A Comparative Empirical Study on Determinants of IT Offshore Outsourcing to China and India as Recipient Countries

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Abstract

IT offshore outsourcing contributes significantly to the global industrial shift from manufacturing to services in the global emerging knowledge economy. IT offshore outsourcing not only helps outsourcing providers achieve lower costs and higher profitability, but also urges recipient countries to enlarge service exports and transform their industrial structures through innovation. Hence, attracting services outsourcing from abroad is of great significance for China to shift its role from a manufacturer to a service provider on the global stage. However, the status quo is that although China has gained a 31.5% market share, second only to India with a 52.8% market share as a recipient of services outsourcing in 2013, a large proportion is attributed to a surge in domestic demand for onshore outsourcing rather than offshore practices. Therefore, China still has a long way to go. The thesis aims to clarify which external and internal factors dominate IT offshore outsourcing decisions and unveil the reasons why China has lagged far behind India as a recipient country of IT offshore outsourcing over the past two decades. By comparison, the thesis sheds some light on the gaps between the key success factors for China and India while suggesting ways, in which the China's IT/ITeS industry could continue to evolve, strengthen existing leverage points, overcome the weaknesses and differentiate itself from other recipients.

Key words: IT offshore outsourcing, Diamond Model, China, India

I. Introduction

1.1 Research Background

The outsourcing phenomenon comprises one of the most fundamental developments in global business strategies. As globalization accelerates and competition intensifies, outsourcing has become a strategic solution for world-wide corporations. India has been the world's largest outsourcing recipient country for long, especially in information technology (IT) services outsourcing, while China, famous for receiving manufacturing outsourcing, had not undertaken much services outsourcing until the 2000s. As a latecomer, China has developed its capabilities in outsourcing so quickly that Forbes Magazine even predicted that China could catch up to India in IT services outsourcing by early in 2008; however China has not overtaken India until 2014.

Despite the fact that China has gained a 31.5% market share, second only to India with a 52.8% market share as a recipient of services outsourcing in 2013, a large proportion is attributed to a surge in domestic demand for onshore outsourcing rather than offshore practices. Meanwhile, India is the world's largest sourcing destination, accounting for approximately 52 per cent of the USD 124 billion market. Moreover, the fact that Japanese companies prefer China, but the United States, a larger market with approximately 60% of the global demand, favors India further raises the question: What are the determinants of IT offshore outsourcing to China and India respectively? In particular, why has China lagged far behind India as a recipient country of IT offshore outsourcing over the past two decades? Further, how could China improve its competitiveness as an offshore outsourcing recipient?

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1.2 Concept Specification

Outsourcing refers to "the contracting of independent third parties to execute well-defined services that would normally be provided in-house" (Simeon, 2010)[3]. Categorized by where the service providers are, one subset of outsourcing, namely onshore outsourcing, takes place in the local environment where services are outsourced to other domestic firms "outside a company but within the same country"(Lipnack & Stamps, 1997)[4]. As the other subset of outsourcing, offshore outsourcing refers to the moving of services to other countries- either by establishing an overseas subsidiary or contracting with an established firm abroad to handle the outsourcing process. Categorized by the type of work being outsourced, one type is manufacturing outsourcing, sometimes called production outsourcing which points to the relocation of physical manufacturing processes to a lower-cost destination. Different from manufacturing outsourcing, IT-enabled services outsourcing is more service-oriented, referring to a company's outsourcing of computer or Internet related services. This thesis will focus on offshore outsourcing of IT-enabled services.

1.3 Thesis Structure

This thesis consists of four chapters. The first section is an introduction of the research background of IT offshore outsourcing, key concepts and structure of the thesis. The second section is a comprehensive literature review. Delving into the previous findings on motives, determinants and effects of offshore outsourcing, this part elaborates on the consensus and divergences upon scholars' insights into IT offshore outsourcing and gives some critiques. The third section is the empirical analysis. Followed by unit root tests, co-integration tests are performed to investigate the long-run equilibrium relationships among the determinants. Based on a modified Diamond model, the regression is run for both China and India respectively to test the relationship between the dependent variable and independent variables. Finally, Granger causality tests are run respectively for China and India to confirm causation for independent and dependent variables. The fourth section is empirical findings, conclusions and policy recommendations. Strategies will be provided to improve China's competitiveness in seizing a larger market share in IT offshore outsourcing market by targeting its own niche market. Meanwhile, limitations of the thesis and prospects for further studies will be presented in the end.

II. Literature Review

2.1 Literature on Motivation for IT Offshore Outsourcing

Initially, cost savings is indeed one of the essential motivations for offshore outsourcing (Udo, 2000).[5] Cost savings can be achieved mainly because the salaries of the staff working abroad are much lower than those of the staff in the outsourcer countries and that salaries are the most important cost in simpler tasks related to IT such as data entry (Ravichandran & Ahmed, 1993)[6] in the early stages. Nevertheless, outsourcing providers' motivation is not static but rather changing dynamically as the outsourcing practices evolve. Earlier, without exposure to their work ethics and performance, decision-makers in outsourcer countries were characterized by "cognitive limitations" as to the full range of opportunities of offshore outsourcing (Maskel & Petersen, 2006)[7]. Examples juxtaposed attest to outsourcing providers' worries about the quality slippage. Most of them take it for granted that remote service providers cannot understand the quality or requirements needed, or even if they understand cannot match the quality needed according to Dossani and Kenny (2004)[8]. When firms learn about other potential resources in foreign locations, their motives change.

Hence, to what extent the service provider can provide the requisite quality can only be learnt as the collaboration unfolds.

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[3] Simeon, R. (2010). Evaluating the strategic implications of Japanese IT offshore outsourcing in China and India. *International Journal of Management and Information Systems*, 14(3); p. 25

[4] Lipnack, J., & Stamps, J. (1997). *Virtual teams: Reaching across space, time, and organizations with technology*. New York, NY: John Wiley & Sons.

[5] Udo, G.G. (2000), Using analytic hierarchy process to analyze the information technology outsourcing decision, *Industrial Management & Data Systems*, 100 (9), 421-9.

[6] Ravichandran, R. and Ahmed, N.U. (1993), Offshore systems development, Information & Management, 24(1), 33-40.

[7] Maskell, P.,Pedersen,T.,Petersen,B.,& Dick-Nielsen,J.(2006): Learning paths to offshore outsourcing - from cost reduction to knowledge seeking. *Industry and Innovation*,14(3),239-257.

[8] Dossani, R. & Kenny M., (2004). Lift and shift: moving the back office to India. *The Massachusetts Institute of Technology Information Technologies and International Development*, 1 (2), 21–37.

Currently, they outsource their non-core activities not simply because this helps them to focus on the core business they do best, but because transferring non-core activities to specialized vendors can deliver satisfactory service of superior quality at a lower cost. Additionally, both parties may develop trust during collaboration and establish durable knowledge networks (UNCTAD, 2005)[9]. As such, what initially starts as a pure cost reduction plan may unexpectedly leads to observations of quality improvement and possibly long-term knowledge sharing in the course of the outsourcing collaboration.

2.2 Literature on Factors Influencing IT Offshore Outsourcing Decisions

Yet looking into the motivations for outsourcing only reveals why outsourcers choose recipients. To understand how outsourcers select a specific recipient, one needs to further examine the factors influencing outsourcing decisions. There is still a large divergence over the correlation between IT offshore outsourcing volumes and factors including cultural differences or institutional quality.

As cultural proximity makes no time differences and efficient vendor-customer communication possible (Su, 2012)[10], it makes sense that cultural proximity facilitates offshore outsourcing while cultural conflicts hinder the process. According to Xu (2015)[11], it is hard to neglect the impact of cultural differences in offshore outsourcing decisions since cultural differences manifested in respecting the authorities, expression, and expectations of work-life balance tend to trigger conflicts. For instance, keen on face-saving, service providers in Asian countries may choose not to point out the problems directly or offend the clients on spot, which is well-intentioned in the first place but may end up with insufficient communication, misunderstandings or even contractual failure. Yet quite on the contrary, Song (2009) [12]conducted an empirical study on factors influencing outsourcing providers' decision by using data from 41 recipient countries with an opposite conclusion that Geert Hofstede's dimensional measurement of cultural distance[13] shows no significant influence upon IT outsourcing decisions. Though slightly contradictory to common sense, the empirical result can be explained when the nature of IT services is taken into account. For one, IT services are essentially inseparable, non-storable services so that IT infrastructure makes the vendor-customer collaboration beyond the geographical differences possible. For the other, the IT-sector-specific terminology and domain knowledge are standardized enough to facilitate efficient communication across countries, especially when the early-stage IT services are limited to data entry and software development.

Another factor that bears strict scrutiny is the institutional quality. Jain and Natarajan (2011),[14] probed into the decision-makers' attitudes by processing data on factors of perceived benefits, roadblocks and risks collected from respondents from sample banks in India. An important insight from this study is that the clients in banking sectors in India tended to value quality factors including process improvement, service improvement, and cost transparency more than cost savings. Similarly, Liu and Feils (2011)[15] used data on the United States services outsourcing across 11 types of services to 31 countries between 1992 and 2005 from Bureau of Economic Analysis to assess the impact of characteristics of services on transaction costs in an outsourcing relationship.

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[9] UNCTAD (2005) *World Investment Report* (Transnational Corporations and the Internationalization of R&D), New York and Geneva: United Nations.

[10] Su, N. [苏娜](2012). Jinzhuan siguo chengjie fuwu waibao jingzhengli yanjiu.金砖四国承接服务外包竞争力研究.[A study on competitiveness of the BRICs in receiving services outsourcing] *Journal of International Economics and Comparison*. 22(5). 63-70.

[11] Xu, R-.N. [徐如浓](2015). Li'an waibao wenhua chayide pingjia biaozhun ji celüe.离岸外包文化差异的评价标准及策略.[Research on the Evaluation Criteria of Cultural Differences in Offshore Service Outsourcing and Strategies] *Journal of International Business Studies*. 36(202).65-73.

[12] Song, L.-L. [宋丽丽](2009). Xinxi jishu fuwu li'an waibao quwei xuanze yanjiu.信息技术服务离岸外包区位选择研究-基于41个东道国的实证研究.[An empirical study on location choice of IT offshore services outsourcing based on data from 41 recipient countries] *Journal of Asia-Pacific Economy*. (z). 7-12.

[13] Notes: Geert Hofstede's Cultural Dimension theory looks at unique aspects of national cultures and rates them on a scale for comparison. Originated from a study of IBM employees conducted between 1967 and 1978 which initially covered 40 different countries, power distance, relationships between individuals and groups, concepts of masculinity and femininity, uncertainty avoidance, long-term orientation and ambiguity have been identified as the six key dimensions to measure and compare different cultures.

[14] Jain, R., & Natarajan, R. (2011). Factors influencing the outsourcing decisions: A study of the banking sector in India. Strat Outs Strategic Outsourcing: An International Journal, 4(3), 294-322.doi: 10.1108/17538291111185485

[15] Liu, R., Feils, D. J., & Scholnick, B. (2011). Why are different services outsourced to different countries? *Journal of International Business Studies*, 42(4), 558–571.

Consequently, many more of the services were outsourced to countries with higher institutional quality. All these findings signal the likelihood that lower institutional quality, for example the lack of intellectual property protection or a defective legal system, may trigger knowledge and information leakage from the recipient domain, which would upset a potential outsourcing relationship. More importantly, Vorontsova and Rusu (2014)[16]'s finding from vis-à-vis interviews that outsourcing providers were more concerned about mutual understanding and confidentiality again justifies the significance of institutional quality from a relation-based recipient-provider perspective. Hence, it turns out way clear that institutional quality matters in IT offshore outsourcing but to what extent it outweighs other cost factors requires further tests.

2.3 Literature on Impacts of IT Offshore Outsourcing

Previous findings identify the impacts of offshore outsourcing as growth in trade, productivity or the economy as a whole, yet still there is no consensus on whether or not services outsourcing cause job losses for outsourcer countries. Ever since Paul Samuelson launched a debate on fears of job losses under the circumstances of outsourcing in 2004,[17] workers from the United States have argued that offshore outsourcing represents stronger competition for the working position they occupy and thus puts at risk their salary level. However, there are no conclusive statistical results about this.

Conversely, job losses due to outsourcing, if any, only account for a small proportion of the workforce in most outsourcer countries. For instance, the job losses due to outsourcing during the first three months of 2004 amounted to less than 2 percent of the total number of layoffs in the United States while in Germany, one of the European countries that used outsourcing more, the job losses derived from offshore outsourcing represented only 0.2 percent of the country's workforce between 1990 and 2001 (OIT, 2005) [18].

Partly because about 70% of U.S. jobs are in consumer service industries such as retailing, catering, restaurants, tourism and personal care which require the consumer and producer to be present in the same place and thus cannot be outsourced[19] (Agrawal & Farrell, 2003), the total amount of job losses in this country is relatively small. More importantly, partly because outsourcing may help create jobs in other sectors, thanks to the resources saved from outsourcing, the direct job losses in IT sectors may be offset by the jobs created. Just like Bhagwati (2004)'s finding indicated, if firms that outsource became more efficient and financially better off due to availability of low-wage skilled workers from abroad, they could expand their output in production stages for which they had comparative advantages and create more jobs[20]. Even though Amiti and Wei (2006) found no correlation between job growth and growth of outsourcing at the sectoral level from 1992 to 2000 in the United States by using less disaggregated data for 96 sectors, the statistical result could not be simply translated into a conclusion that outsourcing had no influence upon employment. By using data disaggregated into 450 sectors as a control group, they found that faster growth in outsourcing in a sector was associated with a negative growth in jobs in that sector[21]. The nuance lies in that at more aggregate levels, job losses in one sector may be replaced by job creation in other sectors, thus leading to no negative correlation between job growth and outsourcing.

2.4 Summary and Critiques

Thanks to scholars' continuous efforts, a series of sequential studies in terms of motivations for outsourcing, factors of outsourcing decisions and perceived impacts of outsourcing do help update the possible determinants of IT offshore outsourcing over the past two decades.

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[16] Vorontsova, A., & Rusu, L. (2014). Determinants of IT outsourcing relationships: a recipient–provider perspective. *Procedia Technology*, 588-597.doi: 10.1016/j.protcy.2014.10.007

[17] Samuelson, P. A. (2004). Where Ricardo and Mill rebut and confirm arguments of mainstream economists supporting globalization. *The Journal of Economic Perspectives*, 18(3), 135-146H.

[18] OIT (2005), Informe sobre el empleo en el mundo 2004-2005. Empleo, productividad y reduccio ´n de la pobreza, Organizacio ´n Internacional del Trabajo. Ginebra. Internet Document, available at: www.ilo.org/public/english/employment/strat/wer2004.htm.

[19] Farrell, D.,& Agrawal, V. (2003) Offshoring and beyond. *The McKinsey Quarterly*, 2003 Special Edition 4, 2435.

[20] Bhagwati, J., Panagariya, A., & Srinivasan, T. N. (2004). The muddles over outsourcing. *The Journal of Economic Perspectives*, 18(4), 93–114.

[21] Amiti, M., &Wei S.-J. (2006), Service Offshoring and Productivity: Evidence from the United States (NBER Working Paper 11926). Cambridge, MA: National Bureau of Economic Research. Retrieved June 2008, from http://users.nber.org/~wei/data/Amiti&Wei2006/Amiti-Wei-NBER_CRIW_June-9-06.pdf.

Yet the existing research is still incomplete due to the lack of comparative empirical studies and failure to embed soft factors into models. First, there is an extensive descriptive literature that discusses IT offshore outsourcing, but a relative dearth of empirical studies that are based on empirical analyses. Moreover, a majority of scholars have studied China or India respectively but only a few do comparative studies on these two recipient countries. And even fewer of those comparative studies have carried out empirical analyses but merely compare and contrast the status quo of the two outsourcing recipients in a qualitative manner. Second, most studies fail to factor in the institutional distance, domestic pressure in outsourcer countries and IPR protection. Although the scholars achieve a consensus on the positive correlation between institutional quality and volumes of offshore outsourcing, the methods they use for measurement of institutional differences are limited to small-scale interviews and sporadic decision-makers' subjective ratings. To better quantify institutional quality, the thesis fills this gap by using WGI reported by World Bank. Further, this thesis will delve deeper into domestic pressure in outsourcer countries and IPR protection by quantifying them in unemployment rates in the United States and charges for the use of IPs.

III. Empirical Analyses of Determinants of IT Offshore Outsourcing to China and India

3.1 Methodology and Empirical Model Specification

This empirical study adopts a modified Diamond model as an appropriate econometric model to analyze countries' competitiveness in attracting IT offshore outsourcing. The model is presented below:

$$Y_t = \alpha + \beta_1 LC_t + \beta_2 TP_t + \beta_3 INFRA_t + \beta_4 RDE_t + \beta_5 IPR_t + \beta_6 ID_t + \beta_7 UR_t + \varepsilon_t$$

Data from 1996 to 2014, during which years IT services outsourcing have witnessed its fastest growth, are selected. Initially, unit root tests are operated to check the stationarity of the time series data. In an effort to check the presence of long-term equilibrium relationships among key determinants and IT service exports, both Engle-Granger and Johansen-integration tests are employed. Under the Engle-Granger framework, all variables are regressed followed by multicollinearity tests and heteroscedasticity tests to adjust the model. Under the Johansen framework, the co-integrating equations for both countries are built. Lastly, Granger causality tests on time-series data are performed to investigate whether lagged values of one variable help in forecasting another variable.

The dependent variable used in the model is the volumes of IT offshore outsourcing to the country denominated in US dollars. Considering factor conditions in the Diamond model, skilled human resources, labor costs and network infrastructure are selected as possible factors influencing IT outsourcing decisions. As for firm strategy, structure and rivalry, firm-wide R&D spending as a strategic investment to drive the development of IT service industry can be counted as part of firm strategy in terms of innovation. As for government, it does play a role in shaping the business contexts and institutional environment via policy tools. IPR protection and institutional distance are selected to examine the role of government on IT outsourcing decisions. In regard to the analysis of chance, external factors exemplified by domestic pressure in outsourcers' countries might influence outsourcing providers' decision-making process. Data are gathered from IBEF, NASSCOM, NBSC, RBI, UNESCAP and World Bank databases.

Table 3.1 Selected Variables and Data Specification

Independent Variable	Data Specification	Correlation Hypothesis
Labor cost(LC)	Average annual wage of IT staff adjusted for inflation ($)	+
Skilled technical professionals with English proficiency(TP)	The number of engineering graduates passing standard English tests per year	−
Network infrastructure(INFRA)	Internet users per 100 people	+
ITeS firms' development(RDE)	R&D expenditure in ITeS industry($ million)	+
IPR protection(IPR)	Charges for the use of intellectual property($ million)	+
Institutional distance(ID)	Difference in institutional environments of the outsourcer country and the recipient country	−
Domestic pressure in outsourcer countries(UR)	Annual unemployment rate in the United States (%)	−

3.2 Empirical Analysis and Results

In order to investigate the percentage change in the variable, the study uses natural logs for variables on both sides of the equation.

3.2.1 Unit Root Test

The first step is to test each variable for the presence of unit roots, which will show whether the series are stationary or not.

Table 3.2 ADF Test Statistics for China

Variables	Test Statistic	Critical Value (1%)	Critical Value (5%)	Critical Value (10%)	Probability	Result
LNY	-1.685	-3.750	-3.000	-2.630	0.439	Non-Stationary
LNLC	-1.969	-3.750	-3.000	-2.630	0.300	Non-Stationary
LNTP	0.681	-3.750	-3.000	-2.630	0.989	Non-Stationary
LNINFRA	-1.385	-3.750	-3.000	-2.630	0.589	Non-Stationary
LNRDE	-1.665	-3.750	-3.000	-2.630	0.449	Non-Stationary
LNIPR	-1.326	-3.750	-3.000	-2.630	0.617	Non-Stationary
LNID	-2.978	-3.750	-3.000	-2.630	0.037	Non-Stationary
LNUR	-1.439	-3.750	-3.000	-2.630	0.564	Non-Stationary

Table 3.3 ADF Test Statistics for India

Variables	Test Statistic	Critical Value (1%)	Critical Value (5%)	Critical Value (10%)	Probability	Result
LNY	2.651	-3.750	-3.000	-2.630	0.999	Non-Stationary
LNLC	-0.429	-3.750	-3.000	-2.630	0.905	Non-Stationary
LNTP	-0.521	-3.750	-3.000	-2.630	0.888	Non-Stationary
INFRA	-0.431	-3.750	-3.000	-2.630	0.905	Non-Stationary
LNRDE	-0.526	-3.750	-3.000	-2.630	0.887	Non-Stationary
LNIPR	-1.009	-3.750	-3.000	-2.630	0.750	Non-Stationary
LNID	-2.202	-3.750	-3.000	-2.630	0.206	Non-Stationary
LNUR	-1.392	-3.750	-3.000	-2.630	0.586	Non-Stationary

As the tables show, the T-statistics of all variables imply that the variables are non-stationary. First differences of the data are taken and the results are listed below.

Table 3.4 ADF Test Statistics for China (after the first difference)

Variables	Test Statistic	Critical Value (1%)	Critical Value (5%)	Critical Value (10%)	Probability	Result
∆LNY	-5.586	-3.750	-3.000	-2.630	0.000***	Stationary
∆LNLC	-7.201	-3.750	-3.000	-2.630	0.000***	Stationary
∆LNTP	-5.031	-3.750	-3.000	-2.630	0.000***	Stationary
∆INFRA	-4.303	-3.750	-3.000	-2.630	0.000***	Stationary
∆LNRDE	-3.120	-3.750	-3.000	-2.630	0.025**	Stationary
∆LNIPR	-5.793	-3.750	-3.000	-2.630	0.000***	Stationary
∆LNID	-3.445	-3.750	-3.000	-2.630	0.009***	Stationary
∆LNUR	-3.636	-3.750	-3.000	-2.630	0.005***	Stationary

Notes: ***Significant at the 1 percent level; **Significant at the 5 percent level;*Significant at the 10 percent level.

Table 3.5 ADF Test Statistics for India (after the first difference)

Variables	Test Statistic	Critical Value (1%)	Critical Value (5%)	Critical Value (10%)	Probability	Result
∆LNY	-3.113	-3.750	-3.000	-2.630	0.026**	Stationary
∆LNLC	-4.740	-3.750	-3.000	-2.630	0.000***	Stationary
∆LNTP	-3.829	-3.750	-3.000	-2.630	0.003***	Stationary
∆LNINFRA	-4.739	-3.750	-3.000	-2.630	0.000***	Stationary
∆LNRDE	-3.552	-3.750	-3.000	-2.630	0.007***	Stationary
∆LNIPR	-3.497	-3.750	-3.000	-2.630	0.008***	Stationary
∆LNID	-4.665	-3.750	-3.000	-2.630	0.000***	Stationary
∆LNUR	-4.590	-3.750	-3.000	-2.630	0.000***	Stationary

Notes: ***Significant at the 1 percent level; **Significant at the 5 percent level;*Significant at the 10 percent level.

From the tables for both China and India, it is obvious that the T-statistics of the eight variables for both countries are smaller than the critical values at the 5% significance level. In this stage, all series are integrated of order one, denoted I (1).

3.2.2 Engle-Granger Co-integration Test

3.2.2.1 Regression

Engle-Granger co-integration test begins with the regression and ends up with the stationarity test for residual sequence. After the initial regression, the VIF test is used to detect multicollinearity in the data. Since the VIF value is smaller than 10, there is no issue of multicollinearity.

Table 3.6 Results of VIF Test for China's Model

Variable	VIF	1/VIF
LnIPR	23.78	0.002204
LnRDE	17.97	0.005619
LnLC	12.38	0.007023
LnINFRA	8.64	0.073317
LnTP	3.23	0.108317
LnUR	2.25	0.444059
LnID	1.67	0.597871
Mean VIF	9.99	

In econometrics, the White test, of which the null hypothesis is that the model has homoscedasticity. The probability is 0.3918, much higher than 0.05 so that the model needs no adjustment.

Figure 3.1 Results of White's Test for China's Model

White's test for Ho:	homoscedasticity		
against Ha:	unrestricted heteroscedasticity		
chi(18)	= 19		
Prob>chi2	= 0.3918		
Cameron & Trivedi's decomposition of IM-test			
Source	chi2	df	p
Heteroscedasticity	19	18	0.3918
Skewness	6.44	7	0.4899
Kurtosis	0.25	1	0.6169
Total	25.69	26	0.4805

Subsequently, the regression results for China are shown as follows:

Table 3.7 Regression Results for IT Offshore Outsourcing to China

Variable	Coefficient	Std. Err.	T-statistics	Prob.
LNLC	-0.1857701	0.2444343	-0.76	0.465
LNTP	0.1888267	0.2352519	0.80	0.437
LNINFRA	1.1610336	0.2317432	5.01	0.000***
LNRDE	0.7296531	0.2817193	2.59	0.023***
LNIPR	0.4264630	0.2120007	2.01	0.045**
LNID	-1.7877460	0.8736348	-2.05	0.042**
LNUR	-0.0328811	0.0449307	-0.73	0.445
_cons	-2.7059330	0.7606061	-3.56	0.004***
Adjusted R-squared	0.9956			
F-value	822.00			

Notes: ***Significant at the 1 percent level; **Significant at the 5 percent level; *Significant at the 10 percent level.

Given the high R-squared value and the coefficients for each independent variable, it is clear that INFRA, RDE, IPR have strong positive correlations with the IT offshore outsourcing volumes while ID has a strong negative correlation with the IT offshore outsourcing volumes as expected. Yet LC, TP and UR show insignificant results. A rise in labor costs is supposed to lower the IT service exports because IT outsourcing providers attach great importance to the cost savings. Quite the opposite, the empirical result signals only a slightly negative correlation between the two. Yet it is understandable if outsourcing providers are not so price-sensitive to a moderate growth in labor costs in outsourcing recipient countries. With the small coefficient representing the elasticity of the IT service outsourcing with respect to the labor costs, chances are that outsourcing providers are not so responsive to changes in labor costs in China because the labor is far more cheaper than that in developed economies and a minor fluctuation does not alter its competitive advantage in costs. Despite the wage inflation in China, the average wage of IT staff is much cheaper even compared with counterparts in developing economies like Mexico and Brazil. Therefore, relative to the sheer volumes of cost savings, a rise does not necessarily change decision-makers' mind or remarkably drive the IT service exports down. Moreover, with IT service providers shifting their business focus from low-end ITO/BPO to the higher end, the negative impact of rising labor costs will be offset by the positive spinoffs of technological innovation.

Another insignificant variable is the number of technical professionals with English proficiency. The reason might be that the IT services outsourced to China are still dominated by low value-added ITO/BPO businesses, which does not require skilled labor forces at all. The excess supply of average labor in China makes IT service exports not so responsive to the fluctuations in the skilled labor forces, resulting in a small elasticity coefficient.

More importantly, even if the higher-end IT-enabled services provided necessitate the skilled labor forces, the potential technical professionals in China are not qualified enough to effect the growth in IT service exports because they are educated in an environment where courses for software or IT services are theory-oriented rather than practice-oriented. The huge knowledge gap between coursework and occupational requirements makes it even harder for them to apply what they learn to the work once they become new technical recruits. Therefore the insignificant result of skilled labor forces in China's case can be understood.

Lastly, seen from the coefficient of the unemployment rate, China seems to suffer less from the domestic pressure in the largest outsourcer country, the United States. Conspicuously, two reasons are presented. First, China has never turned out to be the largest outsourcing recipient of the United States over the past two decades. Second, China has a diversified client base which hedges against the drastic drop in outsourcing volumes in one country.

$$LnY_t = -0.1857701LnLC + 0.1888267LnTP + 1.1610336LnINFRA + 0.7296531LnRDE + 0.4264630LnIPR - 1.7877460LnID - 0.0328811LnUR - 2.7059330$$

With the model for China constructed above, the R-squared value is 0.9956, which sufficiently shows that the model fits the data well. As expected, INFRA, RDE and IPR are positively correlated while ID is negatively correlated with the IT offshore outsourcing volumes. Therefore, network infrastructure, R&D expenditure, IPR protection and institutional distance are identified as the determinants of IT offshore outsourcing to China. Yet there is no point in justifying the model for time-series data unless the residual sequence is found to be stationary as well according to the Engle-Granger tests (Granger & Engle, 1985).[22]

For India, initially, all variables are regressed through the OLS model followed by both the VIF test and the White test.

Since the VIF value is smaller than 10, there is no issue of multicollinearity.

Table 3.8 Results of VIF Test for India's Model

Variable	VIF	1/VIF
LnINFRA	16.09	0.062150
LnTP	12.57	0.079554
LnRDE	11.21	0.089206
LnIPR	10.34	0.096711
LnLC	9.67	0.103412
LnID	4.26	0.234741
LnUR	2.88	0.347222
Mean VIF	9.57	

Next, the White test is operated to tell whether heteroscedasticity exists in the model. The probability is 0.3918, much higher than 0.05 so that the null hypothesis of homoscedasticity cannot be rejected and thus the model needs no adjustment.

Figure 3.2 Results of White's Test for India's Model

White's test for Ho:	homoscedasticity		
against Ha:	unrestricted heteroscedasticity		
chi(18)	= 19		
Prob>chi2	= 0.3918		
Cameron & Trivedi's decomposition of IM-test			
Source	chi2	df	p
Heteroscedasticity	19.00	18	0.3918
Skewness	3.35	7	0.8511
Kurtosis	2.25	1	0.1338
Total	24.60	26	0.5420

[22] Granger, C. W. J. and Engle, R. F. (1985). 'Dynamic Model Specification with Equilibrium Constraints: Cointegration and Error Correction', presented at the World Congress of the Econometric Society, Boston.

Eventually, the regression results for India are shown as follows:

Table 3.9 Regression Results for IT Offshore Outsourcing to India

Variable	Coefficient	Std. Err.	T-statistics	Prob.
LNLC	-0.2514243	0.1215505	-2.07	0.031**
LNTP	0.8085230	0.3263456	2.48	0.029**
LNINFRA	0.1909894	0.1819631	1.05	0.315
LNRDE	0.8330705	0.3219073	2.59	0.024**
LNIPR	0.4441494	0.1476973	3.01	0.011**
LNID	-0.4727184	0.4409979	-1.07	0.305
LNUR	-0.0448531	0.0717996	-0.62	0.545
_cons	-5.1970960	1.5501430	-3.35	0.006***
Adjusted R-squared	0.9938			
F-value	481.44			

Notes: ***Significant at the 1 percent level; **Significant at the 5 percent level;*Significant at the 10 percent level.

From the table above, it is clear that all independent variables show a significant impact on the IT service exports as expected except for network infrastructure, domestic pressure in outsourcer countries and institutional distance. Contradictory with the hypothesis, network infrastructure does not seem to contribute much to the IT offshore outsourcing to India though the coefficient shows a positive sign. It is understandable because there is still a shortage of infrastructure in India, either in terms of telecommunications or public facilities, which did not help much but instead turned out as a bottleneck for India when receiving IT offshore outsourcing. Although immature infrastructure in India cannot be regarded as a major factor influencing its IT service exports, it did facilitate the growth of IT service exports to some degree. This can be explained since some Indian cities in southern and central parts of the country are proved to be immune from the blackouts. With software technology parks (STP), Indian cities like Mumbai, Bangalore and Hyderabad boast special power system as well as advanced network infrastructure despite the relatively low level of infrastructure nationwide. The infrastructure capabilities built there, catering to or even ahead of demand for IT services, verify that outsourcing providers care more about the factor conditions in a specific region or city than the average level of factor conditions in the entire country.

Meanwhile, seen from the T-statistics of the domestic pressure in outsourcer countries, its impact on IT service exports in India is not strong enough. There is still no agreement regarding the correlation between unemployment rate in outsourcer countries and the volumes of IT offshore outsourcing and thus its influence could be insignificant. For one, there is scant justification for the assumption that the soaring IT service outsourcing deprives the outsourcer countries of their jobs. Since the IT/IT-enabled service outsourcing only accounts for a small portion of outsourcer economies, the majority of which are low-end routine services, outsourcing practices actually help outsourcing providers save their money and time for innovation, improve their productivity and create new jobs in numerous business functions in the long term. A case in point is that in the year 2008, American people get 317,000 jobs thanks to the development of outsourcing practices according to the ITAA (Information Technology Association of America).[23] After all, if any, it is a short-term shock for outsourcer countries. For the other, even if IT service outsourcing does impact the unemployment rate from the outsourcing providers' perspective, it is hard to say that a persistent high unemployment rate might result in less IT service exports in return. It is no chicken-egg conundrums as essentially whether the IT outsourcing practices will be influenced depends on the policy responses from the government of outsourcer countries, rather than the mere indicator of employment rate. For the policy responses, it depends so that the influence varies. Therefore, it is likely that the unemployment rate in the outsourcer countries appears insignificant in the model.

Another insignificant independent variable is institutional distance, which shows the difference in institutional quality between outsourcer countries and outsourcing recipients. A possible explanation is that India is not so much constrained by its institutional distance from outsourcer countries. With the colonial legacy from Britain back in the 18th century, both financial and judicial institutions similar to the Western ones are kept and thus widely accepted by the Western outsourcing recipients.

[23] Klein, L., Behravesh, N. & Miller, H. (2004). Global sourcing and the U.S. economy. *Information Technology Association of American.*

The Indian institutions are believed to be of the highest quality by outsourcing providers, simply because they are so similar to institutions in Western countries that the transaction costs are minimized. Differentials in institutional quality could vary from time to time, but a sense of identity towards similar institutions embraced by outsourcer countries ensures that IT service outsourcing to India will not be hindered by a minor change in institutional distance.

$$LnY_t = -0.2514243LnLC + 0.808523LnTP + 0.1909894LnINFRA + 0.8330705LnRDE + 0.4441494LnIPR - 0.4727184LnID - 0.0448531LnUR - 5.197096$$

With the model for India built up above, the R-squared value is 0.9938, indicative of the fact that the model fits the data well. As expected, TP, RDE and IPR are positively correlated while LC is negatively correlated with the IT offshore outsourcing volumes. Therefore, the determinants of IT offshore outsourcing to India consist of labor costs, the number of technical professionals with English proficiency, R&D expenditure and IPR protection. Yet the empirical findings above cannot stand unless the residual sequence is also stationary according to the Engle-Granger tests.

3.2.2.2 Stationarity Test for Residual Sequence

Delving into the possible long-run equilibrium relationship between key determinants and IT service outsourcing volumes, co-integration tests are run. Now that the OLS regression has been run, the last step is to store the residuals denoted as "r" and examine whether they are stationary or not. Here an ADF test, as explained earlier, is performed on the saved residuals from every regression.

Table 3.10 Stationarity Test for Residual Sequence for China

	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
z(t)	-4.046	-3.750	-3.000	-2.630
Mackinnon approximate p-value for Z(t)=0.0012				

Table 3.11 Stationarity Test for Residual Sequence for India

	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
z(t)	-3.234	-3.750	-3.000	-2.630
Mackinnon approximate p-value for Z(t)=0.0181				

After calculation, for China, the residual sequence is stationary since the t-statistic is -4.046, smaller than the critical value -3.750. For India, the critical value at 5% significance level is -3.234, larger than the t-statistic for the residuals presented below. With the null hypothesis of no co-integration among variables rejected, the variables from the model are co-integrated and thus the regression results estimated from the OLS regression make sense.

The Regression Model for China

$$LnY_t = -0.1857701LnLC + 0.1888267LnTP + 1.1610336LnINFRA + 0.7296531LnRDE + 0.4264630LnIPR - 1.7877460LnID - 0.0328811LnUR - 2.7059330$$

The Regression Model for India

$$LnY_t = -0.2514243LnLC + 0.808523LnTP + 0.1909894LnINFRA + 0.8330705LnRDE + 0.4441494LnIPR - 0.4727184LnID - 0.0448531LnUR - 5.197096$$

3.2.3 Johansen Co-integration Test and Co-integrating Equation

Although the Engle-Granger co-integration test above detects a co-integrating relationship via the OLS regression estimation, using OLS regression in general can identify only one co-integrating vector even when there are many variables in the system (Dolado et al., 1991)[24]. In a system of more than two variables, the Johansen method, a multivariate approach to co-integration, makes it possible to detect all co-integrating relationships among the variables. In this thesis, the Johansen method is further used to perform the analysis of co-integrating relationships.

[24] Dolado, J., Galbraith, J. W., & Banerjee, A. (1991). Estimating intertemporal quadratic adjustment cost models with integrated series. *International Economic Review*, 919-936.

For China, the Johansen co-integration test result below demonstrates that there are two co-integrating relationships among the five variables.

Table 3.12 Johansen Tests for Co-integration for China

Johansen tests for co-integration					
Rank	Parms	LL	Eigenvalue	Trace Statistic	5% Critical Value
0	35	168.99017	·	230.7538	77.74
1	44	242.09513	0.99982	84.5439	54.64
2	51	267.65181	0.95054	33.4305*	34.55
3	56	275.91943	0.62192	16.8953	18.17
4	59	282.70196	0.54975	3.3302	3.74
5	60	284.36707	0.17790		

Table 3.13 Normalized Coefficients of Co-integrating Equation for China
Normalized Co-integrating Coefficients

LNY	LNINFRA	LNRDE	LNINIPR	LNID	α
1	-2.106342	-1.995092	-0.945741	0.750880	-11.63945
	0.914635	0.840244	0.422871	0.322080	-5.27392

The co-integration can be expressed as follows:

$$LnY_t = 11.63945 + 2.106342\ LnINFRA + 1.995092LnRDE + 0.945741LnIPR - 0.750880LnID$$

Seen from the results of China, it is clear that the coefficients of IPR, RDE, INFRA and ID correspond to the theoretical hypothesis. A 1% rise in the network infrastructure results in a 2.106% rise in IT offshore outsourcing volumes. A 1% rise in R&D spending of the ITeS firms is accompanied by 1.995% increase in IT offshore outsourcing volumes. A 1% rise in the IPR protection will raise the IT offshore outsourcing volumes by approximately 0.946%. A 1% rise in the institutional distance will shrink the IT offshore outsourcing volumes by approximately 0.751%. Comparatively speaking, network infrastructure and R&D expenditures initiated by firms are more influential in determining the competitiveness in attracting IT offshore outsourcing from China's perspective.

Likewise, for India, the Johansen co-integration test demonstrates that there is one co-integration among the five variables.

Table 3.14 Johansen Tests for Co-integration for India

Johansen tests for co-integration					
Rank	Parms	LL	Eigenvalue	Trace Statistic	5% Critical Value
0	30	134.77029	·	83.3354	68.52
1	39	153.66352	0.89169	45.5489*	47.21
2	46	164.90757	0.73362	23.0608	29.68
3	51	170.63892	0.49047	11.5981	15.41
4	54	173.79686	0.31032	5.2822	3.76
5	55	176.43798	0.26708		

Table 3.15 Normalized Coefficients of Co-integrating Equation for India
Normalized Co-integrating Coefficients

LNY	LNTP	LNLC	LNRDE	LNIPR	α
1	-0.60027	0.0158473	-3.591675	-1.044972	11.84752
	0.222011	0.0073332	1.009657	0.4304741	

The co-integration can be expressed as:

$$LnY_t = -11.84752 + 0.6002698LnTP - 0.0158473LnLC + 3.591675LnRDE + 1.044972LnIPR$$

Seen from the results of India, it is clear that the coefficients of technical professionals, labor costs, R&D expenditure and IPR protection correspond to the theoretical hypothesis. A 1% rise in the number of skilled technical professionals results in a 0.6% rise in IT offshore outsourcing volumes. A 1% rise in labor costs will shrink the IT offshore outsourcing volumes by approximately 0.015%. A 1% rise in R&D spending of the ITeS firms is accompanied by 3.591% increase in IT offshore outsourcing volumes. A 1% rise in the IPR protection will raise the IT offshore outsourcing volumes by approximately 1.045%. The R&D expenditure in IT offshore outsourcing and IPR protection are more influential than other variables in determining the competitiveness of India in attracting IT offshore outsourcing.

3.2.4 Granger Causality Test

Co-integration indicates the existence of long-run relationships among variables, but cannot reveal whether the relationship is causal. Granger causality tests suggest which variable in the model is the statistically significant cause of the future values of each of the remaining variables.

For China, the P-values in the brackets are less than 5%, which points out that the INFRA, RDE, IPR and ID are "Granger causes" of the dependent variable.

Table 3.16 Granger Causality Tests for China

Equation	Excluded	chi2	df	Prob > chi2
d1_lny	d1_lnipr	28.9520	2	0.000
d1_lny	d1_lninfra	53.5030	2	0.000
d1_lny	d1_lnid	23.2710	2	0.000
d1_lny	d1_lnrde	23.2230	2	0.000
d1_lny	ALL	67.6130	8	0.000
d1_lnipr	d1_lny	3.4210	2	0.181
d1_lnipr	d1_lninfra	4.0799	2	0.130
d1_lnipr	d1_lnid	5.9701	2	0.051
d1_lnipr	d1_lnrde	1.9719	2	0.373
d1_lnipr	ALL	7.1950	8	0.454
d1_lninfra	d1_lny	4.1590	2	0.120
d1_lninfra	d1_lnipr	2.9990	2	0.240
d1_lninfra	d1_lnid	4.9951	2	0.107
d1_lninfra	d1_lnrde	1.1660	2	0.390
d1_lninfra	ALL	6.2760	8	0.620
d1_lnid	d1_lny	1.6836	2	0.431
d1_lnid	d1_lnipr	0.8086	2	0.667
d1_lnid	d1_lninfra	1.0582	2	0.589
d1_lnid	d1_lnrde	0.9851	2	0.611
d1_lnid	ALL	6.3282	8	0.611
d1_lnrde	d1_lny	2.6987	2	0.259
d1_lnrde	d1_lnipr	3.2156	2	0.200
d1_lnrde	d1_lninfra	3.1080	2	0.209
d1_lnrde	d1_lnid	2.8560	2	0.234
d1_lnrde	ALL	3.5730	8	0.171

By the same token, in India's case, the previous values of TP, LC, RDE and IPR could help predict the current value of IT service outsourcing volumes in the future because the probabilities in the brackets are less than 5%.

Table 3.17 Granger Causality Tests for India

Equation	Excluded	chi2	df	Prob > chi2
d1_lny	d1_lnipr	11.809	2	0.003
d1_lny	d1_lntp	7.2907	2	0.045
d1_lny	d1_lnlc	7.3708	2	0.025
d1_lny	d1_lnrde	9.5095	2	0.004
d1_lny	ALL	20.252	8	0.009
d1_lnipr	d1_lny	5.8128	2	0.055
d1_lnipr	d1_lntp	5.4227	2	0.066
d1_lnipr	d1_lnlc	4.153	2	0.073
d1_lnipr	d1_lnrde	4.2244	2	0.121
d1_lnipr	ALL	5.695	8	0.057
d1_lntp	d1_lny	4.3619	2	0.113
d1_lntp	d1_lnipr	4.3698	2	0.112
d1_lntp	d1_lnlc	3.0185	2	0.168
d1_lntp	d1_lnrde	2.59	2	0.202
d1_lntp	ALL	4.896	8	0.104
d1_lnlc	d1_lny	0.57322	2	0.751
d1_lnlc	d1_lnipr	4.9143	2	0.086
d1_lnlc	d1_lntp	5.1317	2	0.068
d1_lnlc	d1_lnrde	0.92894	2	0.629
d1_lnlc	ALL	5.788	8	0.059
d1_lnrde	d1_lny	0.5008	2	0.784
d1_lnrde	d1_lnipr	0.3683	2	0.879
d1_lnrde	d1_lntp	3.8688	2	0.142
d1_lnrde	d1_lnlc	4.0464	2	0.133
d1_lnrde	ALL	4.3686	8	0.121

Hence, the Granger Causality test shows that the co-integrating relationship is causation among the dependent variable and independent variables for both China and India. With co-integrating equations built below, the key determinants influencing IT offshore outsourcing to China and India in the long term are justified respectively.

$$LnY_t = 11.63945 + 2.106342\, LnINFRA + 1.995092 LnRDE + 0.945741 LnIPR - 0.750880 LnID$$

$$LnY_t = -11.84752 + 0.6002698 LnTP - 0.0158473 LnLC + 3.591675 LnRDE + 1.044972 LnIPR$$

In the long run, it is IPR protection, R&D expenditures, network infrastructure and institutional distance that determine the competitiveness of China in attracting IT offshore outsourcing. From China's perspective, network infrastructure and R&D expenditures initiated by firms are more influential in determining the competitiveness in attracting IT offshore outsourcing.

In the same vein, it is technical professionals, labor costs, R&D expenditure and IPR protection that exert great influence on India's competitiveness in attracting IT offshore outsourcing. The R&D expenditure by IT firms and IPR protection are more influential than other variables in determining the competitiveness of India in attracting IT offshore outsourcing.

IV. Summary, Conclusions and Policy Recommendations

4.1 Summary and Conclusions

Against the backdrop of global outsourcing practices, India, the undisputed industry leader, remains the most attractive IT offshore outsourcing destination. Despite the fact that China is closing in on India in recent years, thanks to major progress in improving educational skills and cultural adaptability, the contrasting market shares captured by the two necessitates an in-depth comparative study in the IT offshore outsourcing era.

The study is intended to investigate the key determinants of IT offshore outsourcing to China and India as recipient countries at the national level through a comparative approach. This thesis complements and extends prior services outsourcing research by reexamining the determinants of competitiveness in attracting IT offshore outsourcing with current data to quantify more subtle factors applying a modified Diamond model.

In the first place, network infrastructure, R&D expenditure, IPR protection and institutional distance are important factors influencing China's competitiveness in attracting IT offshore outsourcing while qualified IT professionals with English proficiency, low labor costs, higher R&D intensity for firms and IPR protection are main drivers of India's competitiveness based on regression results.

Furthermore, China has lagged behind India in IT offshore outsourcing due to the paucity of technically skilled workforce with English proficiency, the lack of IPR protection, the insufficient R&D spending of IT firms, the larger institutional distance with outsourcer countries.

4.2 Strategies to Improve China's Competitiveness as a Recipient

The rapid changes like the shift to automation and artificial intelligence as well as India's successful outsourcing practices have profound implications for companies, outsourcing providers and countries alike. Efforts are required for China's IT service industry to realize its potential and accelerate its growth trajectory in the offshore outsourcing market over the next decade. From the aforementioned analysis, China could ride the next wave of growth by sustaining its competitive advantages, learning from India and differentiating itself from other recipients in a strategic manner.

In specific, policy recommendations include 1)sustaining existing competitive advantages in cost and infrastructure; 2)increasing employability and talent pools by providing quality higher education and vocational training; 3)providing adequate mechanisms to enforce intellectual property protection; 4)building business relationships via a greater onsite presence; 5)improving corporate quality management by adopting standards of CMMI; 6)catering to the growing domestic demand for onshore outsourcing to enhance the competitiveness of China's IT service industry; 7)carving out a niche in BPO/KPO market segments; 8)creating innovation hubs to advance China's IT service industry along the value chain.

4.3 The Limitations of the Thesis and Topics for Further Research

This study has some limitations. For one, the empirical study only takes a small sample to examine the external and internal factors that dominate IT outsourcing decisions. Partly because the outsourcing phenomenon grew into prominence in India in the 1990s when IT services outsourcing just got off the ground in China, and partly because data in earlier years are unavailable, the empirical study only has limited units of observation covering 19 years. Hopefully, the statistical bureau or software service associations in both countries could undertake the responsibility to collect the missing data, segregate IT offshore outsourcing data into clearly-defined categories and make them available to the public.

For the other, although the firm-level factors have been recognized in this analysis, the researcher failed to factor industrial concentration, onshore outsourcing volumes and profit margins into the model due to data unavailability and her focus on the national level. This called for further firm-level work to understand the factors that drive IT offshoring as corporate managerial capabilities need to be fully articulated and elaborated.

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VI. Appendix

LIST OF ABBREVIATIONS

ADF	Augmented Dickey-Fuller Test
BPO	Business Process Outsourcing
CET-4	College English Test Band 4 Certificate
CMMI	Capability Maturity Model for Software
IBEF	India Brand Equity Foundation
IPR	Intellectual Property Rights
ITeS	Information Technology Enabled Services
ITO	Information Technology Outsourcing
KPO	Knowledge Process Outsourcing
NASSCOM	National Association of Software and Service Companies
NBER	National Bureau of Economic Research
NBSC	National Bureau of Statistics of China
RBI	Reserve Bank of India
R&D	Research and Development
STP	Software Technology Park
UNCTAD	United Nations Conference on Trade and Development
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
VIF	Variance Inflation Factor
WGI	Worldwide Governance Index