



# Incomplete contracts and the boundaries of the multinational firm<sup>☆</sup>

Nathan Nunn<sup>a,\*</sup>, Daniel Trefler<sup>b</sup>

<sup>a</sup> Department of Economics, Harvard University, 1805 Cambridge Street, Cambridge, MA 02138, USA

<sup>b</sup> Rotman School of Management and Department of Economics, University of Toronto, Toronto, Ontario M5S 3E6, Canada

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## ABSTRACT

Using data on U.S. intra-firm and arm's-length imports for 5705 products imported from 220 countries, we examine the determinants of the share of U.S. imports that are intra-firm. We examine two predictions that arise from Antràs (2003), Antràs and Helpman (2008) and Antràs and Helpman (2004). First, we find that, consistent with the implicit logic of Antràs (2003) and the explicit predictions of Antràs and Helpman (2008), vertical integration is increasing in the importance of *non-contractible* headquarter inputs relative to *non-contractible* supplier inputs. In other words, we show that only non-contractible headquarter inputs affect the firm's make-or-buy decision. Second, we also provide empirical support for the Antràs and Helpman (2004) prediction that intra-firm trade is largest where *non-contractible* headquarter inputs are important and productivity is high.

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## 1. Introduction

Recently, a rich research agenda examining the determinants of intra-firm trade has developed. The literature has been able to develop deep insights into the multinational firms' decision regarding the elements of international trade that are done internally to the firm and which are done outside the boundaries of the firm.<sup>1</sup> In this paper, we are interested in a strand of the literature that examines the relationship between a multinational firm and its supplier. Each contributes a customized input that is non-contractible. As a result, there is a classic hold-up problem and the multinational must decide whether to vertically integrate its supplier or outsource to its supplier. One strand of the literature treats the difference between these two organizational forms as the difference between the outside options of the multinational in the event that the hold-up problem cannot be resolved through bargaining. This treatment of the difference between vertical integration and outsourcing originates with Antràs (2003) and appears again in Antràs and Helpman (2004, 2008).

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\* Corresponding author.

E-mail addresses: [nunn@fas.harvard.edu](mailto:nunn@fas.harvard.edu) (N. Nunn), [dtrefler@rotman.utoronto.ca](mailto:dtrefler@rotman.utoronto.ca) (D. Trefler).

URLs: <http://www.economics.harvard.edu/faculty/nunn> (N. Nunn), <http://www.rotman.utoronto.ca/~dtrefler> (D. Trefler).

<sup>1</sup> Seminal contributions include McLaren (2000), Antràs (2003, 2005), Grossman and Helpman (2002, 2003, 2004, 2005), and Antràs and Helpman (2004).

These papers yield two important insights about the determinants of the share of total U.S. imports that are imported by U.S. multinationals from their foreign affiliates (i.e., intra-firm). First, [Antràs \(2003\)](#) argues that when the U.S. headquarters firm provides the bulk of the non-contractible inputs, underinvestment in inputs is reduced by highly incentivizing the headquarter. Vertical integration provides such incentives because it allows the headquarter to control at least some of the supplier's inputs even if bilateral bargaining breaks down. In contrast, when the foreign supplier provides the bulk of the non-contractible inputs, the foreign supplier must be highly incentivized. This is done by outsourcing: outsourcing strips the headquarters firm of any control over the supplier's inputs and thus strengthens the bilateral bargaining position of the supplier. In short, the share of U.S. imports that are intra-firm is increasing in the share of (non-contractible) inputs provided by the U.S. headquarters firm.<sup>2</sup>

While [Antràs \(2003\)](#) examines the simplified case where all inputs are non-contractible, [Antràs and Helpman \(2008\)](#) allow a portion of the inputs to be contractible. (An alternative interpretation is that they allow all inputs to be partially contractible.) Because [Antràs \(2003\)](#) assumes all inputs were non-contractible, in his model what matters is the relative importance of total headquarter-provided inputs relative to supplier inputs. However, as [Antràs and Helpman \(2008\)](#) illustrate, when some investments are contractible it is now only necessary to incentivize the non-contractible investments. Therefore, what matters is the importance of non-contractible headquarter investments relative to non-contractible supplier investments.

The second prediction about the share of total U.S. imports that is intra-firm is developed in [Antràs and Helpman \(2004\)](#). The authors start with the well-known fact that firms display heterogeneous productivities. They then argue that the fixed costs of producing abroad are lower when outsourcing to a foreign supplier than when using foreign direct investment (vertical integration). Since only the most productive firms capture the market share needed to offset the high costs of vertical integration, not all firms identified by [Antràs \(2003\)](#) as candidates for vertical integration will in fact integrate. Only the most productive will. Thus, the share of U.S. imports that are intra-firm will be large when two conditions are simultaneously satisfied: (i) the share of inputs provided by the headquarters firm is large (as in [Antràs, 2003](#)) and (ii) firm productivity is high.

Using data on U.S. intra-firm and arm's-length imports for 5705 products imported from 220 countries, we examine these determinants of the share of U.S. imports that are intra-firm. Our conclusions mirror the two predictions listed above. (i) In terms of the [Antràs \(2003\)](#) and [Antràs and Helpman \(2008\)](#) mechanism, we find support for the role of the importance of non-contractible headquarter inputs relative to non-contractible supplier inputs. (ii) We also find strong support for the [Antràs and Helpman \(2004\)](#) prediction that intra-firm trade is largest where headquarter inputs are important *and* productivity is high.

The paper is organized as follows. Section 2 examines the predictions of [Antràs \(2003\)](#) and [Antràs and Helpman \(2008\)](#), and Section 3 examines the predictions from [Antràs and Helpman \(2004\)](#). Section 4 concludes.

## 2. The boundary of the firm and the role of $\eta$ ([Antràs, 2003](#); [Antràs and Helpman, 2008](#))

We begin by reviewing the salient features of the [Antràs \(2003\)](#) and [Antràs and Helpman \(2004, 2008\)](#) models from the perspective of the empirical work to follow. Since the models have been presented and summarized elsewhere, we only review its most important features here.<sup>3</sup>

A U.S. firm produces a brand of a differentiated variety  $j$  of a product in industry  $i$ . Demand is generated by CES preferences. To produce the good, the firm must use two inputs, those produced by the U.S. firm ( $h_i(j)$  for headquarters) and those produced by a foreign supplier ( $m_i(j)$  for intermediates). Output of the final good is given by a Cobb–Douglas production function with two key parameters: a Hicks-neutral productivity parameter  $\theta(j)$  that is variety (i.e., match) specific and the cost share of the input provided by the firm  $\eta_i$ , which is an industry-specific parameter. Specifically, production is given by:

$$q_i(j) = \theta(j) \left( \frac{h_i(j)}{\eta_i} \right)^{\eta_i} \left( \frac{m_i(j)}{1 - \eta_i} \right)^{1 - \eta_i}. \quad (1)$$

In [Antràs \(2003\)](#) and [Antràs and Helpman \(2004\)](#) it is assumed that the two inputs are entirely customized and not contractible. This assumption is relaxed in [Antràs and Helpman \(2008\)](#). Customization raises quality to a threshold which allows the final good to be sold to consumers. Unfortunately, for the U.S. firm and its foreign supplier, the investments in customization are non-contractible and they have no value outside of the relationship. Thus, there is a standard hold-up problem. After the investments in customization have been made there is renegotiation over how the *ex post* quasi-rents from the relationship will be shared.

The timing of the game played by the U.S. firm and its foreign supplier is as follows. After the two parties match, the U.S. firm chooses the organizational form. Then investments in customized inputs are made. Finally, the initial contract is renegotiated and, if there is agreement, the product is sold.

Let  $\beta$  be the generalized Nash share of the *ex post* quasi-rents from the relationship that go to the U.S. firm. The U.S. firm receives this share plus its outside option. The organizational form – vertical integration versus outsourcing – chosen by the

<sup>2</sup> This logic is a specific instance of the larger property rights approach to the firm e.g., [Grossman and Hart \(1986\)](#).

<sup>3</sup> See [Helpman \(2006\)](#) and [Nunn and Trefler \(2008\)](#).

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