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Does services liberalization affect manufacturing firms' export performance? Evidence from India.

Maria Bas

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DOES SERVICES LIBERALIZATION AFFECT MANUFACTURING FIRMS' EXPORT PERFORMANCE? EVIDENCE FROM INDIA.

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HIGHLIGHTS

- Services liberalization in India resulted in 6 to 8.5 % increase in the probability of exporting for manufacturing firms.
- Services reform in India was associated with 5 % expansion in export shares of manufacturing firms.
- The initially more productive manufacturing firms have benefited more from services liberalization.

ABSTRACT

This paper investigates the relationship between the reform of energy, telecommunications and transport services in India in the mid-1990s and manufacturing firms' export performance. The empirical analysis relies on exogenous indicators of regulation of Indian services sectors and detailed firm-level data from India in the 1994-2004 period. I find that the reform of upstream services sector has increased the probability of exporting and export sales shares of firms producing in downstream manufacturing industries. The results suggest that the effect of services liberalization on manufacturing firms' export performance is stronger for initially more productive firms. These empirical findings are robust to alternative econometric specifications that control for other reforms, industry, firm characteristics and that deal with potential reverse causality concerns.

JEL Classification: O10, O12, F1, L8

Keywords: Services liberalization, manufacturing firms' export performance, firm heterogeneity and firm level data.



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POINTS CLEFS

- La libéralisation des services en Inde a augmenté de 6 à 8,5% la probabilité d'exporter des entreprises manufacturières.
- La réforme des services en Inde est associée avec une expansion de 5% de la part des exportations dans la production des entreprises manufacturières.
- Les entreprises initialement les plus productives sont celles dont les performances à l'exportation bénéficient le plus de la libéralisation des services.

RÉSUMÉ

Ce papier étudie la relation entre la réforme du secteur tertiaire de l'énergie, télécommunications et transport en Inde au milieu des années 1990 et la performance à l'export des entreprises. L'analyse empirique est fondée sur un indicateur exogène de régulation du secteur des services et sur des données des entreprises détaillées de l'Inde pour la période 1994-2004. Les résultats montrent que la réforme du secteur des services a augmenté la probabilité d'exporter et les ventes à l'exportation des entreprises qui produisent dans le secteur manufacturier. Les résultats suggèrent que l'effet de la libéralisation des services sur la performance à l'export des entreprises manufacturières est plus important pour les entreprises qui sont initialement plus productives. Ces résultats empiriques sont robustes à des spécifications économétriques alternatives qui contrôlent pour autres réformes, des caractéristiques des entreprises et des industries.

Classification JEL : O10,O12,F1,L8

Mots clés : Libéralisation des services, performance à l'exportation des entreprises manufacturières, hétérogénéité des entreprises et données des entreprises.

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1. INTRODUCTION

Services liberalization was at the core of structural reforms applied by several developing countries in the last decades. One of the goals of services reform is to enhance efficiency of service providers through strengthened competition. The transformation of services sectors in the last decades explains the steady growth of services relative to other economic sectors. Today the share of services in GDP in developed countries is 70 percent, while in developing countries represents 50 percent.² Services have also contributed to global economic growth through input-output linkages (François and Hoekman, 2010). Given the important role of services used as intermediate goods in manufacturing, the analysis of the impact of upstream services reform on manufacturing firms' performance has become key to the understanding of the micro-determinants of economic growth in developing countries.

Recent micro-level studies have shed new light on how services liberalization affects manufacturing firms' productivity gains in several developing countries (Arnold et al. (2011a), Arnold et al. (2011b), Fernandes and Paunov (2012) and Bas and Causa (2013)). These works make a critical distinction between downstream and upstream industries, focusing on the indirect effects of regulation in upstream services on firm performance in downstream manufacturing industries. Firms in downstream industries rely on intermediate service inputs, which are generally characterised by relatively strict regulation and weak competitive pressures. Lack of competition in upstream services both among domestic firms and between domestic and foreign firms can induce trickle-down effects that affect the productivity performance of downstream manufacturing sectors through different channels. Based on input-output linkages, this literature has highlighted several channels through which services liberalization shapes downstream firms' efficiency: the reduction of production factor costs, access to higher-quality service inputs, positive foreign spillovers and the availability of new varieties of services used as inputs.

¹I would like to thank Jens Arnold, Antoine Berthou, Daniel Berkowitz, Orsetta Causa, Sebastien Jean and participants of the Royal Economic Society Meeting 2013 London. I'm responsible for any remaining errors.

*CEPII (Centre d'Etudes Prospectives et d'Informations Internationales). Tel: +33 1 53 68 55 77. FAX: +33 1 53 68 55 01. E-mail: maria.bas@cepii.fr. Postal address: 113, rue de Grenelle, 75007 Paris, France.

²This figures are from UNTAC. In India, the share of services over GDP has almost doubled from 30 percent in 1950 to almost 60 percent in 2009. Manufacturing and agricultural sectors contribute only to 28.6 percent and 14.6 percent of GDP in 2009, respectively.

This paper contributes to this literature by investigating the direct effects of upstream services liberalization on downstream manufacturing firms' export performance. The liberalization of transport and telecommunications sectors is expected to reduce both fixed and variable trade costs that manufacturing firms faced when shipping their goods abroad.³ Indirect effects of upstream services reform on manufacturing firms' export patterns might also be at stake. Given that access to more efficient and/or lower cost service inputs enables manufacturing firms to improve their productivity gains, we should also expect a positive impact on their export performance.⁴ The export-selection effect of the most productive firms into the export market could be reinforced by the use of better inputs.⁵ Despite the predominant role of services reform, little is known about its impact on downstream firms' export patterns. The aim of this paper is to fill this gap by exploring the relationship between firms' export performance and services reform affecting energy, telecommunications and transport in a developing country. India represents an interesting setting to study this relationship since it experienced a substantial services liberalization that significantly exposed its service producers to competition from other domestic and foreign firms during the mid-1990s.

The empirical analysis relies on Indian firm-level data, Prowess, over the 1994-2004 period, provided by the Centre for Monitoring the Indian Economy.⁶ To measure services liberalization, I rely on a time series index measuring regulation in energy, transport and communications sectors (ETCR) on yearly basis from 1994 to 2004 constructed by the OECD. This index captures the extent of public control, entry barriers and market structure of each service sector. This index was constructed using the OECD methodology explained by Conway and Nicoletti (2006).⁷ The ETCR index was already used by Bas and Causa (2013) to measure the effects of services liberalization on manufacturing firms' productivity gains in China. I rely on the upstream-downstream approach that has been applied in the empirical literature on the impact of input-tariff liberalization and services reform on firm performance.⁸ The identification strategy consists in exploiting the variation in the magnitude of upstream services reforms

³Section 2 describes in detailed the theoretical mechanisms through which services reform affect firms' export performance.

⁴Focusing on other structural reform affecting the efficiency of intermediate inputs, Bas (2012) shows that input-trade liberalization, through reductions of manufacturing intermediate goods tariffs, has a positive effect on firms' export choices. Bas and Strauss-Kahn (2012) find that importing more varieties of intermediate goods from developed countries raises firm' TFP and export scope in France.

⁵Roberts and Tybout (1997), Clerides et al. (1998) and Bernard et al. (2009) find that most productive firms self-select into export markets. Recent developments in the theoretical literature have suggested that heterogeneous firm characteristics explain why only a subset of the most productive firms is able to export (Melitz (2003), Bernard et al. (2003) and Melitz and Ottaviano (2008)).

⁶The section 4 describes in detailed the Indian firm level dataset.

⁷In the Appendix there is a detailed description of the methodology used to construct the ETCR index.

⁸Several firm level studies have examined the effects of trade liberalization on firms' characteristics (see among others, Amiti and Konings (2007); Goldberg et al. (2010); Bas (2012) and Bas and Causa (2013)). Other strand of the literature has focused on the impact of services and product market reforms on industry characteristics (Conway and Nicoletti (2006), Barone and Cingano (2011), Francois and Woerz (2008), Fernandes (2009) and Bourlès et al. (2012)) or on firm productivity (Arnold et al. (2011b) , Arnold et al. (2011a), and Bas and Causa (2013)).

across downstream manufacturing industries, depending on the extent to which manufacturing firms rely on services. Hence, I relate export decision and export sales shares of manufacturing firms to the state of liberalization in services sectors weighted by the manufacturing industry's reliance on intermediate goods from the services sector. These weights are computed using national input-output matrix in the pre-sample year (1993) before the services reform to avoid potential reverse causality issues. The econometric identification assumes that the gains from services reform have a differential impact on export performance of downstream manufacturing firms depending on the extent to which they rely on services inputs produced in upstream regulated industries.

To establish the causal link between services liberalization and export participation of manufacturing firms, I focus on the Indian reform of energy, telecommunications and transport services during the mid-1990s. In the 1980s, these services were highly regulated and characterized by a predominant role of state-owned enterprises under a monopoly structure. These state-owned services companies might have tried to delay the entry of private domestic and foreign firms in the services sector. However, it is unlikely that downstream manufacturing firms have lobbied on the timing of services reforms (Hoekman et al., 2007). To deal with this potential endogeneity issue, I present evidence that the services index used to proxy the reform is free of reverse causality concerns. Changes in the services index are uncorrelated with industry and initial firm characteristics. Moreover, I also rely on a GMM estimator where the services exposure measure (the weighted ETCR index) is considered as endogenous. Finally, in the sensitivity tests I use the US input-output matrices to construct an alternative set of input weights for the services index that are not correlated with Indian firm and industry characteristics. Hence, I exploit exogenous changes in the services index across manufacturing firms to identify how liberalization of energy, telecommunications and transport affect the export performance of downstream manufacturing firms.

The results shed new light on the direct impact of services liberalization on firms export performance in developing countries. First, firms producing in industries with the largest service input cost reductions experienced the greatest increase in their probability of exporting and in their export sales shares. Our estimates suggest that a one-standard-deviation decrease in the services index resulted in 6 to 8.5 percent increase in the probability of exporting in the period.⁹ Our empirical estimates would imply that aligning services regulation to the average level observed in OECD countries would allow an additional increase in the likelihood of exporting by 2.25 percent per year. Firms' export-sales shares are also positively correlated with services liberalization. In our preferred specification, using export shares (ratio of export over total sales) as the dependent variable, the effect of services liberalization was an increase in export shares of 5 percent for a one-standard-deviation decrease in the services index. The estimates would imply that aligning services regulation to the average level observed in OECD countries would allow an additional increase in export sales shares of 1.3 percent per year. I then investigate

⁹The lower the index of services implies a higher degree of liberalization of the services sector.

whether the effect of services liberalization on manufacturing firms' export performance differs across firms according to initial firm productivity.¹⁰ Our results suggest that for a one-standard-deviation decrease in services index, initially more productive firms have a 5 percent and 4.3 percent greater probability of export and export shares relative to least productive firms. These findings confirm that initially more productive firms have benefited the most from services liberalization to export.

These results are robust to specifications which control for firm and industry characteristics that could be related to services liberalization and might change over time. I explicitly take into account the effect of firm total factor productivity, capital intensity and age. I also verify that the size, capital intensity and market structure of the manufacturing industry are not picking up the results. Additional sensitivity tests were carried out to test the robustness of our results. The findings remain robust and stable when I explicitly control for other reforms that took place during the 1990s in India. I take into account trade liberalization, including both output and input tariffs at the industry level, financial sector reform and other structural reforms affecting Indian states over time, by introducing region-year fixed effects. The results are also robust to alternative weights using input-output matrix of the US and firm-level measures of services intensity. Finally, these findings are not driven by specific firms in our sample (such as multinationals or state-owned firms) or by the econometric specifications.

This paper contributes to the recent growing empirical literature on the role of services liberalization in determining firm performance. Arnold et al. (2011b), using firm-level data for Czech Republic, show that services liberalization, through the entry of foreign providers, has positive effects on manufacturing firms' productivity. Along the same lines, Fernandes and Paunov (2012), relying on firm-level data from Chile and specific measures of firm level services use, find that FDI services liberalization has improved firm productivity. Recently, the study of Arnold et al. (2011a) on India's services liberalization finds that banking, telecommunications, insurance and transport reforms boost total factor productivity gains of manufacturing firms. Bas and Causa (2013), relying on firm level data for China and on a similar index used in this work measuring regulation in energy, transport and communications, show that services reforms enhance downstream firms' productivity and the effect is stronger for those firms producing closer to the technological frontier.

My findings also complement recent work on the effects of structural reforms in India. Many of these works use the Prowess dataset. Alfaro and Chari (2009) show that although the importance of private firms in the Indian economy has been growing after the economic reforms in the early 1990's, state-owned firms still represent an important share of total production and assets in some sectors. Topalova and Khandelwal (2010), Goldberg et al. (2010, 2009) and DeLoecker et al. (2012) study the micro-economic effects of trade liberalization in India in the early 90s. Input-tariffs cuts have contributed significantly to firm productivity growth and also to the ability of firms to introduce new products. My results confirm that services liberalization

¹⁰The initial productivity is measured by firms' TFP in the initial year that the firm appears in the sample.

enables firms to increase their efficiency and competitiveness in the export markets.

The remainder of the paper is organized as follows. Section II presents a simple theoretical motivation that describes the main channels via which services reform might shape firms' export performance. Section III describes India's services liberalization and presents evidence on the performance of services firms in India. Section IV presents the firm level data and the exogenous services index. Section V describes the estimation strategy and the results of the baseline specifications, and Section VI then explores the robustness of the main results. Last, Section VII concludes.

2. THEORETICAL MOTIVATION

2.1. Set-up of the model

The aim of this section is to motivate our empirical analysis by introducing a simple model of the determinants of firms' export decisions. The theory rationalizes the mechanisms through which upstream services liberalisation might affect firms' decision to export and export sales. The model is a simple extension of Melitz (2003) framework incorporating an upstream services sector providing transport, telecommunication and energy services used as inputs by final goods producers.

Firms producing final consumption manufacturing goods employ services as intermediate goods in the production process. Take a firm producing in the electrical machinery sector. In order to produce the final product, this firm uses inputs such as energy, telecommunications and transport services. Changes in regulation costs of upstream services producers will then affect the performance of downstream manufacturing firms through these input-output linkages.

The price reduction of service inputs and the increased efficiency of these inputs also affect variable and fixed export costs via direct channels. On the one hand, cost reduction or more efficient transport services directly affect per-unit variable export costs. On the other hand, to enter the export market firms also face sunk fixed export costs related to the investments that they have to make to learn about the foreign market and contact foreign buyers (Roberts and Tybout, 1997). The investment in these fixed export costs allows firms to adapt their products to the foreign tastes and production norms. Access to high-quality and/or lower costs telecommunications and transport services reduces fixed export costs that firms make in order to learn about foreign markets.

Preferences. The representative household allocates consumption from among the range of differentiated varieties of final goods ω . Consumer preferences are assumed to take the Constant Elasticity of Substitution (CES) utility function: $U = \left[\int_{\omega \in \Omega} q(\omega)^{\frac{\sigma-1}{\sigma}} d\omega \right]^{\frac{\sigma}{\sigma-1}}$, where $\sigma > 1$ is the elasticity of substitution between two varieties and Ω the set of available varieties. The optimal demand function for each differentiated variety is given by: $q(\omega) = Q \left[\frac{p(\omega)}{P} \right]^{-\sigma}$, where

$Q \equiv U$ is the aggregate consumption of available varieties, P the price index and $p(\omega)$ the price set by a firm. $R = PQ$, aggregate revenue. The price index dual to the CES utility function is $P = \left[\int_{\omega \in \Omega} p(\omega)^{1-\sigma} d\omega \right]^{\frac{1}{1-\sigma}}$.

2.2. Production

Upstream service sector. There are two sectors in the economy. The upstream sector produces a domestic constant-return-to-scale service-input, s , with one unit of labor requirement. Labor is inelastically supplied and the wage is used as a numeraire. This upstream services sector is regulated, so that the price of services inputs equals the marginal cost of producing the services ($w = 1$) and the regulation cost (r_s): $p_s = r_s w = r_s$.¹¹

Downstream manufacturing sector. This sector produces a continuum of differentiated final goods under monopolistic competition. There is a continuum of firms, which are all different in terms of their initial productivity level φ . The production of each variety of final good involves a fixed production cost f . Firms combine labor (l) and services inputs (s) to produce the final manufactured good. Downstream firms are price-takers in the services-input markets. Technology is represented by the following Cobb-Douglas production function that combines labor (l) and services (s) to produce output (q) with factor shares η and $1 - \eta$:

$$q = \varphi \left(\frac{\gamma s}{\eta} \right)^{\eta} \left(\frac{l}{1 - \eta} \right)^{1 - \eta}$$

$\gamma > 1$ represents the efficiency of the services inputs. The first-order condition of monopolistic firms is such that prices reflect a constant mark-up, $\rho = \frac{\sigma - 1}{\sigma}$, over marginal costs: $p_d = \frac{c}{\rho \varphi}$.

The per unit cost of production c equals $\frac{(p_s)^{\eta} (w)^{1 - \eta}}{\gamma}$. Since the wage is normalized to one and the price of services inputs equals the regulation cost r_s , the per unit cost of production can be written as a function of the parameters affecting the upstream services providers $c = \frac{(r_s)^{\eta}}{\gamma}$. An increase in the efficiency of services providers (γ) or a reduction of the regulation cost will enhance downstream firms' efficiency for all manufacturing firms by reducing marginal costs.

Combining the demand faced by each firm, $q(\varphi) = \left(\frac{P}{p(\varphi)} \right)^{\sigma} C$, and the price function, revenues are given by $r_d(\varphi) = q(\varphi)p(\varphi) = \left(\frac{P}{p_d} \right)^{\sigma - 1} R$. Firm profit is then $\pi_d(\varphi) = \frac{r_d(\varphi)}{\sigma} - f$.

¹¹Under perfect competition, the services provider charge the regulation tax to manufacturing firms in the final price of services inputs.

2.3. Firms' decisions

The decision to exit or stay and produce

Firms have to pay a sunk entry cost f_e to enter the market before they know what their productivity level will be. Entrants then derive their productivity φ from common distribution density $g(\varphi)$, with support $[0, \infty)$ and cumulative distribution $G(\varphi)$. After observing its productivity draw, firms decide whether to stay and produce or to exit the market. Since there is a fixed production cost, f , only those firms with enough operating profits to afford this cost can produce. The profits of the marginal firm that decides to stay and produce are equal to zero: $\pi_d(\varphi_d^*) = 0$. The value φ_d^* is the survival productivity cutoff to produce in the domestic market. This cutoff is determined by the following condition: $\frac{r_d(\varphi_d^*)}{\sigma} = f$.¹²

Export decision

Selling in the export market implies both fixed export costs and trade variable costs. Participating in the export market requires a fixed investment costs that is not related to the volume of sales but rather to the fact of selling in a foreign market. We assume that firms must pay a per-period fixed export costs (f_x) in investments on telecommunication and transport services to be able to adapt their products to foreign tastes, to carry out marketing, advertising projects and conform to shipping rules. The fixed export costs are then determined by the cost of telecommunication and transport services-inputs $f_x = \frac{r_s}{\gamma}$. Trade variable costs (τ) captured variable transport services costs.

Given the monopolistic price rule, the price in the foreign market $p_x(\varphi)$ scales up the domestic price by a factor of τ : $p_x(\varphi) = \tau p_d(\varphi)$, with $\tau > 1$. Export revenue $r_x(\varphi)$ scales up the domestic one by a factor of $\tau^{1-\sigma}$: $r_x(\varphi) = \tau^{1-\sigma} r_d(\varphi)$. Export profits are then given by $\pi_x(\varphi) = \frac{r_x(\varphi)}{\sigma} - \frac{r_s}{\gamma}$. As in the baseline framework of Melitz (2003), firm heterogeneity in terms of initial productivity levels (φ) and fixed export costs lead to the selection of most productive firms into foreign markets. The cutoff productivity level for exporting (φ_x^*) is determined by $\pi_x(\varphi_x^*) = 0$. Only those firms that have enough operating export profits to cover the fixed export costs on telecommunication and transport services will be able to sell in the foreign markets: $\frac{r_x(\varphi_x^*)}{\sigma} = \frac{r_s}{\gamma}$.

2.4. Testable Implications

Firms' export decision is determined by fixed and variable trade costs that depend on the costs of services inputs. These parameters cover the regulation tax on services providers (r_s), the

¹²All firms that have a productivity draw lower than the survival cutoff are not able to pay the fixed production cost, they make losses and exit the market ($\varphi < \varphi_d^*$). Firms with a productivity draw greater than the survival cutoff stay in the market and produce ($\varphi > \varphi_d^*$).

efficiency of services (γ) and the variable transport costs (τ). Using the price and revenue functions, firms' export profits can be expressed as $\pi_x(\varphi) = \frac{\varphi^{\sigma-1}}{\sigma} \left(\frac{\rho}{\tau} \frac{\gamma}{r_s^\eta} \right)^{\sigma-1} P^{\sigma-1} R - \frac{r_s}{\gamma}$. We can define the probability that a firm i exports at time t as:

$$\Pr(\pi_x > 0) = \Pr\left[\frac{\varphi^{\sigma-1}}{\sigma} \left(\frac{\rho}{\tau} \frac{\gamma}{r_s^\eta} \right)^{\sigma-1} P^{\sigma-1} R - \frac{r_s}{\gamma} > 0\right]$$

The probability of exporting is directly determined by the parameters affecting services providers. The reform of upstream services reducing the regulation cost of services providers (r_s), or increasing the efficiency of these services inputs (γ), will have a positive effect on firms' export decision.

Testable implication 1: Liberalisation of upstream services reduces both fixed and variable export costs having a direct positive effect on the likelihood of exporting.

The second testable prediction relates to the effects of services liberalization on firms' export revenues: $r_x(\varphi) = \varphi^{\sigma-1} \left(\frac{\rho}{\tau} \frac{\gamma}{r_s^\eta} \right)^{\sigma-1} P^{\sigma-1} R$. Reductions in the regulation costs of services or an increase in their efficiency, reduce marginal costs and boost firms' export revenues.

Testable implication 2: Liberalisation of upstream services has a direct positive impact on firms' export revenues.

In this monopolistic competition framework with heterogeneous firms, the most productive firms set lower prices and have larger export revenues to finance the fixed export cost on telecommunication and transport services. The equations determining firms' export revenues and profits show that the initially more productive firms (with a high productivity draw φ) will benefit the most from upstream services reform.

Testable implication 3: The effect of upstream services liberalisation on firms' export performance will be greater for initially more productive firms.

3. SERVICES REFORM

3.1. Services liberalization in India

This section describes the characteristics of services sector reform in India during the mid-1990s. I pay a particular attention to the policy-instruments that were applied in three services sectors: telecommunications, transport and energy.

In the 1980s, services sector in India was characterized by a predominant role of state-owned enterprises. The regulation of services was based on high entry barriers and restrictions to private domestic firms and foreign companies. In the telecommunication sector the competition structure was a public monopoly. The central government operates the National Telecom Company. The transport services sector was also operated by state-owned companies during the 1980s. More specifically, Air transport was run by two public carriers and the shipping sector was highly regulated and dominated by public owned firms. The electricity power generation sector was also under the control of the central government.

In a context of a balance of payments crisis at the beginning of the 1990s, IMF structural reforms were applied in several areas of the economy such as trade, banking and other services sectors. Trade liberalization was rapidly settled at the beginning of the 1990s, while service liberalization in the energy, telecommunications and transport sectors was implemented at the mid-1990s as a part of this package of reforms. Given that the investment needed to expand capacity and improve quality of the services sectors could not be mobilized by the government, these services sectors were opened to private investment. The policy-measures applied in the service sector aimed at increasing efficiency of the sector. Two main policy-instruments were implemented: (i) privatization via the elimination of entry barriers for domestic firms and (ii) removal of restrictions to foreign companies. Both measures have strengthened domestic and foreign competition in the services sector. The greater the competitive pressures in the service sector due to entry of new firms put down services prices. This fall in relative factor prices increases manufacturing firms' profitability and competitiveness. In this sense, lower prices of services used as inputs reduces the cost of production of manufacturing firms and allows firms that were previously unable to export to pay the fixed cost of exporting. Those firms that were already exporting might benefit by expanding their sales in the foreign markets. The second effect of intensified competition is related to technological investments. In order to face competition, firms in the service sector increase their competitiveness and efficiency through technological investments. Hence, greater competitive pressures in services sector have lead to a reduction of prices of service inputs and increased in quality/efficiency of these inputs used by downstream manufacturing industries.

The elimination of restrictions and entry barriers for foreign firms in this sector has created incentives for multinationals to locate their affiliates in India to provide services. From the mid-1990s, the Indian services sector have experienced large inflows of foreign direct investment (FDI). FDI in the service sector grew faster than in manufacturing goods. While the former grew by 36 percent between 1992 and 2002, the latter was 20 percent (WorldBank, 2004). This second policy-instrument can improve the efficiency of service sector not only through competitive pressures, but also via technology transfer. Multinational firms rely on more advanced and modern technologies than their domestic counterparts in developing countries. Modernization and technology upgrading in the Indian service sector was mainly explained by the entry of foreign companies. As highlighted by Hoekman and Mattoo (2008), one of the main reasons for the Indian government to undertake the reform of the service sector was the significant techno-

logical investments required in this sector. In order to improve the quality of services, licences to private and foreign companies were provided to carry out the major technological investments in the transport, telecommunication and even in the energy sector. The removal of restrictions to private and foreign firms in these sectors might provide then access to high-quality services due to both competition effects and superior capacity on technological investments. These high-quality input services are particularly useful in the production of high-quality manufacturing goods for export. Verhoogen (2008) shows that firms in developing countries tend to sell products of higher quality in export rather than in domestic markets.¹³ As a result, if services liberalization boosts the quality of services inputs, it may be also related to export participation: the availability of high-quality services used as intermediate goods, which were not available prior to services liberalization, allows firms to produce sufficiently high-quality goods to enter the export market.

Telecommunication sector was the one that has experienced the greater liberalization process. In 1994, the government applied the National Telecom Policy that consisted in attracting private investments. During the following years, the government decided to remove all restrictions to private domestic and foreign companies. Relative to the other services sectors, telecommunications sector has attracted the higher FDI inflows. In 2001, the ratio of FDI over GDP in the telecommunication sector was 28 percent, while in Transport sector was 1 percent and in distribution of energy 0.2 percent. As a consequence of this reform, the price of telecommunications (telephone calls) has decreased significantly. To get an order of idea of the price reduction in the telecommunication sector: the average price of a one-minute wireless call within the same circle has fallen from around Rs.12 in 2000 to RS.3 in 2003. Similarly, the price of a one-minute call to the United States was around Rs. 75 in 1995 and in 2003 is Rs. 20 (WorldBank, 2004). Reduction on telecommunications costs affect directly the costs that exporting firms faced when entering the export market related to learning about the foreign market and contact foreign buyers.

In the mid-1990s, the government also removed restrictions for private and foreign firms in Air and shipping transport sectors. Competitive pressures in the transport sector push down the prices and increase the incentives to improve the efficiency. Labor productivity in the Air transport in India increased five times during the 1994-2004 period. As a consequence, Indian carriers grew by 15 percent yearly in passenger traffic and 11 percent yearly in cargo traffic (Arnold et al., 2011a). Concerning shipping transport, the new private sector port facilities have also established high standards of productivity. The infrastructure of roads has also been reformed. In 1998, a tax was imposed on gasoline and the collected revenues have financed the development of the national highways, state roads and rural roads. The result was an upgrading of national highways connecting main cities. Some toll roads have been awarded to the private sector for development. The liberalization of the transport services has a direct effect on reducing variable trade costs that firms located in different states of India has to make to ship their

¹³He finds in Mexican firm-level data that firms upgrade quality for exporting due to greater export opportunities after an exchange-rate devaluation.

products till the nearest port.

The liberalization of the energy sector consisted in opening electricity generation to private domestic and foreign firms participation. During the 1990s, the central government has accorded 17 private power projects, giving raise to the Independent Power Producers. Despite these policies, liberalization of the energy sector was slow as compared with the other reforms in the services sector. In 2003, a new electricity Act was implemented to complete the liberalization process in the energy sector. One of the most outstanding features of this Act was the completely removal of FDI limits on generating companies, allowing 100 percent equity participation to foreign companies.

The whole services sector in India grew at an annual rate of 9 percent from the mid-1990s, contributing nearly 60 percent of the overall growth rate of the economy. Not only financial services have experienced an important growth rate, but also telecommunication, transport and energy services. Table 1 in the Appendix shows valued added and total production for the telecommunications, energy and transport services in 1993 and 1999.¹⁴ As can be notice, these services sectors have expanded their production after the reforms. The last column reports information on the service input expenditures by manufacturing industries in India for each of the three service sectors. The consumption of energy by manufacturing industries has increased the most, following by telecommunication inputs and finally by transport services.

3.2. The performance of services firms in India

This section provides evidence on the investments of private and foreign firms relative to state-owned firms in the services sector in India in the period after privatization and FDI services liberalization policies were implemented (1994-2004).

To examine the performance of services firms, I rely on Indian firm level information from the Prowess dataset provided by the Centre for Monitoring the Indian Economy. I restrict the analysis to firms producing in the following three services sectors of interest for our analysis: (i) transport (airlines, shipping, railway, road services and infrastructure), (ii) telecommunications (post and communications) and energy (electricity distribution and generation).

The Prowess dataset allows us to classified firms according to their ownership status: private, foreign, public-owned and mixed firms (public and domestic private firms). I look at performance premia of foreign and private firms relative to public and mixed companies. I regress firms' investments, marketing expenses and foreign royalties and technical know-how on firm ownership dummies, 2 digit sector indicators and year dummies. I also control for firm size measured by the logarithm of the wage-bill and the age of the firm. The omitted category is mixed firms.

¹⁴This information comes from the input-output matrices from OECD at the 2 digit industry level. Unfortunately, there is no disaggregated data available for more recent years.

Table 2 reports the estimation results. Relative to public and mixed companies, foreign and private firms have carried out greater investments in capital (column 1). Only foreign firms have improved their investments in marketing (column 2). In the last column, I look at the probability to invest in foreign royalties and technical know-how for services firms. In this case, within the same industry, also foreign-owned companies and private Indian firms are more likely to engage in foreign royalties relative to state-owned and mixed firms.

Next, I provide evidence that these technological investments made in the services sector are correlated with the ETCR index measuring the degree of services liberalization. I regress firms' investments, marketing expenses and foreign royalties and technical know-how on the ETCR index and 2 digit sector indicators.¹⁵ Table 3 shows the estimation results. The coefficient on the ETCR index is negative and significant as expected indicating that services liberalization has a positive impact on technological investments made by services firms.

These technological investments made by foreign and private firms in the services sector have improved their efficiency. Through competitive pressures, the entry of more efficient providers might have not only put down prices of transport, telecommunication and energy services, but also upgrade the quality of these services used as intermediate goods by downstream manufacturing firms.

4. DATA

4.1. Firm level data

The Indian firm-level dataset is compiled from the Prowess database by the Centre for Monitoring the Indian Economy (CMIE)¹⁶. This database contains information from the income statements and balance sheets of listed companies representing more than 70 percent of total output in the formal manufacturing sector of India. The database is thus representative of large and medium-sized Indian firms.¹⁷ As previously mentioned this dataset was already used in several studies on the performance of Indian firms.¹⁸

The dataset covers the period 1994-2004 and the information varies by year. It provides quantitative information on domestic and export sales, capital stock, income from financial and non financial sources, consumption of raw material and energy, wage-bill, ownership group and year of incorporation of the firm. This dataset allows us to compute total factor productivity (TFP) using Levinsohn and Petrin (2003) methodology.¹⁹

¹⁵Note that in this specification year dummies are not included since the ETCR index varies on yearly basis.

¹⁶The CMIE is an independent economic center of India. For more information see: <http://www.cmie.com/database>.

¹⁷Since firms are under no legal obligation to report to the data collecting agency, the Prowess data do not allow properly identifying entry and exit of firms.

¹⁸See Topalova and Khandelwal (2010), Topalova (2004), Goldberg et al. (2010), Goldberg et al. (2009), Bas and Berthou (2012) Alfaro and Chari (2009), DeLoecker et al. (2012).

¹⁹Firms' sales, capital stock, materials and wage-bill are deflated using specific NIC 2-digit industry deflators.

I restrict the analysis to manufacturing firms. Our final sample contains information for 5,756 firms in organized industrial activities from manufacturing sector for the period 1994-2004. The total number of observations firm-year pairs is 29,205. Table 4 summarizes the main firm level variables used in the empirical analysis for the whole period and in the initial and last year of the sample. In order to keep a constant sample throughout the paper and to establish the stability of the point estimates, I keep firms that report information on all the firm and industry level control variables. Although our panel of firms is unbalanced, there is no statistical difference in the average firm characteristics presented in table 4 between the initial year (1994) and the final year (2004) of our sample.

4.2. Services sector index

The services reform analysis relies on a time series index measuring the regulation in energy (electricity and gas), transport (air and land) and communications (post and telecommunications) sectors (ETCR) in India on yearly basis from 1994 to 2004 constructed by the OECD. The Appendix presents detailed information on the construction of the ETCR index.

The ETCR sub-indexes are constructed based on subindicators that measure entry barriers, public and foreign ownership and market structure.²⁰ The methodology used by OECD to construct the ETCR index is described in Conway and Nicoletti (2006) and used for OECD countries by Bourlès et al. (2012).

For each downstream manufacturing industry, an industry-specific services index is constructed by weighting each upstream industry sub-component of the ETCR indicator by the manufacturing industry's reliance on those upstream sectors' (energy, transport and communication). This weight is measured by the share of each of these service inputs used by each manufacturing industry on total input expenditures, based on India's input-output matrices at the 3-digit industry level. To reduce potential endogeneity issues between service input weights and firms' performance, I use the input-output matrix in the pre-sample year (1993). The services reform exposure measure for each manufacturing industry s and year t is then given by:

$$\text{Services reform exposure}_{s,t} = \sum_j \chi_{j,s} \text{ETCR sub-indexes}_{j,t}$$

where $\chi_{j,s}$ is the value share of energy, transport and communication inputs used in the production of the final goods of 3-digit manufacturing industry s . As described in the previous section and reflected in the changes of the policy indicators, some steps towards liberalization

²⁰Each of these subindicators is computed from several questions. Take for example entry barriers and air transport services, the question raise was: "Is the domestic aviation market in your country fully liberalised? That is, there are no restrictions on the number of (domestic) airlines that are allowed to operate on domestic routes?". Concerning public ownership the questions target the percentage of shares in the sector that are owned by government. Market structure is measured by the market share of new entrants in each services sector and the market share of the largest company in the sector.

took place in two essential providers of upstream services, namely electricity and Telecommunications (telecom and post). Table 5 in the Appendix shows the ETCR sub-indicators for India in the initial and final year of the sample. A reduction on these indicators implies a higher degree of liberalization. This table also provides the same ETCR sub-indicators for the average of OECD countries. As can be noticed in 1994, all services sectors in India had a greater level of regulation relative to the average of OECD countries. Relative to transport and energy sectors, telecommunications experienced the greater liberalization process in India during the period. This evidence is in line with the reforms of the services sector presented in Section 3.1.

During the period under analysis, the average service reform exposure index, defined as a weighted average of the sub-indexes, varies between 0.11 and 0.94, with an average of 0.49 and a standard deviation of 0.17. There is also significant variation in movements in the service regulation index by industry over the 1994-2004 period. The change in the service regulation index across manufacturing industries between 1994 and 2004 ranges between -0.26 for the highest reduction (paper industry) to -0.05 for the lowest variation (transport equipment) with an average change of -0.15 points.

We exploit these changes in the regulation of the service sector across manufacturing industries to identify the effect of the reduction of variable costs of service inputs used by manufacturing firms on their export patterns.

4.3. Exogenous services sector index

Services reform in India might not be free of political economy concerns. State-owned services companies might have lobbied to delay the privatisation and removal of restrictions to foreign-owned companies in the services sector. These political economy arguments explain why services reform in India was implemented at the mid-1990s after trade liberalization.

Hoekman et al. (2007) describe that the timing of service liberalization might have been affected by political considerations concerning the services sector. Chari and Gupta (2008) show that in capital-intensive industries, some profitable state-owned firms were protected from competition of foreign and domestic-private firms at the beginning of the 1990s.

Nevertheless, it is unlikely that manufacturing firms producing in downstream industries have affected the liberalization in services sector. The question here is whether manufacturing industries that increased their exports were able to lobby for reforms targeting the services sector in order to get lower costs and/or more efficient service inputs. If this was the case, the services reform exposure measure used as a proxy of the degree of services liberalization would suffer from reverse causality concerns.

A second reason why the service index could be considered as endogenous is the way in which the service input weights are computed based on input-output linkages. For example, if bigger and more productive industries rely relatively more on energy, transport and telecommunications, the cross-industry variation in the service index might reflect the cross-industry variation

in size and productivity. One way of dealing with this issue is to rely on the pre-sample year Indian input-output matrix, 1993, before the reform of the services sector took place. All estimations are then run in the 1994-2004 period. Still, endogeneity risk cannot be completely get rid of if there is persistence in productivity and size growth over time. To address this issue, I rely on a GMM estimator where the services exposure measure (the weighted ETCR index) is considered as endogenous in section 6.2. Moreover, I also carry out sensitivity tests using an alternative set of weights which are not correlated with Indian firm and industry characteristics. I rely on US input-output matrices to construct an alternative set of input weights for the services reform exposure measure in section 7.4.

A preliminary descriptive analysis provides evidence supporting the view that the service index used in the main specifications is exogenous to industry and firm characteristics. First, the services index varying across manufacturing sectors is only weakly correlated with manufacturing industry characteristics. The correlation between the change in the services index between 1994 and 2004 and initially industry size in 1994 measured by total sales at the 3-digit level is 0.03, while that with export sales is 0.02 and with the wage-bill is 0.06. As such, it seems unlikely that firms producing in manufacturing industries with greater liberalization of services were able to lobby for these lower costs or more efficient services inputs.

An additional step towards addressing this issue, which makes economic sense, is to see whether changes in the service index are exogenous to initial firm characteristics. I provide some evidence that changes across 3-digit manufacturing industries in the service index between 1994 and 2004 were uncorrelated with initial firm-level outcomes in 1994, such as export status, export sales, exports over total sales, firm TFP and domestic sales. Had downstream manufacturing firms successfully lobby for liberalization of the service sector, we would expect the service index changes to be correlated with initial firm performance. A similar approach is taken by several works on trade liberalization to test whether tariff changes are exogenous to initial firm characteristics (Goldberg et al. (2010), Teshima (2010) and Bas (2012)).

Table 6 shows the coefficients on the change in services index (1994-2004) from firm-level regressions of initial firm characteristics on these services index changes. There is no statistically significant correlation between firm initial characteristics and the reductions of the service index across manufacturing firms.

Overall this evidence shows that our measure that captures the degree of service liberalization in each manufacturing industry is free of reverse causality concerns.

5. ESTIMATION STRATEGY

5.1. Services liberalization and manufacturing firms' export decision

Using the services index to identify changes in the variable costs of regulation of upstream sectors across manufacturing industries, I first investigate the relationship between services reform

and firms' export decision. To test the first implication of the simple theoretical framework, I estimate the probability that firm i exports in year t using the following linear probability model:

$$Exporter_{ist} = \gamma_1 \text{ Services reform exposure}_{s,t-1} + \gamma_2 X_{i,t-1} + \gamma_3 Z_{s,t-1} + \mu_i + \nu_t + \varepsilon_{ist} \quad (I)$$

Here $Exporter_{ist}$ is a dummy variable for firm i producing in 3-digit industry s having positive export sales in year t . Services reform exposure $_{s,t-1}$ represents the regulation index of service sector of the 3-digit NIC manufacturing industry s in year $t - 1$. $X_{i,t-1}$ is a set of firm level control variables and $Z_{s,t-1}$ is a set of industry level control variables. All specifications include firm fixed effects, μ_i , that take into account unobservable firm characteristics and year fixed effects that control for macroeconomic shocks affecting all firms and industries in the same way, ν_t . The standard errors are corrected for clustering across 3-digit industries level.

Using micro-level data, a number of pieces of work have shown that export participation is positively correlated with productivity and capital intensity (Aw et al. (1999), Clerides et al. (1998), Roberts and Tybout (1997), Aw et al. (1999) and Bernard et al. (2005)). I therefore expect that non-exporting firms which experienced significant growth in total factor productivity and capital intensity were more likely to export. To deal with additional concerns of omitted variables, I introduce different control variables at the industry level which may affect firms' export decisions and could reflect the effects of service liberalization. I first include the wage-bill as a proxy of industry size and capital intensity measured as the industry median of firm level logarithm of wage-bill and the ratio of capital stock to wage-bill. Second, we also include a Herfindhal index at the sectoral level to control for concentration of sales.

Identification of γ_1 comes from the variation of the services index across manufacturing industries and over time. The lower the services index is associated with higher degree of liberalization. As India has experienced a deregulation of the services sector during the period 1994-2004, I expect that $\gamma_1 < 0$ indicating that firms producing in those manufacturing industries with greater service input cost reductions increase their probability of exporting. Table 7 shows the estimation results for equation (I) using a within firm estimator. Column (1) presents a univariate regression and the coefficient of services index obtained the expected sign. I next include firm and industry level variables that could be picking up the effect of service regulation index. The coefficient of interest is robust and stable when we control for the age of the firm (column 2) and firm TFP and capital intensity (column 3). Our estimations confirm that firm productivity is positively correlated with the probability of exporting. In line with the previous empirical findings on the literature, the older the firm and the more capital intensive the higher the likelihood of exporting. Column (4) includes the Herfindhal index, the size and the capital intensity of the industry. The coefficient on the services index remains negative, significant and stable, however. It is very similar in size to the estimation without any control variable shown in columns (1).

Keeping in mind that the lower the index of services implies a higher degree of liberalization, the estimated coefficients in column (4) suggests that a one-standard-deviation decreased in

the index of services liberalization resulted in 8.5 to 6 percent increase in the probability of exporting. The average change in the weighted ETCR indicator between 1994 and 2004 leads to 5 to 6 percent increase in the likelihood of exporting. Next, I look at the additional gains that manufacturing Indian firms would get if they have adopted at the end of the period, in 2004, the level of services regulation of the average OECD countries. Adopting the average level of services regulation of OECD countries, would increase the probability of exporting for Indian firms by 24 percent in eleven years. Hence, the empirical estimates would imply that aligning services regulation to the average level observed in OECD countries would allow to increase the likelihood of exporting by 2.25 percent per year.

5.2. Controlling for past-export experience

The results presented in the previous section might suffer from an omitted variable bias since previous export experience matters to explain firms' current export decision.

In this section, I perform a dynamic specification of equation (I) in which firm export status depends on its past export participation. This implies the following auto-regressive multivariate model:

$$Exporter_{ist} = \gamma_0 Exporter_{is,t-1} + \gamma_1 \text{ Services reform exposure}_{s,t-1} + \gamma_2 X_{i,t-1} + \gamma_3 Z_{s,t-1} + \mu_i + \nu_t + \varepsilon_{ist} \quad (\text{II})$$

If the error term contains a specific time-invariant unobserved heterogeneity, the lagged export status is then endogenous to the error term. The GMM estimator developed by Arellano and Bond (1991) provides an econometric strategy to consistently estimate equation (II). This strategy exploits moment conditions of exogeneity of the lags of the endogenous dependent variable (export status).

Table 8 reports the results. Following Bond (2002), I first include OLS and within-group (WG) estimators to identify an interval within which a consistent estimate of the autoregressive coefficient γ_0 should lie. Column (1) reports the OLS results, column (2) the within-group estimates and column (3) shows the GMM results. Comparing the results from column (1) and (2) reveals that the coefficient of the auto-regressive term ($Exporter_{i,t-1}$) is greater under the OLS specification than in the case of within-group regressions. This result implies that the number of export status lags on the right-hand side (one lagged in this case) is correct and this implies that the dynamic specification is consistent.

The GMM estimator relies on a set of instruments composed by deep lags (five to seven lags) of both export status and Services reform index which are treated as endogenous. Since not only export status is considered as an endogenous variable but also the services exposure measure, the GMM specification provides an additional sensitivity tests on the potential endogeneity issue between services liberalization and firms' export decision discussed in Section 4.3. The Hansen and Sargan tests validate our instrument choice.²¹

²¹The number of individuals relative to the number of instruments is reassuring as regards any possible bias in the

Note that under the dynamic GMM specification once we correct for the potential omitted variable issue controlling consistently by past export experience, the sign and magnitude of the coefficient on services reform index is stable relative to the within-group estimation presented in Table 7. These findings confirm that services reform in upstream sectors in India has a positive effect on manufacturing firms' export decision. Moreover, this robustness test suggests that our previous results are free of reverse causality concerns.

5.3. Services liberalization and manufacturing firms' export sales

In this section, I explore the effects of services liberalization on the intensive margin of exports. The second testable prediction suggests that reductions of services costs reduce firms' marginal costs and boost firms' export revenues.

One concern that arises in the estimation of the determinants of export sales is that this variable is observed only over some interval of its support. In this case, the sample is a mixture of observations with zero and positive values. An OLS estimation with firm fixed effects of the logarithm of export sales will exclude the zero export values leading to sample-selection bias and inconsistent parameter estimates as the censored sample is not representative of the entire sample of Indian firms. In our case, only half of firms report positive export sales. To address this issue, I also use export shares (export over total sales) on the left-hand side, to explicitly take into account the zero values. Section 6.2. presents alternative econometric specifications.

Table 9 shows the results for the OLS estimation with firm fixed effects using as dependent variable the logarithm of export sales in columns (1) to (3) and the export share in columns (4) to (6). Reductions on service input costs boost export sales of the average firm (column (1)) and export sales shares (column (4)). This result is robust and stable when we include firm and industry level control variables in the remaining columns. Since the first specification might suffer from a selection bias induced by the exclusion of almost half of the sample firms that have reported zero export sales, I focus on the second specification, that do not suffer from sample selection bias, to quantify the results. The estimated coefficient presented in column (6) suggests that services liberalization in India leads to 5 percent expansion of export shares for the average firm for a one-standard-deviation decrease in the liberalization index. Then, I compute the additional gains that manufacturing Indian firms would obtain if they have adopted in 2004 the level of services regulation of the average OECD countries. This estimates would imply that aligning services regulation to the average level observed in OECD countries would allow an additional increase in export sales shares of 14 percent in eleven years and thus, 1.3 percent per year.

test when using a large number of instruments (Windmeijer (2005)).

5.4. The adjustments of services reform during the 10-years period 1994-2004

The previous results suggest that services reform in upstream sectors in India has boosted export performance of manufacturing firms. The reforms might take time to implement and the effects of these structural reforms on firms' export performance might be stronger in long term. Since most measures concerning services liberalization were introduced in the second half of the 1990, this subsection tests the robustness of our previous results when taking long differences between 1994 and 2004.

Taking long first differences of Equation (I) eliminates any time-invariant firm and industry unobserved heterogeneity:

$$\Delta \text{Exporter}_{is,04-94} = \gamma_1 \Delta \text{Services reform exposure}_{s,04-94} + \gamma_2 \Delta X_{i,04-94} + \gamma_3 \Delta Z_{s,04-94} + \gamma_4 S_s + \Delta \varepsilon_{is} \text{(III)}$$

Where Δ stands for the long first differences between 1994 and 2004. Equation (III) investigates if the changes in upstream services between 1994 and 2004 across 3-digit manufacturing industries affect the probability of exporting in 2004 holding constant the service input intensity in 1993.

Table 10 shows the estimation results of Equation (III) by Ordinary Least Squares (OLS). Columns (1) and (2) report the estimates for the probability of exporting and columns (3) to (6) for the intensive margin of exports (change in the logarithm of export sales and in export shares). These estimations show the impact of lower upstream input services costs on export performance of manufacturing firms (1994-2004). Columns (2), (4) and (6) include the baseline industry and firm level controls in long first differences between 1994 and 2004. All specifications also include 2-digit industry fixed effects and standard errors are clustered at the 3-digit industry level.

After controlling for changes in industry and firm observable characteristics in column (2), the coefficient on services reform exposure change is negative and significant at the 5% confidence level, indicating that the drop in service input costs between 1994 and 2004 increased the probability of entry into the export market. Columns (3) and (4) show the effect of changes in upstream services on variations in firms' export sales between 1994 and 2004 for firms exporting in the two years. The coefficient on services reform exposure change is negative and significant at the 5% confidence level, suggesting that services reform has boosted export sales of exporting firms. Specifications in columns (5) and (6) take into account firms that do not export in 1994 and export in 2004 since the dependent variable is the change in the share of exports over total sales between 1994 and 2004. The results confirm that upstream services liberalization in India has a positive effect on the intensive margin of exports.

Overall, these findings confirm that the liberalization of upstream services in India was associated with greater export performance of manufacturing firms.

5.5. Heterogeneous effects of services reform on export performance

Services liberalization might affect firms' export patterns differently according to their productivity level. The last testable prediction suggests that the effect of upstream services liberalization on firms' export performance is heterogeneous. I explore in this section whether the impact of services reform depends on initial firm TFP. Since the literature has shown that services liberalization affects firm TFP, I use the TFP of the firm in the initial year that the firm appears in the sample. To investigate this relationship, I introduce an interaction term between services index and firms' initial TFP. I estimate the following model:

$$Exporter_{ist} = \beta_1 \text{Services reform exposure}_{s,t-1} \times TFP_{i,t0} + \beta_2 X_{i,t-1} + \beta_3 Z_{s,t-1} + \mu_i + \nu_t + \varepsilon_{ist} \quad (IV)$$

Here *Exporter* is the dummy variable for firm *i* producing in 3-digit industry *s* having positive export sales in year *t*. In the intensive margin specification, the dependent variable is the logarithm of export sales or export share. $\text{Services index}_{s,t-1} \times TFP_{i,t0}$ is the interaction term between services index and firm TFP in the initial year that the firm appears in the sample. The same firm and industry level control variables presented in the previous section are included.

The estimation results of equation (IV) are presented in Table 11. Columns (1) and (2) report the estimates for the probability of exporting. After controlling for past firm export experience in a dynamic GMM specification in column (2), the impact of reductions of service input costs on the likelihood of exporting is greater for the initially more productivity firms.

Next, I explore if the effect is also heterogeneous for export sales. Columns (3) to (6) present these findings. Columns (3) and (4) show the results from the OLS estimation using firm fixed effects and the logarithm of export sales as dependent variable. The reduction of costs on services has also a positive effect on export sales for initially more productive firms. Columns (5) and (6) present the results for the export shares as dependent variable. The previous finding is robust and stable. Our estimates suggest that for a one-standard-deviation decrease in services index initially more productive firms have a 5 percent and 4.3 percent greater probability of export and export shares relative to least productive firms.

These findings suggest that initially more productive firms have benefited the most from services liberalization to export. The export-selection effect of the most efficient firms into the export market is reinforced by the used of lower cost and/or high quality services inputs.

5.6. Services liberalization and other firms' outcomes

If the deregulation of services sector is a factor contributing to greater firm performance, it should also affect other manufacturing firm outcomes besides export patterns. In this section, I explore the role of services input costs reductions, quality upgrading of services inputs or foreign technology transfers on enhancing manufacturing firms' productivity gains and technological investments.

First, I show that services liberalization is associated with an expansion of manufacturing firms' consumption of energy and transport services. Unfortunately, there is no information on telecommunication services consumption at the firm level. Given that these services are used as intermediate goods by manufacturing firms, I expect that firms have actually increased their consumption of these services after the reform. The coefficient on services index is negative and significant indicating that services reform has a positive effect on downstream firms' expenditures on energy and transport services in column (1) of Table 12.

Next, I explore the relationship between services reform and manufacturing firms' TFP and technological investments. I thus estimate equation (I) with these firm performance variables as the dependent variables. Services liberalization boosts firms' TFP confirming previous findings in the literature (column (2)). Column (3) shows the estimates of regressing the logarithm of technological investments of firm i in year t on the services index in $t - 1$. As can be notice, reduction on services costs has induced an expansion of firms' investments.

6. ROBUSTNESS TESTS

In this section, I present a series of robustness tests for the previous results. I first allow for the possibility that other reforms that took place in India in the 1990s drive the results. Second, I present alternative econometric specifications. Third, I explore the robustness of the previous results for different samples of firms' ownership. Fourth, I use alternative weights to compute the reliance of each manufacturing industry or firm on services sectors.

6.1. Other reforms in India

During nineties India has experienced structural reforms in several areas of the economy. In order to test whether the coefficient on services index is not picking up the effects of other reforms that took place in India, I carry out alternative sensitivity tests.

Table 13 presents the results. Columns (1) to (3) present the results for the probability of exporting and columns (4) to (6) for export shares. First, I examine if trade liberalization is not affecting the previous results by including MFN tariffs applied by India on final goods at 3-digit NIC industry level. Using firm level data from Argentina, Bas (2012) shows that input-liberalization is an important determinant of manufacturing firms' export decisions. Hence, I also include input tariffs at 3-digit industry level to test if input tariff liberalization is driven the previous findings on services liberalization.²² I also control for financial liberalization that took place at the mid 1990's in India. I rely on the IMF financial sector reform index developed by Abiad et al. (2008). This index is composed of eight sub-indices covering the following policy areas: credit controls, reserve requirements, aggregate credit ceilings, interest rate liberalization, entry barriers in the banking sector, capital account transactions, banking privatization,

²²MFN tariffs measures are provided by the World Bank (WITS dataset). Input-tariffs at the 3-digit industry level are computed using the MFN output tariffs and the Indian 1993 input-output matrix.

securities markets and banking sector supervision. The IMF financial reform index is then weighted by the proportion of banking inputs used by each manufacturing sector, based on the pre-reform year input-output matrix of India using the same methodology that was used for the ETCR index. This index has been already used by Bas and Causa (2013) to measure financial sector liberalization in China. An increase in the reform index value signals financial market liberalization.

Columns (1) and (3) of Table 13 show the results. Output and input tariffs turn out not significant. The coefficient on the IMF financial reform index is positive and significant in columns (1) and (2) indicating that financial liberalization reduces credit constraints and it has a positive effect on firms' export decision. Nevertheless, the coefficient of interest measuring the degree of services liberalization remains robust and stable, suggesting that financial services reform is not picking up the effects of transport, communication and energy services liberalization.

Given that other reforms like labor market regulations were introduced at the beginning of the nineties at the State level, we introduce region-year fixed effects to control for unobservable characteristics affecting Indian states and varying over time in columns (2) and (5). The estimates confirm that service liberalization is not picking up the effects of state-level reforms. Finally, I include in columns (3) and (6) industry-year fixed effects to take into account all unobservable characteristics varying over time that could affect industries. In this case only the interaction term between the services index and initial firm TFP is included. The coefficient of this interaction term is negative and significant, and the magnitude is very similar to the one found in the baseline specification.

Overall, these results confirm that our previous findings do not suffer from omitted variable bias related to other policy-reforms that took place in India.

6.2. Alternative econometric specifications

This section presents two alternative econometric specifications to estimate the determinants of the probability of exporting and export revenues.

Concerning firms' export decision, I explore if the previous findings are robust when using a Probit model with random fixed effects instead of a linear probability model with firm fixed effects. The linear probability model allows taking into account the unobservable firm characteristics that do not vary over time, but it assumes that the likelihood of exporting varies linearly with changes in independent variables. This implies that the incremental effect of the independent variables on export decision remains constant throughout. Instead, the Probit model assumes a non-linear relationship between the probability of exporting and the independent variables.²³ Columns (1) and (2) of Table 14 show the results. Both testable implications of

²³For each firm, there exists a threshold level that determines whether the firm exports or not. The Probit model assumes that the unobservable threshold level that determines firms' export decision is normally distributed.

the model are confirmed when I rely on the random effects probit model: service liberalization enhances the probability of exporting and the effect tends to be stronger for initially more productivity firms.

Next, I test the effects of services reform on manufacturing firms' export sales relying on a Tobit estimation with export shares (export over total sales) on the left-hand side. Relative to the within-specification, the Tobit model takes explicitly censoring into account by considering the zero values as a left-censored. The predicted values from Tobit estimations account for the lower limit of the censored data.²⁴ Tobit models with individual fixed effects have an incidental parameters problem, and are generally biased (Greene 2003). I thus report results from random effects Tobit. Columns (3) and (4) of Table 14 report these estimates. The previous results are robust to this alternative econometric specification.

One caveat of the Tobit estimator is that it imposes the same marginal effects for the discrete decision and the continuous outcome. To deal with this issue, I run a two-stage Heckman selection estimator that does not impose this restriction on marginal effects. Columns (5) to (8) of Table 14 present the results for the first and second stage of the Heckman selection model. The first stage corresponds to the selection equation on firms' export decision and the second stage corresponds to the continuous outcome. As can be noticed, the previous Tobit results are validated by a general Heckman estimator.

6.3. Alternative samples

In this section, I address another potential concern related with firms' ownership. We test our main specification for different samples of firms to investigate whether firms' ownership is driving our previous results.

Previous studies on multinational firms show that foreign firms in developing countries tend to use more advanced technologies and be more productive relative to domestic firms (Javorcik, 2004). In general, the fact that foreign companies are more efficient and use more advanced technology could potentially explain our results. Arnold et al. (2011a) shows that the effects of services reform in India on manufacturing firms' productivity gains tend to be stronger for foreign firms. Foreign affiliates might also benefit more service liberalization to export. In order to address this issue, I exclude from our sample multinational firms in columns (1) and (2) of Table 15. Our coefficients of interest on service index remain robust and stable when we restrict the sample to domestic firms, implying that services liberalization matters for non multinational firms.

Moreover, previous works using the same firm-level dataset have emphasized the role of state-owned firms relative to private companies in India (Topalova, 2004; Alfaro and Chari, 2009). I restrict the sample to private firms in columns (3) and (4), excluding state-owned companies.

²⁴We should keep in mind that Tobit estimation relies on the assumption of homoskedastic normally-distributed errors for consistency.

The point estimates of the service index remain robust and stable for the sample of private firms. These sensitivity tests confirm that different firm ownership characteristics are not picking up our previous findings.

6.4. Alternative weights

The services index is computed based on the ETCR indicators and on input-output interlinkages. One possible issue concerns the way in which the service input weights are computed. In the previous specifications the weights are measured by the share of services in total input expenditures of each manufacturing firm using the 1993 Indian input-output matrix. Industry performance might affect input weights, in which case the services index might be endogenous. For example, if bigger and more productive industries rely relatively more on energy, transport and telecommunications, the cross-industry variation in the services index might reflect the cross-industry variation in size and productivity. This potential source of endogeneity arises from the use of domestic input-output weights that can be a function of domestic policies. One way of dealing with this issue is to use an alternative set of weights which are not correlated with Indian firm performance. Therefore, I present a series of robustness checks using US input-output matrices to construct an alternative set of input weights for the service index.

A second issue related to the weights is that they might not reflect the actual input services used by manufacturing firms. Although the weights are computed based on a disaggregated 3-digit input-output matrix, within each industry firms might rely differently on each service input. Most of the studies in the literature rely on this type of industry service input weights due to the lack of information of services used at the firm level. One important exception is the recent study of Fernandes and Paunov (2012) on the effects of services FDI liberalization in Chile on firm TFP. They use service FDI penetration weighted by firm-level intensity of service usage. Following Fernandes and Paunov (2012), I present robustness tests using firm-level weights for electricity and transport services. Unfortunately, there is no information in the Prowess dataset on the usage at the firm level of telecommunication services. Hence, I computed the firm-level service index using only the ETCR sub-indexes on energy and transport and the corresponding firm level weights as a share of firms' sales. The advantage of this measure relative to the previous one is that it identifies variation of service users within each industry, but the main caveat is that it excludes the telecommunication sector which has experienced the greater liberalization process. Since firm level weights are measured as the share of energy and transport expenditures over domestic sales, in this case I report estimations for the logarithm of export sales as dependent variable instead of export shares (export over total sales) to avoid potential reverse causality issues.

Table 16 presents the results. These sensitivity tests confirm the robustness of our previous findings. The services index using both alternative sets of weights have a negative and significant effect on the probability of exporting and on export revenues suggesting that services liberalization increases manufacturing firms export performance.

7. CONCLUSION

Does liberalization of upstream services affect downstream manufacturing firms' export performance? The removal of entry barriers for domestic private and foreign firms in the services sector intensifies competition, increasing the efficiency, quality and lowering the price of services providers. Through input-output linkages, manufacturing firms benefit from the lower costs and/or high-quality service inputs. Previous works have shown that downstream manufacturing firms have boosted their productivity gains thanks to services liberalization (Arnold et al. (2011a), Arnold et al. (2011b), Fernandes and Paunov (2012) and Bas and Causa (2013)).

The contribution of this paper to this literature is to show that services reform might also improve export performance of manufacturing firms. Services liberalization affects directly firms' export performance by reducing fixed and variable export costs. I provide firm level evidence that this was the case after the liberalization of telecommunication, transport and energy services in India in the mid-1990s. Downstream manufacturing firms have increased their probability of exporting and have also expanded their export sales shares after the reform of services sector was implemented. These findings are robust to alternative specifications that control for other reforms that took place in India in the same period. These results are not driven by the identification strategy of input-output linkages or the econometric specifications.

My findings also confirm that services liberalization has increased services used and has improved firm productivity gains. More interestingly, I also find evidence on a positive effect of services reform on manufacturing firms' technological investments. More direct evidence on how services liberalization shapes downstream firms' R&D decisions requires further research.

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8. DESCRIPTION OF THE ETCR INDEX

The ETCR (Energy, Transport and Communication regulations) indicators for India are time-series indicators of policy restrictions to competition across services sectors: airlines, telecom, electricity, gas, post and rail transport. Table 5 in the Appendix shows the ETCR sub-indicators for India and for the average of OECD countries. In the initial year of this analysis (1994), all services sectors in India had a greater level of regulation relative to the average of OECD countries. Telecommunication services have experienced the greater liberalization process in India during the period relative to the other sectors.²⁵

Unlike the PMR (product market regulation) indicators of OECD, which have only been estimated for developed countries for only four years, the ETCR indicators are computed on an annual basis over the sample period 1975 to 2007 for developed and some developing countries and so they allow an assessment of changes in regulatory patterns through time.²⁶

The ETCR indicators for India are also constructed by the OECD following the same methodology applied to compute the ETCR indicators for OECD countries as describe by Conway and Nicoletti (2006).²⁷ The ETCR indicators have been estimated on an annual frequency based on a number of published sources as well as on replies to the OECD Regulatory Indicators Questionnaire. The sources used to collect this regulatory data and to construct the ETCR indicators include international agencies engaged in the policy debates such as the World Bank, the Asia Development Bank and the World Trade Organisation and reports of local governments and academics. Moreover, firms producing in most of the services sectors covered by the ETCR indicators tend to be large and often outline relevant regulatory changes as part of their corporate histories on their websites.

The methodology used by the OECD to construct the ETCR indicators can be summarized in three steps as follows. First, the basic information from the different sources was coded into quantitative scores that are increasing in restrictions to competition. Second, these scores were aggregated into indices that cover specific areas of regulation (called low-level indicators). Each of the ETCR indicators on energy, transport and communications is composed by the following low-level indicators: barriers to entry in all sectors; public ownership in all sectors except road freight; vertical integration in electricity, gas and rail transport; market structure in rail transport, gas and telecommunications; and price controls in road freight. In the last step, these low-level indicators were aggregated into an overall indicator of regulation for each sector (energy, transport and communication).

When analyzing the empirical findings, we should keep in mind that these indicators were

²⁵Detail information on the ETCR index and the methodology is available on <http://www.oecd.org/eco/reform/indicatorsofregulationinenergytransportandcommunicationsetcr.htm>.

²⁶However, the trade-off between using ETCR or PMR indicators is that the range of regulatory measures covered by the ETCR indicators is not as broad as that of the indicators of PMR.

²⁷The ETCR indicators are described in detail in the OECD Economics Department Working Paper No. 530 "<http://search.oecd.org/officialdocuments/displaydocumentpdf/?doclanguage=encote=eco/wkp%282006%2958>".

Table 1 – Services performance in India (1993 and 1999)

	Value added		Industrial output		Intermediate consumption from manufacturing	
	1993	1999	1993	1999	1993	1999
Electricity	1.635.675	3.728.875	4.955.183	11.080.164	3.259.700	7.199.122
Transport	3.896.624	7.865.325	9.393.319	19.319.725	3.560.098	5.754.885
Telecommunications	942.000	2.450.000	1.130.656	2.858.810	291.121	495.661

Notes: All variables are in Rs. In Lakhs (10 lakh=1 million). Information comes from input-output matrices from OECD in 1993 and 1999.

constructed based on the perspective of regulations that create barriers to firms and restrict competition in domestic markets.

Table 2 – Performance of services firms

	(1) Investments	(2) Marketing expenditures	(3) Foreign royalties technical know-how
Foreign	1.178*** (0.391)	0.485** (0.216)	0.039* (0.022)
Private	2.025*** (0.199)	0.031 (0.140)	0.033*** (0.009)
State-owned	0.582* (0.302)	-0.676*** (0.242)	-0.021 (0.013)
Firm level controls	Yes	Yes	Yes
Industry 2 digit fixed effects	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
Observations	1191	1457	2576
R^2	0.520	0.678	0.122

Notes: The dependent variables are reported in each column. Investments and marketing expenditures are expressed in logarithms. Foreign royalties and technical know-how is a dummy variable equal to one if the firm i reports positive expenditures in foreign royalties in year t . Firm level controls include the age of the firm and firm size measured by the wage-bill. Foreign, private and state-owned are firm-ownership dummy variables. The omitted category is mixed firms (stated and private companies). Heteroskedasticity-robust standards errors are reported in parentheses.

Table 3 – Performance of services firms

	(1) Investments	(2) Marketing expenditures	(3) Foreign royalties technical know-how
ETCR index	-1.356*** (0.283)	-0.551*** (0.111)	-0.674*** (0.115)
Firm level controls	Yes	Yes	Yes
Industry 2 digit fixed effects	Yes	Yes	Yes
Observations	1191	1457	2576
R^2	0.416	0.462	0.485

Notes: The dependent variables are reported in each column. Investments and marketing expenditures are expressed in logarithms. Foreign royalties and technical know-how is a dummy variable equal to one if the firm i reports positive expenditures in foreign royalties in year t . Heteroskedasticity-robust standards errors are reported in parentheses.

Table 4 – Descriptive statistics

	1994-2004	1994-2004	1994	1994	2004	2004
	(2)	(2)	(3)	(4)	(5)	(6)
	mean	sd	mean	sd	mean	sd
Exporter	0.573	0.495	0.597	0.491	0.560	0.496
Export sales	1.312	2.306	0.768	2.166	1.913	2.363
Export share	0.119	0.405	0.083	0.179	0.131	0.236
TFP	1.320	0.523	1.325	0.438	1.348	0.533
Capital intensity	2.622	1.675	2.577	1.585	2.525	1.807
Age	2.866	0.788	2.918	0.799	3.032	0.677

Notes: The table reports mean and standard deviation (sd) values of the main firm level variables used in the analysis for the full sample, the initial and final years. Export sales, TFP, capital intensity and the age are in expressed in logarithm.

Table 5 – Descriptive statistics

	India		OECD countries	
Upstream regulation indexes	1994	2004	1994	2004
Airlines	6	4,3	3,4	1,7
Telecom	4,3	1,7	4,0	1,5
Electricity	6,0	3,8	4,8	2,2
Gas	4,3	3,5	4	2,7
Post	5,5	3,2	4	2,9
Rail	6	5	5,4	3,7

Notes: The table reports the ETCR subindexes of upstream regulation for airlines, telecom, electricity gas, post and rail for India and the average of OECD countries in the initial (1994) and last year (2004) of the period sample.

Table 6 – Exogenous services index

	(1)	(2)	(3)	(4)	(5)
	Exporter dummy	Exports	Export share	TFP	Sales
Δ Services Index (1994-2004)	-0.738 (0.767)	2.744 (4.879)	0.243 (0.306)	-0.501 (0.699)	-1.498 (2.664)
Observations	949	628	949	943	949
R-squared	0.056	0.057	0.097	0.184	0.065

Notes: The dependent variables in each column are the initial firm-level outcomes in 1994. The table shows the coefficients on changes in services index between 1994 and 2004 from firm-level regressions of initial firm characteristics on services index changes and 2 digit industry fixed effects. Firm-level variables are expressed in logarithms except for the exporter dummy and export share (the ratio of exports over total sales). Heteroskedasticity-robust standards errors are reported in parentheses. Errors are corrected for clustering at the 3-digit industry level.

Table 7 – Services liberalization and firms' export decision

Dependent variable: a dummy equal to one if the firm i exports in year t .				
	(1)	(2)	(3)	(4)
Services reform exposure(s,t-1)	-0.589*** (0.205)	-0.577** (0.212)	-0.526** (0.214)	-0.509** (0.199)
Age(i,t-1)		0.070*** (0.019)	0.060*** (0.018)	0.061*** (0.018)
TFP(i,t-1)			0.015* (0.009)	0.014 (0.009)
Capital intensity(i,t-1)			0.069*** (0.005)	0.069*** (0.005)
Herfindhal index(s,t-1)				-0.359 (0.346)
Capital intensity (s,t-1)				0.013 (0.037)
Size(s,t-1)				-0.025 (0.019)
Firm fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Observations	29205	29205	29205	29205
R^2	0.006	0.008	0.024	0.025

Notes: The dependent variable is a dummy for firm i producing in 3-digit industry s having positive export sales in year t . Age(i,t-1) is the logarithm of firm age. The Prowess dataset provides information on the year of incorporation of the firm. TFP(i,t-1) is the logarithm of firm total factor productivity estimated using Levinsohn and Petrin (2003) methodology. Capital intensity (i,t-1) is measured by capital stock over the wage-bill. Herfindhal index(t-1) measures the concentration of sales of the industry. Size(s,t-1) is the industry median of firm level logarithm of wage-bill and capital intensity(s,t-1) is the industry median of the ratio of capital stock to wage-bill. Heteroskedasticity-robust standard errors are reported in parentheses. Errors are corrected for clustering at the 3-digit industry level. ***, **, and * indicate significance at the 1, 5 and 10 percent levels respectively.

Table 8 – Dynamic specification

Dependent variable: a dummy equal to one if the firm i exports in year t .			
	(1) OLS	(2) Within	(3) GMM
Exporter($i,t-1$)	0.738*** (0.007)	0.298*** (0.013)	0.691*** (0.075)
Services reform exposure($s,t-1$)	-0.098** (0.037)	-0.368** (0.160)	-0.559** (0.277)
Age($i,t-1$)	0.003 (0.003)	0.021 (0.015)	-0.044** (0.021)
TFP($i,t-1$)	0.001 (0.007)	0.006 (0.008)	0.005 (0.014)
Capital intensity($i,t-1$)	0.032*** (0.002)	0.052*** (0.004)	0.097*** (0.016)
Herfindhal index($s,t-1$)	0.137 (0.140)	-0.241 (0.253)	3.041* (1.592)
Capital intensity (s)	-0.011 (0.022)	0.005 (0.029)	0.027 (0.076)
Size($s,t-1$)	-0.007 (0.011)	-0.021 (0.016)	-0.011 (0.012)
Industry fixed effects	Yes	No	No
Firm fixed effects	No	Yes	Yes
Year fixed effects	Yes	Yes	Yes
Observations	29205	29205	29205
R-squared	0.648	0.115	
p-value of Sargan	.	.	0.221
p-value of Hansen	.	.	0.138
p-value AR3	.	.	0.928

Notes: The dependent variable is a dummy for firm i producing in 3-digit industry s having positive export sales in year t . Firm and industry level control variables are described in Table 7. The GMM estimator relies on a set of instruments composed by deep lags (five to seven lags) of both export status and Services reform index which are treated as endogenous. Heteroskedasticity-robust standards errors are reported in parentheses. Errors are corrected for clustering at the 3-digit industry level. ***, **, and * indicate significance at the 1, 5 and 10 percent levels respectively.

Table 9 – Services liberalization and firms' export sales

Dependent variable:	logarithm of export sales			export over total sales		
	(1)	(2)	(3)	(4)	(5)	(6)
Services reform exposure(s,t-1)	-4.035** (1.748)	-3.507** (1.726)	-3.396** (1.744)	-0.315*** (0.102)	-0.310*** (0.097)	-0.289*** (0.091)
Age(i,t-1)		0.436*** (0.131)	0.327** (0.127)		-0.020* (0.010)	-0.026** (0.011)
TFP(i,t-1)		0.218*** (0.059)	0.199*** (0.062)		0.001 (0.006)	-0.000 (0.006)
Capital intensity(i,t-1)		0.551*** (0.047)	0.534*** (0.048)		0.015** (0.005)	0.012** (0.005)
Herfindhal index(s,t-1)		-1.080 (2.361)	-1.115 (2.312)		-0.037 (0.133)	-0.019 (0.120)
Size(s,t-1)		-0.177 (0.141)	-0.169 (0.140)		-0.017** (0.007)	-0.016** (0.007)
Capital intensity (s)		0.059 (0.156)	0.039 (0.154)		0.006 (0.015)	0.004 (0.014)
Exporter(i, t-1)						0.045*** (0.005)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	16497	16497	16497	29205	29205	29205
R ²	0.103	0.156	0.175	0.006	0.011	0.022

Notes: In columns (1) to (3) the dependent variable is the logarithm of export sales and in columns (4) to (6) is the ratio of export sales over total sales of firm i producing in 3-digit industry s in year t . Firm and industry level control variables are described in Table 7. Heteroskedasticity-robust standards errors are reported in parentheses. Errors are corrected for clustering at the 3-digit industry level. ***, **, and * indicate significance at the 1, 5 and 10 percent levels respectively.

Table 10 – Estimation in first differences between 1994 - 2004

Dependent variable:	Δ export dummy (04-94)		Δ export sales (04-94)		Δ export share (04-94)	
	(1)	(2)	(3)	(4)	(5)	(6)
Δ services reform (s,04-94)	-0.861** (0.408)	-0.817** (0.346)	-7.885** (3.316)	-7.241** (3.357)	-0.699*** (0.115)	-0.720*** (0.122)
Industry and firm level controls	No	Yes	No	Yes	No	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	993	993	572	572	993	993
R-squared	0.003	0.030	0.011	0.135	0.017	0.036

Notes: In columns (1) and (2) the dependent variable is the change in the export status of firm i producing in 3-digit industry s between 1994 and 2004. In columns (3) and (4) the dependent variable is the change in the logarithm of export sales and in columns (5) and (6) is the change in the ratio of export sales over total sales of firm i producing in 3-digit industry s between 1994 and 2004. The same firm and industry level control variables presented in table 7 in first differences between 1994 and 2004 are included. Specifications include constant and industry dummies. Heteroskedasticity-robust standards errors are reported in parentheses. Errors are corrected for clustering at the 3-digit industry level. ***, **, and * indicate significance at the 1, 5 and 10 percent levels respectively.

Table 11 – Heterogeneous effect of services liberalization on firms' export performance

Dependent variable:	export dummy		export sales		export share	
	(1)	(2)	(3)	(4)	(5)	(6)
Exporter($i,t-1$)		0.792*** (0.070)				
Services reform exposure($s,t-1$) \times TFP $_{t0}$	-0.314*** (0.118)	-0.426** (0.217)	-3.455** (1.347)	-3.346*** (1.153)	-0.232** (0.099)	-0.255*** (0.083)
Services reform exposure($s,t-1$)	-0.223 (0.201)	0.113 (0.351)	0.079 (2.594)	-0.052 (2.598)	-0.045 (0.164)	-0.001 (0.143)
Industry and firm level controls	No	Yes	No	Yes	No	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	29205	29205	16497	16497	29205	29205
R-squared	0.006		0.105	0.138	0.007	0.021
p-value of Sargan	.	0.126	.	.	.	.
p-value of Hansen	.	0.475	.	.	.	.
p-value AR3	.	0.963	.	.	.	.

Notes: In columns (1) and (2) the dependent variable is a dummy for firm i producing in 3-digit industry s having positive export sales in year t . In columns (3) and (4) the dependent variable is the logarithm of export sales and in columns (5) and (6) is the ratio of export sales over total sales of firm i producing in 3-digit industry s in year t . TFP $_{t0}$ is firm level TFP in the initial year that the firm appears in the sample. Firm and industry level control variables are included in all specifications and are described in Table 7. Heteroskedasticity-robust standards errors are reported in parentheses. Errors are corrected for clustering at the 3-digit industry level. ***, **, and * indicate significance at the 1, 5 and 10 percent levels respectively.

Table 12 – Services liberalization and other firms' outcomes

Dependent variable:	Services	TFP	Technological investments
	(1)	(2)	(3)
Services reform exposure (s,t-1)	-1.734*** (0.662)	-0.791*** (0.181)	-3.044*** (1.059)
Industry and firm level controls	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
Observations	24,906	28,321	5,597
R-squared	0.191	0.033	0.021

Notes: In column (1) the dependent variable is the logarithm of electricity and transport expenditures by firm i producing in 3-digit industry s in year t . In column (2) the dependent variable is the logarithm of firm TFP and in column (3) of technological investments of firm i producing in 3-digit industry s in year t . Control variables are described in Table 7. Heteroskedasticity-robust standards errors are reported in parentheses. Errors are corrected for clustering at the 3-digit industry level. ***, **, and * indicate significance at the 1, 5 and 10 percent levels respectively.

Table 13 – Other reforms in India

Dependent variable:	export dummy			export share		
	(1)	(2)	(3)	(4)	(5)	(6)
Services reform exposure(s,t-1)	-0.358** (0.169)	-0.326** (0.168)		-0.288*** (0.084)	-0.283*** (0.089)	
Services reform exposure(s,t-1) × TFP _{t0}			-0.332*** (0.120)			-0.233*** (0.076)
IMF financial reform index(s,t-1)	0.124** (0.059)	0.117** (0.052)	0.749 (1.440)	0.003 (0.024)	0.002 (0.026)	0.461** (0.215)
Output tariffs (s,t-1)	0.014 (0.024)	0.015 (0.021)	-0.160*** (0.042)	-0.001 (0.011)	0.000 (0.010)	-0.064*** (0.016)
Input tariffs (s,t-1)	-0.037 (0.078)	-0.046 (0.075)	0.000 (0.000)	0.001 (0.031)	0.005 (0.031)	0.000 (0.000)
Industry and firm level controls	Yes	Yes	Yes	Yes	Yes	Yes
Region year fixed effects	No	Yes	No	No	Yes	No
Industry year fixed effects	No	No	Yes	No	No	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	29,205	29,205	29,205	29,205	29,205	29,205
R-squared	0.115	0.138	0.118	0.022	0.040	0.033

Notes: In columns (1) to (3) the dependent variable is a dummy for firm i producing in 3-digit industry s having positive export sales in year t . In columns (4) and (6) the dependent variable is the ratio of export sales over total sales of firm i producing in 3-digit industry s in year t . Output tariffs are applied MFN tariffs at the 3-digit industry level from WITS dataset (World Bank) and input tariffs are constructed using the MFN tariffs and the 1993 Indian input-output matrix. TFP_{t0} is firm level TFP in the initial year that the firm appears in the sample. Firm and industry level control variables are described in Table 7. Heteroskedasticity-robust standards errors are reported in parentheses. Errors are corrected for clustering at the 3-digit industry level. ***, **, and * indicate significance at the 1, 5 and 10 percent levels respectively.

Table 14 – Alternative econometric specifications

	Probit		Tobit		Heckman selection model			
	(1)	(2)	(3)	(4)	Selection (5)	Stage 2 (6)	Selection (7)	Stage 2 (8)
Services(s,t-1)	-3.846*** (0.537)	-2.167*** (0.632)	-0.622*** (0.059)	-0.446*** (0.062)	-1.022*** (0.139)	-2.545*** (0.258)	-0.529*** (0.142)	-2.230*** (0.257)
Services(s,t-1) × TFP _{t0}		-1.252*** (0.138)		-0.143*** (0.0155)			-0.447*** (0.026)	-0.269*** (0.058)
Industry and firm controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Random effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Log likelihood	-210.0	-210.0	-210.0	-210.0	-5155	-5155	-5155	-5155
Chi	1110	1110	1110	1110	2270	2270	2257	2257
Sigma _{it}	1.519*** (0.0454)	1.947*** (0.0481)	0.309*** (0.004)	0.323*** (0.004)	1.797*** (0.010)	1.797*** (0.010)	1.797*** (0.010)	1.797*** (0.010)
Sigma _e			0.131*** (0.001)	0.131*** (0.001)				

Notes: In columns (1), (2), (5) and (7) the dependent variable is a dummy for firm i producing in 3-digit industry s having positive export sales in year t . In columns (3) and (4) the dependent variable is the ratio of export sales over total sales of firm i producing in 3-digit industry s in year t . TFP_{t0} is firm level TFP in the initial year that the firm appears in the sample. Firm and industry level control variables are described in Table 7. Heteroskedasticity-robust standards errors are reported in parentheses. Errors are corrected for clustering at the 3-digit industry level. ***, **, and * indicate significance at the 1, 5 and 10 percent levels respectively.

Table 15 – Alternative samples

Dependent variable:	export dummy	export share	export dummy	export share
	(1) No MNF	(2) No MNF	(3) Private	(4) Private
Services reform exposure(s,t-1)	-0.535*** (0.156)	-0.328*** (0.071)	-0.617*** (0.172)	-0.395*** (0.077)
Industry and firm level controls	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Observations	23,768	23,768	27,339	27,339
R-squared	0.026	0.017	0.026	0.011

Notes: In columns (1) and (3) the dependent variable is a dummy for firm i producing in 3-digit industry s having positive export sales in year t . In columns (2) and (4) the dependent variable is the ratio of export sales over total sales of firm i producing in 3-digit industry s in year t . Columns (1) and (2) exclude multinational firms from the estimation sample and columns (3) and (4) exclude state-owned firms. Firm and industry level control variables are described in Table 7. Heteroskedasticity-robust standards errors are reported in parentheses. Errors are corrected for clustering at the 3-digit industry level. ***, **, and * indicate significance at the 1, 5 and 10 percent levels respectively.

Table 16 – Alternative weights

Dependent variable:	export dummy (1)	export share (2)	export dummy (3)	exports (4)
Services reform exposure (US weights) (s,t-1)	-0.309** (0.149)	-0.129*** (0.045)		
Services reform exposure(firm weights) (t-1)			-0.039*** (0.009)	-0.181** (0.071)
Industry and firm level controls	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Observations	29,205	29,205	29,124	16,404
R-squared	0.031	0.015	0.014	0.153

Notes: The dependent variable is reported in each column. Services index (US weights) (s,t-1) is computed using US input-output matrix and Services Index (firm weights) (t-1) is computed using firm level weights as the share of electricity and transport expenditures on firm sales. Firm and industry level control variables are described in Table 7. Heteroskedasticity-robust standards errors are reported in parentheses. ***, **, and * indicate significance at the 1, 5 and 10 percent levels respectively.