International Production Sharing and Export Growth in the Service Sector (Evidence from India)

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ABSTRACT— ***International production sharing activities have increased substantially in the service sector. India as a host-country has attracted a large amount of those activities and by now holds a significant position in the global service supply chain. This development may have shaped significantly India's service industry and affected the country's trade patterns. Therefore, the paper examines the inflow of production sharing activities in the service sector in India, and assesses econometrically the role and quantitative effect on India's service exports. Our empirical findings indicate that international production sharing had subsequently a decisive impact on the growth of service exports from India to her trade partners.***

Keywords—Production Sharing, Multinationals, Service Exports, India

1. INTRODUCTION

International production sharing has become an eminent feature of the global economic integration process in recent years. This has led to the formation of global production and supply chains and to the growing interconnection of national economies. In fact, a remarkable growth in international trade in intermediate inputs has been observed (e.g. [1], [2]). This type of trade, which sometimes is referred to as vertical trade, is by now dominating world trade flows, and has indeed induced a new pattern of international division of labor across countries labelled as vertical specialization.

Though the phenomenon is mainly found in the manufacturing sector, in recent years it has grown substantially in the service sector as well. Production sharing – in the form of offshoring, outsourcing, or subcontracting certain intermediate or peripheral service operations – is nowadays particularly important in financial, insurance, communication, information, and computer-related services. With the formation of large special export processing zones and assembly lines in many South-East Asian countries, the Asia-Pacific region has become one of the most significant international production sharing networks in the world (e.g. [3], [4], [5]).

More recently, India's economy has also significantly opened-up to the global economic system and has achieved an improvement in the export performance. Furthermore, India is increasingly attracting offshoring activities and has emerged in the global Information Technology (IT) service sector as one of the major exporters of IT services in the world (e.g. [6], [7], [8]).

Although, there are some studies devoted to the phenomenon of offshoring and international production sharing networks in India (e.g. [9], [10], [11]), there is a rather small number of studies focusing specifically on the effect of offshoring on growth or export development (e.g. [12], [13]). However, even those studies provide rather general insights than offering quantitative assessments. Thus, our main aim is to provide a quantitative analysis specifically on the role and impact of service production sharing/offshoring on India's export development in services.

The rest of the paper proceeds as follows. Section 2 examines the relevant conceptual background. Section 3 discusses the empirical measurement of international production sharing and the data. Section 4 presents the econometric methodology and reports the empirical results. Section 5, finally, presents the concluding remarks and discusses some policy implications.

2. CONCEPTUAL BACKGROUND

In general, international production fragmentation or production sharing arises when the production of a final good or a service activity is fragmented into several separate production stages / business activities which take place in different

countries. The various intermediate inputs, resulting from each production stage at a different location, are combined in later stages and also in the final stage to produce the final good or service. International trade in intermediate inputs (services) is an integral part of the overall business process, as it connects the separate production processes and business activities.

Fragmentation results from a firm's strategy of its production organization with the goal of minimizing overall costs. In the context of services, which our examination focuses, the production sharing/offshoring and international trade that takes place between two countries can be conceptually illustrated by Figure 1. Here, the parent firm located in the home country produces the intermediate stages of the final service that are human capital-intensive.

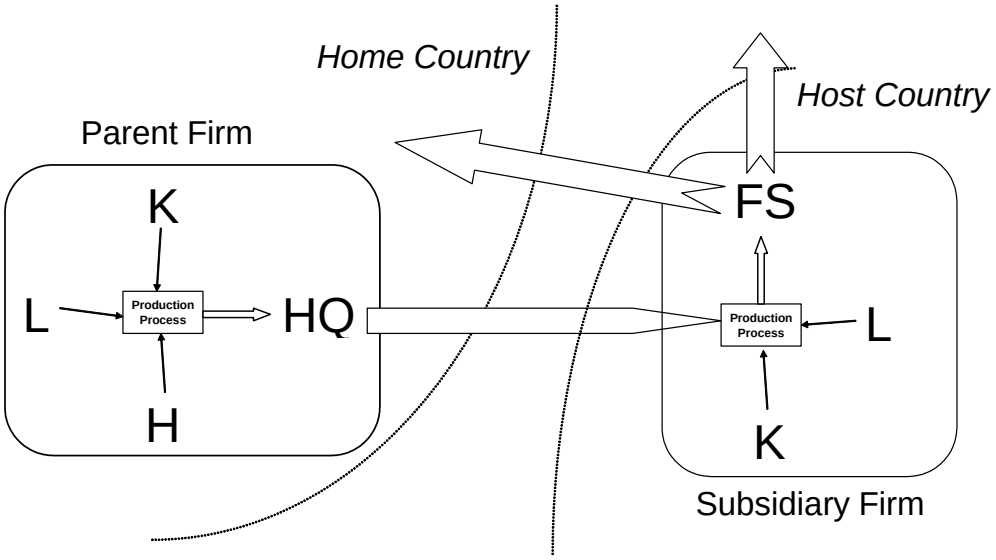

Figure 1: Production sharing (offshoring) in services as undertaken by a MNE

Source: Authors' own drawing.

As seen in the figure, besides human capital (H) other factors such as physical capital (K) and (low-skilled) labor (L) also enter to some degree the production process, but are much less important (capital represents here the buildings, offices, and equipment including information and communication technology; labor is used for peripheral and supporting tasks). The human capital-intensive intermediate service (HQ) is exported to the subsidiary firm located in the host country in order to be used as an input in the subsequent production process for the final service. The intermediate service (HQ) includes operations such as Research and Development (R&D), management, marketing, distribution, and other higher level business service activities, which are often referred collectively as headquarter services (HQ). It has to be noted that in the case of services the intermediate inputs are not strictly interpreted as in the manufacturing case as intermediate components to be further processed. Here it also includes oversight & management services from parent company, and therefore it involves R&D as well. Together with capital and labor the final service (FS) is produced and exported to the home country as well as to third countries, as there is potential demand for the service also from those countries.

3. MEASUREMENT OF INTERNATIONAL PRODUCTION SHARING AND DATA

We measure international production sharing (IPS) in a given sector between 2 countries as the value of the intermediate services (HQ) in a sector that are exported from the home to the host in order to be used in the production of a final (end-use) business activity / service in that given sector. The data source is the OECD-WTO Trade in Value Added (TiVA) and variable we use as the IPS indicator is named "Foreign value added embodied in domestic final demand". TiVA combines data from OECD Input Output (IO) Tables and the Bilateral Trade Database in goods by industry and end-use category (including service sectors and bilateral trade flows in services). According to this database, it "aims at better tracking global production networks and supply chains".

India is the host country and the OECD economies and some other countries are the home countries (from which the foreign value added of the intermediate service input originates and flows into (is incorporated) in the given domestic

service sectors production process in order to produce the final service activity). This empirical measure of PS corresponds to the conceptual notion as described in Figure 1 based on the theoretical framework of Helpman and Krugman's (1985) model with Vertical MNEs [14].

As the database relies on input-output tables, the data are only available for the years 1995, 2000, 2005, and 2009, and thus we can conduct our empirical analysis with this IPS measure for four time-points only. However, as the period ranges over (and covers) a long time, where developments in production sharing have manifested with increasing intensity, our analysis can capture the relevant dynamics and evolution of this phenomenon.

4. ECONOMETRIC ANALYSIS OF THE EFFECT OF OFFSHORING ON SERVICE EXPORTS

4.1 Theoretical framework and econometric methodology

We proceed with the estimation of two appropriate panel-econometric models. First, the estimable equation is derived from the Helpman- Krugman international trade theory model with vertical multinational firms engaging in offshoring [14], shown below with their original notation:

$$VT = \left(1 - s^2 - s^{*2}\right) \cdot \left(GDP + GDP^*\right) \cdot \left(1 + \frac{c_{HQ}\mu}{GDP^*}\right) \quad (1)$$

where the asterisk (*) denotes the foreign country (to be distinguished from home country), VT is bilateral trade volume, s is a country's expenditure share in total expenditure (of the two countries), GDP is gross domestic product, c_{HQ} is the value of headquarter services, and μ denotes the number of multinational firms. Basically, equation (1) predicts that bilateral trade volume depends positively on the economic similarity in the country's total expenditure among partners (first term), the combined absolute economic size (second term), and the extent of offshoring (last term).

The first term is empirically given by the GDP similarity index [15]. The offshoring/production sharing term according to the above trade equation is defined as the total flow of headquarter services (intermediate inputs) of the home country (multinational firms) to the host country over the host country's GDP.

We consider an export version of equation (1) for India's bilateral service exports, resulting in the following log-linear panel regression model[1]:

$$\ln(X_{Ijt}) = \alpha_0 + \alpha_1 \ln(SIM_{Ijt}) + \alpha_2 \ln(SIZE_{Ijt}) + \alpha_3 \ln(IPS_{Ijt-1}) + \eta_{Ij} + \varepsilon_{Ijt} \quad (2)$$

$$j=1, 2, 3\ldots,50;\ \ t=1996, 2001, 2006, 2010;\ \ \varepsilon_{Ijt} \sim N\left(0, \sigma^2\right);\ \alpha_1 > 0,\ \alpha_2 > 0,\ \alpha_3 > 0$$

where subscripts *I*, *j*, and *t* stand for India, the partner countries[2], and time, respectively, and ε_{Ijt} is the stochastic error term. *X* is India's bilateral service exports, *SIM* is the GDP similarity index, *SIZE* is the sum of the GDPs, and *IPS* is the international production sharing (offshoring) variable, defined as the ratio of the IPS indicator presented in the previous section over India's GDP. Thus, the explanatory variables in the empirical estimable equation (2) are defined as those in the theoretical equation (1).

Although equation (1) does not include country-pair specific effects, we add those effects (η_{Ij}) in a second estimation, which allows us to take into account unobserved effects and control for omitted-variables bias. Moreover, since there might be to some extent an endogeneity problem associated with the offshoring variable in the export equation (2), we include this variable with a time-lag (t-1).

The second econometric model is based on the well-known gravity model of international trade that is compatible with several alternative theoretical frameworks (e.g. [15], [16]). This complementary alternative

[1] The panel regression model is log-linear in the sense that it represents a linear regression model with log-transformed variables, which is sometimes also called log-linearized, log-log or double-log model.

[2] Argentina, Australia, Austria, Belgium, Brazil, Bulgaria, Canada, Chile, China, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hong Kong, Hungary, Indonesia, Ireland, Israel, Italy, Japan, Korea, Latvia, Luxembourg, Malaysia, Malta, Mexico, Netherlands, New Zealand, Norway, Philippines, Poland, Portugal, Romania, Russia, Saudi Arabia, Singapore, Slovakia, Slovenia, South Africa, Spain, Sweden, Switzerland, Thailand, Turkey, United Kingdom, United States.

examination serves the purpose of a robustness analysis, as the theoretical trade equation (1) is quite restrictive in the assumptions and includes a limited number of factors.

In the augmented gravity model we include the partner's GDP, per capita GDP, bilateral distance, the service value added to GDP ratio, the urban population to total population ratio, the IPS variable, a dummy variable capturing the effect of the common language, and country specific fixed-effects (controlling thus for multilateral resistance and other country effects).[3] The linear panel-gravity equation in logs that is to be estimated takes the following form:

$$\ln X_{Ijt} = \beta_0 + \beta_1 \ln GDP_{jt} + \beta_2 \ln PCGDP_{jt} + \beta_3 \ln D_{Ij} + \beta_4 \ln RSVA + \beta_5 \ln RUP + \beta_6 \ln IPS_{Ijt-1} + \beta_7 LANG_{Ij} + \eta_{Ij} + \varepsilon_{Ijt} \quad (3)$$

$$j=1, 2, 3\ldots,50; \quad t=1996, 2001, 2006, 2010; \quad \varepsilon_{Ijt} \sim N(0, \sigma^2)$$

where the subscripts, X_{Ijt}, IPS_{Ijt-1}, η_{Ij}, and ε_{Ijt} denote the same as in equation (2). The service value added to GDP ratio (RSVA) and the urban population to total population ratio (RUP) are included, as partner countries/destination markets with a high relative importance of the service sector and urban population might exhibit a higher demand for imported services. Again, to control for a potential endogeneity problem we include the offshoring variable with a time lag (t-1).

4.2 Econometric results and discussion

The results for the effect of service offshoring on India's service exports from the estimation of the Helpman-Krugman model are shown in Table 1. First we have estimated the model by pooled OLS, thus not taking into account any country-specific effects (as given by the theoretical model where only the three relevant explanatory variables are considered).

The IPS and SIZE variables are both statistically significant, whilst GDP similarity is found to be insignificant. Since the estimable equation is given in logs, the estimated slope coefficients represent elasticities and we can therefore evaluate the relative impact of each explanatory variable. The joint GDP variable of India and her partner countries exhibits an elasticity of about 3.8, whereas a slightly lower, but still quite high, elasticity is found for the IPS variable. In particular, the pooled OLS estimation results suggest that a 1% increase in the service offshoring from the source-countries to the host-country India causes bilateral service exports of India to those countries to increase by about 1.9%.

In order to check for robustness with regard to the impact of the production sharing variable, the Helpman-Krugman model has been estimated also by panel fixed-effects with panel corrected standard errors (PCSE), taking thus into account country-specific effects[4] and controlling for omitted variables bias, cross-sectional correlation (among the partner countries), and panel heteroscedasticity. The joint GDP and IPS variables are again found to be highly statistically significant with elasticity coefficients of 3.7 and 1.7, respectively. Thus, the impact of the combined absolute economic size of India and the partner countries increases significantly, while that of offshoring drops a little bit. However, the IPS variable still exerts a strong effect on the bilateral service exports of India.

Table 2 reports the empirical results of our augmented panel-gravity model. We follow the relevant empirical international trade literature and estimate the gravity model with the panel fixed-effects estimator. Again the PCSE method is employed in order to account and control for several potential problems typically encountered in panel-econometric analyses. First, it is evident that all variables show the expected sign and are statistically significant at various levels of significance (except distance).

Table 1: Effect of Production Sharing on India's Service Exports
with Helpman-Krugman model

[3] See [17] for a discussion on the issue of controlling for multilateral resistance term.
[4] The Hausman specification test for fixed versus random effects clearly rejects the null hypothesis that the individual specific effects are uncorrelated with the model's regressors (that random effects estimation is consistent and efficient) with a test statistic $\chi^2(3)=79.121$ and p-value=0.000.

Variables	Pooled OLS		Panel Fixed-Effects with PCSE	
	Coefficient (Elasticity)	Significance (p-value)	Coefficient (Elasticity)	Significance (p-value)
SIM (GDP similarity)	0.3860	0.2883	0.2008	0.5487
SIZE (Joint GDP)	3.8542	0.0000	3.7627	0.0000
IPS (IPS Indicator/GDP)	**1.9304**	**0.0000**	**1.7585**	**0.0000**
Constant term	-6.5319	0.1371	-70.8649	0.0000
Statistics				
Adjusted R^2	0.7836		0.8794	
F-statistic	653.21		714.82	
p-value (F-statistic)	0.0000		0.0000	

Notes: Dependent variable is the natural logarithm of India's bilateral service exports. Explanatory variables are also expressed in logs. The number of total panel observations is 200. PCSE refers to panel corrected standard errors estimation method, where panel-level heteroskedasticity and cross-section correlation are taken into account.

According to the estimated elasticity coefficients, the most important determinants of India's service exports are found to be the partner country's GDP, per capita GDP, and service production sharing (IPS variable).

Table 2: Effect of Production Sharing on India's Service Exports with Augmented Gravity Model

Variables	Panel Fixed-Effects with PCSE	
	Coefficient (Elasticity)	Significance (p-value)
GDP_j (partner's GDP)	1.6054	0.0000
$PCGDP_j$ (partner's per capita GDP)	1.0929	0.0000
$RSVA_j$ (partner's service-GDP ratio)	0.5813	0.0000
RUP_j (partner's urban population ratio)	0.4170	0.0731
D_{Ij} (bilateral distance)	-0.2724	0.1285
IPS_{Ij} (IPS Indicator/GDP)	**0.9508**	**0.0000**
$LANG_{Ij}$ (Common Language)	0.3922	0.0430
Constant term	-73.1847	0.0000
Statistics		
Adjusted R^2	0.9160	
F-statistic	835.98	
p-value (F-statistic)	0.0000	

Notes: Same as in Table 1. In addition, the distance and language variables have been estimated through a second-stage estimation procedure from the estimated country specific fixed-effects.

The common language dummy variable suggests that India's service exports are higher in partner countries that share a common language with India (English). Our main explanatory variable of interest, IPS, exerts a highly statistically significant impact on service exports. Furthermore, the estimated elasticity suggests that there

is an important economic effect associated with offshoring, although its magnitude is smaller to the one obtained by the Helpman- Krugman model with vertical multinationals.

The panel-gravity model shows that distance is not a relevant determinant of India's bilateral service exports. Several empirical studies in the literature have also found an insignificant effect of geographical distance on service exports. For instance, an analysis on the determinants of India's software exports by means of a gravity model [18] shows that distance does not have a statistically significant adverse impact on those exports. Similar findings have been found by [19 and [20].

5. CONCLUSIONS AND POLICY IMPLICATIONS

As knowledge on the subject is crucial, our empirical analysis has contributed to the literature by assessing the role of service production sharing in India for the country's export development in the service sector. Furthermore, it provides several policy relevant insights and implications for India, and to some degree for developing economies that are involved in service offshoring.

More specifically, India's service sector participates to large extent and with increasing intensity over time in global service production sharing networks. Our panel-econometric analysis indicates that service production sharing has a large positive effect on India's service exports. Hence, India's export growth in services has been aided to some extent by international production sharing networks in the service sector.

In light of the recent trends in globalization, our findings imply that offshoring in the service sector is expected to increase further and become an even more significant determinant of service exports for India. This in turn, could potentially induce certain beneficial indirect or spill-over effects to the service industry in the form of productivity and the creation of higher value-added and quality service activities. Besides the above effects, international production sharing might contribute more generally to closer bilateral economic relations and cooperation between India and the source countries. This in turn in the long-run could lead to increased Indian non-service or offshoring-related exports towards those markets, as well as to the attraction of more foreign direct investment in other sectors.

Finally, the current trends in the global economy suggest a move towards a finer division of international specialization in services. This prospect constitutes a potential opportunity not only for India, but also for other developing countries to engage in selected operations and business service activities in which they have (or could build in a relatively short time) a comparative advantage and expertise.

6. APPENDIX: VARIABLES AND DATA SOURCES

India's service exports are taken from the TiVA database, measured in current US dollars. We convert the export data in constant (2006) prices using India's export price index obtained from the IMF's IFS database. Similarly, the IPS explanatory variable is also converted from current to constant (2006) prices using India's import price index, as the IPS variable represents imports (from the partner countries) of intermediate service inputs. GDPs and PCGDPs are measured in constant 2006 (using GDP deflators) are obtained from the World Bank's World Development Indicators (WDI). The RSVA and RUP variables also originate from WDI database. The distance variable and the common language dummy are obtained from CEPII's geography and distance database.

7. REFERENCES

[1] Baldwin, R. and Lopez-Gonzalez, J., "Supply-chain Trade: A Portrait of Global Patterns and Several Testable Hypotheses", World Economy, 2014 (doi: 10.1111/twec.12189).
[2] Ferrarini, B., Vertical Trade Maps. Asian Economic Journal, vol. 27, issue 2, pp. 105–-23, 2013.
[3] Athukorala, P., Global production sharing and trade patterns in East Asia, Chapter 13, pp. 333-361, 2014, in: Kaur, I. and Singh, N. (Eds.) The Oxford Handbook of the Economics of the Pacific Rim, Oxfor University Press, Oxford.
[4] Yang, L., "Production Sharing in East Asia: China's Position, Trade Pattern and Technology upgrading", Working Paper No. 07/2014, Berlin Working Papers on Money, Finance, Trade and Development, University of Applied Sciences, Berlin, Germany.
[5] Chiu, D., "Advancing the Production Networks in East Asia", Modern Management Science & Engineering, vol. 1, issue 1, pp. 79-99, 2013.
[6] Banga, R. and Kumar, D., "India's Exports of Software Services: Role of External Demand and Productivity", Paper presented at the Annual Conference of IASSI, Madras School of Economics, March 19-21, 2010.
[7] Dossani, R. and Kenney, M., "Service Provision for the Global Economy: The Evolving Indian Experience", Review of Policy Research, vol. 26, pp. 77-104, 2009.
[8] Chanda, R., "India and Services Outsourcing in Asia", Singapore Economic Review, vol. 53, issue 3, pp. 419-447, 2008.

[9] Pereira, V. and Anderson, V., "A longitudinal examination of HRM in a human resources offshoring (HRO) organization operating from India", Journal of World Business, 2012, vol. 47, issue 2, pp.223-231, 2012.
[10] Beretta, S. and Targetti Lenti, R., "India in the Outsourcing/Offshoring Process: A Western Perspective", Economia Internazionale / International Economics, vol. 64, issue 3, pp. 269-296, 2011.
[11] Anukoonwattaka, W. and Mikic, M., "India: A New Player in Asian Production Networks?" Studies in Trade and Investment No. 75, UNESCAP, United Nations Economic and Social Commission for Asia and the Pacific, Bangkok, Thailand, 2011.
[12] Kuruvilla, S. and Ranganathan, A., "Economic Development Strategies and Macroand Micro-Level Human Resource Policies: The Case of India's "Outsourcing" Industry", Industrial and Labor Relations Review, vol. 63, article 3, 2008.
[13] Meyer, T., "India's specialisation in IT exports: Offshoring can't defy gravity", Research Notes, No 27, Deutsche Bank Research, Frankfurt am Main, 2007.
[14] Helpman, E. and Krugman, P., Market Structure and Foreign Trade: Increasing Returns, Imperfect Competition, and the International Economy, MIT Press, Cambridge, MA, 1985.
[15] Helpman, E., "Imperfect Competition and International Trade: Evidence from Fourteen Industrial Countries", Journal of the Japanese and International Economies, vol. 1, pp. 62-81, 1987.
[16] Anderson, J. and van Wincoop, E., "Gravity with Gravitas: A Solution to the Border Puzzle", American Economic Review, vol. 93, pp. 170-192, 2003.
[17] Feenstra, R., Advanced International Trade: Theory and Evidence, Princeton University Press, Princeton, NJ, 2004.
[18] Tharakan, P., van Beveren, I., and van Ourti, T., "The Determinants of India's Software Exports and Goods Exports", The Review of Economics and Statistics, vol. 87, pp. 776-780, 2005.
[19] Brandicourt, V., Schwellnus, C., Worz, J., "Austria's Potential for Trade in Services", FIW Research Report No. 002, The Vienna Institute for International Economic Studies, Vienna, Austria, 2008.
[20] Walsh, K., "Trade in Services: Does Gravity Hold?", Journal of World Trade, vol. 42, pp. 315–334, 2008.