. The FDI liberalization occurred somewhat more slowly, and only in 2000 all industries became eligible for automatic FDI approval, except those requiring an industrial license or meeting several other conditions.

To capture the effects of the delicensing reforms, we use information from Harrison et al. (2011), who extended the data used by Aghion et al. (2008) to 2004, on the basis of Press Notes from the Ministry of Commerce and Industry. The delicensing variable is a dummy that takes on a value of one if any products in a 3-digit industry have been delicensed, and zero otherwise. Similarly, the measure of FDI reform was compiled by Harrison et al. (2011) also based on Press Notes from the Ministry of Commerce and Industry. It takes on a value of one if any products in a 3-digit industry have been liberalized, and zero otherwise.[31]

In Table 7, we present the results from the modified specification. We find a positive correlation between delicensing and FDI reform and firm productivity. More importantly for the purposes of this paper, our results on services reform are barely affected by this change.[32]

Excluding manufacturing industries supplying services sectors

If services reform leads to expansion of services industries, it may increase the demand faced by manufacturing sectors supplying machinery and equipment to services providers. The increased demand may boost the productivity of manufacturing firms through the realization of scale economies, but this effect would work through a channel different from the one we intend to capture.

To address this issue, we exclude from our sample firms operating in manufacturing sectors that sell more than 5 percent of their output to the four services industries considered in our paper.[33] Doing so reduces our sample to 16,751 observations (see on-line Appendix C Table C2). Nevertheless, our conclusions are not affected by this change. We find a positive and statistically significant relationship between reforms in each services industry and the performance of downstream manufacturing firms. A similar relationship holds for the aggregate liberalization index.

Instrumenting the services liberalization index

In order to ensure that our finding of services reforms improving manufacturing performance is not driven by reverse causality, we instrument for reform in India using measures of services reform in two

[31] We are very grateful to Ann Harrison, Leslie Martin and Shanthi Nataraj for sharing the data with us. Industries have been converted from 3-digit NIC 87 industry codes to 4-digit NIC98 industry codes. Where direct correspondences were not found, averages were used at the 2-digit NIC98 level.

[32] Including these additional controls in all other specifications presented in the paper would not change its conclusions.

[33] We use the input output matrix to identify these sectors. They are: manufacture of petroleum products, manufacture of motor vehicles parts and accessories, manufacture of rubber products, paper products and printing, manufacture of office machinery, manufacturing of industrial equipment, manufacture of electronic components and receivers. textile manufacturing.,

countries, Indonesia and China. Indonesia's services commitments were made in the context of the services negotiations during the Uruguay Round which led to the General Agreement on Trade in Services (GATS). These commitments reflected liberalization pressure from the industrial countries on developing countries with large markets and significant services protection (Hoekman, 1996). Since India shares these attributes with Indonesia, and was subject to similar pressure, we can presume that there is an association between the pace (i.e., timing) of Indonesia's services commitments and India's services policies.[34] Chinese services commitments were made during that country's accession to the WTO, and were a result of tough bilateral negotiations with the key WTO members, particularly the European Union and the United States.[35] Since India sees China as a competitor, progress in China's market-opening commitments is likely to have influenced Indian policy reform. In other words, the pace of services reforms in these two countries is likely to be correlated with developments in India, and is thus likely to make for suitable instruments, as the test statistics of the first stage regressions confirm. Furthermore, since both Indonesia and China's commitments were primarily outcomes of industrial country pressure to open services markets (apart from domestic considerations), they were exogenous to changes in India's manufacturing productivity.

Accordingly, we measure services liberalization using the WTO commitments in a given sector. More specifically, we focus on the number of commitments made by a country expressed as a percentage of possible commitments. For the years prior to the first full year of the WTO membership of a given country (e.g. 2002 for China), the number of commitments equals zero. To create an instrument relevant to a particular manufacturing sector, the measure of services liberalization is multiplied by the proportion α_{jk} of inputs sourced by the manufacturing sector *j* from the services sector *k*, as with the services index in equation 1. In this way we create two instruments: (i) pertaining to China's commitments and (ii) pertaining to Indonesia's commitments. Each instrument varies by time, manufacturing industry and

[34] We could have used Indonesia's actual policies rather than its Uruguay Round commitments as instruments but we do not have information on the latter. In any case, in most countries, there was a fairly close relationship between relative commitments across sectors and actual policy (Hoekman, 1996).

[35] As a matter of fact, China's accession to the WTO was held up by the negotiations on services market opening (Mattoo, 2003). China was offering foreign firms access to its insurance sectors but wanted to limit foreign equity share to 50 percent. A US firm, AIG that already had wholly-owned subsidiaries in China, wanted their status to be grandfathered. This was opposed by the EU negotiators who wanted equal treatment for their firms. On October 1, 2001 the *Washington Post*, reported: "The interest of a single U.S. company, insurance giant AIG, was stopping a final agreement on China's WTO membership." China joined the organization on December 11, 2001. The close interplay in China's case between its accession commitments and actual policy reform implies that the two were even more closely related than in the case of other countries.

services sector. An alternative specification, using instead the commitments of all WTO members yielded similar results (available upon request).

The results from IV regressions are reported in Table 8. As expected, the first stage results indicate that Indian services reform responded to services liberalization in China and Indonesia. The F-statistics suggest that our instruments perform well. The Sargan test does not cast doubt on their validity with the exception of the specification focusing on the transport sector. The second stage confirms our earlier finding that services reforms have improved manufacturing performance. This gives us confidence that reverse causation is not driving our results.

Break regressions

While the construction of our services liberalization index was undertaken with great care and confirmed by extensive consultations with sector experts in India, a composite index is by its very nature always prone to measurement imperfections. We therefore wish to check the robustness of our findings to more parsimonious approaches to measuring services reform. Although a "true" measure of policy reform does not exist, it may be possible to identify the key structural break points in policy regimes with greater objectivity than is involved in the construction of a composite index that necessarily reflects a judgment of the relative importance of specific reforms. Hence we check the previous findings by using a simpler measure of structural breaks for each services sector.[36] This is done by identifying the year in which a service sector experienced the most transformative policy reform and generating a simple indicator variable that divides years into "before" and "after" this structural break.[37] These policy cornerstones in services sectors are then weighted by the input-output coefficients linking services and manufacturing sectors, in the same way as with the policy index:

$$Break_{jt} = a_{jk} I_{kt} \qquad (5)$$

where α_{jk} is the share of inputs sourced from services sector k by manufacturing sector j, and I_{kt} is an indicator variable for services sector k taking on the value of one if an observation pertains to the year of the structural break year or a later period, and zero otherwise.

[36] Note that it is not possible to do this for the aggregate measure as the timing of structural breaks varies from sector to sector.

[37] The use of these structural policy breaks may also help us to distinguish the impact of reform from the impact of technological progress in sectors like telecommunications. For example, the year of the most significant policy change in telecommunications was 2002, which was much later than the emergence of new mobile communication technologies in the early 1990s.

The structural breaks were determined as follows. The most important reforms in the banking sector occurred in 2001, when there was full deregulation of the interest rates and banks were allowed greater flexibility in choosing borrowers and designing loan terms. Liberalization of the banking sector allowed for improved allocation of credit and increased investment by private and foreign banks.

The most important reforms in the telecommunications sector in India occurred in 2002, when the government terminated the VSNL (publicly owned telecommunications company) monopoly and allowed free entry into the long distance sector. This policy reform in the telecommunications sector quickly led to entry in the sector and intense competition.

For transportation, the most important reform came in 1997 when increased privatization in port management was allowed. Approval was granted for up to 74 percent foreign ownership in port management, foreign and private investment in construction, and increased private and foreign investment in aviation. The effect was to make the transportation industry more competitive, which translated into gains in the speed with which processes were completed at ports and deliveries were made.

In the insurance industry, 2002 is the most important year of reform, as it marked the registration of sixteen new providers, and permission for twelve new insurance providers to enter the market. Yet the insurance reforms were slower to be instituted than the other services reforms.

The results obtained from replacing the services index in equation (4) with the variable $Break_{jt}$ pertaining to individual services industries confirm our earlier findings (Table 9). Important policy changes in services sectors appear to have left their mark on the performance of manufacturing firms dependent on services inputs. Strong productivity effects can be identified from the banking, telecommunications, insurance and transport sectors, and as in the index regressions, the coefficients are particularly large for the telecom and transport sectors. Again when measures for several services industries enter jointly, the insurance measure loses its statistical significance. As is evident from web Appendix Table C3, these regressions also confirm that there is a stronger productivity effect on foreign firms than on domestic firms.

Liberalization year falsification test

In order to ensure that the liberalization measures identify effects of reforms rather than spurious effects from broader industry-level productivity trends, we test the liberalization discontinuity effect on years prior to the reform. If the effect captured by the liberalization breaks were simply related to industry

trends, we would expect the coefficient on years prior to the reform to be as large and significant as the coefficient on our variable of interest. To implement this test we create a new variable

$$1\ year\ prior\ to\ break_{jt} = a_{jk} IP_{kt} \quad (6)$$

where α_{jk} is the share of inputs sourced from services sector k by manufacturing sector j, and IP_{kt} is an indicator variable for services sector k taking on the value of one in the year prior to the year of the structural break, and zero otherwise. We also define an analogous variable for the two-year period preceding the structural break which we use in an alternative specification.

As is evident from Table 10, we find that in each industry the coefficient on the break in the year of reform is larger and significantly different from the coefficient on the years preceding the reform. The results are somewhat weaker in the second specification for the transport reform (the last column) where the p-value of the test equal 0.126. Only in 3 of 10 specifications is the coefficient on the falsification variable positive and statistically significant.

Other robustness checks

A potential concern is that the service indices increase monotonically over time. This makes the empirical strategy susceptible to picking up spurious sectoral trends. If the sectors that are intensive in the more reformed services were more dynamic and productivity grew in these sectors for reasons unrelated to input improvements, we could get the results obtained so far even in the absence of a true effect of services liberalization on firm performance.

To address this concern, we replace year fixed effects with sector-specific time trends (we use the sector aggregation presented in Table 3). The results, presented in Table 11, confirm our earlier findings. We find a positive link between the aggregate measure of services reform and the performance of downstream manufacturing firms. A similar relationship is found for both measures of banking reform. The effect of banking reform remains significant even when entered jointly with the other sectoral reform indices.

When we allow for the effects to differ between Indian firms and foreign affiliates (the table not reported to save space), we also find a positive link between the aggregate measure of services reform and the performance of downstream manufacturing firms. As before, larger benefits appear to accrue to foreign affiliates. A similar pattern is detected for the banking reform. When it comes to the telecom, insurance and transport sectors, the benefits of services liberalization appear to accrue only to foreign firms. The

magnitudes of the effects are similar to those found in Table 6 and are statistically significant at the one percent level.

Finally, we examine whether our results are subject to an autocorrelation problem that could lead to the underestimation of standard errors, as discussed by Bertrand et al. (2004). To check for this potential estimation bias, we take their advice and ignore the time-series information when computing standard errors. We perform the test in three steps. First, we regress the logarithm of TFP on control variables (other than the services variables) and fixed effects and keep the residuals. Second, we divide the residuals into two groups: residuals from the years before the structural break and residuals from the post-break period and calculate a within-firm average for each period. In the last step, we regress the two-period panel of mean residuals on the $Break_{jt}$ variable defined in equation (5). We cluster standard errors for each manufacturing industry. We repeat the procedure for a break in each services sector considered in the analysis.

As is evident from Table 12, we find positive and statistically significant (at the one percent level) effects for the banking sector, telecoms and insurance reform. Somewhat surprisingly, we obtain a negative coefficient for the transport reform. Given these findings, we feel reasonably confident that our baseline results are not subject to the autocorrelation problem.

VI. Services liberalization and manufacturing output

Productivity is not the only manufacturing outcome that could be affected by services reform. Services reform could be also have a first order effect on increasing output of the manufacturing sector. Essentially, lower input costs and relaxation or disappearance of critical infrastructure bottlenecks should allow firms to expand (whether or not accompanied by productivity improvements). Therefore, in our final exercise, we examine the relationship between services reform and manufacturing output. The output is expressed in real terms, and the empirical specifications mirror those in the baseline table (Table 4). The results, presented in Table 13, show a positive and statistically significant relationship between manufacturing output and the overall index of services liberalization and both proxies for the banking sector liberalization. Manufacturing output also appears to be positively linked to the telecom liberalization, but the effect is less precisely estimated (it is statistically significant at the 11 percent level). The insurance liberalization does not appear to matter, while the transport liberalization seems to have a negative effect (perhaps due to increasing competition).

In Table 14, we decompose the manufacturing output growth 1995-2004 into the contribution made by increased use of capital, material and energy inputs, services inputs, labor and total factor productivity.[38] All manufacturing sectors have registered an increase in their output, with the growth of output ranging from 22 percent in graments, leather goods and shoes to 107 percent in coke, fuel, petroleum and chemicals. In each sector, increased used of services appears to have contributed to output growth, though its contribution was smaller in magnitude than the contribution of capital, materials/energy inputs and in most cases labor. Productivity growth appears to have boosted output in 7 of 11 industry group considered.

VII. Conclusions

This paper suggests that previous explanations for the post-1991 growth of India's manufacturing sector have ignored an important factor: the contribution of India's policy reforms in services. By gathering detailed information on the pace of policy reform in Indian services sectors and constructing a series of reform indices, we demonstrate a strong and significant empirical link between progress in policy reforms in services sectors and productivity in manufacturing industries. Our findings are robust to a number of checks, including instrumenting for the pace of reform in Indian services sectors, controlling for trade liberalization, foreign ownership, sector-specific time trends and autocorrelation. We also investigate the relative contribution of reform in each of the services sectors to the productivity of manufacturing firms, and find that liberalization in the banking and telecommunications sectors had the most robust productivity effects on manufacturing firms over the period. When distinguishing the effect of services reform by ownership, we find that foreign-owned subsidiaries in India display an even greater ability to reap the benefits of services reforms than domestic firms.

[38] This is done as follows. We keep firms present in both 1995 and 2004 (we focus on these years to increase the number of observations). In each year (1995 and 2004), we aggregate firm-level output and input data to the industry level. The input shares (β, γ and φ) are the average input shares found in each industry. The capital share (α) is calculated assuming constant returns to scale. Then our decomposition is as follows, where Y denotes output, K capital stock, M materials, E energy input, S services inputs, L labor input, and A is the total factor productivity (calculated as the residual):

$$\Delta \ln Y = \alpha \Delta lnK + \beta \Delta \ln(M + E) + \gamma \Delta lnS + \varphi \Delta \ln L + \Delta lnA$$

Our decomposition results should be treated with caution as our dataset does not include the population of firms and we ignore firm entry and exit.

The particularly robust effects of banking and telecommunications liberalization are intuitive results. Liberalization in the banking sector has improved capital allocation and allowed investment in higher return projects. Liberalization of the telecommunications sector has interacted with technological change not only to enhance the reliability and reduce the cost of communication, but it has also paved the way for entirely new ways of communication and organizing production. Liberalization of the transport sector allows easier and less expensive transportation of raw materials and goods for export. However, reforms in several areas of the transportation sector in India have been slow, and some control over transport remains at the state level. Given that we cannot capture this state-level variation in our index, the results for the transportation sector seem somewhat weaker, although significant in a number of specifications. Insurance sector reforms do not appear to have had a strong influence in our data, possibly due to their limited scope so far.

Services reforms in India remain incomplete and barriers to domestic and foreign competition exist in many other countries. This paper suggests that in addition to retarding the development of the services sectors, these barriers also penalize the manufacturing sector. Wider appreciation of this link may help create broader political support for services reform. It may also provide greater perspective for international trade negotiations, which only notionally address impediments to services trade and investment and continue for the most part to focus on goods – agriculture and manufacturing.

References:

Ackerberg, Daniel, Kevin Caves, and Garth Frazer (2006). "Structural Identification of Production Functions," mimeo, UCLA.

Aghion, Philippe, Robin Burgess, Stephen Redding, and Fabrizio Zilibotti (2008). "The Unequal Effects of Liberalization: Evidence from Dismantling the License Raj in India." *American Economic Review* 98(4): 1397-1412.

Ahsan, Ahmad and Carmen Pagés (2009). "Are all labor regulations equal? Evidence from Indian manufacturing," *Journal of Comparative Economics* 37(1): 62-75.

Aitken, Brian and Ann Harrison (1999). "Do Domestic Firms Benefit from Direct Foreign Investment? Evidence from Venezuela." *American Economic Review* 89 (3): 605-618.

Arnold, Jens Matthias, and Beata S. Javorcik (2009). "Gifted Kids or Pushy Parents? Foreign Investment and Plant Productivity in Indonesia," *Journal of International Economics* 79(1): 42–53.

Arnold, Jens Matthias, Beata Javorcik, and Aaditya Mattoo (2011) "The Productivity Effects of Services Liberalization: Evidence from the Czech Republic," *Journal of International Economics* 85(1): 136-146.

Banerjee, Abhijit and Esther Duflo (2004). "Do Firms want to Borrow More? Testing Credit Constraints Using a Directed Lending Program." CEPR Discussion Paper 4681.

Banga, Rashmi and Bishwanath Goldar (2004). "Contribution of Services to output growth and productivity in Indian manufacturing: Pre and post reforms." ICRIER Working Paper No. 139, Indian Council for research on international economic relations, New Delhi.

Bertrand, Marianne, Esther Duflo and Sendhil Mullainathan (2004). "How Much Should We Trust Difference-in-Differences Estimates?" *Quarterly Journal of Economics* Feb. 2004: 249-275.

Bertrand, Marianne, Antoinette Scholar and David Thesmar (2007). "Banking Deregulation and Industry Structure: Evidence from the French Banking Reforms of 1985." *Journal of Finance* 62(2): 597-628.

Besley, Timothy and Robin Burgess (2004). "Can Labor Regulations Hinder Economic Performance? Evidence from India." *Quarterly Journal of Economics* 119(1): 91-134.

Bollard, Albert, Peter J. Klenow and Gunjan Sharma (2010), "India's Mysterious Manufacturing Miracle", mimeo.

Bosworth, Barry, Susan Collins, and Arvind Virmani, (2006). "Sources of Growth in the Indian Economy." Brookings Working Paper.

Bosworth, Barry and Susan Collins, (2008). "Accounting for Growth: Comparing India and China." *Journal of Economic Perspectives*, 22(1): 45-66.

Bourlès, Renaud; Gilbert Cette, Jimmy Lopez, Jacques Mairesse and Giuseppe Nicoletti (2013). "Do Product Market Regulations In Upstream Sectors Curb Productivity Growth? Panel Data Evidence for OECD Countries," *The Review of Economics and Statistics*, 95(5): 1750-1768.

Burgess, Robin and Rohini Pande (2005). "Do Rural Banks Matter? Evidence from the Indian Social Banking Experiment." *American Economic Review* 95(3): 780-795.

Central Statistics Office, Ministry of Statistics and Programme Implementation, Government of India (2005). *National Accounts Statistics.*

Chari, Anusha and Nandini Gupta (2008) "Incumbents and Protectionism: Firm level Evidence from India," *Journal of Financial Economics* 88(3): 633-656.

Contractor, Farok J., Vikas Kumar and Sumit K. Kundu (2007). "Nature of the Relationship between International Expansion and Performance: The Case of Emerging Market Firms," *Journal of World Business*, 42(4): 401–417.

Department of Public Enterprises, Ministry of Heavy Industries and Public Enterprises, Government of India, *Public Enterprises Survey 2002-03* Vol.1.

Department of Telecommunications (2008). Indiastat, 2008.

Directorate General of Civil Aviation, Government of India (2005). "Air Transport Statistics 2004-2005." http://dgca.nic.in/reports/stat-ind.htm.

Eichengreen, Barry and Poonam Gupta, (2010). "The Service Sector as India's Road to Economic Growth?" Indian Council for Research on International Economic Relations, Working Paper #249.

Eschenbach, Felix and Bernard Hoekman (2006). "Services Policy Reform and Economic Growth in Transition Economies." *Review of World Economics* 142(4): 746-764.

Ethier, Wilfred (1982). "National and International Returns to Scale in the Modern Theory of International Trade." *American Economic Review* 72(3).

European Bank for Reconstruction and Development (2004). *Transition Report 2004*. http://www.ebrd.com/pubs/econo/series/tr.htm.

Goldberg, Penny, Amit Khandelwal, Nina Pavcnik, and Petia Topalova (2009). "Trade Liberalization and New Imported Inputs," *American Economic Review Papers & Proceedings* 99(2): 494-500.

Goldberg, Penny, Amit Khandelwal, Nina Pavcnik, and Petia Topalova (2010a). "Imported Intermediate Inputs and Domestic Product Growth: Evidence from India," *Quarterly Journal of Economics*, 125 (4): 1727-1767.

Goldberg, Penny, Amit Khandelwal, Nina Pavcnik, and Petia Topalova (2010b). "Multi-Product Firms and Product Turnover in the Developing World: Evidence from India," *Review of Economics and Statistics*, 92(4): 1042-1049.

Gordon, James and Poonam Gupta (2004). "Understanding India's Services Revolution." IMF Working Paper No. 171, IMF, Washington, DC.

Grossman, G. and E. Helpman (1991). *Innovation and Growth in the Global Economy*. MIT Pres.

Harrison, Ann, Leslie Martin and Shanthi Nataraj (2011). "Learning versus Stealing: How Important Are Market Share Reallocations to India's Productivity Growth?" RAND Working Paper WR-832.

Hoekman, Bernard (1996). "Assessing the General Agreement on Trade in Services." Chapter 4 in Will Martin and L. Alan Winters (editors), The Uruguay Round and the Developing Countries, Cambridge University Press, Cambridge.

Hoekman, Bernard, Aaditya Mattoo, and Andre Sapir (2007). "The political economy of services trade liberalization: a case for international regulatory cooperation?" *Oxford Review of Economic Policy* 23(3) 367-391.

"Insurance: Indian and Foreign firms test positive for Growth Steroid." *India Knowledge@Wharton*, November 16, 2006.

Insurance Development and Regulatory Authority, *Annual Report 2004*. www.irdaindia.org.

Javorcik, Beata S. (2004) "Does Foreign Direct Investment Increase the Productivity of Domestic Firms? In Search of Spillovers through Backward Linkages" *American Economic Review* 94(3).

Jones, Chad (2011). "Intermediate Goods and Weak Links in the Theory of Economic Development" *American Economic Journal: Macroeconomics* 3: 1–28.

Khandelwal, Amit and Petia Topalova (2011) "Trade Liberalization and Firm Productivity: The Case of India" Review of Economics and Statistics 93(3):995-1009.

Javorcik, Beata S. and Yue Li (2013). "Do the Biggest Aisles Serve a Brighter Future? Global Retail Chains and Their Implications for Romania," *Journal of International Economics*, 90(2).

Levinsohn, James and Amil Petrin (2003). "Estimating Production Functions Using Inputs to Control for Unobservables." *Review of Economic Studies* 70(2): 317-341

Krishna, Pravin and Devashish Mitra (1998) "Trade Liberalization, Market Discipline and Productivity Growth: New Evidence from India." *Journal of Development Economics* 56 447-462.

Markusen, J.R. (1989). "Trade in Producer Services and in Other Specialized Intermediate Inputs" *American Economic Review* 77: 85-95.

Mattoo, Aaditya (2003). "China's Accession to the WTO: The Services Dimension," *Journal of International Economic Law*, vol. 6, no. 2, 299-339.

Mattoo, Aaditya, Randeep Rathindran and Arvind Subramanian (2006). "Measuring Services Trade Liberalization and its Impact on Economic Growth: an Illustration." *Journal of Economic Integration* 21: 64-98.

Ministry of Commerce and Industry(2008). Indiastat.

Ministry of Shipping, Road Transport, and Highways (2008), Indiastat

Ministry of Statistics and Programme Implementation (2008). Indiastat.

OECD (2011). *Economic Survey of India*, OECD Publishing, Paris, France

Olley, Steven and Ariel Pakes (1996). "The Dynamics of Productivity in the Telecommunications Equipment Industry." *Econometrica* 64:1263-1295

Panagariya, Arvind (2008). *India: The Emerging Giant*. Oxford: Oxford University Press.

Pavcnik, Nina (2002) "Trade Liberalization, Exit, and Productivity Improvement: Evidence from Chilean Plants," *Review of Economic Studies* 69(1), 245-76.

Rajan, Raghuram G. and Luigi Zingales (1998). "Financial Dependence and Growth." *American Economic Review* 88: 559-586.

Reddy, Y.V. (2002). "Monetary and financial sector reforms in India: a practitioner's perspective." Bank for International Settlements, http://www.bis.org/review/r020425d.pdf.

Reddy, Y.V. (2005). "Banking Sector Reforms in India-an Overview" Bank for International Settlements, http://www.bis.org/review/r050519b.pdf.

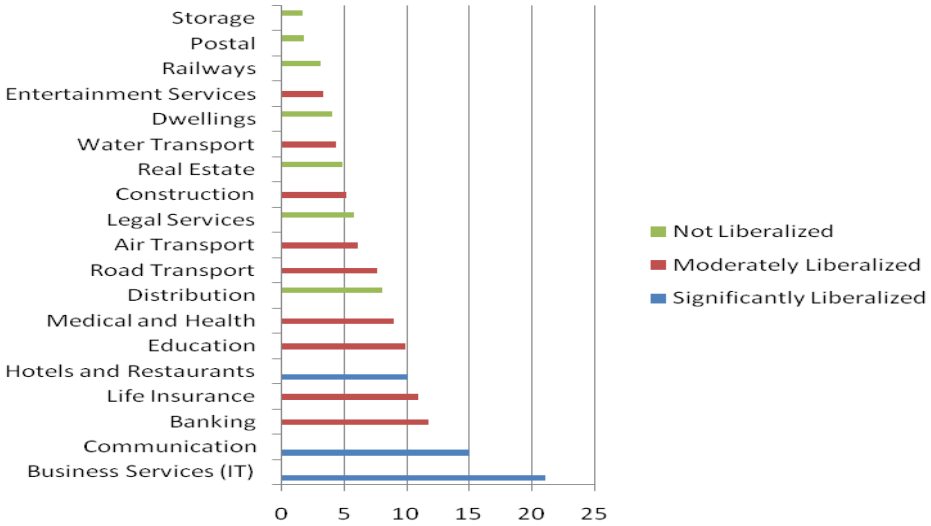
Reserve Bank of India. (2008) *Index Numbers of Industrial Production*. Database. http://www.rbi.org.in/scripts/statistics.aspx.

Sivadasan, Jagadeesh (2009). "Barriers to Competition and Productivity: Evidence from India." *The B.E. Journal of Economic Analysis & Policy* 9(1) (Advances): Article 42.

World Bank (2004). "Sustaining India's Services Revolution: Access to Foreign Markets, Domestic Reform and International Negotiations." World Bank Policy Research Working Paper 31795.

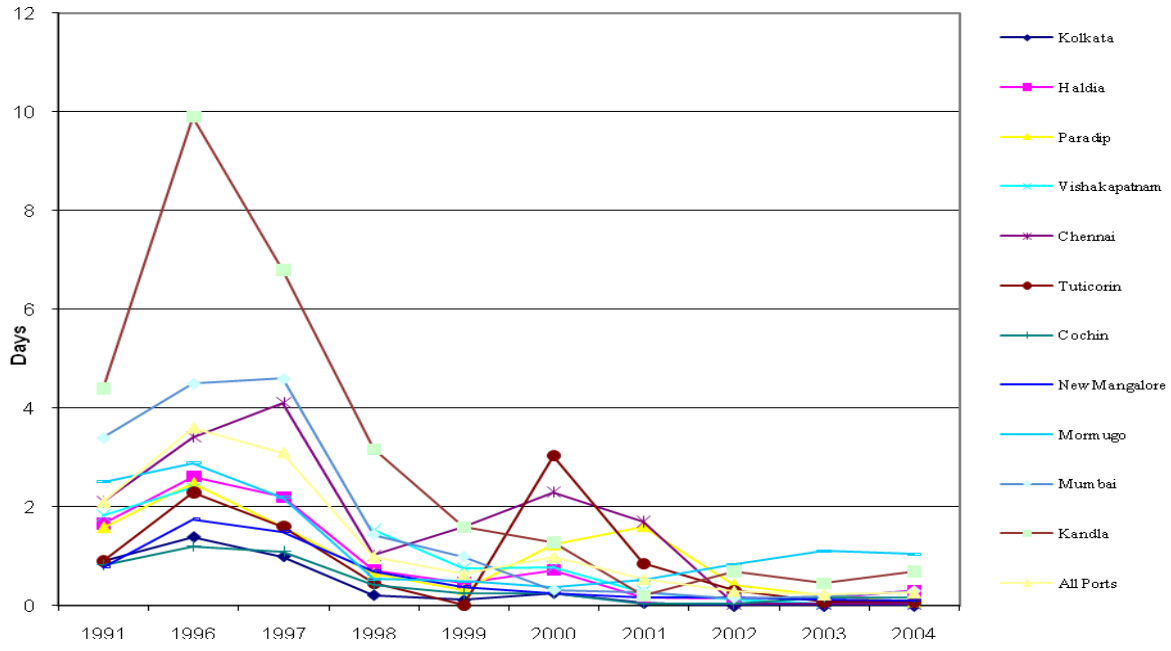
Charts

Chart 1: Growth Rates of Services Output by Level of Liberalization, 1993-2002



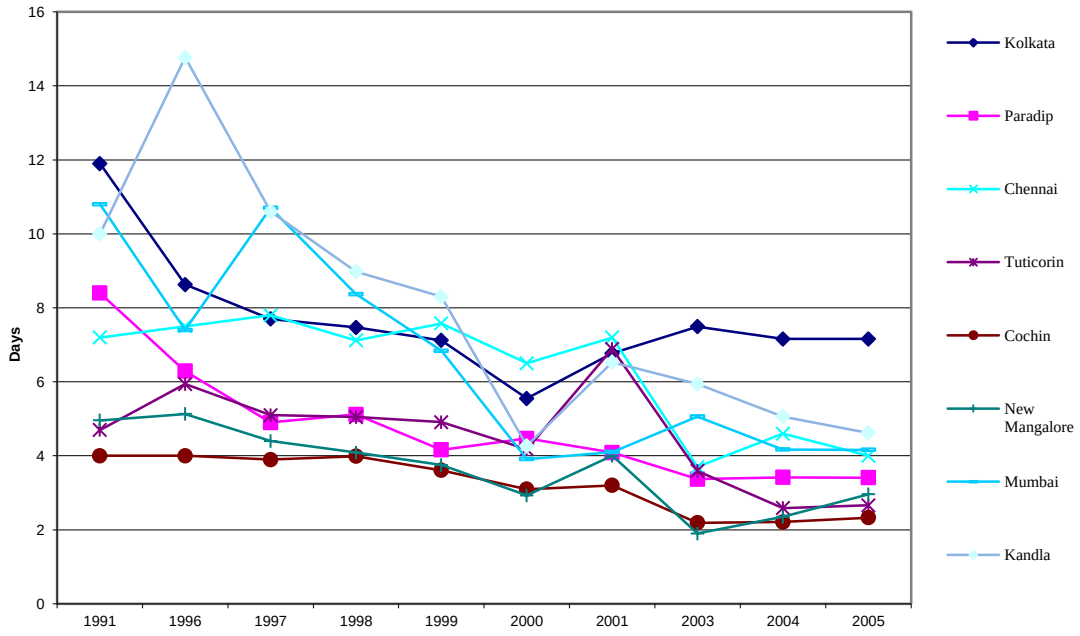
Source: World Bank (2004).

Chart 2: Length of Pre-Berthing Detention at Ports



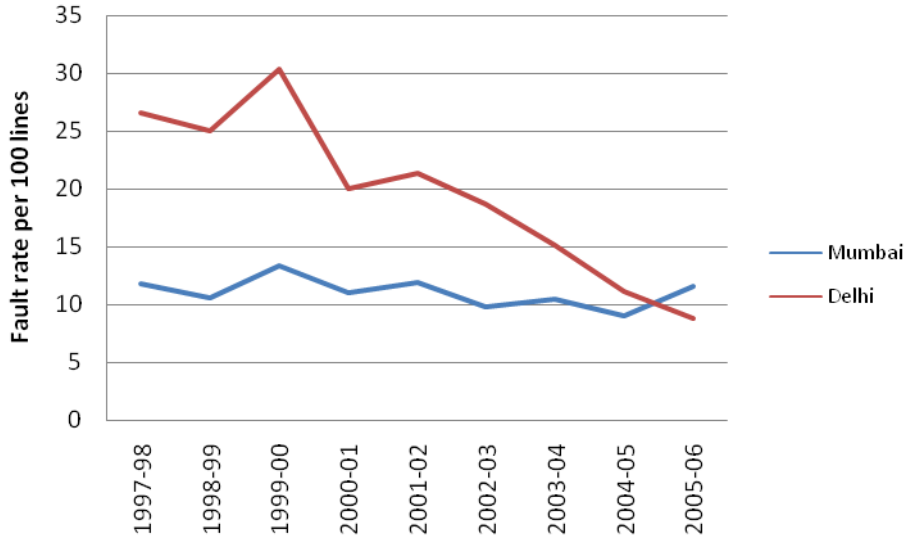
Source: Ministry of Shipping, Road Transport and Highways, Govt. of India, Indiastat (2008).

Chart 3: Length of Turn-Around Time at Major Ports



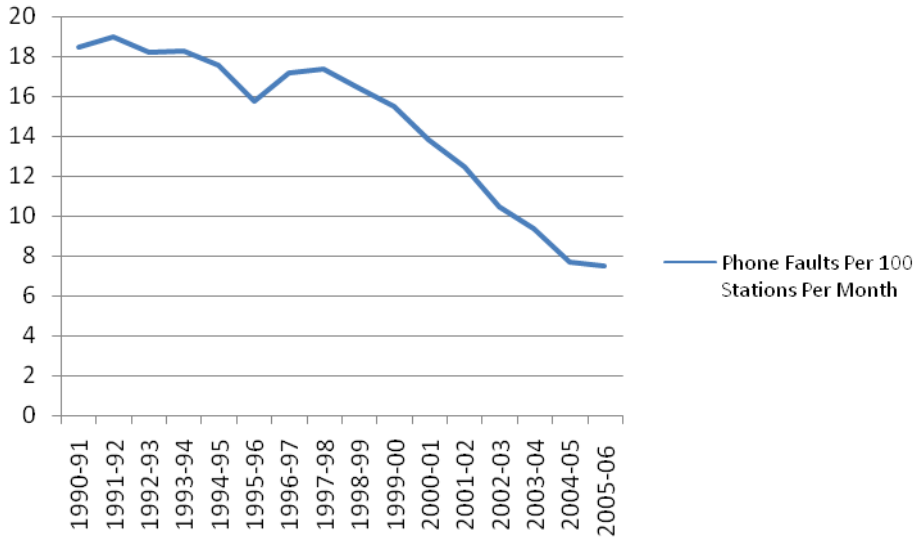
Source: Ministry of Shipping, Road Transport and Highways, Govt. of India, Indiastat (2008).

Chart 4: Phone Faults in Delhi and Mumbai per 100 Stations per month



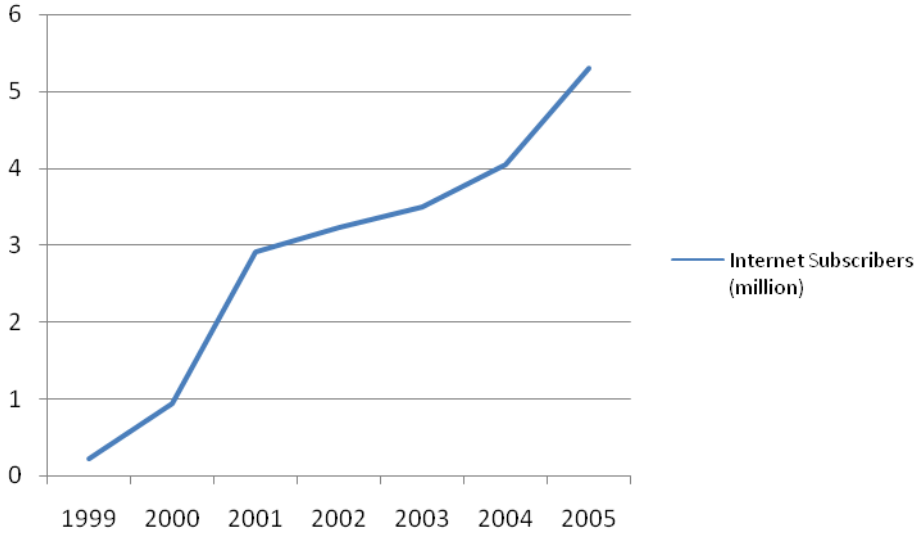
Source: Department of Telecommunications, Ministry of Communications, Indiastat 2008.

Chart 5: Telephone Faults across India



Source: Department of Telecommunications, Ministry of Communications, Indiastat, 2008.

Chart 6: Growth in Internet Density in India



Source: Ministry of Statistics and Programme Implementation, Indiastat, 2008.

Tables

Table 1: Improvements in Telecom, Transport, and Banking Services between 2002 and 2006

	All respondents		Foreign firms		Domestic firms	
	2002	2006	2002	2006	2002	2006
	Percentage of respondents reporting it is an obstacle to business operations[1]					
Telecommunications	60	35	62	54	60	35
Transport	61	41	41	43	62	40
Access to finance	68	45	56	51	68	45
Cost of finance	41	23	50	35	41	23
	No. of days needed to obtain a phone connection (landline)[2]					
50th percentile of respondents	30	4	10	2	30	4
75th percentile of respondents	60	10	30	7	60	10
95th percentile of respondents	365	30	180	20	365	30

Source: World Bank investment climate surveys in India in 2002 and 2006. There were 1,818 manufacturing firms surveyed in India in 2002 of which 1,784 were domestic and 34 were foreign. There were 2,195 manufacturing firms surveyed in India in 2006 of which 2,158 were domestic and 37 were foreign.
(1) In response to the question: "Please tell us if any of the following issues are a problem for the operation and growth of your business. A. Telecommunications. B. Transportation. C. Access to financing (eg. collateral). D. Cost of Financing (eg. interest rates).
(2) In response to the question "Based on the experience of your establishment over the last two years, what is the actual delay experienced (from the day you applied to the day you received the service or approval) i. Mainline telephone connection."

Table 2: Summary Statistics

Variable	Obs	Mean	Std. Dev.
ln TFP Ackerberg et al.	22558	1.53	1.10
ln Output	22558	2.57	2.01
ln Energy	22558	-0.12	2.04
ln Capital	22558	2.52	1.77
ln Labor	22558	0.45	1.79
ln Material inputs	22558	2.62	1.90
ln Services inputs	22302	0.27	1.92
Services Index lagged	22558	0.18	0.10
Banking Index lagged	22558	0.06	0.07
Rajan Zingales Banking Index lagged	22558	0.71	0.74
Telecom Index lagged	22558	0.02	0.02
Insurance Index	22558	0.01	0.02
Transport Index lagged	22558	0.10	0.04
Foreign Dummy	22558	0.18	0.38
Tariff lagged	22558	36.47	17.17
Input Tariff lagged	22558	16.41	9.38
Delicensing lagged	22558	0.97	0.15
FDI reform lagged	22558	0.87	0.33

Table 3: Production function coefficients

	OLS			Ackerberg et al.		
	Capital	Labor	Sum	Capital	Labor	Sum
Food processing and tobacco products	0.155	0.682	0.837	0.166	0.829	0.995
Textiles	0.345	0.604	0.949	0.357	0.543	0.900
Garments, leather goods and shoes	1.002	0.707	1.709	0.074	0.898	0.972
Wood products, paper products, printing and publishing	0.116	0.864	0.980	0.302	0.780	1.081
Coke, fuel, petroleum and chemicals	0.216	0.616	0.832	0.295	0.811	1.106
Plastic and rubber products	0.326	0.660	0.986	0.261	0.778	1.039
Concrete, cement and glass	0.139	0.735	0.874	0.437	0.651	1.089
Iron and steel	0.211	0.611	0.822	0.257	0.677	0.934
Metal products, machinery and tools	0.056	0.832	0.888	0.145	0.831	0.975
Electrical, lifting, medical and industrial equipment	0.189	0.824	1.013	0.325	0.678	1.003
Motor vehicles and transport systems	0.218	0.870	1.088	0.312	0.745	1.058

Table 4: Productivity Effects of Services Liberalization. OLS Approach

Services Index $_{(t-1)}$	0.875***						
	(0.228)						
Banking Index $_{(t-1)}$		0.765***					0.620***
		(0.246)					(0.239)
Banking Index Rajan-Zingales weights $_{(t-1)}$			0.164***				
			(0.033)				
Telecom Index $_{(t-1)}$				4.594***			4.215***
				(1.354)			(1.320)
Insurance Index $_{(t-1)}$					0.933		0.322
					(0.930)		(0.954)
Transport Index $_{(t-1)}$						2.921*	3.282**
						(1.587)	(1.548)
Tariffs $_{(t-1)}$	0.001	0.000	0.002	0.000	0.000	0.000	0.001
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Input Tariffs $_{(t-1)}$	-0.002	-0.002	-0.003	0.001	-0.002	-0.004	-0.002
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.007)	(0.007)
Foreign	0.040**	0.041**	0.041***	0.042***	0.044***	0.046***	0.041***
	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)
Observations	22,558	22,558	22,558	22,558	22,558	22,558	22,558
R-squared	0.257	0.256	0.259	0.257	0.255	0.256	0.258
Number of firms	3771	3771	3771	3771	3771	3771	3771

Notes: The estimated specification is described in equation (4) in the text. The dependent variable is the log of real firm value added. Explanatory variables include capital and labor, all expressed in real terms and logs. Coefficients on production inputs are allowed to vary for each of 11 sectors. All specifications include firm and year fixed effects. Robust standard errors, clustered at the industry-year level, are reported in parentheses. *** denotes significant at the 1 percent level, ** at the 5 percent level, * at the 10 percent level

Table 5: Productivity Effects of Services Liberalization. Ackerberg et al. TFP Measure

Services Index $_{(t-1)}$	1.171***						
	(0.227)						
Banking Index $_{(t-1)}$		1.046***					0.911***
		(0.249)					(0.245)
Banking Index Rajan-Zingales weights $_{(t-1)}$			0.194***				
			(0.032)				
Telecom Index $_{(t-1)}$				4.765***			4.037***
				(1.281)			(1.213)
Insurance Index $_{(t-1)}$					1.649*		0.853
					(0.952)		(0.994)
Transport Index $_{(t-1)}$						3.675**	4.300**
						(1.702)	(1.660)
Tariffs $_{(t-1)}$	0.001	0.000	0.003	0.000	0.000	0.000	0.001
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Input Tariffs $_{(t-1)}$	-0.003	-0.003	-0.004	-0.001	-0.003	-0.007	-0.004
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.008)	(0.007)
Foreign	0.027	0.029*	0.030*	0.033**	0.035**	0.041**	0.032**
	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)	(0.016)	(0.016)
Observations	22,558	22,558	22,558	22,558	22,558	22,558	22,558
R-squared	0.032	0.030	0.035	0.030	0.028	0.029	0.034
Number of firms	3771	3771	3771	3771	3771	3771	3771

Notes: The dependent variable is the log TFP estimated using the Ackerberg et al. method for each of the 11 industries listed in Table 2. All specifications include firm and year fixed effects. Robust standard errors, clustered at the industry-year level, are reported in parentheses. *** denotes significant at the 1 percent level, ** at the 5 percent level, * at the 10 percent level

Table 6: Differential Effect of Services Liberalization on Foreign Firms. Ackerberg et al. TFP Measure

Services Index $_{(t-1)}$	1.106***						
	(0.236)						
Services Index $_{(t-1)}$* Foreign	0.135**						
	(0.063)						
Banking Index $_{(t-1)}$		0.932***					0.896***
		(0.264)					(0.263)
Banking Index $_{(t-1)}$ * Foreign		0.239**					0.035
		(0.115)					(0.124)
Banking Index Rajan-Zingales weights $_{(t-1)}$			0.182***				
			(0.034)				
Banking Index Rajan-Zingales weights $_{(t-1)}$ * Foreign			0.026**				
			(0.012)				
Telecom Index $_{(t-1)}$				4.000***			3.454**
				(1.391)			(1.337)
Telecom Index $_{(t-1)}$ * Foreign				1.442***			1.198**
				(0.454)			(0.554)
Insurance Index $_{(t-1)}$					0.914		0.277
					(0.955)		(0.955)
Insurance Index $_{(t-1)}$* Foreign					2.061***		1.630***
					(0.449)		(0.508)
Transport Index $_{(t-1)}$						3.659**	4.347***
						(1.700)	(1.656)
Transport Index $_{(t-1)}$* Foreign						0.258*	-0.225
						(0.135)	(0.160)
Tariffs $_{(t-1)}$	0.001	0.000	0.003	0.000	0.000	0.000	0.001
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Input Tariffs $_{(t-1)}$	-0.003	-0.003	-0.004	-0.001	-0.003	-0.007	-0.004
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.008)	(0.007)
Foreign	0.017	0.021	0.021	0.023	0.024	0.032**	0.021
	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)	(0.016)	(0.016)
Observations	22,558	22,558	22,558	22,558	22,558	22,558	22,558
R-squared	0.032	0.030	0.035	0.030	0.028	0.029	0.035
Number of firms	3771	3771	3771	3771	3771	3771	3771

Notes: The dependent variable is the log TFP estimated using the Ackerberg et al. method for each of the 11 industries listed in Table 2. All specifications include firm and year fixed effects. Robust standard errors, clustered at the industry-year level, are reported in parentheses. *** denotes significant at the 1 percent level, ** at the 5 percent level, * at the 10 percent level

Table 7: Controlling for Delicensing and FDI Reform. Ackerberg et al. TFP Measure

Services Index $_{(t-1)}$	1.285***						
	(0.229)						
Banking Index $_{(t-1)}$		1.212***					1.010***
		(0.249)					(0.242)
Banking Index Rajan-Zingales weights $_{(t-1)}$			0.190***				
			(0.031)				
Telecom Index $_{(t-1)}$				5.025***			4.097***
				(1.328)			(1.258)
Insurance Index $_{(t-1)}$					2.211**		1.118
					(0.978)		(0.995)
Transport Index $_{(t-1)}$						2.986*	3.569**
						(1.550)	(1.466)
Tariffs $_{(t-1)}$	-0.001	-0.001	0.001	-0.001	-0.002	-0.001	-0.000
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Input Tariffs $_{(t-1)}$	-0.004	-0.004	-0.005	-0.001	-0.004	-0.007	-0.004
	(0.008)	(0.008)	(0.008)	(0.008)	(0.009)	(0.008)	(0.007)
Delicensing $_{(t-1)}$	0.243**	0.217**	0.212*	0.231**	0.217**	0.244**	0.279**
	(0.110)	(0.109)	(0.109)	(0.111)	(0.109)	(0.110)	(0.113)
FDI reform $_{(t-1)}$	0.167***	0.173***	0.139**	0.152**	0.164**	0.112*	0.134**
	(0.064)	(0.065)	(0.064)	(0.066)	(0.065)	(0.057)	(0.057)
Foreign	0.030*	0.030*	0.033**	0.036**	0.037**	0.043***	0.033**
	(0.017)	(0.017)	(0.016)	(0.016)	(0.017)	(0.016)	(0.016)
Observations	22,558	22,558	22,558	22,558	22,558	22,558	22,558
R-squared	0.036	0.034	0.038	0.033	0.032	0.032	0.037
Number of firms	3,771	3,771	3,771	3,771	3,771	3,771	3,771

Notes: The dependent variable is the log TFP estimated using the Ackerberg et al. method for each of the 11 industries listed in Table 2. All specifications include firm and year fixed effects. Robust standard errors, clustered at the industry-year level, are reported in parentheses. *** denotes significant at the 1 percent level, ** at the 5 percent level, * at the 10 percent level

Table 8: Productivity Effects of Services Liberalization. Instrumental variables approach using Ackerberg et al. TFP

Second stage regressions							
Services Index $_{(t-1)}$	1.277***						
	(0.260)						
Banking Index $_{(t-1)}$		1.061***					0.864***
		(0.247)					(0.280)
Banking Index Rajan-Zingales weights $_{(t-1)}$			0.224***				
			(0.056)				
Telecom Index $_{(t-1)}$				5.459***			4.199***
				(1.469)			(1.507)
Insurance Index $_{(t-1)}$					2.527**		2.646*
					(1.139)		(1.500)
Transport Index $_{(t-1)}$						6.891	10.174**
						(4.206)	(4.288)
Tariffs $_{(t-1)}$	0.0009	0.0004	0.0030	0.0004	0.0002	0.0002	0.0019
	(0.0018)	(0.0017)	(0.0019)	(0.0018)	(0.0018)	(0.0016)	(0.0018)
Input Tariffs $_{(t-1)}$	-0.0031	-0.0035	-0.0042	-0.0001	-0.0030	-0.0094	-0.0079
	(0.0090)	(0.0093)	(0.0089)	(0.0090)	(0.0093)	(0.0067)	(0.0059)
Foreign	0.027	0.029**	0.030*	0.032*	0.034**	0.045***	0.038**
	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)	(0.016)	(0.0160)
Observations	22,558	22,558	22,558	22,558	22,558	22,558	22,558
R-squared	0.032	0.030	0.035	0.030	0.028	0.028	0.029
Number of firms	3771	3771	3771	3771	3771	3771	3771
First stage regressions							
WTO commitments – China	2.970***	3.746***	17.665***	1.471***	2.645***	0.675***	
	(0.229)	(0.288)	(2.282)	(0.199)	(0.598)	(0.196)	
WTO commitments – Indonesia	0.564***	0.210**	1.675	2.117***	0.398**	4.972***	
	(0.141)	(0.120)	(1.665)	(0.146)	(0.198)	(0.941)	
Tariffs $_{(t-1)}$	0.0003	-0.0001	-0.0122***	-0.0000	-0.0000	0.0001	
	(0.0003)	(0.0001)	(0.0018)	(0.0000)	(0.0000)	(0.0001)	
Input Tariffs $_{(t-1)}$	0.0006	0.0001	0.0044	-0.0000	-0.0000	0.0004	
	(0.0005)	(0.0001)	(0.0074)	(0.0001)	(0.0001)	(0.0003)	
Foreign	0.003***	0.001**	-0.001	0.000	0.000*	-0.001	
	(0.001)	(0.000)	(0.009)	(0.000)	(0.000)	(0.000)	
Test statistics							
F-stat	129.470	151.650	34.440	291.620	16.590	50.410	20.690
p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Sargan test	0.068	0.216	0.322	0.763	1.561	6.040	5.345
p-value	0.795	0.642	0.570	0.382	0.212	0.014	0.254

Notes: The dependent variable is the log TFP estimated using the Ackerberg et al. method for each of the 11 industries listed in Table 2. All specifications include firm fixed effects. Robust standard errors, clustered at the industry-year level, are reported in parentheses. *** denotes significant at the 1 percent level, ** at the 5 percent level, * at the 10 percent level.

Table 9: Productivity Effect of Services Liberalization, Structural Break Approach. Ackerberg et al. TFP measure

Banking Break 2001	2.626***					2.269***
	(0.641)					(0.549)
Rajan-Zingales Break 2001		0.484***				
		(0.081)				
Telecom Break 2002			8.126***			6.226***
			(2.347)			(2.223)
Insurance Break 2002				5.218**		3.015
				(2.227)		(1.937)
Transport Break 1997					8.103***	8.528***
					(2.628)	(2.633)
Tariffs $_{(t-1)}$	0.000	0.003	0.000	0.000	-0.000	0.001
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Input Tariffs $_{(t-1)}$	-0.004	-0.004	-0.003	-0.003	-0.010	-0.009
	(0.009)	(0.009)	(0.009)	(0.009)	(0.007)	(0.006)
Foreign Dummy	0.029*	0.030*	0.034**	0.035**	0.043***	0.034**
	(0.017)	(0.017)	(0.017)	(0.017)	(0.016)	(0.016)
Observations	22,558	22,558	22,558	22,558	22,558	22,558
R-squared	0.030	0.034	0.029	0.028	0.032	0.036
Number of firms	3771	3771	3771	3771	3771	3771

Notes: The dependent variable is the log TFP estimated using the Ackerberg et al. method for each of the 11 industries listed in Table 2. Structural break is a binary variable taking on the value of one in the year in which a service sector experienced the most transformative policy reform and in all subsequent years. The variable is equal to zero in years prior to the reform. All specifications include firm and year fixed effects. Robust standard errors, clustered at the industry-year level, are reported in parentheses. *** denotes significant at the 1 percent level, ** at the 5 percent level, * at the 10 percent level

Table 10: Break falsification test. Ackerberg et al. TFP Measure

	Banking break	Banking break	Banking break (Rajan-Zingales)	Banking break (Rajan-Zingales)	Telecom break	Telecom break	Insurance break	Insurance break	Transport break	Transport break
	2001	2001	2001	2001	2002	2002	2002	2002	1997	1997
Break	2.610***	2.480***	0.528***	0.558***	9.125***	9.794***	5.198**	3.890	8.053***	7.427***
	(0.662)	(0.706)	(0.084)	(0.091)	(2.528)	(2.605)	(2.345)	(2.417)	(2.635)	(2.633)
Falsification test: 1 year prior to break	-0.070		0.180		4.565*		-0.099		0.381	
	(1.171)		(0.129)		(2.763)		(1.836)		(1.259)	
Falsification test: 2 years prior to break		-0.330		0.161*		4.070		-3.378*		2.700*
		(0.854)		(0.095)		(2.765)		(1.961)		(1.397)
Tariffs $_{(t-1)}$	0.000	0.000	0.003	0.003*	0.001	0.000	0.000	0.000	-0.000	-0.000
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Input Tariffs $_{(t-1)}$	-0.004	-0.004	-0.004	-0.004	-0.003	-0.002	-0.003	-0.003	-0.010	-0.010
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.007)	(0.007)
Foreign Dummy	0.029*	0.029*	0.029*	0.029*	0.033**	0.033**	0.035**	0.036**	0.043***	0.044***
	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)	(0.016)	(0.016)
Observations	22,558	22,558	22,558	22,558	22,558	22,558	22,558	22,558	22,558	22,558
R-squared	0.030	0.030	0.035	0.035	0.030	0.030	0.028	0.028	0.032	0.033
Break coeff = year(s) prior coeff										
F-stat	5.21	10.74	7.2	17.09	2.91	4.39	5.02	7.57	6.59	2.36
p-value	0.023	0.001	0.008	0.000	0.089	0.037	0.026	0.006	0.011	0.126

Notes: The dependent variable is the log TFP estimated using the Ackerberg et al. method for each of the 11 industries listed in Table 2. All specifications include firm and year fixed effects. Robust standard errors, clustered at the industry-year level, are reported in parentheses. *** denotes significant at the 1 percent level, ** at the 5 percent level, * at the 10 percent level.

Table 11: Productivity Effects of Services Liberalization. Ackerberg et al. TFP Measure. Adding Industry Time Trends

Services Index $_{(t-1)}$	0.985***						
	(0.295)						
Banking Index $_{(t-1)}$		1.081***					1.166***
		(0.321)					(0.319)
Banking Index Rajan-Zingales weights $_{(t-1)}$			0.122***				
			(0.037)				
Telecom Index $_{(t-1)}$				0.982			-0.636
				(1.844)			(1.871)
Insurance Index $_{(t-1)}$					2.540		3.092
					(1.762)		(1.976)
Transport Index $_{(t-1)}$						-0.079	0.307
						(0.697)	(0.682)
Tariffs $_{(t-1)}$	0.000	0.000	-0.000	0.001	0.001	0.001	-0.000
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Input Tariffs $_{(t-1)}$	0.001	-0.000	0.000	0.001	0.000	0.001	-0.001
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Foreign	0.029*	0.030*	0.031**	0.031*	0.033**	0.032**	0.032**
	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)
Observations	22,558	22,558	22,558	22,558	22,558	22,558	22,558
R-squared	0.029	0.029	0.029	0.027	0.027	0.027	0.030
Number of firms	3771	3771	3771	3771	3771	3771	3771

Notes: The dependent variable is the log TFP estimated using the Ackerberg et al. method for each of the 11 industries listed in Table 2. All specifications include firm and year fixed effects as well as industry time trends. Robust standard errors, clustered at the industry-year level, are reported in parentheses. *** denotes significant at the 1 percent level, ** at the 5 percent level, * at the 10 percent level

Table 12: Robustness Check on Autocorrelation. Ackerberg et al. TFP Measure

Banking Break 2001	2.859***				
	(0.686)				
Rajan-Zingales Break 2001		0.412***			
		(0.061)			
Telecom Break 2002			30.678***		
			(2.411)		
Insurance Break 2002				15.203***	
				(2.219)	
Transport Break 1997					-1.453***
					(0.512)
Observations	6,142	6,142	6,059	6,059	5,440
R-squared	0.003	0.007	0.026	0.008	0.001
Number of firms	3771	3771	3771	3771	3771

Notes: The dependent variable is the log TFP estimated using the Ackerberg et al. method for each of the 11 industries listed in Table 2. *** denotes significant at the 1 percent level, ** at the 5 percent level, * at the 10 percent level

Table 13: Output Effects of Services Liberalization

Services Index $_{(t-1)}$	0.553***						
	(0.170)						
Banking Index $_{(t-1)}$		0.873***					0.975***
		(0.184)					(0.188)
Banking Index Rajan-Zingales weights $_{(t-1)}$			0.039*				
			(0.021)				
Telecom Index $_{(t-1)}$				1.358^			1.265
				(0.845)			(0.869)
Insurance Index $_{(t-1)}$					-0.356		-1.812***
					(0.727)		(0.623)
Transport Index $_{(t-1)}$						-1.611*	-1.791**
						(0.858)	(0.814)
Tariffs $_{(t-1)}$	0.000	0.000	0.000	-0.000	-0.000	-0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Input Tariffs $_{(t-1)}$	0.004	0.004	0.004	0.005^	0.004	0.005*	0.006*
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Foreign	0.166***	0.164***	0.169***	0.169***	0.170***	0.168***	0.161***
	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)
Observations	22,558	22,558	22,558	22,558	22,558	22,558	22,558
R-squared	0.047	0.049	0.046	0.046	0.046	0.046	0.050
Number of firms	3771	3771	3771	3771	3771	3771	3771

Notes: All specifications include firm and year fixed effects. Robust standard errors, clustered at the industry-year level, are reported in parentheses. *** denotes significant at the 1 percent level, ** at the 5 percent level, * at the 10 percent level, ^ at the 11 percent level

Table 14: Decomposition of Manufacturing Output Growth

Industry	Output growth	Contribution of				
		capital	materials & energy	services inputs	labor	TFP
Food processing and tobacco products	0.67	0.30	0.36	0.03	0.04	-0.06
Textiles	0.46	0.08	0.18	0.01	0.03	0.15
Garments, leather goods and shoes	0.22	0.12	0.07	0.02	0.05	-0.04
Wood products, paper products, printing and publishing	0.56	0.26	0.14	0.03	0.05	0.09
Coke, fuel, petroleum and chemicals	1.07	0.38	0.71	0.03	0.06	-0.11
Plastic and rubber products	0.56	0.19	0.27	0.03	0.02	0.05
Concrete, cement and glass	0.49	0.18	0.05	0.06	0.02	0.18
Iron and steel	0.47	0.20	0.34	0.02	0.02	-0.11
Metal products, machinery and tools	0.61	0.16	0.08	0.02	0.04	0.31
Electrical, lifting, medical and industrial equipment	0.58	0.12	0.09	0.04	0.04	0.29
Motor vehicles and transport systems	0.97	0.26	0.46	0.05	0.05	0.15

[ON-LINE APPENDICES, NOT FOR PUBLICATION]

Appendix A. Recent History of Services Reform in India

In collaboration with a team of local economists in India, we collected detailed information about policy changes affecting services sectors, in order to identify the key policy breaks for each sector. The local team consulted extensively with government and regulatory agencies, business associations, and sector specialists. These consultations were helpful to get an understanding of the relative importance of different policy changes, and to get a grasp of the degree to which reforms were actually implemented at a given point in time. One of the main angles from which we looked at services reform was the degree to which market forces were active in the sector, triggered by the possibility of new entry into the sector, both domestic and foreign. In some cases, legal or de-facto restrictions on entry were reduced, leading to actual entry of new providers, and in other cases market discipline increased due to a potential threat of new entry.

Our investigations took into account any major policy changes enacted between 1991 and 2003. In 1991, India embarked on a radical change of course in economic policy, involving deregulation and tariff reductions in many sectors. The initial reforms affected principally manufacturing sectors, while services were generally affected in the years following the first reforms. We record the first significant changes in financial services, telecommunications and transport as early as the 1993/94 fiscal year.[39] In what follows we highlight some of the major policy changes we recorded for 4 services sectors, and then describe our strategy for quantifying this information into a services liberalization index.

Telecommunications

Initially, the sole provider of telecom services in India was the Department of Telecommunications (DoT), a government agency. Two large corporate entities were spun off from DoT in 1986, MTNL for Delhi and Mumbai, and VSNL for all international services.

The process of entry of private players in providing telecommunication services commenced in 1992 with several licenses issued to the private sector, for a switching capacity of over 1.5 million lines. The first privately-owned lines in operation were limited to private networks in industrial areas, which emerged during the fiscal year 1993/94.

In the 1994/95 fiscal year, cellular phone service emerged in India, with initially only consumers in major cities being able to choose between providers. All of these have a minority participation of foreign capital, which is restricted to 40 percent of equity.

During the same fiscal year, the government announced a new National Telecom Policy, which was the first official recognition of a move towards a privately operated telecommunications sector. The new policy provided the guidelines for further private sector engagement in Indian telecommunications. For fixed line services, the government decided to issue one additional license to provide basic telecom services in each state, additional to the local public incumbent provider. The licensing process for this begins but is not concluded in this fiscal year.

During 1995/96, the government attempted to auction additional licenses for both landline and cellular services, with some letters of intent issued to some operators for cellular operations. Rebidding had to take place for landline licenses in 13 states after the initial bids were considered low. Towards the end of that fiscal year, the telecom regulator (TRAI) was set up, to regulate further private engagement and settle disputes between operators.

[39] We dated policy changes to the fiscal year rather than to the calendar year. The fiscal year in India starts on April 1st and ends on March 31st.

In 1996/97, the government issued letters of intent for additional licenses in fixed services, and removed restrictions on cross-border borrowing for telecom projects. The following fiscal year saw the opening up of internet services for private providers, as well as the expansion of the definition of priority sector lending to include telecoms projects. This facilitated access to credit for telecom investments. In June 1998, the first private landline services became operational. By 1998, there was an effective choice of cellular services providers across most of the country.

During the 1999/00 fiscal year, the government issues a new telecommunications policy, which strengthened the regulating agency and outlined a further opening up of national long distance to private sector as well as the liberalization of international calls. Moreover, the licensing fee arrangements were shifted from a fixed license fee to revenue sharing for existing cellular and fixed line providers which reduced financing constraints of operators. The Department of Telecommunications was corporatized during the 2000/01 fiscal year.

During the 2002/03 fiscal year, the national long distance sector was opened to the private sector without any restriction on the number of operators. Despite an initial announcement that the international segment would not be liberalized before 2004, the government also terminated the VSNL monopoly in international services at the beginning if the 2002/03 fiscal year.

Transport Services

Before the beginning of the reforms in the transport sector, the state played a dominant role in all segments. In air transport, there were two public monopoly carriers: Indian Airlines for domestic routes and Air India for international connections. Airport infrastructure was almost entirely operated by the National Airports Authority and the International Airports Authority, two public sector entities. In maritime transport services, the state controlled the major ports, and shipping services were controlled by both public and domestic private enterprises. The latter were tightly regulated by the state, and required official permissions for acquiring and selling a vessel. In the road transport sector, the public sector was the only provider of road infrastructure, and only nominal tolls were collected at a few bridges. Transport operations were subject to many rules and regulations related to the registration of different types of vehicles. Preferential access to credit for small trucking companies implied that these accounted for about 95 percent of the sector.

In 1990/91, citizens were allowed to apply for a license to operate air taxis, which was a way to circumvent to the domestic air transport monopoly to a limited degree. Air taxis faced a number of limitations, however. They were constrained to using small air craft and could not publish regular schedules. In maritime transport, regulation was changed in 1992/93 so as to allow foreign shipping lines to bring containers from the hinterland to a port and carry them to destinations abroad without trans-shipment en route. The acquisition and sale of vessels was no longer subject to government approval as of this fiscal year.

In 1993/94, entry into domestic air services was liberalized substantially with the official abolition of Indian Airlines' monopoly on domestic air services. This resulted in entry into domestic air services and competitive pressure in the domestic market. In maritime transport, freight and passengers fares which were previously set by the public sector were decontrolled to promote coastal shipping. In road transport, the National Highways Act was amended to enable levying of a fee on selected sections of national highways. This was an important step towards encouraging private engagement in road construction. In addition, most states abolished the "octroi" duty in 1993/94, which had previously acted as an internal tariff levied on the movement of goods across states.

In 1994/95, private participation was invited into the construction of container terminals, warehousing and storage facilities and for repairs and transportation within ports. In road transport, an amendment was passed to remove ceilings on the number of stage carriage permits that can be held by an individual or a company, thus facilitating the emergence of large trucking companies in a sector that was previously restricted to small enterprises. The

government also created the National Highways Authority (NHAI) in order to accelerate the pace of private sector participation in road building.

During 1995/96, operative restrictions on shipping companies were loosened. In particular, these were permitted to get their ships repaired at any shipyard without seeking prior approval from the government. In the following fiscal year, local equity requirements for companies owning a ship in India were abolished.

In 1997/98, foreign direct investment (FDI) in airlines was allowed up to a 40 percent ceiling, although foreign airlines were still barred from investing in the Indian air transport sector. Non-resident Indians were exempted from the FDI ceiling. In maritime transport, FDI up to 74 percent of equity was allowed in port construction and up to 51 percent in support activities such as pier operation. In road transport, 100 percent private engagement on a BOT ("Build, operate, transfer") basis was permitted. Prior to this, the role of the private sector had been dismal, except as contractors to the government entities involved in infrastructure creation. For up to 74 percent of foreign participation in the construction, maintenance of roads and bridges, the investment approval was made automatic. In those cases where the collection of tolls was suspended due to political opposition, the government pledged to compensate investors according to international norms. The FDI ceiling in port construction was abolished entirely in 1998/99.

Starting in 1999/00, foreign equity participation in air infrastructure ventures was permitted up to 74 percent with automatic approvals and up to 100 percent with special permissions. Restructuring of some of the airports of the Airport Authority of India was envisaged to take place through long term leases to the private sector. In 2004, private airlines were allowed to operate international routes from India. Private airline Jet Airways has already gained a market share of 46 percent.

Banking Services

In the initial situation before 1993, public sector banks controlled most of the Indian market for banking services, coexisting with a few international banks and private banks. The expansion of foreign banks, however, was limited by a host of explicit and non-explicit hurdles. Branch licensing policy required any bank to obtain a license before it could open a branch. The Ministry of Finance was responsible for the operations of public sector commercial banks and the RBI regulated all banks' activities. Interest rates of all types were determined by the government, and market forces were generally not active in this sector.

In the 1993/94 fiscal year, the government passed legislation to establish the in-principle approval of new private sector banks. The in-principle approval meant that the government was generally open to new entry with no explicit barriers, but potential entrants still had to go through various clearance processes. Approvals were not easy due to stringent RBI regulatory supervision. Equity holdings in new private banks up to 20 percent were explicitly allowed to "foreign institutional investors", but foreign banks were barred from holding equity in a new private bank in India. Non-resident persons of Indian origin (termed NRIs) could hold equity of up to 40 percent. As far as operations are concerned, bank lending norms were liberalized and banks were given more freedom to allocate their inventories and receivables across different items. They were also allowed greater freedom in deploying their foreign exchange resources. Seven new private banks entered the market in this fiscal year.

The period between 1994 and 2000 saw only minor changes to banking regulations. A first cautious attempt of deregulating interest rates was made in 1994/95, but this only affected very large loans and hence a few corporate houses able to borrow such large amounts. The active interest rates on deposits over 2 years were freed in 1996/97. Moreover, the ceiling for housing loans to private individuals was raised in 1998/99, and a number of items were added to the definition of "priority sectors", to which 40 percent of all lending was funneled by regulation.

In 2000/01, the government revised norms for entry of new banks in the private sector. While the government had signaled its general acceptance of private entry in 1994/95, this measure reduced the implicit barriers to entry. As of 2000, entry was made easier provided the entrant observed a continuous capital adequacy ratio of 10 percent from the date of start of operation and opened 25 percent of the branches in rural and semi urban areas. In addition, every bank was subject to allocating 40 percent of lending to priority sectors. In the same year, the government signaled its intention to eventually withdrawing from being a major player in the banking sector by reducing the minimum government equity share in nationalized banks to 33 percent and enabling the public sector banks to raise fresh equity from the capital.

In 2001/02, the government undertook a major step towards the deregulation of interest rates. Banks were allowed to lend at rates below the official "Prime Lending Rate" to exporters and other credit worthy borrowers (including public enterprises). Banks were allowed to set their own lending rates, and to undercut them when necessary. This marked the emergence of price competition for loans. Private sector banks have grown significantly more important as lenders by this time.

The restrictions to foreign engagement in the Indian banking sector were significantly reduced in 2002/03. The clearance process for foreign participation up to 49 percent in private banks was made automatic, rather than case-by-case as before. Beyond this ceiling for automatic clearance, foreigners could still apply for case-by-case permission. Foreigners could also acquire capital shares up to 20 percent in public sector banks,

In the Union Budget for 2003/04, the limit of Foreign Direct Investment (FDI) in banking companies was raised from 49 percent to 74 percent. Aggregate foreign investment in a private bank from all sources allowed up to a maximum of 74 percent of the paid up capital of the bank. A full opening of the Indian banking sector to foreign capital, however, is yet to come.

Insurance services

Reforms in the insurance sector commenced only in the second half of the 1990s. Prior to that, insurance was a public sector dominated sector. Life, general and medical insurance were all only conducted by four public sector entities under the control of the Ministry of Finance. A handful of very small domestic private sector insurers did exist. The level of competition was very low as each of the 4 large entities tended to specialize in one or two segments of the insurance market.

In 1998/99, the government announced its intention to open the Indian insurance industry to the private sector, including joint ventures between domestic and foreign providers. This announcement was implemented with the Insurance Regulatory Development Authority (IRDA) Bill passed in December 1999, which explicitly opened up the insurance sector to private providers, allowed foreign equity in domestic insurance companies subject to a maximum of 26 percent of capital. Potential new entrants would have substantial freedom with respect to pricing and management decisions, but would be subject to regulatory supervision. However, an entry permission was still required, and given the dominance of the public sector enterprises, significant acquisitions were more or less ruled out.

In 2000/01, the regulator passed 15 regulations regarding freedom of operations of private insurance companies as well as explicit disclosure norms. While this was important to define the rules of private entry, actual entry of private insurers did not take place before 2002. During the 2002/03 fiscal year, 12 new companies, among which life insurance and general insurance companies, were granted licenses and started business. In 2005, the government announced its intention to raise the FDI limit in the insurance sector from 26 percent to 49 percent.

Appendix B. The Construction of the Services Liberalization Index

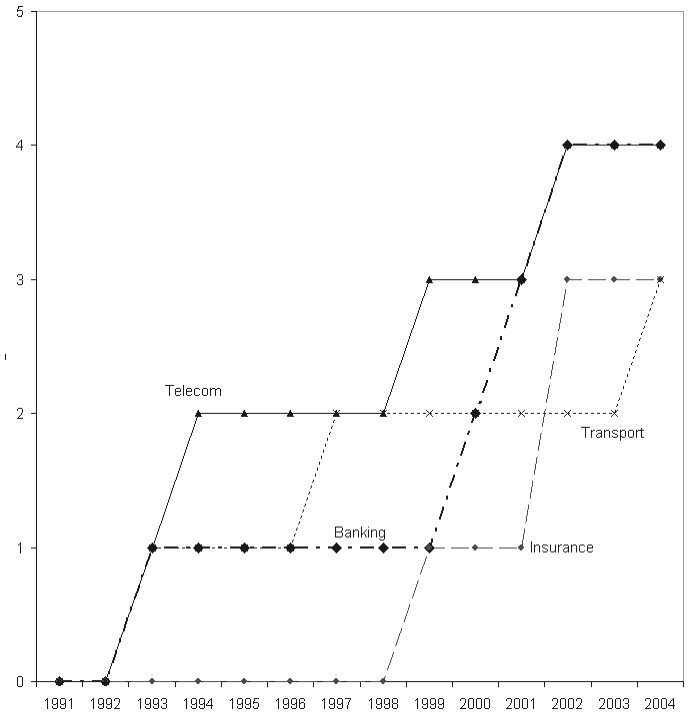
In order to make the services policy information amenable to quantitative analysis, we translated the policy changes into a sector-specific liberalization index, taking values from 0 to 5.[40] Our primary concern was to maintain comparability across sectors, because our empirical strategy measures firms' exposure to upstream services reform by means of a weighted sum of the state of reform in four services sectors. Common definitions of what level of reform constitutes a given value of the index were used to preserve comparability. We started out with a general template of degrees of openness that is not specific to any sector, and then adapted this template to the specificities of each of the four services sectors.

In our general template, we attach an index value of 0 to a situation where hardly any progress has been made and the public sector is either the only relevant provider of services or has an extremely strong grip on private providers. A level of 1 indicates at least some scope for private sector participation and some liberalization of operational decisions, combined with some very limited scope for foreign participation (limited, for example, by low FDI ceilings or announced only as intentions). In order to qualify for an index value of 2, we required that there be only a limited degree of interference with operational decisions by public authorities, a substantial price liberalization, and clear scope for foreign participation even if only in narrowly defined segments and as minority participations. Still, the state remains a dominant actor in the sector. An index of 3 implies significant scope for private providers, including foreign ones, a noticeable competitive pressure on the public incumbents from new entrants, and explicit possibilities for foreign equity participation. A level of 4 is equivalent to little public intervention into the freedom of operation of private providers, the possibility of majority foreign ownership, and the dominance of private sector entities. Finally, a level of 5 would be equal treatment of foreign and domestic providers, a full convergence of regulation with international standards and unrestricted entry into the sector.

In adapting the template to sectors, one needs to take into account that in some sectors liberalization can proceed at different paces in different segments. In telecommunications, for example, developing countries are typically quicker to allow private (and foreign) capital into cellular services than into landlines. In segments where private entry is possible, operators tend to face relatively little public intervention in the operation of their business. As a result, one is likely to observe a coexistence of segments in which market forces can govern more freely with others that remain a public monopoly. In other sectors such as banking, there is no such natural division into segments. Instead, one might find a situation in which private (and foreign) entry has taken place into the provision of almost all banking products, but significant public interference with private decisions remains in the form of directed lending to priority sectors or interest rate restrictions. Hence the need to rephrase the index definitions for different sectors while trying to maintain the same sense of "average" openness associated to a given level of the services liberalization index. In what follows we present the sector-specific definitions of the index, and juxtapose these with the actual reform events that determined progress to the next level of the index. To illustrate India's reform progress in the services sectors we analyze in this paper, Figure 1 gives a graphical illustration of the variation contained in the services liberalization index.

[40] The European Bank for Reconstruction and Development produces a similar set of indices for transition countries in their 2004 Transition Reform, and some of the definitions used in that index have inspired the construction of our index.

Figure B1. A graphical representation of the Services Policy Liberalization Index



Telecommunications

Definition of step		Year of achievement in India, and accomplishments indicating reform progress	
0	Clear public sector dominance with no private sector involvement At most announcement of future private sector role strong political interference in management decisions low tariffs and extensive cross-subsidies		
1	Some first instances of private sector involvement, but limited to particular segments of the market. Some liberalization of operational decisions where private sector is involved. At most there is talk about allowing foreign presence, but not yet in operation.	1993/94	The first private networks in industrial areas were licensed and put in operation. Licensing process for cellular service begins, envisaging the possibility for foreign participation.
2	Private participation begins in important segments of the market, most likely the cellular segment (which tends to be the first to rely on private participation). In these segments, public interference with operational decisions is limited. There is clearly defined scope for foreign participation, but with certain limits. In other segments, the public sector remains dominant, with fixed-line tariffs still politically set.	1994/95	Private cellular service providers emerge in major cities, all of which have some foreign equity. Process of issuing further licenses to private sector begins. New Telecom Policy announced to define framework for further private sector participation. FDI possible up to 49 percent.
3	Significant scope for private providers, including foreign ones, beyond one segment of the market. Some competitive pressure on pre-reform fixed line incumbent. Explicit possibilities for foreign equity participation.	1999/00	New Telecom Policy issued which defines the way ahead for a complete opening of national and international long distance market. Regulator strengthened, licensing fee arrangement made more favorable for private operators.
4	Hardly any public intervention in cellular and value added services, where the private sector is dominant and foreign investors significantly present. Free entry into relevant segments of the fixed line market. Comprehensive regulatory and institutional reforms.	2002/03	National long distance market fully open with no restrictions on the number of operators. Public monopoly in international gateways abolished.
5	Private sector providers dominate in almost all segments. Effective regulation through independent regulator including a coherent framework to deal with interconnection and licensing. Effective competition in most segments of the market with unrestricted entry.	-	

Transport

Definition of step		Year of achievement in India, and accomplishments indicating reform progress	
0	Little progress, public sector is the sole provider of all infrastructure, and has dominant stakes in several segments of the transport sector. Where the public sector is not an operator such as in road transport, it regulates operations heavily.		
1	Increased scope for private sector participation in some segments of the sector. Some liberalization of operational decisions Some limited scope for foreign participation in serv provision At most there is talk about allowing foreign presence, but not yet in operation.	1993/94	Abolition of the formal monopoly in domestic air services, entry into domestic air services. Liberalization of prices in maritime freight and passenger transport. Explicit recognition of the possibility to levy user fees on national highways, which was considered a precondition for private engagement.
2	Private participation begins in important segments of the market. In these segments, public interference with operational decisions is limited. There is clearly defined scope for foreign participation, but with certain limits. In other segments, the state remains the dominant actor.	1997/98	FDI in air transport up to 40 percent is allowed (although foreign airlines are excluded). Majority FDI possible in the construction and operation of ports. First private sector engagement in road infrastructure under the "Build, Operate, Transfer" scheme.
3	Significant scope for private providers, including foreign ones, beyond one segment of the market. Some competitive pressure on public sector operators. Explicit possibilities for foreign equity participation.	2004/05	Private airlines permitted to serve international routes. Both public sector airlines feel significant competitive pressure from private competitors.
4	Important segments are almost free of public intervention, with private sector operators being dominant and significant foreign engagement present. Free entry into relevant segments of the transport market.	-	
5	Private sector providers dominate in almost all segments. Effective competition in most segments of the market with unrestricted entry. Equal treatment of foreign and domestic providers.	-	

Banking

Definition of step		Year of achievement in India, and accomplishments indicating reform progress	
0	Little progress, public sector plays the dominant role. Where there are private operators, their operations and scope of services on offer are tightly regulated.		
1	Increased scope for private sector participation. Some liberalization of operational decisions, but directed lending remains prevalent. Some limited scope for foreign participation in domestic banks.	1993/94	Legislation passed to signal government's in-principle approval of new private entry into banking sector. 7 new banks enter the market. FDI up to 20 percent but foreign banks are barred. Banks given more freedom to allocate their inventories and receivables across different items.
2	Significant private participation becomes possible. Public interference with operational decisions and discretionary barriers to entry are limited. There is clearly defined scope for foreign participation, but with certain limits. The state remains a dominant actor.	2000/01	Discretionary barriers to entry into banking sector are lowered significantly. State signals its intent to eventually withdraw from the banking sector.
3	Significant scope for private banks, including explicit possibilities for foreign equity participation. Some competitive pressure on public sector operators.	2001/02	Major interest rate deregulation allows banks to set prices more freely. Private sector banks gain more relevance as lenders and begin to crowd out public sector banks in some instances.
4	Important segments are almost free of public intervention, with private sector operators being dominant and significant foreign engagement present. Free entry into relevant segments of the transport market. Majority foreign ownership is possible.	2002/03	Foreign participation in Indian banks is made significantly easier. Clearance for up to 49 percent of equity is automatic, and majority ownership is possible subject to case-wise approval.
5	Private sector providers dominate in almost all segments. Effective competition in most segments of the market with unrestricted entry. Equal treatment of foreign and domestic providers. Full convergence of regulation with international standards.	-	

Insurance

Definition of step		Year of achievement in India, and accomplishments indicating reform progress	
0	Little progress, public sector plays the dominant role.		
1	Increased scope for private sector participation. Some liberalization of operational decisions, but still massive intervention. Some limited scope for foreign participation but low FDI ceilings.	1999/00	Bill passed to open up the insurance sector to private entry, including foreign equity participation up to 26 percent. Substantial freedom with respect to pricing, but strict regulatory supervision. Discretionary entry permission was required, and no acquisitions possible due to public sector dominance.
2	Significant private participation becomes possible. Public interference with operational decisions and discretionary barriers to entry are limited. There is clearly defined scope for foreign participation, but with certain limits. The state remains a dominant actor.	-	
3	Significant scope for private banks, including explicit possibilities for foreign equity participation. Some competitive pressure on public sector operators.	2002/03	Entry of 12 new private providers of insurance services, which constitutes a massive shake-up of the market. Competitive pressure on incumbent public insurers. FDI ceiling remains at 26 percent.
4	Most operational decisions are almost free of public intervention, with private sector operators being dominant and significant foreign engagement present. Free entry into relevant segments of the market. Majority foreign ownership is possible.	-	
5	Private sector providers dominate. Effective competition in most segments of the market with unrestricted entry. Equal treatment of foreign and domestic providers. Wide array of insurance services available at competitive prices. Full convergence of regulation with international standards.	-	

Appendix C. Additional Tables

Table C1: Alternative measures of services reform

	All services	Banking	Telecomm	Transport
Privatization $_{(t-1)}$	0.065***	0.057***	0.150**	0.077*
	(0.015)	(0.014)	(0.058)	(0.046)
Observations	22,558	22,558	22,558	22,558
R-squared	0.032	0.029	0.029	0.029
FDI $_{(t-1)}$	0.223***	0.281***	0.093	0.753**
	(0.064)	(0.092)	(0.106)	(0.293)
Observations	22,558	22,558	22,558	22,558
R-squared	0.029	0.028	0.027	0.029
Privatization $_{(t-1)}$	0.068***	0.082***	0.201***	0.534*
	(0.020)	(0.024)	(0.074)	(0.318)
FDI $_{(t-1)}$	-0.028	-0.194	-0.164	0.044
	(0.088)	(0.148)	(0.122)	(0.052)
Observations	22,558	22,558	22,558	22,558
R-squared	0.032	0.030	0.029	0.029
Services Index $_{(t-1)}$	0.717	0.819	3.967**	3.599**
	(0.461)	(0.719)	(1.696)	(1.392)
Privatization $_{(t-1)}$	0.018	-0.014	0.054	0.735**
	(0.097)	(0.198)	(0.100)	(0.332)
FDI $_{(t-1)}$	0.031	0.016	0.005	-0.001
	(0.035)	(0.060)	(0.135)	(0.042)
Observations	22,558	22,558	22,558	22,558
R-squared	0.032	0.030	0.030	0.031

Notes: The dependent variable is the log TFP estimated using the Ackerberg et al. method for each of the 11 industries listed in Table 2. All specifications include foreign dummy, output tariff, input tariff, firm and year fixed effects. Robust standard errors, clustered at the industry-year level, are reported in parentheses. *** denotes significant at the 1 percent level, ** at the 5 percent level, * at the 10 percent level

Table C2: Excluding manufacturing industries supplying services sectors. Ackerberg et al. TFP Measure

Services Index $_{(t-1)}$	1.330***						
	(0.320)						
Banking Index $_{(t-1)}$		0.997***					0.471*
		(0.304)					(0.257)
Banking Index Rajan-Zingales weights $_{(t-1)}$			0.368***				
			(0.055)				
Telecom Index $_{(t-1)}$				9.526***			12.309***
				(2.803)			(4.655)
Insurance Index $_{(t-1)}$					8.085**		-1.617
					(3.498)		(5.957)
Transport Index $_{(t-1)}$						5.463**	6.777***
						(2.191)	(2.060)
Tariffs $_{(t-1)}$	0.003	0.002	0.007***	0.002	0.002	0.002	0.003*
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Input Tariffs $_{(t-1)}$	-0.002	-0.001	-0.006	0.002	-0.001	-0.006	-0.003
	(0.010)	(0.010)	(0.010)	(0.010)	(0.011)	(0.008)	(0.007)
Foreign	0.010	0.012	0.014	0.013	0.014	0.022	0.016
	(0.021)	(0.021)	(0.020)	(0.020)	(0.020)	(0.020)	(0.020)
Observations	16,751	16,751	16,751	16,751	16,751	16,751	16,751
R-squared	0.029	0.026	0.040	0.029	0.026	0.029	0.036
Number of firms	2,842	2,842	2,842	2,842	2,842	2,842	2,842

Notes: The dependent variable is the log TFP estimated using the Ackerberg et al. method for each of the 11 industries listed in Table 2. All specifications include firm and year fixed effects. Robust standard errors, clustered at the industry-year level, are reported in parentheses. *** denotes significant at the 1 percent level, ** at the 5 percent level, * at the 10 percent level

Table C3: Productivity Effect of Services Liberalization, Structural Break Approach. Differential Effect of Services Liberalization on Foreign Firms. Ackerberg et al. TFP Measure

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Banking Break 2001	2.376***					2.318***
	(0.667)					(0.592)
Banking Break 2001 *Foreign	0.649*					-0.179
	(0.384)					(0.376)
Rajan-Zingales Break 2001		0.449***				
		(0.085)				
Rajan-Zingales Break 2001* Foreign		0.097**				
		(0.046)				
Telecom Break 2002			6.145**			4.962*
			(2.670)			(2.626)
Telecom Break 2002*Foreign			5.484***			3.418
			(1.965)			(2.256)
Insurance Break 2002				3.558*		1.934
				(2.122)		(1.818)
Insurance Break 2002*Foreign				4.884***		3.266**
				(1.184)		(1.369)
Transport Break 1997					7.983***	8.433***
					(2.640)	(2.640)
Transport Break 1997*Foreign					1.306***	0.989**
					(0.481)	(0.471)
Tariffs $_{(t-1)}$	0.000	0.003	0.000	0.000	-0.000	0.001
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Input Tariffs $_{(t-1)}$	-0.004	-0.004	-0.003	-0.003	-0.010	-0.009
	(0.009)	(0.009)	(0.009)	(0.009)	(0.007)	(0.007)
Foreign Dummy	0.019	0.012	0.018	0.019	-0.013	-0.025
	(0.017)	(0.018)	(0.017)	(0.017)	(0.024)	(0.024)
Observations	22,558	22,558	22,558	22,558	22,558	22,558
R-squared	0.030	0.034	0.030	0.029	0.032	0.037
Number of firms	3771	3771	3771	3771	3771	3771

Notes: The dependent variable is the log TFP estimated using the Ackerberg et al. method for each of the 11 industries listed in Table 2 Structural break is a binary variable taking on the value of one in the year in which a service sector experienced the most transformative policy reform and in all subsequent years. The variable is equal to zero in years prior to the reform. All specifications include firm and year fixed effects. Robust standard errors, clustered at the industry-year level, are reported in parentheses. *** denotes significant at the 1 percent level, ** at the 5 percent level, * at the 10 percent level