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A simple model of service offshoring with time zone differences☆

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ABSTRACT

We propose a two-country monopolistic competition model of business service offshoring that captures the advantage conferred by time zone differences. We emphasize the role of the *entrepreneurs*, who decide how to produce business services (i.e., domestic service provision or service offshoring). It is shown that the utilization of communication networks induces a dramatic change in industrial structure due to entrepreneurial relocation (i.e., service offshoring) to take advantage of time zone differences. We show also show that in the presence of moving costs for entrepreneurs, technological improvements and the resulting increase in service offshoring may reduce a country's welfare.

1. Introduction

Offshoring of information and communication technology (ICT) services and business process outsourcing (BPO, which includes call centers, data entry firms, and other back-office operations) are revolutionizing international trade in services, which do not require physical shipments of products.[1] The past decade has seen substantial growth in international outsourcing (offshoring) of business services, admittedly from a low baseline (Amiti & Wei, 2005, 2009; Head, Mayer, & Ries, 2009). It is

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[1] In what follows, for brevity, we will refer to both ICT services and BPO as "business services." Also, we use the term "offshoring" to denote the outsourcing of business services to foreign locations.

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also well recognized that the utilization of new types of communication network (e.g., the Internet) plays a major role in these trends.[2] The rise of India's software industry provides a prime example. The programming problems of some U.S. corporation are e-mailed to India at the end of the U.S. workday. Indian software engineers work on them during their regular office hours and provide solutions.[3] By the time the offices reopen in the U.S., the solutions have already arrived, mainly as e-mail attachments. Ireland, pitching to host Europe's main international call centers, offers another example. Cairncross (1997, p. 219) emphasizes the rise of the call-center service industry in Ireland, which is taking geographical advantage of being between the U.S. and Europe.

These types of business service offshoring require two basic conditions. Firstly, there must be a difference in time zones between the trading partners: having a wide time zone difference makes it possible for a company to operate a 24-hour business day. Second, there must be good connections via communication networks which enable the business service to be "transported" quickly with little marginal cost. Thanks to the communication revolution, time zone differences can become a primary driving force behind service offshoring. To provide an adequate assessment of the rise of business service offshoring one must not neglect the division of business activities across different time zones.

Relatively few attempts have been made to model the role of time zone differences in business service offshoring. In a pioneering paper, Marjit (2007) examined the role of international time zone differences in a vertically integrated Ricardian framework under perfect competition. He showed that time-difference emerges as an independent driving force of international trade besides taste, technology and endowment.

Pursuing this line of research, we propose a two-country monopolistic competition model of business service offshoring that captures the advantage conferred by time zone differences.[4] Following Marjit (2007), we consider two countries located in different time zones. Unlike Marjit who assumed perfectly competitive markets, we examine the role of time zone differences under monopolistic competition. This formulation allows us to emphasize the importance of a scarce factor, *entrepreneurs*, who decide whether to produce business services domestically or to offshore them.[5] The substitutability between domestically provided services and offshored services plays an important role in our analysis. Furthermore, by introducing differentiated business services, we will be able to analyze the impact of technological change on the expansion of offshored service varieties.

Our main building block is the concept of multi-stage production that takes place in real time. For concreteness, consider a non-traded final good in the home country (H). We posit that the production of this good necessarily involves two stages. The second-stage production, which can only be done in H, takes one whole working day (say 12 hours) and consists of "assembling" business services received at the beginning of the day. The first-stage is the production of various business services, each being provided by a specialised firm. The first-stage production of each business service also takes the whole working date. Thus, to have a unit of the final good ready in H on Tuesday evening, the business services that it embodies must be produced during day time on Monday in H, or in the foreign country (F), on Monday evening (H's time), which is day time in F.

We assume the final good producers value the continuity of production activities. If they utilize domestic business services, on top of the price they pay for them, they also incur an inconvenience cost (or "interest cost") because of the time lag between the provision of those services and their assembling into the final good. On the other hand, if they utilize offshored services there exists no time lag (or only a negligible one) between service provision and the transformation.

[2] Freund and Weinhold (2002) found that Internet penetration, as measured by the number of Internet hosts in a country, has a positive and significant effect on service trade. See also Hanley and Ott (2009).

[3] According to a recent McKinsey report, India contributed about two-thirds of global ICT outsourcing and about a half of global BPO offshoring in 2004 (*The Economist*, June 3–9, 2006).

[4] The fragmentation of production stages and of service provision has been studied within a trade-theoretic framework by Jones and Kierzkowski (1990, 2001), Grossman and Helpman (2005), Long, Riezman, and Soubeyran (2005), Do and Long (2008), Mitra and Ranjan (2008), Feenstra and Spencer (2005) dealt with both theory and empirical analysis. Spencer (2005) provided an excellent survey of the literature on outsourcing. Kikuchi and Iwasa (2010) presented a different type of monopolistic competition trade model with time zone differences in which services are assumed to be a final good.

[5] On role of entrepreneurship in international trade, see e.g., Yu (2002); Schmitt and Yu (2001) developed a model with heterogeneous fixed export costs, which can be interpreted as differences in entrepreneurship.