Export processing and International Outsourcing. Evidence on the Determinants of Outward Processing Exports to the European Union*

Xavier Cirera†, Dimitra Petropoulou‡and Dirk Willenbockel§

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Abstract

This paper analyzes the determinants of a key type of international outsourcing, outward processing trade. We develop a model of outsourcing choice that compares outward processing (OP) trade with generic outsourcing (GO). The model incorporates quality differentiation, input specificity, tariffs and monitoring costs as crucial elements of this choice, and predicts that higher tariffs, lower monitoring costs, higher search costs for alternative suppliers or more quality differentiation increase the likelihood of choosing OP trade *vis-à-vis* GO. Institutions and the rule of law affect this choice by impacting on the likelihood of contractual breakdown under GO, while input specificity is shown to have an ambiguous effect. The predictions of the model are confirmed using OP trade data in the EU from 2002-2008, with the role of proximity and quality differentiation emphasised as determinants of the selection of OP trade. OP trade appears to be concentrated in specific sectors and in a few countries. The empirical analysis suggests a positive impact of input specificity in OP trade and a very significant impact of institutions on the choice of GO over OP, suggesting that relationship-specific investments and monitoring costs associated with OP trade may work as a substitute for institutions and rule of law.

Keywords: Outward processing, outsourcing, European Union

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†Institute of Development Studies, University of Sussex, Brighton, BN1 9RE, United Kingdom. Email: x.cirera@ids.ac.uk

‡Department of Economics, University of Sussex, Falmer, Brighton, BN1 9SL, United Kingdom. Email: d.petropoulou@sussex.ac.uk

§Institute of Development Studies, University of Sussex, Brighton, BN1 9RE, United Kingdom. Email: D.Willenbockel@ids.ac.uk

1 Introduction

The way we understand trade and production has changed dramatically in recent decades. Three main elements deserve special consideration when analysing the change in trade patterns over this period. First, there has been extensive fragmentation of production beyond the boundaries of the production plant, firm and country. Production processes have been fragmented and outsourced, assisted by innovations in information systems and management services. Thus, the production cycle for most products no longer occurs within the boundaries of the firm. Processes and inputs are outsourced, and firms in different countries specialise in some stage of the production process, giving rise to vertical specialisation (see Hummels *et al.*, 2001, for an overview). As a result, several types of intra- and inter-firm production relationships (governance) have emerged, ranging from vertical integration to different types of contract outsourcing with independent suppliers.

This process of vertical fragmentation of production has translated into rapid changes in the patterns of trade, which are not confined solely to manufactured goods, but extend also to services, and, of particular importance for developing countries, to agricultural and primary products linked to global retailers. As a result of these changes in trade patterns, a large literature has emerged focusing on the determinants of international outsourcing and the choice of organizational forms. This literature emphasizes the role of incomplete contracts in explaining outsourcing organizational forms and locations (Spencer, 2005).

This new pattern of trade, however, has not spread evenly across countries. While some countries in Asia, notably China and India, as well as Eastern Europe and North Africa have benefited and engage in global production sharing, other regions, especially Sub-Saharan Africa, remain largely isolated from participation in this type of trade. Understanding the determinants of this process is therefore key to integrating poorer regions into this type of trade.

A second key element is the existence of large differences in export prices within product categories. The same product, defined at a very high level of disaggregation, is usually exported by different countries to the same market at different prices. These price differentials can be very large, and tend to be the result of significant quality differentiation, which in turn is correlated with countries' income per capita and endowments (Schott, 2004). There is also evidence that exporters vary product quality across destination markets according to demand characteristics (e.g. Görg *et al.*, 2010, Crozet *et al.*, 2009, Manova and Zhang, 2009). Richer countries tend to export high quality goods and obtain higher prices, with goods competing in different quality segments (Hummels and Klenow, 2005), but also tend to import relatively more from countries that produce high quality goods (Hallak, 2006). Therefore, there is large scope for differentiation and quality upgrading within narrowly defined products.

A third important element when looking at changes in the structure of trade is related to

the emergence of different types of outsourcing modes, which require different degrees of inter-firm governance, contractual relations and relationship-specific investments. One specific outsourcing mode that merits consideration is processing trade. This type of outsourcing mode requires inputs to be sent and processed offshore and then re-imported to be used as inputs or final products, and allows countries to specialize in very specific assembling and processing tasks. Despite the proliferation of export processing zones worldwide in the last two decades, participation in processing trade has been very concentrated in some countries such as China, the ASEAN region and countries in Eastern Europe; some of which have relatively poor institutions or rule of law. In addition, is some of these countries, especially China, processing trade has had large impacts on exports and employment creation.

The purpose of this paper is to understand the determinants of participation in processing trade, concretely in outward processing (OP) trade, as compared to arms length trade, or generic outsourcing (GO). We develop a model of firm choice between outward processing and generic outsourcing as a form of foreign outsourcing, where OP contracts are incomplete due to the input specificity and contracts under GO can break down. In the model, firms in the North (buyers) prefer to engage in OP trade when the quality and complexity of the input or final product they require is high, which is reflected in a high price premium, and compensates monitoring costs (distance and trade costs) over firms in the South (suppliers). On the other hand, suppliers need relationship-specific investments to engage in OP trade and their choice to participate in this type of outsourcing depends on the price of their input, the size of the sunk costs to adjust production to the type of processing required, and the potential value of the input they produce for other firms as an outside option. Also, the quality of institutions and the rule of law play an important role through their impact on the likelihood of contract breakdown under GO.

The predictions of the model are then tested using the COMEXT database, which decomposes trade flows to and from the European Union (EU) at the product level (HS-8) according to whether flows use the outward processing regime or the normal regime (generic outsourcing). The fact that outward processing flows in the EU enjoy a rebate on import duties allows us to differentiate imports from OP vs. GO. In addition, while most papers analysing processing trade focus on China, we provide evidence on the location and importance of this type of outsourcing in other developing countries.

The paper, therefore, contributes to the the literature that focus on the choice of outsourcing mode, and incorporates quality differentiation when analysing the choice. It also contributes to the literature that analyses the role of institutions in explaining trade flows, and on the outsourcing mode. The main findings of the paper are that OP trade is more likely in closer proximity countries, with lower trade costs and in products with higher tariffs. Also, OP trade is prevalent in products that are more asset specific and where there is more scope for product differentiation proxied by larger differences in unit values. An interesting

result relates to the quality of institutions. While political stability is important in explaining the choice of OP trade, the rule of law and the quality of other institutions seem to favour generic outsourcing trade. This is not surprising given the concentration of OP trade in the EU in Eastern European countries such as Albania, Armenia Ukraine or Moldova; and it can be explained by several factors. First, the fact that contractual breakdown is also important in generic outsourcing, since delays or non-delivery may have large costs on EU firms. Second, because relation-specific investments from suppliers and monitoring costs from buyers associated with OP trade may increase inter-firm coordination and reduce the likelihood of contractual breakdown and the need for institutions in trade. Finally, an alternative explanation is the role of export processing zones in providing more legal certainty in countries where the quality of institutions is poor. Furthermore, these findings emphasize the importance of trade facilitation in reducing trade and monitoring costs for integrating LDCs in OP trade.

This paper is organized as follows. Section 2 defines OPT and summarizes the main determinants identified by the literature explaining organizational forms of outsourcing. Section 3 presents the theoretical model of outward processing *vis-à-vis* generic outsourcing, and draws hypotheses regarding outward processing trade based on the model and the broader literature. Section 4 analyzes the determinants of OP trade to the EU empirically. The final section concludes.

2 Outward processing versus generic outsourcing as organizational forms of international outsourcing

International outsourcing can arise in many different organizational forms with different degrees of intra-firm coordination; ranging from vertically integrated suppliers to generic outsourcing in spot markets. Under vertical integration, the outsourcing firm keeps total control of the supplying firm, while under generic outsourcing there is less firm coordination and the transaction occurs through spot markets. In between these extreme organizational modes, there are modes with different degrees of contractual relationships and relationship specific investments. A large literature has analysed the determinants of outsourcing. In general, this literature analyses the firm decision to outsource part of the production process outside the boundaries of the production plant, either domestically or internationally.[1] These studies, however, tend to differ in relation to the choice of outsourcing organizational mode they analyse. For example, Antràs (2003), Antràs and Helpman (2004, 2006), Grossman and Helpman (2004) or Feenstra and Hanson (2005) focus on analysing the choice between vertically integration and contractual outsourcing. Another strand of the literature focuses

[1] In this paper we focus mainly on international outsourcing, also called offshoring, which generates international trade in intermediate goods.

on the choice of two other types of outsourcing, specialized inputs under incomplete contracts and outsourcing in spot markets (Spencer, 2005). These include Spencer and Qiu (2001), Qiu and Spencer (2002), Head *et al.* (2004), Feenstra and Spencer (2005) and Feenstra *et al.* (2012).

There are several elements that may determine the outsourcing organizational choice. The "transaction costs" literature establishes that the degree and form of production fragmentation is the result of cost minimization by firms. Once the firm decides it is more profitable to outsource part of the production process, the question becomes what kind of relationship the firm establishes with the supplier: outsourcing its inputs to a downstream producer via arms-length trade or to establish a long-term contract, or else to vertically integrate. The former type of outsourcing implies the existence of hold-up costs in the presence of incomplete contracts, while the latter type implies governance costs of managing and controlling the supplier. Clearly, different variables related to governance costs impact the costs of different forms of integration, such as cost of searching for other suppliers (Grossman and Helpman, 2002), the thickness of input markets (McLaren, 2000) or the need for relationship-specific investments. In these models, integration is more likely in very competitive sectors.

A second strand of the literature, the property rights approach, has focused on internal incentives and the ownership of assets in determining the type of outsourcing. For example, Antràs (2003) develops a property rights model that makes the costs and benefits of integration endogenous. In this model, integration is more likely in capital-intensive industries, since the hold up costs under normal outsourcing imply higher capital inefficiency than the governance costs of integration.

Other papers have emphasized the role of proximity, cultural and geographical, on increasing contractual outsourcing via lowering monitoring costs and facilitating contract enforcement (Antràs, 2005; Feenstra and Spencer, 2005). The role of incomplete contracts is also emphasized in papers that consider outsourcing via spot markets or arms-length trade as outside options (Schwartz and Van Assche, 2010; Head *et al.* 2004).

The critical element in the choice of organizational mode literature is the fact that suppliers of inputs are required to carry out relationship-specific investment. In the presence of investments to adapt production to specialized inputs, contracts are incomplete and cannot be written conditional on the level of investment. In this context, the relationship between buyers and suppliers need to be solved via bargaining, and, therefore, the outside options available to both firms become key determinants of the choice of outsourcing mode.

2.1 Outward processing trade as input specific outsourcing

Input specific outsourcing provides a good framework for analysing OP trade. OP trade requires interactions between the outsourcing firm, who sends the input for processing, and

the supplier that go beyond those required on spot markets outsourcing. The specificities of processing usually require relationship-specific investments to allow transformation of the specific set of inputs, and firm coordination to guarantee quality standards and timely delivery. Due to the nature of this type of trade, it can be easily identified in some countries, since it is associated with a specific customs regime. The EU, for example, defines OP trade as ".. a customs procedure that lets you pay duty on the added value while the goods are processed outside the EU, instead of on the full value of the goods that's normally due. OPR also enables faulty goods to be returned to a third country for repair or for replacement" (COMEXT database). Under this regime, importers are allowed to claim relief on duties of the imported product, which otherwise would have lost EU status and, therefore, would have incurred full duties. Importers are required to pay the duty on the final product, but are subsequently refunded with the duties applicable to the intermediate product they exported for processing. As a result of these tax rebates, OP trade flows are recorded by customs authorities.[2] But while OP trade clearly benefits from import tariff exemptions, firm decisions to outsource using OP depend on more factors other than tariff margins.

One difficulty when analysing OP trade is the fact that it can adopt different forms of ownership. Both vertical integration of a supplier and contractual outsourcing are possible when dealing with the input specificity involved in OP trade. This is clear for example in Feenstra and Hanson (2005) who endogenise the degree of foreign ownership of Chinese suppliers engaging in processing activities. The type of organizational mode selected clearly affects the degree of contract incompleteness and more generally the relationship between sellers and buyers.

This relationship between input specificity, ownership and contracts is an important one. There is a large literature emphasizing the important role that institutions play in facilitating trade.[3] Good institutions facilitate trade through making contracts binding and predictable. In the case of outsourcing trade, this is important since contract costs are higher when negotiating with an external supplier than with an internal agent within the own corporation. Moreover, relationship-specific investments may require larger contract intensity. Nunn (2007) shows that the importance of institutions in facilitating trade is larger in those goods that have larger asset specificity since these require more contract intensity. Feenstra *et al.*

[2]The main disadvantage of the COMEXT classification, however, is that we only observe this type of trade flow in the data when it has been declared by firms. For example, outward processing may still *de facto* occur in some products that can be re-imported duty free, but since there is no incentive for tariff rebate this trade flow is registered as a normal import. This issue is especially significant for those cases where the MFN rate is zero. Yet contrary to what one would expect, OP trade is still observed in cases where products are eligible for preferential treatment. The most likely explanation for this finding relates to the costs of compliance required to obtain preferential status. Brenton and Manchin (2003) suggest that in some cases the costs of proving origin, due to documentation costs, risk of delays if status is rejected at border or stringent Rules of Origin (RoOs), is sometimes higher than obtaining duty relief through OP. Therefore, the relevant variable in determining OP is the preference margin rather than the preferential rate.

[3]See for example Rauch and Watson (2004), Anderson and Marcoullier (2002) or Levchenko (2007).

(2012) examine contractual vs. non-contractual trade and the role of institutions in Chinese provinces. They find that the quality of institutions increases trade for all but matters more for processing trade and for foreign firms.

There are two elements, however, that are less clear in this literature. The first is that under contractual outsourcing and relationship-specific investments there are many different types of governance between buyers and suppliers that can take place. This has been emphasized by the value chain literature, which has focused on the governance costs of production fragmentation. Gereffi *et al.* (2005) classify the types of value chain governance according to three main factors: the degree of complexity and knowledge transfer for transaction, the extent to which information required for the transaction can be codified and the capabilities of the supplier to carry out the transaction. According to these three variables outsourcing governance structure varies from more flexible forms, such as arms-length market transactions or modular networks to more rigid ones, such as captive suppliers. As a result, input specific outsourcing can be more or less flexible, and more importantly it further requires monitoring, supervision and sometimes transfer of know-how between firms. This is important when thinking about OP trade, especially in processing trade with the EU, and the role of institutions and contracts facilitating trade. In some cases, more "captive" relationships between buyers and suppliers due to large relationship-specific investments may facilitate the bargaining process and compensate for lack of efficient legal and government institutions. This may explain why countries with less institutional quality are able to attract large OP trade from the EU.

The second unclear element in the literature regarding the role of institutions and contracts relates to arm's length or generic outsourcing. Despite the flexibility of not requiring relationship-specific investments, generic outsourcing still requires contracts to be binding. This is important in the context of just-in-time production processes where it is critical for buyers to be able to enforce penalties to suppliers for delays, damage or non-deliveries. Therefore, while the literature gives more weight to the role of institutions in increasing input specific trade, in some cases generic outsourcing may require even better institutions than OP trade, especially when relationship-specific investments and coordination costs create conditions of value chain captivity that replace the role of institutions.

Finally, one important element when explaining the different forms of outsourcing is the link to quality differentiation and sophistication. The data for the EU shows that at very disaggregated product levels (HS-8) some European firms outsource products via OP trade while others outsource inputs from the same country using arms-length imports. In these cases, contract enforcement elements and value chain governance will be very similar since both the product and countries involved in trade are the same. One potential explanation for the difference in outsourcing mode is differences in the quality or complexity of the production process, which requires stronger inter-firm governance and coordination. As an

example, if a European firm wants to produce a highly sophisticated mobile handset, it is likely to outsource part of the production process in China, for example, and use OP trade, providing inputs and monitoring the process. On the other hand, the same firm could outsource low quality handsets purchased in spot markets from China if the objective is to sell cheap mobile phones.[4] As a result, one should observe larger OP trade in those products with larger quality/sophistication premia, since the incentives for OP trade are larger.

The following section develops a simple model to explain the choice between OP trade and generic outsourcing. Our framework contributes to the literature by allowing for quality differentiation, and emphasizing the role of monitoring costs in inter-firm relationship, relationship-specific investments, tariffs incentives and the role of institutions for generic outsourcing. The key determinants of the choice between outward processing and generic outsourcing are identified and then tested using EU OP trade data.

3 A model of choice between outward processing and generic outsourcing

We present a partial equilibrium model of outsourcing, similar to Schwartz and Van Assche (2010), modified to the fact that we are only interested in the decision between producing a final good through generic outsourcing (GO) *vis-à-vis* outward processing (OP). Rather than looking at whether a firm produces in-house or outsourced either externally or to a vertically integrated firm, our stylised model explains outward processing trade mainly as a function of quality differences, tariff levels, asset specificity and contract enforceability.

The structure of the model is depicted in Figure 1. Suppose that to generate a variety of a final product an EU producer, buyer (B), needs to contract with an intermediate good firm located overseas in order to acquire a necessary input, z, produced at cost C_Z. This reflects generic outsourcing in the model.

EU producers can further decide whether to produce a low quality or a high quality variety of the final product, for which the prevailing exogenous market prices are P^L and P^H, respectively. The price of high quality products is strictly higher than that of low quality varieties of the same product, so $P^H > P^L$, and buyers cannot influence these prices. To make a low quality final product, the EU producer must import a low quality input from an overseas supplier and incur a transformation cost δ^L. Let P_Z^L denote the exogenous spot market price for a low quality input, assumed to be supplied perfectly elastically at this price. Moreover, imported low quality inputs incur an import duty $(1+\tau)$, where τ denotes the *ad*

[4] A good example is the strategies of clothing retailers ZARA and HM. The former uses OP as part of a very sophisticated process with very short product cycles within just-in-time production techniques, keeping textile production facilities and using captive sewing workshops (Bonnin, 2002). The latter has opted for a less complex production fragmentation, directly outsourcing final products.

valorem tariff rate.

Alternatively, the EU producer can produce a high quality product variety, which it can do in one of two ways. First, through generic outsourcing, by transforming a low quality imported input into a high quality final good, by incurring a higher transformation cost $\delta^H > \delta^L$. Alternatively, the firm can generate a high quality good by producing an input, or intermediate good, at cost C_Y and sending it for outward processing to an external supplier, S. The outward processing scheme requires relationship specific investments to be made by both parties; besides production cost C_Y, the EU producer incurs monitoring costs, h, in order to guarantee a high quality level in the processing stage. A key determinant of monitoring costs is likely to to be distance between the EU producer and its overseas supplier, as well as corruption levels overseas; moreover, h may also reflect the transport costs of having to export the intermediate and re-import it after processing.[5] The overseas supplier must make a relationship specific investment, K, to adapt production capacity to high quality production.

Following the property rights approach we assume contracts are incomplete under OP, in the sense that the EU producer and overseas supplier cannot pre-commit to a particular price P_Z^H for the processed good. In particular, suppose the supplier can threaten non-delivery after it has invested K and after the EU firm has produced the raw input and shipped it out. *Ex post* bargaining between B and S over price P_Z^H is modelled as a symmetric Nash bargaining game, where the two parties share *ex post* surplus equally. If *ex post* bargaining is unsuccessful, then the EU firm produces through GO. If successful, then the processed good is imported back to the EU; to reflect the EU OP regime, we assume no import duties are applied when the processed input is re-imported.[6]

If the OP relationship between B and S breaks down, firm B has the outside option of acquiring an input through generic outsourcing and transforming it into either a low or a high quality variety. The supplier is assumed to retain residual rights over the processed input, giving it the right to put it to alternative use if the relationship between B and S breaks down. A key assumption is that inputs are not entirely specific to the requirements of a particular buyer, so S can supply the processed input *ex post* to an alternative buyer. To find an alternative buyer, the supplier incurs search costs C_S. Moreover, as the processed input is of higher quality than a generic input purchasable on the spot market, S can expect to receive a premium over the spot price. Suppose S has the outside option of receiving $P_Z^L(1+\sigma)$ from an alternative buyer, where σ reflects the degree to which the higher quality characteristics of the processed input can be put to use by another buyer. The larger is σ, the more valuable these characteristics are to alternative buyers. Setting $\sigma = 0$ corresponds to the case where all high quality features embedded into the processed input are specific

[5] We abstract from transport costs under generic outsourcing.

[6] In practice, duties are applied on the value added only from outward processing, with the EU producer claiming relief for the rest. For simplicity, no duties are applied on re-imported outward processed inputs in the model.

to B. Alternatively, σ could reflect market thickness on the buyer side; the more potential buyers there are, the more likely it is to find an alternative buyer willing to pay a premium for the particular characteristics of the processed input.

We further assume there is a risk of contractual breakdown under GO, the degree of which depends on the quality of institutions overseas. In particular, let θ reflects the probability that the low quality input under GO does not arrive, or is delayed. If this occurs the EU firm can enforce the contract through legal or other channels, incurring a cost F for the time cost of the delay, legal fees etc. The larger isθ, then the costlier is GO as a means of acquiring an input.

Finally, assume both B and S are risk-neutral. In the analysis that follows we solve for the optimal organizational structure through backward induction.

3.1 Quality selection under GO

Let $\Pi^B_{GO,H}$ and $\Pi^B_{GO,L}$ denote the profits of the EU buyer under GO[7], when producing a high or low quality variety respectively, where:

$$\Pi^B_{GO,H} = P^H - P^L_Z(1+\tau) - \delta^H - \theta F \quad (1)$$

$$\Pi^B_{GO,L} = P^L - P^L_Z(1+\tau) - \delta^L - \theta F. \quad (2)$$

The profits of the external supplier are given by $\Pi^S_{GO} = P^L_Z - C_Z$, irrespective of final product quality, so provided $P^L_Z \geq C_Z$, S is willing to supply an input at the spot price[8].

It follows from equations (1) and (2) that the buyer prefers to produce a low quality variety under GO, than a high quality variety, if the output price quality premium satisfies:

$$P^H - P^L < \delta^H - \delta^L. \quad (3)$$

If condition (3) is satisfied then B has the choice of producing a low quality variety through GO or a high quality variety through OP. Otherwise, B produces a high quality variety irrespective of organizational structure and the choice between GO and OP hinges on factors other than the quality premium. Each of the two cases is considered in turn.

3.2 GO versus OP for high quality production

In solving the model, let us first consider the case where condition (3) is violated, so high quality GO is the only relevant alternative to OP. Consider the symmetric Nash bargaining game, that takes place after relationship specific investments are sunk on both sides. If

[7] All pay-offs for the various outsourcing outcomes are listed in Table 1.

[8] We could assume the low quality input market is perfectly competitive, so $P^L_Z = C_Z$.

bargaining fails, then B purchases a low quality input from the spot market and transforms it into a high quality variety[9], while S incurs search costs and sells the processed input to an alternative buyer. The payoffs from these outside options, denoted by $\Pi^B_{OO,H}$ and Π^B_{OO}, are

$$\Pi^B_{OO,H} = P^H - P^L_Z(1+\tau) - \delta^H - C_Y - h - \theta F \quad (4)$$
$$\Pi^S_{OO} = P^L_Z(1+\sigma) - C_S - K. \quad (5)$$

Let P^{H*}_Z denote the agreed price if *ex post* bargaining is successful. Corresponding payoffs from OP, denoted by Π^B_{OP} and Π^B_{OP}, are thus

$$\Pi^B_{OP} = P^H - P^{H*}_Z - C_Y - h \quad (6)$$
$$\Pi^S_{OP} = P^{H*}_Z - K. \quad (7)$$

The minimum price acceptable to S, $P^H_{Z,\min}$, is that which makes Π^S_{OP} just equal to Π^S_{OO}. Moreover, the maximum price B is willing to pay, $P^H_{Z,\max}$, is that which makes payoff Π^B_{OP} exactly equal to $\Pi^B_{OO,H}$. It follows from equations (4) - (7) that:

$$P^H_{Z,\min} = P^L_Z(1+\sigma) - C_S \quad (8)$$
$$P^H_{Z,\max} = P^L_Z(1+\tau) + \delta^H + \theta F. \quad (9)$$

Hence, the higher are P^L_Z and σ and the lower is C_S, the better is the supplier's outside option and thus the higher the minimum acceptable price for S. Similarly, the lower are P^L_Z, τ, $\delta^H$and θF, the better is the buyer's outside option and thus the higher the maximum price B is willing to pay. Any price $P^H_Z \in \left[P^H_{Z,\min}, P^H_{Z,\max}\right]$ can be supported as a Nash equilibrium, but we assume an equal split of quasi-rents for simplicity.[10] Hence

$$P^{H*}_Z = \frac{1}{2}\left(P^H_{Z,\min} + P^H_{Z,\max}\right) = P^L_Z\left(1 + \frac{\tau+\sigma}{2}\right) + \frac{\delta^H}{2} + \frac{\theta F}{2} - \frac{C_S}{2}. \quad (10)$$

This price is mutually acceptable and thus players' outside options are never exercised. Substituting equation (10) into (6) and (7) gives the equilibrium payoffs under OP from the Nash solution:

[9] Running the risk that with probability λ an enforcement cost F will be paid.

[10] *Ex post* quasi-rents from OP are $\Pi^B_{OP} + \Pi^S_{OP} - \Pi^B_{OO,H} - \Pi^S_{OO} = P^L_Z(\tau - \sigma) + \delta^H + \theta F + C_S$, which is assumed positive.

$$\Pi_{OP}^{B*} = P^H - P_Z^L\left(1+\frac{\tau+\sigma}{2}\right) - \frac{\delta^H}{2} - \frac{\theta F}{2} + \frac{C_S}{2} - C_Y - h \quad (11)$$

$$\Pi_{OP}^{S*} = P_Z^L\left(1+\frac{\tau+\sigma}{2}\right) + \frac{\delta^H}{2} + \frac{\theta F}{2} - \frac{C_S}{2} - K. \quad (12)$$

Π_{OP}^{B*} must be at least as large as $\Pi_{GO,H}^{B}$ for the EU buyer to (weakly) prefer OP to GO, while Π_{OP}^{S*} must be at least as large as Π_{GO}^{S} for the supplier to accept. The EU buyer weakly prefers to engage in OP if (13) is satisfied:

$$P_Z^L\left(\frac{\tau-\sigma}{2}\right) + \frac{\delta^H}{2} + \frac{\theta F}{2} + \frac{C_S}{2} - C_Y - h \geq 0 \quad (13)$$

It follows that high quality producing EU firms are more likely to choose OP the greater the financial incentive to avoid import duties (i.e, the higher is τ and the higher the price of the input, P_Z^L), the greater the cost of transformation under GO,δ^H, the worse the quality of institutions, θF, the lower the buyer's costs associated with OP i.e. C_Y and h, the greater are the supplier's search costs for an alternative buyer, C_S, and the smaller the price the supplier stands to receive from an alternative buyer (i.e. σ, which reflects the degree of product specificity).

The supplier will accept to engage in OP provided (14) is satisfied:

$$P_Z^L\left(\frac{\tau+\sigma}{2}\right) + \frac{\delta^H}{2} + \frac{\theta F}{2} + C_Z - \frac{C_S}{2} - K \geq 0. \quad (14)$$

Higher search cost, C_S, and a smaller premium, σ, worsen the supplier's outside option once investments K is sunk, *ceteris paribus*, making it less likely S will accept. Conversely, lower costs of modifying the production process to carry out the processing, K, also make it more likely S accepts.

3.3 GO versus OP under quality switching

Now consider the case where condition (3) is satisfied, so if the EU firm prefers OP to GO it switches from being a low quality producer to being a high quality producer. If the OP contract breaks down and Nash bargaining fails, then B purchases a low quality input from the spot market and transforms it into a low quality variety. B's payoff from the outside option is denoted by $\Pi_{OO,L}^{B}$ and given by

$$\Pi_{OO,L}^{B} = P^L - P_Z^L(1+\tau) - \delta^L - C_Y - h - \theta F, \quad (15)$$

whereas Π_{OO}^{S} is as in (5). The minimum price acceptable to S is unchanged, but the maximum price B is willing to pay is that which equates Π_{OP}^{B} to $\Pi_{OO,L}^{B}$, and is given by:

$$P^H_{Z,\max} = \left(P^H - P^L\right) + P^L_Z(1+\tau) + \delta^L + \theta F. \tag{16}$$

Hence, the larger the output price quality premium, the higher is the maximum price B is willing to pay, which in turn impacts on P^{H*}_Z:

$$P^{H*}_Z = \frac{P^H - P^L}{2} + P^L_Z\left(1 + \frac{\tau+\sigma}{2}\right) + \frac{\delta^L}{2} + \frac{\theta F}{2} - \frac{C_S}{2}. \tag{17}$$

Payoffs under OP are thus:

$$\Pi^{B*}_{OP} = \frac{P^H + P^L}{2} - P^L_Z\left(1 + \frac{\tau+\sigma}{2}\right) - \frac{\delta^L}{2} - \frac{\theta F}{2} + \frac{C_S}{2} - C_Y - h \tag{18}$$

$$\Pi^{S*}_{OP} = \frac{P^H - P^L}{2} + P^L_Z\left(1 + \frac{\tau+\sigma}{2}\right) + \frac{\delta^L}{2} + \frac{\theta F}{2} - \frac{C_S}{2} - K. \tag{19}$$

Π^{B*}_{OP} must be at least as large as $\Pi^B_{GO,L}$ for the EU buyer to (weakly) prefer OP to GO, while it is again sufficient for $\Pi^{S*}_{OP} \geq \Pi^S_{GO}$ in order for the supplier to accept. B chooses to engage in OP if (20) is satisfied and S accepts if (21) is satisfied:

$$\frac{P^H - P^L}{2} + P^L_Z\left(\frac{\tau-\sigma}{2}\right) + \frac{\delta^L}{2} + \frac{\theta F}{2} + \frac{C_S}{2} - C_Y - h \geq 0 \tag{20}$$

$$\frac{P^H - P^L}{2} + P^L_Z\left(\frac{\tau+\sigma}{2}\right) + \frac{\delta^L}{2} + \frac{\theta F}{2} + C_Z - \frac{C_S}{2} - K \geq 0. \tag{21}$$

The results are similar to those found in the previous section, except OP is now more likely the larger is the output price quality premium, $\left(P^H - P^L\right)$.

3.4 Main predictions of the model

The testable hypotheses for explaining OP trade based on the model can be summarized as follows:

- Cross-country differences in the degree of outward processing should respond to the variables associated in the literature to outsourcing. Concretely, a larger share of OP should be observed:
  - in low cost producers but with higher quality capability (corresponding to C_Y),
  - the lower is contract enforcement quality and, therefore, the more likely are contract breakdowns (higher θF),
  - the larger the MFN rate and higher incentive to tariff exemptions through OP trade (higherτ),

  - the closer proximity (distance, common language etc), the lower is corruption and greater is political stability (corresponding to transport and monitoring cost h),
  - the greater the costs to search for another importer and transport the input, C_S,
  - the larger the differences in relative factor endowments, reflecting Hechkscher-Ohlin theory,
  - the larger market size differences, reflecting new trade theory (e.g. Egger and Egger, 2005).

- Cross-product differences in OP trade may be the result of the degree of complexity of transactions, the asset specificity required, the degree of standardization of the transaction, the thickness of input markets
  - the higher the quality premium ($P^H - P^L$),
  - the higher the spot price, $\left(P_Z^L\right)$,
  - the lower the cost of the initial input sent for processing (corresponding to C_Y),
  - the higher the cost of transforming input into output through GO (corresponding to δ^L, δ^H),
  - the greater are search costs for the supplier to search for another importer and transport input, C_S,
  - the lower is the premium from adaptability in higher quality, σ,

These predictions complement the literature in new ways. First, they emphasize the role of quality differentiation/sophistication/complexity as a determinant of the choice of outsourcing mode. Second, they stress the importance of trade and monitoring costs for OP trade. Third, they show that the impact of input specificity on the choice of outsourcing mode is ambiguous. On the one hand, larger input specificity requires larger relationship-specific investment and influences the seller's decision to accept to engage in OP; all other things equal, OP is more likely to take place the lower is K. On the other hand, input specificity influence the premium from adaptability in higher quality, σ, which has conflicting effects on the buyer's willingness to engage in OP and the seller's willingness to accept to engage in OP. Once investments$K$ are sunk, greater product specificity implies a lower adaptability premium σ, which worsens the supplier outside option making engaging in OP less likely. Conversely, a smaller adaptability premium σ, implies a lower price for the buyer under processing, increasing the buyer's willingness to engage in OP. Fourth, contrary to some of the standard models in the outsourcing literature, the impact of institutions is more important for generic outsourcing due to the likelihood of contractual breakdown (θF) in this type of outsourcing mode.

4 The determinants of outward processing trade in the European Union

This section tests the hypotheses presented in the model developed above.

4.1 Data and variable construction

We use trade statistics from the COMEXT database from 2002 to 2008. This database, provided by EUROSTAT, disaggregates monthly trade flows into the EU by origin and destination, product defined at 8 digits of the Combined Nomenclature (CN), which uses the Harmonized System (HS), and the statistical regime. This allows us to differentiate imports in the EU using the OP trade regime from those imported using the "normal imports" regime. Monthly values on imports and quantities are aggregated according to country of origin and country of destination within the EU for each year. We drop observations below 5,000 Euros, since these do not represent any meaningful trade flow between firms and for the OP trade could reflect items to be repaired.

An important element to consider is that not all products are suitable for outward processing. This is especially the case for agricultural products and primary commodities, as well as for some types of manufactures. Analysing which types of products are more suitable for outward processing is beyond the scope of this paper, since it largely depends on changes in demand and technology. The focus of this paper is on the determinants of outward processing for those products where this type of production chain is feasible technologically. The dataset is thus restricted to those products that experience at least one flow of outward processing trade to the EU at some point between 2000 and 2007. We also aggregate flows to a single destination in the EU, since OP imports by the same EU firm can enter the EU by different countries in order to supply different plants across the EU. Concretely, the final dataset includes 4,404 product lines that at some point during the period had positive imports under regime 3, outward processing; this represents around 34% of total product lines over the period. The final dataset includes more than 600,000 observations, between 80,000 and 90,000 for each year from 2002 to 2008. Each observation corresponds to an import flow into the EU from country i in product k in year t. For each observation, there is at least one import flow observed, corresponding to normal imports, outward processing or both. This allows us to define the outward share ratio for each country i in product k in year t as the share of outward processing imports in total imports:

$$S_{ikt} = \frac{outward_{ikt}}{normal_{ikt} + outward_{ikt}} \tag{22}$$

Since OP trade in the EU is associated with a duty drawback system for imports, it is

expected that larger product tariffs increase the attractiveness of OP trade, as suggested by the model. For each observation we thus use the TARIC database and obtain the tariff paid for each flow and the MFN tariff for each particular product.

Table 2 summarises all the variables used to test the predictions of the model. Besides tariffs, we use "gravity" variables such as distance, contiguity, common language and colony from the CEPPI database and the political stability index developed by Kaufmann *et al.* (2010) to reflect monitoring costs and the importance of proximity. Measuring relationship-specific investments required due to asset and input specificity is difficult since specificity may arise in the context of specific assets or tasks required, or else as complexity in the production process. We use the measures of specificity proposed by Nunn (2007), which consider, for each product, whether the input is sold in an organized exchange or whether it is reference priced in a trade publication using the Rauch (1999) classification. The measure treats asset specificity as the degree of product differentiation embedded in the inputs required to produce an output. The main assumption is that inputs traded in organized exchanges, or that are reference priced, have thicker markets which reduce potential hold up problems. Therefore, the lower is the input content that is traded in an organized exchange or is reference priced, the more asset specific is a product. We use available EU input-output tables from 2000 to 2007 to compute for each sector the share of each type of input and calculate the two measures proposed by Nunn (2007). The first measure considers inputs neither sold in organized exchange nor reference priced ($Nunn_1$), while the second measure considers inputs that are not sold in an organized exchange only ($Nunn_2$). In order to capture other dimensions of asset specificity, we complement the Nunn (2007) measures with the Pavitt (2000) measure of sector R&D intensity, since more R&D intensive sectors may require larger inter-firm coordination during outsourcing, as well as with the degree of capital intensity proxied by the capital to labour ratio, since more capital intensive sectors are less contract intensive than skill intensive sectors (Nunn, 2007). Finally, we complement these with the sophistication measure proposed by Hausmann *et al.* (2007).[11]

For the cost of transforming low quality into high quality inputs, we use as a proxy the number of OP flows divided by the number of flows using "normal" imports. The assumption here is that more flows imply more countries involved in this transformation, which presumably implies the use of more mature technologies, which are therefore less costly. To control for low cost producing capacity we use population from the World Development Indicators (WDI, 2011) and to capture the quality premium we use the ratio of the 90th to the 10th percentile in the unit values of each product.

Search costs have two components. First, to measure market thickness we use the number of countries that are OP exporters for each product. Second, to capture ease of exporting to

[11] Concretely, we use the sophistication measure proposed by Hausmann *et al.* (2007), which is a weighted average of the GDP per capita using each country export share for a given product normalized by the RCA.

a different buyer we use air traffic volume. To capture the premium for adaptability to other buyers we use the ratio between the premium in unit values between OP to normal trade, normalized by the normal trade unit value. This measure captures the scope for buyers to obtain higher prices from selling high quality OP products to other buyers. At the same time, however, this premium depends on the rigidity of the input specificity, which is also captured by the Nunn (2007) measure. Finally, we use the rule of law index developed by Kaufmann *et al.* (2010) to measure the quality of institutions that affect θF.

OP imports represent a small share of imports to the EU. Considering only the products in our sample, those that experienced outward processing during the period 2000-2008, this regime accounts for around 3.45% of total imports and only 7.7% of all observations. Clearly, this this type of trade is far less prevalent that normal trade.

Table 3 shows the top 20 countries, ranked by their share of outward processing exports to total exports to the EU[12]. The table shows some interesting results. First, the importance of this type of trade in some Central and Eastern European countries is striking. This suggests that proximity may play a very important role in explaining this type of trade by reducing monitoring costs significantly and increasing delivery reliability. Second, while the importance of institutions and the rule of law may still be important factors in explaining total trade, it is less clear how important rule of law is for the importance of OP in total trade. Figure 2 shows the local polynomial smoother plot for the relationship between OP share and the rule of law index for all country years available in our sample. The OP share is slightly decreasing in the rule of law index, although the negative correlation is small at -0.14. In addition, regarding country participation in OP trade it is interesting that China, one of the main processing platforms for processing trade, only exports around 0.24% of its exports to the EU as OP trade; while this share for the US is more than 12% on average.

Another interesting element that arises from a first glance at the data is the unclear role of nominal tariffs on outward processing. As suggested above, the rationale to apply for the outward processing scheme is the fact that the importer can claim for a duty drawback equivalent to the tariff that would be applied to the input that was exported for processing. Surprisingly, some of the countries in Table 3 have enjoyed preferential access to the EU market for a large number of products. For example, in 2000 the EU granted preferences to most products coming from the Western Balkans.[13] In addition, countries eligible for the EBA scheme also have positive, although small, shares of outward processing exports. Two elements may explain this fact; first, in some cases importers can claim VAT relief. This implies that, even in the case of preferential access, there may be, in some cases, an incentive to apply for the outward processing regime. Second, and more important, it is a well known

[12]This share is calculated as the weighted average share of OP exports to total exports for each product and year. This excludes other processing regimes such as the textile regime.

[13]Albania, Bosnia and Herzegovina, Croatia, the former Yugoslav Republic of Macedonia, Montenegro, Serbia and Kosovo.

fact that there are significant costs of compliance to be eligible to preferential access.[14] As a result, in the case of outward processing trade, it may be less costly for the importer to apply to this regime than for the exporter to request the preference.

Regarding the sector composition of outward processing shares, Table 4 shows the 20 HS-2 chapters with the largest share of OP trade. The main sector where OP trade takes place "87 Vehicles other than railway", with around 28% of OP trade on total trade. This sector is followed by "28 Inorganic chemicals", "88 Aircraft, spacecraft,.." and "62 Articles of apparel and clothing, not knitted.."; however the OP shares for these sectors range from 11.5% to 7.35% on average. Only in five sectors does outward processing represent more than 5% of exports of these countries to the EU, and this type of trade also includes, although to a lesser extent, processing agricultural products. It is likely that the importance of OP trade is underestimated in relation to the textile and clothing sectors, since in addition to using this OP regime, firms also enjoy a specific outward processing regime in the EU.

The preliminary analysis of the data shows that OP trade, when compared to generic outsourcing, seems to be concentrated in countries with better proximity to the EU and in the vehicles sector. We next test the predictions of the model developed in Section 3.

4.2 Outward processing trade and the quality premium

One important assumption in the model is that firms engage in OP trade as compared to generic outsourcing because they seek to produce products with more quality, complexity or sophistication attributes. This product can be produced either by starting the production process in-house and sending an input abroad for processing and then re-imported (OP trade) or by transforming a lower quality input imported via generic outsourcing. These differences in quality or sophistication should be translated in a price premium of OP imported products *vis-à-vis* arms length imports.

Despite not having price data available, we can proxy prices using unit values. We compute unit values by diving total imports by total quantities under each regime for each year, product and country pair. Our unit of observation is thus each specific trade flow, so for country pairs with normal and OP flows for a given product in the same year we have two observations. Furthermore, in order to minimize distortions in unit values due to the aggregation of flows we use the initial disaggregated dataset with the different countries in the EU as import destination. This is the closest we can get to approximating each observation to a single export flow. In total, our disaggregated dataset has around 4.5 million observations.

In order to test for the presence of a price premium in OP trade reflecting quality/complexity differentiation of inputs we estimate the following equation:

[14] Carrère and de Melo (2004) estimate such costs for EU preferential schemes and FTAs (PANEURO) lie between 4.7% and 8.2% of the *cif* export price. Manchin (2006) obtains a similar estimate of around 4.5%.

$$ln(uv)_{ijkt} = \alpha + \beta_1 Out_{ijnt} + \beta_2 GDP_{it} + \beta_3 GDP_{jt} + \sum \lambda_t + \sum_{u}^{U} \lambda_u Uti_u + \sum \lambda_{ij} + \sum_{k}^{K} \lambda_k + e_{ijkt}. \tag{23}$$

The log of the yearly unit value for each country pair ij, product k and year t, is regressed on a dummy variable Out_{ijkt} with value one if the import flow is registered under the outward processing regime, and zero otherwise. Therefore, $\beta_1$captures the price premium associated to OP trade *vis-à-vis* normal imports. We also introduce different controls to capture other factors that may affect prices. In line with the literature we use GDP per capita in the exporting country and the EU destination market to control for supply and demand factors that may be affecting prices. Richer countries tend to export more sophisticated products and export prices tend to be higher in higher income markets. We use time dummies λ_t to control for business cycle elements in EU markets and changes in demand. In addition, since tariff preferences create a price margin that is partially transmitted to export prices (Cirera, 2010) we use dummies for whether the trade flow is carried out duty free, under a positive MFN rate, under preferences and under MFN not using existing preferences; preference utilization dummies are denoted by λ_u. Finally, in one specification we also control for country pair fixed effects, λ_{ij}, and product fixed effects, λ_k.

The results are summarized in Table 5. The result from estimating the model with fixed effects with and without utilization dummies, are reported in columns (2) and (3). Columns (4) and (5) report results with product fixed effects and dummies for utilization, while in columnn (5) we control for GDP per capita levels. Finally, column (6) controls for all other factors by adding country pair and product fixed effects in the estimation.

The R^2 is significantly low in most specifications. The coefficients on GDP per capita are mainly non-significant but, more importantly, the coefficient on the export premium is, however, statistically significant for all specifications, and suggests that unit values of exports under outward processing are on average around 9% to 28% higher than normal imports. This is consistent with our model, which suggests that outward processing flows correspond to more sophisticated/complex products, provided product sophistication/complexity is translated into higher unit values.

4.3 Determinants of outward processing

In order to test the predictions of the model we use the dataset that averages observations over EU countries, considering the EU as one market.[15] This includes most exporters[16] to the EU during the period 2002-2008. The model yields predictions in relation to the choice of outsourcing type between OP and GO outsourcing. This implies that we need to look at the choice between outsourcing modes, rather than OP trade *per se*.

We construct two variables to capture the outsourcing choice. The first variable is simple an OP index D_{ikt}, which takes the value one when a country exports to the EU only under the OP regime, and 0 otherwise. This dummy index captures total specialization in OP trade. The second variable measures the importance of OP trade in each flow, OP intensity, by using the share of OP trade in total trade for each product, S_{ikt}.

The following general equation is estimated:

$$y_{ikt} = \alpha_0 + \alpha_1 \tau_{ikt} + \sum \beta_n x_{kt} + \sum \delta_l z_{it} + \sum \lambda_t + u_{ikt}, \tag{24}$$

where y_{ikt} is one of the OP trade choice indicators defined above (D_{ikt}or S_{ikt}) for each product k and imports from country i to the EU in period t. The variables used and their construction are summarized in Section 4.1 and Table 2. $\tau_{ikt}$is the tariff paid in the EU by normal imports by product k imported from country i to the EU in period t; z_{it} is a vector of country specific variables in period t; x_{kt} is a vector of product specific variables in period t; λ_t are year dummies, and; u_{ikt} is a normally distributed error term $N \sim (o, \sigma^2)$.

When estimating the decision to use OP using the D_{ikt} index, we use a probit estimator. When looking at OP trade intensity using the share indicator S_{ikt} the dependent variable is bounded between 0 and 1, and as a result estimation of (24) using a proportion implies that OLS estimates are biased. In this case the error term is heteroscedastic since the errors are, by definition, smaller when observations are closer to 0 and 1. As a result this model is estimated using the generalized linear model with a logistic function (Cameron and Trivedi, 2005).

4.3.1 Results OP choice

Table 6 shows the results for the estimates of the choice of OP. Specification (1) is the baseline specification that uses the $Nunn_1$ measure. Specifications (3) and (5) use the alternative $Nunn_2$ measure and the PRODY sophistication measure proposed by Hausmann *et al.* (2007). Even specifications add a new interactive term in line with Feenstra *et al.* (2012)

[15] Here zero flows refer only to outward flows. All our observations refer to some positive imports from a country either under one or the other regime. This differs from the idea of zero flows in the gravity model sense, which refers to lack of imports between country pairs.

[16] Countries without available macro data are dropped. This corresponds mainly to small Caribbean and Pacific islands, some European territories such as the Canary Islands or Melilla, and Kosovo and Taiwan.

that interacts the specificity measure with a dummy index with value 1 if the law index is above average, reflecting that institutions in the country are above average.

Table 6 reports the marginal effects of the probit estimates directly, to facilitate interpretation. As expected tariffs increase the probability of specializing completely in OP; a change in the tariff increases the probability of OP specialization by 2.5%. Regarding monitoring costs, distance reduces the probability of OP choice by around 3.9%. This highlights the importance of proximity in OP trade stressed by Feenstra and Spencer (2005). Also, political stability increases the probability of OP; a unit increase in the political stability index increases around 40% the probability of OP choice. The coefficients for common language, contiguity and former colony are all negative, suggesting that these links increase the probability of using GO instead.

With regards to input specificity, both Nunn (2007) measures, as well as the sophistication measure PRODY, increase the probability of using OP, although the coefficient for the sophistication measure is not always statistically significant. Interestingly, however, when we interact specificity with whether the country has better than average institutions, the results suggest that the positive effect of input specificity in countries with better institutions is significantly reduced. One potential explanation is that inter-firm relationships arising from OP trade compensate for the lack of good institutions when outsourcing inputs. Moreover, the estimates suggest that capital intensive sectors are less likely to use OP trade since they are less contract-intensive than other sectors, while sectors with more R&D intensity are more likely to use OP trade; increases in R&D intensity increase the probability of OP trade around 10%.

Other important predictions of the model, such as the cost of transforming low quality into high quality input, proxied by number of flows using OP divided by number of flows using "normal" imports, or the scope for price differentiation are also statistically significant. More OP flows for a given product as a proxy for cheaper transformation and more mature technology increases the probability of using OP trade. Also, more scope for price differentiation within a given product increases the probability of OP trade. Interestingly, population as a proxy for labour costs reduce the probability of OP trade, suggesting that low costs are not important determinants of this type of outsourcing.

In relation to search costs for buyers, input market thickness, measured by the number of OP countries for a given product decrease the probability of using OP trade between 0.2% and 0.3%. This is somehow puzzling, since thicker markets imply lower search costs for alternative buyers. However, this may indicate instead that search costs are larger due to the fact that alternative buyers have also more supplier options. In addition, the volume of air traffic for measuring the ease of changing suppliers, reducing search costs for alternative suppliers, increase the probability of OP trade by around 7%. It is likely that this variable is capturing the importance of in-time delivery for OP trade rather than search costs for

alternative suppliers.

Another critical variable affecting the choice of OP trade in the model is the premium for adaptability of the input to alternative buyers. The coefficient on the unit value premium between OP and GO trade is not statistically significant. However, as suggested above ,it is likely that the effect of this variable is captured by the input specificity proxies. Higher specificity imply lower value to alternative uses and more likelihood of OP trade. In general, the positive impact of asset specificity on OP trade indicates that the negative impact of sunk investment costs is outweighed by the loss in the premium of the outside option for specialized suppliers.

Finally, another interesting result relates to the role of institutions proxied by the rule of law index. As suggested by the model, institutions may be more important in GO by affecting the likelihood of contractual breakdown. This is reflected in our estimates, since increases in the rule of law index reduce the probability of using OP *vis-à-vis* GO between 77% to 80%.

4.3.2 Results OP intensity

Table 7 shows the results for the estimates on OP trade intensity measured by the share of this type of trade. The results of the generalized linear model estimates are very similar to the probit estimates. Tariffs, proximity and political stability increase the intensity of OP trade. Tariffs increase the incentives provided by OP regime exemptions, and proximity and political stability lower monitoring costs for buyers. To be a former colony or contiguous to the EU reduce the intensity of OP trade. As before, asset specificity increase OP trade intensity, but this is lower for countries with good institutions, and OP trade is higher in R&D intensive sectors and lower in capital intensive sectors. The results for the sophistication variable are mixed, and not always significant. The main difference between these and the probit estimates lies in the role of labour costs, with lower labour costs increasing OP trade intensity. Furthermore, the estimates again suggest a negative effect of the rule of law index on the intensity of OP trade.

In general, the estimates confirm the main predictions of the model, and emphasize the role of tariffs, proximity, and especially asset specificity and the rule of law in explaining the choice of outsourcing mode. Tariffs increase the incentives of OP regimes. Proximity reduces monitoring costs for buyers, while asset specificity increases the need for inter-firm coordination through OP trade and reduces the value of the outside option for suppliers. The most interesting result relates to the role of institutions. Better institutions tend to increase the likelihood of GO given the higher risks associated with contract breakdown, such as delays or non-deliveries. While it is likely that institutions have a significant impact on the level of trade, OP trade via relationship specific investments and monitoring may increase

inter-firm coordination, compensating for poor institutions.

5 Conclusions

This paper has attempted to explain participation in processing trade as a type of outsourcing mode. OP trade appears to be concentrated in specific sectors and in a few countries. Data from the EU show that this type of trade is mainly concentrated in Eastern European countries, some of which have poor institutional quality and rule of law. In order to explain OP trade, we develop a model of outsourcing choice that compares outward processing trade with generic outsourcing in order to explain OP trade. The model incorporates quality differentiation, input specificity, tariffs and monitoring costs as critical elements of the choice between OP and GO. Specifically, the model predicts that higher tariffs, lower monitoring costs, higher search costs for alternative suppliers or more quality differentiation increase the likelihood of choosing OP trade *vis-à-vis* GO. It also predicts that institutions and the rule of law have an important effect through their impact on the likelihood of contract breakdown under GO. The impact of input specificity is shown to be theoretically ambiguous since higher specificity implies, on the one hand, larger sunk investments required to adapt production, while on the other hand, a smaller premium for selling the specialized input to alternative suppliers.

Testing these predictions using OP trade data in the EU for the period 2002-2008 confirms these predictions, and emphasises the role of proximity and quality differentiation in selecting OP trade. The empirical analysis shows there is a positive impact of input specificity in OP trade and a very significant impact of institutions on the choice of GO over OP. This suggests that relationship-specific investments by buyers and monitoring costs from suppliers associated with OP trade may offset the need for better institutions and rule of law, which may be more important for contract breakdown under GO. Contractability, related to input specificity, may be replaced by stronger inter-firm governance.

Further research is needed to better understand the different degrees of governance rigidity within value chains under both OP and GO types of outsourcing, as well as how this overlaps with different types of ownership.

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6 Tables and Figures

Table 1. Summary of payoffs

Outcome	**Buyer**	**Seller**
GO; High quality	$\Pi^B_{GO,H} = P^H - P^L_Z(1+\tau) - \delta^H - \theta F$	$\Pi^S_{GO} = P^L_Z - C_Z$
GO; Low quality	$\Pi^B_{GO,L} = P^L - P^L_Z(1+\tau) - \delta^L - \theta F$	$\Pi^S_{GO} = P^L_Z - C_Z$
OP	$\Pi^B_{OP} = P^H - P^{H*}_Z - C_Y - h$	$\Pi^S_{OP} = P^{H*}_Z - K$
OO; High quality	$\Pi^B_{OO,H} = P^H - P^L_Z(1+\tau) - \delta^H - C_Y - h - \theta F$	$\Pi^S_{OO} = P^L_Z(1+\sigma) - C_S - K$
OO, Low quality	$\Pi^B_{OO,L} = P^L - P^L_Z(1+\tau) - \delta^L - C_Y - h - \theta F$	$\Pi^S_{OO} = P^L_Z(1+\sigma) - C_S - K$

Table 2. Variable description and construction

variable	description	proxies
τ	tariffs	- MFN tariff for product
		- Effective tariff paid for normal flows (TARIC)
h	Monitoring costs supplier	- Distance, contiguity, common language common border (CEPII)
		- Political stability index (Kaufmann *et al.*, 2010)
K	relation specific investments /specialized input	- Nunn asset especificity measures (Nunn, 2007)
		- Sophistication measure (Hausmann *et al.*, 2006)
		- R & D intensity (Pavitt, 2000)
		- Sector capital to Labour ratio (GTAP database)
δ^h	Cost of transforming low quality into high quality input	- Proxied by number of flows using OP divided by number of flows using "normal" imports ratio_quality
C_Y	Input costs	- labour endowment (WDI, 2011)
$P^H - P^L$	Quality premium	- Ratio 90th percentile to 10th percentile in the unit value for each product
C_S	Search costs	- Market thickness measured by the number of OP exporters
		- Air traffic volume (WDI, 2011)
σ	Premium for adaptability in higher quality	- Ratio between the average unit value premium(OP-normal) to the average uv of normal tarde for each product
		- Nunn asset especificity measures (Nunn, 2007)
θF	Cost of constract breakdown	- Rule of law index (Kaufmann *et al.*, 2010)

Table 3. Countries with larger OP trade shares (weighted average ratio of outward to normal trade)

Country	2002	2003	2004	2005	2006	2007	2008	average
Albania	64.32%	57.79%	62.03%	65.02%	52.27%	50.29%	46.09%	56.83%
Armenia	18.70%	79.31%	24.91%	16.33%	48.37%	66.20%	61.14%	44.99%
Ukraine	52.66%	56.44%	41.13%	33.75%	30.31%	22.14%	19.11%	36.51%
Moldova	41.64%	38.67%	39.87%	33.98%	25.11%	24.57%	22.55%	32.34%
Macedonia	31.91%	30.78%	28.40%	29.27%	27.45%	35.36%	38.23%	31.63%
United States	7.52%	10.56%	12.87%	8.37%	15.28%	16.59%	14.57%	12.25%
Belarus	33.21%	15.08%	11.38%	6.51%	4.41%	4.64%	6.27%	11.64%
Romania	14.98%	12.50%	10.28%	9.76%	7.66%			11.04%
Bulgaria	9.07%	10.34%	10.20%	8.51%	7.28%			9.08%
Bosnia	9.75%	9.02%	9.77%	7.34%	6.29%	7.45%	7.69%	8.19%
South Africa	7.57%	7.68%	8.08%	10.69%	15.38%	1.82%	1.28%	7.50%
Brunei	0.00%	0.00%	0.14%	0.00%	7.93%	40.17%	1.81%	7.15%
Sao Tome	4.00%	41.93%	0.00%	0.00%	0.00%	0.95%	0.00%	6.70%
Iraq	35.01%	0.00%	0.00%	0.00%	0.00%	10.81%	0.00%	6.55%
Myanmar	2.64%	3.58%	3.09%	9.04%	8.61%	9.32%	9.03%	6.48%
Sri Lanka	12.66%	8.21%	9.29%	6.49%	2.39%	1.85%	1.81%	6.10%
Morocco	6.59%	6.11%	6.15%	5.61%	4.19%	4.54%	4.34%	5.36%
Somalia	0.00%	0.00%	35.80%	0.00%	0.00%	0.00%	0.00%	5.11%
Croatia	6.62%	4.57%	4.19%	4.74%	4.12%	3.89%	4.11%	4.61%
Brazil	0.15%	0.23%	0.08%	7.59%	6.60%	6.57%	10.55%	4.54%

Source: COMEXT database

Table 4. OP trade by HS-2 Chapter

HS-2 chapter	**2002**	**2002**	**2002**	**2002**	**2002**	**2002**	**2002**	**Average**
87 Vehicles other than railway	24.24%	26.74%	28.47%	22.36%	31.07%	32.36%	30.58%	27.97%
28 Inorganic chemicals,..	11.47%	11.47%	9.31%	15.24%	11.80%	8.71%	12.57%	11.51%
88 Aircraft, spacecraft,..	4.83%	11.91%	6.15%	6.88%	16.60%	13.67%	8.54%	9.80%
62 Articles of apparel and clothing, not knitted..	9.86%	9.27%	8.54%	7.51%	6.72%	4.74%	4.80%	7.35%
13 Lac, gums, resons,..	16.09%	18.18%	2.33%	0.02%	0.00%	0.09%	0.00%	5.24%
21 Miscellaneous edible preparations,..	8.82%	9.88%	12.10%	1.80%	0.06%	0.06%	0.63%	4.77%
64 Gootwear, gaiters,..	7.09%	6.17%	4.54%	3.77%	3.53%	1.72%	2.10%	4.13%
18 Cocoa and cocoa preparations	7.38%	5.41%	7.10%	3.11%	2.90%	0.19%	0.17%	3.75%
19 Preparations of cereal, starch,..	4.67%	6.01%	9.32%	1.75%	0.55%	0.84%	0.66%	3.40%
53 Other vegetable textile fibres	1.16%	4.70%	5.83%	1.73%	2.35%	2.00%	4.56%	3.19%
29 Organic chemicals	2.52%	3.62%	2.88%	2.11%	2.41%	2.05%	2.81%	2.63%
05 Products of animal origin	2.12%	3.68%	3.94%	2.86%	2.08%	0.74%	0.24%	2.24%
20 Preparations of vegetables, fruits, nuts	1.56%	1.65%	1.48%	1.67%	1.36%	3.46%	2.42%	1.94%
81 Other base metals	1.19%	2.30%	1.74%	1.26%	2.58%	1.56%	1.06%	1.67%
83 miscellaneous articles of base methals	1.12%	2.59%	2.39%	1.51%	1.57%	1.30%	0.65%	1.59%
61 Articles of apparel and clothing, knitted.	2.28%	1.95%	1.60%	1.23%	1.07%	1.17%	1.16%	1.49%
15 Animal and vegetable fats and oils,..	0.01%	0.08%	1.08%	2.91%	3.72%	1.08%	0.75%	1.38%
86 Railway and tramway locomotives	0.51%	0.35%	0.45%	0.57%	0.67%	3.42%	2.55%	1.22%
70 Glass and glassware	4.89%	0.39%	0.98%	0.55%	0.30%	0.40%	0.29%	1.12%
43 Furskins and artificial fur	0.32%	0.62%	1.29%	0.63%	0.30%	1.69%	2.70%	1.08%

Table 5. Estimates of the unit value premium of OP trade

VARIABLES	(1) OLS1[a]	(2) OLS2[b]	(3) FE1[c]	(4) FE2[c]	(5) GPREG[d]
outward	16.27*	28.77***	9.465**	9.689**	8.881**
	(8.466)	(6.513)	(3.810)	(3.940)	(4.109)
gdp_cap				0.000633***	-5.30e-05
				(4.05e-05)	(0.000730)
gdp_cap_imp				-3.68e-07	-0.00130
				(6.98e-05)	(0.00126)
Constant	56.24***	114.6***	65.55***	56.43***	
	(8.619)	(27.82)	(3.383)	(3.915)	
Observations	4,456,753	4,456,753	4,456,753	4,181,140	4,181,140
R-squared	0.0002	0.001	0.0003	0.0004	0.0004

[a]Year dummy coefficients not reported

[b]Year and utilisation dummiy coefficients not reported

[c]Product fixed effects. Year and utilisation dummiy coefficients not reported

[c]Product and country pair fixed effects. Year and utilisation dummiy coefficients not reported

[d] Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 6. Probit marginal effects. OP choice

	(1)	(2)	(3)	(4)	(5)	(6)
Tariff	0.0265***	0.0246***	0.0273***	0.0255***	0.0256***	0.0255***
	(0.0005)	(0.0006)	(0.0006)	(0.0006)	(0.0005)	(0.0005)
distance	-0.3855***	-0.3905***	-0.3841***	-0.3886***	-0.3915***	-0.3867***
	(0.0053)	(0.0052)	(0.0053)	(0.0052)	(0.0054)	(0.0054)
Colony	-0.1077***	-0.0316*	-0.1065***	-0.0307*	-0.1130***	-0.0963***
	(0.0148)	(0.0149)	(0.0148)	(0.0149)	(0.0153)	(0.0153)
Contig	-0.1885***	-0.2945***	-0.1898***	-0.2917***	-0.1974***	-0.2210***
	(0.0152)	(0.0152)	(0.0152)	(0.0152)	(0.0156)	(0.0156)
common language	-0.0392*	-0.1461***	-0.0387*	-0.1420***	-0.0489**	-0.0782***
	(0.0171)	(0.0171)	(0.0171)	(0.0171)	(0.0178)	(0.0179)
pol.stab	0.4168***	0.3953***	0.4161***	0.3914***	0.4287***	0.4171***
	(0.0086)	(0.0087)	(0.0086)	(0.0086)	(0.0089)	(0.0089)
nunn1	0.4640***	0.9948***				
	(0.0358)	(0.0371)				
nunn1*dlaw		-0.8774***				
		(0.0147)				
nunn2			1.3408***	1.7172***		
			(0.1234)	(0.1226)		
nunn2*dlaw				-0.6990***		
				(0.0123)		
PRODY					0.0000	0.0000***
					(0.0000)	(0.0000)
PRODY*dlaw						-0.0000***
						(0.0000)
Capital/lab	-0.2925***	-0.2250***	-0.3777***	-0.3149***	-0.4390***	-0.4315***
	(0.0283)	(0.0284)	(0.0269)	(0.0268)	(0.0282)	(0.0282)
R&D	0.1079***	0.0720***	0.1084***	0.0765***	0.1485***	0.1411***
	(0.0143)	(0.0144)	(0.0144)	(0.0145)	(0.0155)	(0.0156)
population	-0.1365***	-0.0697***	-0.1366***	-0.0696***	-0.1417***	-0.1231***
	(0.0047)	(0.0051)	(0.0047)	(0.0051)	(0.0048)	(0.0050)
OP/GO flows	5.5401***	5.7083***	5.6803***	5.8301***	5.6997***	5.6819***
	(0.0675)	(0.0689)	(0.0660)	(0.0672)	(0.0674)	(0.0673)
Price diff	0.0006***	0.0006***	0.0006***	0.0006***	0.0006***	0.0006***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
number OP	-0.0027***	-0.0037***	-0.0025***	-0.0033***	-0.0021***	-0.0021***
	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0003)
Air	0.0777***	0.0366***	0.0771***	0.0355***	0.0830***	0.0696***
	(0.0031)	(0.0032)	(0.0031)	(0.0032)	(0.0031)	(0.0032)
OP/GO premium	0.0027	-0.0011	0.0032	-0.0005	0.0052	0.0042
	(0.0058)	(0.0058)	(0.0057)	(0.0058)	(0.0059)	(0.0060)
Law	-0.7680***	-0.4015***	-0.7669***	-0.4019***	-0.7938***	-0.6857***
	(0.0106)	(0.0118)	(0.0106)	(0.0120)	(0.0109)	(0.0123)
Constant	1.9992***	1.1187***	1.1285***	0.2890*	2.5465***	2.2819***
	(0.0835)	(0.0871)	(0.1405)	(0.1414)	(0.0815)	(0.0829)
Observations	2177259	2177259	2177259	2177259	2012760	2012760
Pseudo R2	0.299	0.323	0.298	0.319	0.303	0.305

Year dummy coefficients not reported

*** p<0.01, ** p<0.05, * p<0.1

Table 7. Generalized linear Model estimates OP share

	(1)	(2)	(3)	(4)	(5)	(6)
Tariff	0.0429***	0.0395***	0.0441***	0.0410***	0.0419***	0.0418***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
distance	-1.0750***	-1.1181***	-1.0750***	-1.1129***	-1.0902***	-1.0898***
	(0.015)	(0.014)	(0.015)	(0.014)	(0.015)	(0.015)
Colony	-0.0948*	0.0943*	-0.0936*	0.0878*	-0.0967*	-0.0749
	(0.044)	(0.042)	(0.044)	(0.042)	(0.045)	(0.045)
Contig	-0.8001***	-1.1888***	-0.8037***	-1.1635***	-0.8066***	-0.8442***
	(0.050)	(0.052)	(0.050)	(0.052)	(0.051)	(0.052)
common language	-0.0301	-0.2180***	-0.0288	-0.2105***	-0.0613	-0.0893
	(0.050)	(0.050)	(0.050)	(0.050)	(0.052)	(0.052)
pol.stab	0.7858***	0.8198***	0.7842***	0.8107***	0.7962***	0.7936***
	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)
nunn1	0.4467***	1.1929***				
	(0.098)	(0.097)				
nunn1*dlaw		-1.2990***				
		(0.038)				
nunn2			1.7155***	2.2766***		
			(0.344)	(0.336)		
nunn2*dlaw				-1.0106***		
				(0.031)		
PRODY					-0.0000**	0.0000
					(0.000)	(0.000)
PRODY*dlaw						-0.0000***
						(0.000)
Capital/lab	-0.3719***	-0.2888***	-0.4153***	-0.3430***	-0.6111***	-0.6047***
	(0.072)	(0.071)	(0.069)	(0.068)	(0.072)	(0.072)
R&D	0.1148**	0.0677	0.1033**	0.0648	0.1638***	0.1579***
	(0.039)	(0.040)	(0.040)	(0.040)	(0.042)	(0.042)
population	0.0606***	0.1415***	0.0600***	0.1389***	0.0536***	0.0635***
	(0.012)	(0.013)	(0.012)	(0.013)	(0.012)	(0.012)
OP/GO flows	8.9531***	9.0579***	9.0300***	9.1155***	8.8970***	8.8986***
	(0.124)	(0.125)	(0.121)	(0.122)	(0.125)	(0.125)
Price diff	0.0011***	0.0011***	0.0011***	0.0010***	0.0011***	0.0011***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
number OP	-0.0214***	-0.0252***	-0.0214***	-0.0247***	-0.0190***	-0.0193***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Air	0.0559***	0.0157*	0.0554***	0.0147	0.0647***	0.0576***
	(0.007)	(0.008)	(0.007)	(0.008)	(0.008)	(0.008)
OP/GO premium	-0.0301**	-0.0363**	-0.0307**	-0.0366**	-0.0314**	-0.0319**
	(0.011)	(0.012)	(0.011)	(0.012)	(0.012)	(0.012)
Law	-1.2598***	-0.7233***	-1.2579***	-0.7356***	-1.3037***	-1.2306***
	(0.027)	(0.029)	(0.027)	(0.029)	(0.028)	(0.031)
Constant	2.0935***	1.3494***	0.8440*	0.1167	2.8719***	2.7523***
	(0.206)	(0.216)	(0.379)	(0.377)	(0.201)	(0.204)
Observations	488,902	488,902	488,902	488,902	449,151	449,151

Year dummy coefficients not reported

*** p<0.01, ** p<0.05, * p<0.1

Figure 1. Model Summary

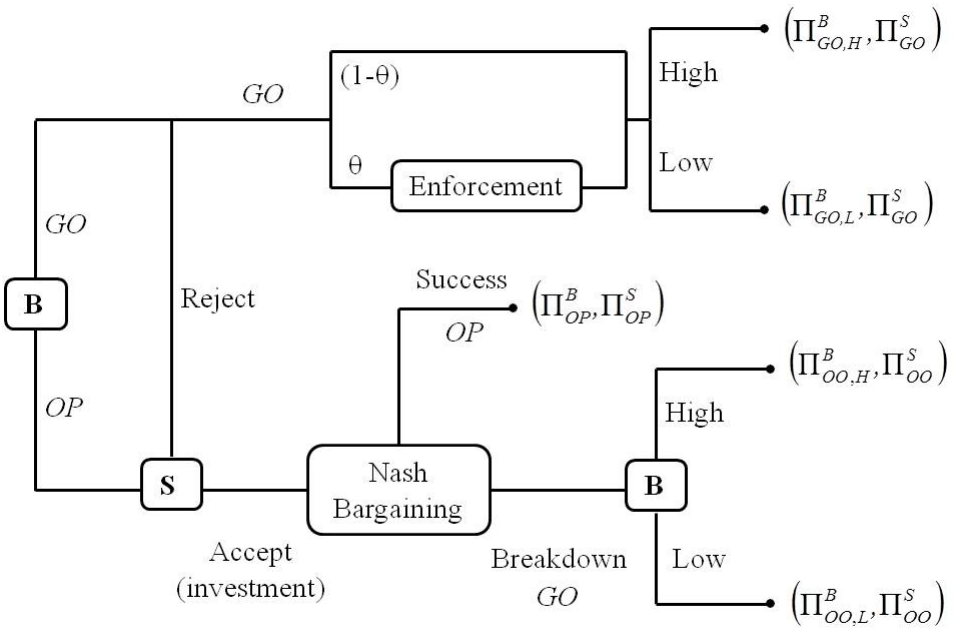

Figure 2. Non-parametric local polynomial smooth OP share and rule of law index