Response to Referee Report 1

Title: On the Role of Vertical Differentiation in Enhancing the Survival of Export Flows: Evidence from a Developing Country (MS 2258)

We would like to thank the reviewer for careful and thorough reading of this manuscript and for the thoughtful comments and constructive suggestions. Responses are given below (following the original comments).

1. Reverse causality - My main concern for the paper is that it asks whether participating in global production network helps export survival without taking into account selection. The paper simply regresses trade presence on a dummy that captures whether a particular industry qualifies as vertical differentiation (or an interaction term of the dummy with product type). Their results may simply suggest that larger or more successful firms self-select into producing machinery parts and components rather than finished products. I do not think that a causal inference can be established.

This is a fair comment. However, the paper uses product-level trade data not firm-level data, therefore, it is believed that sample selection issue should not affect the present findings. The focus of the paper is to investigate the impact of vertical differentiation on export survival at the product-level. Off course, it would be ideal to use intra-firm trade statistics to assess the degree of fragmentation. Unfortunately, such data are not available with the detail needed. The stated argument need to be tested with firm-level data.

2. Lack of clarity in its research focus

(a) In my opinion, the main focus of the paper is on "the role of vertical differentiation" as the title suggests. What this implies is that the authors should discuss clearly what vertical differentiation means and what measures are best as a proxy. Instead, the paper only has a short section to discuss the measure of Greenaway et al. (1995) on page 7, together with why a threshold of 0.25 is chosen. There should be more discussions on other measures such as Johnson and Noguera (2012).

We thank the Referee for having raised this issue. The initial version of the paper had discussions on other measures, but due to the page limit, they are removed from the original manuscript. In the revised version of the paper, we do hope that with the following additions and changes into the section 2.2, this issue could be clarified:

"In the literature, there are two approaches to compute an indicator for vertical integration of production in an analysis. One may use quantities such as Feenstra et al.(1998), Hummels et al. (2001) and Johnson and Noguera (2012), or prices such as Greenway et al (1995) and Abd-el Rahman (1991).

Feenstra and Hanson (1998) define the extent of fragmentation or specialization in production as "imported input embodied in gross output as a share of total gross output" to point out the rising trends in outsourcing. Hummels et al. (2001) define it as "a share of imported input embodied in its exported goods in total exports". In these approaches it is assumed a country's exports are entirely absorbed by either domestic or foreign final demand. In other words these two approaches ignore the fact that imported intermediate inputs can be used to produce another form of intermediate inputs which will be either exported or used to produce domestic final goods. Johnson and Noguera (2012), unlike Feenstra and Hanson (1998) and Hummels et al. (2001), by using input-output data for source and destination countries simultaneously, generate bilateral value added flows. More recently, the Trade in Value Added (TiVA) database based on OECD/WTO national input-output tables (the World Input-Output Database, WIOD), enable researchers to map and measure bilateral back-and forth production sharing globally.

These databases definitely allow tracking intermediate inputs as they cross geographic boundaries and industrial processing stages on their destination to foreign or possibly domestic final demands. However, they have one major shortcoming that makes the employment of this method rare in the trade duration literature: they provide information only at the industry level, while what is needed for duration analysis is the trade information at the product-level. Due to that in this paper we follow the approach proposed by Greenway et al (1995) and Abd-el Rahman (1991) and use unit value indexes to compute an indicator product level vertical differentiation."

(b) The paper uses a dummy that captures whether a particular industry qualities as vertical differentiation, based on the 0.25 threshold. Why not using the degrees of vertical differentiation?

We thank the Referee for having drew our attention on this. The analysis is based on the 0.25 threshold, which is in line with the literature (Abd-el Rahman, 199; Greenway, et al., 1995; Ando, 2006; Wakasugi, 2007; Kimura, 2007; Türkcan and Ateş, 2011). We also refer to these studies in the text. We also performed the case where threshold is 0.15 and VD dummy is replaced with VIIT index. The results did not change significantly. We might add the results of different thresholds as well as of the index of VIIT to the revised version of the paper in the Appendix section to provide more robust results.

(c) As above, the main analysis should be on and around different thresholds or measures of vertical differentiation. Instead, the paper distributes disproportionate shares to all the conditioning variables. The discussion of the key findings on vertical differentiation falls short (only one paragraph towards the end of page 15). What the readers expect would be the significance of the role of vertical differentiation. I am afraid I do not see satisfactory discussions addressing the key research question.

This is a fair criticism. The section 2.2 after the discussion on the computation of an indicator for vertical differentiation gives information on the link between vertical differentiation and duration of exports. However, it appears that the discussions apparently fall short on that variable. To address the issue raised by the Referee, Section 2.2. in the revised version of the paper can be extended by adding paragraphs above and explanatory footnotes. In our opinion, such changes help to highlight the main topics of the paper and clearly explain the main results obtained. Also following explanations regarding the estimation results for the interaction terms may be added to the section 4.3 (replacing the paragraph at the end of page 15):

"The estimated coefficients for the interaction terms between product types (finished machinery products and machinery parts and components) and binary variables of vertically differentiated products are the key interests in this study. These interaction terms have been incorporated in the estimation models to isolate the impact of vertical differentiation induced by production sharing activities on the survival of export flows. In particular, the estimates show that the interaction term for P&C is negative and statistically significant, whereas the interaction term for machinery finished products is positive but not statistically significant (Table 4). Note that interaction terms for P&C and finished products has different interpretations: interaction term for finished products proxies quality whereas that of P&C proxies different stage of production. Thus it is not meaningful to compare the magnitudes of the estimated coefficients. However, the results are generally consistent with the prediction that the influence of vertical differentiation in P&C is more significant in the survival of machinery exports than that of the finished products.

Meantime, the estimated coefficient of vertical differentiation in Table 5 is statistically significant with the expected negative sign, suggesting that increase in product quality in finished products reduces the hazard rate in exports, in line with the findings of Görg et al. (2012). This result is consistent with the view that elasticities of substitution in vertically differentiated products are relatively lower than that of the horizontally differentiated products. In other words, when finished products are vertically differentiated, importers who like a particular brand's qualities and attributes are more likely to continue to purchase that brand even after its price increases by a certain amount, leading to long-lasting export relationships. Similarly, the vertical differentiation has a significant negative effect on the hazard rate of P&C (Table 6). The results also confirm the previous studies which showed that firms within production networks incur high-cost of fixed investment (i.e. sunk costs), which makes it more difficult and costly for these firms to begin and end new export relationships, thereby having relatively longer export duration (Obashi, 2010; Shao et al., 2012; Corcoles et al., 2012, 2014)."

(d) The paper proxies for GPN participation with the interaction term between the vertical differentiation dummy and the product type dummy for parts and components. This is a bit unclear - why can't firms be part of a network if they export finished goods? Why does it have to be parts and components? Again, I do not feel that the authors provide clear discussion in terms of what vertical differentiation means and which type it is that they are capturing.

Thanks for raising this valid point. In the revised version, we aim to improve and clarify this issue. In the current version of the paper, (section 4.2.2) we explain how we computed product- specific explanatory variables. In addition, we reported all relevant estimated coefficients in Tables 4-9. Results are discussed in last two paragraphs of the section 4.3 in detail and section 4.4. Note that the interpretation of the interaction dummies varies depending on for which type of the goods it is computed. If it is computed for finished product then it measures the difference in product quality rather than the differences in the stage of production. However, as suggested by the reviewer, we aim to be more compact and clear on this issue in the revised version of the paper.

3. Lack of clarity in its analysis

(a) It's unclear to me what the dependent variable is.

We would like to thank the Referee for pointing out this problem in the manuscript. The analysis is on the duration of exports and as explained in section 2.1 (data section) and it is measured by the length of different spells of trade. The length of the spell is computed as the number of consecutive years that the export relationship takes place without interruption. With this information about the spell length, the binary dependent variable takes the value of zero when export relationship is active, and one when export relationship is ceased. In each regression analysis, hazard ratios are reported. Thus, a negative coefficient will indicate higher survival rate or or lower hazard rate. This information could be added into the section of 3.2 (Empirical strategy) to clarify any possible confusion regarding the dependent variable.

Where is the empirical specification?

We agree that there is not enough discussion on the empirical methods of the paper. The initial version of the paper had longer version of the Section 3.1., but due to the page limit, they are removed from the original manuscript. Accordingly, in the revised version of the paper, the empirical section of the paper could be extended as follows:

"Following the recommendations of Hess and Persson (2011a), this study employs a discrete-time hazard models to analyze the determinants of the duration of Turkey's machinery exports. Discrete-time hazard

models can be specified in terms of conditional probabilities of termination of a particular trade relation in a given time interval. Using the same notation as in Hess and Persson (2011a), define T_i as continuous, non-negative random variable measuring the survival time of a particular trade relation. The hazard probability is then defined as the probability of terminating a trade relation within specified time interval $[t_k, t_{k+1}), k = 1,2, \dots, k^{max}$ and $t_{1=0}$, given that failure has not occurred prior to the starting time of the interval and the explanatory variables are added to the regression model. This conditional probability can be expressed as a discrete-time hazard rate:

$$h_{ik} = P(T_i < t_{k+1} | T_i \geq t_k, x_{ik}) = F(x'_{ik}\beta + \gamma_k) \tag{3}$$

where x_{ik} is a vector of time-varying covariates that are assumed to effect the hazard rate, β is a vector of coefficients to be estimated. A positive (negative) sign of coefficients means higher (lower) likelihood of terminating an export relationship and consequently lower (higher) probability of surviving in the export market. γ_k is a function of (interval) time that allows the hazard rate to vary across periods, and $F(.)$ is an appropriate distribution function ensuring that $0 \leq h_{ik} \leq 1$ for all i, k. In this study, i denotes separate export spells for any given importer-product combination. In addition, since the underlying baseline hazard is unknown in practice, γ_k is included into the regression model as a set of dummy variables marking the length of each spell.

The discrete-time proportional hazards model can be estimated by maximizing the following log-likelihood function:

$$\ln \mathcal{L} = \sum_{i=1}^{n} \sum_{k=1}^{k_i} [y_{ik}\ln(h_{ik}) + (1 - y_{ik})\ln(1 - h_{ik})] \tag{4}$$

where k_i refers to terminal time period, the subscript i indicates that it may vary with the spell. y_{ik} is a binary variable and takes the value of one if spell i is observed to cease during the kth time interval, and zero otherwise. Hence, with this specification, discrete-time hazard models can be regarded as a sequence of binary dependent variable models. This is convenient because any standard model for binary dependent variables (such as logit, probit or cloglog) can be applied to estimate discrete-time hazard models.

Consequently, this specification of the log-likelihood function requires underlying export database to be changed in the following way. If the spell of the ith subject is completed, then the binary dependent variable assumes the unit value for the last time point (T_i) while it is zero for the rest of time points $(1,2, \dots T_i - 1)$ of the time interval. For example, consider that Turkey exports a given product to a particular destination country from 2000 to 2004. Such an export relationship is regarded as having a spell length of four years. With this information about the spell length, the binary dependent variable takes the value of zero from 2000 to 2003 and one for the fourth year. The advantage of this approach is that it allows the inclusion of time-varying explanatory variables into the regression model (Esteve-Perez et. al., 2007).

In order to estimate the parameters of equation (4), it is necessary to determine the functional form of hazard rate, h_{ik}. As discussed in Hess and Persson (2011a), logit, probit and complementary log-log (cloglog) specifications are the most common function specifications for estimation of models with binary dependent variables. The cloglog model is the discrete-time counterpart of the continuous-time Cox proportional hazards model. In contrast, both logit and probit models provides a non-proportional hazard assumption. Furthermore, Hess and Persson (2011a) argued that the inclusion of random effects into the binary choice model framework is satisfactory approach because parameter estimates are less affected by the choice of heterogeneity distribution and this approach is convenient from a computational point of view. Therefore, following Hess and Persson (2011a) this study utilizes xtlogit, xtprobit and xtcloglog commands in STATA, respectively, to estimate the logit, probit and cloglog models with random effects."

(b) In Section 2.1, the paper draws the conclusion that survival rates are higher for parts and components than finished products. Why? Is it simply comparing a mean of 3.25 years and 2.96 years? I do not see why the difference is significant.

We agree that looking at only average values is not enough to reach this conclusion. However, there is no reason to conduct a hypothesis testing of the difference between two group means because in Section 2.1,

the Kaplan-Meier estimator of the survival functions in Figure 2 has already proved that the probability of surviving is highest for P&C and the gap increases with time.

(c) For the relative unit value measure, it requires that Turkey both imports and exports the same HS6 product. What happens if that's not the case?

We agree with you. The unit values ratio equal either zero when Turkey doesn't export or import the same HS item. When Turkey does have only an export or import relationship, it means that total trade equals to the inter-industry trade (i.e. intra-industry trade equals to zero). IIT itself consists of two parts: Vertical and Horizontal IIT. When VD dummy equals to zero, it either means no IIT trade or there is some IIT but not fit our criteria of VD (could be HIIT). This information could be added as a footnote into the revised version of the paper.

(d) Unclear contribution – what's novel here? I could not find any discussion on this in the introduction.

This is a fair comment. However, in fourth and fifth paragraphs in the introduction discuss the major contribution of this study to the literature (as quoted below). We would like to keep the contribution of the paper as smooth as possible in the revised version of the paper.

".. empirical studies point out the significance of P&C trade on the survival rate of trade relationships; however, they are unable to distinguish the nature of the linkage in the networks. In other words, they fail to adequately address (1) the horizontal nature of trade in similar goods with differentiated varieties, (2) the vertical nature of trade in differentiated goods distinguished by quality and (3) the vertical specialization that involves the exchange of technologically linked goods (Jones et al., 2002; Ando, 2006). Using trade in P&C as the sole indicator of GPN in an empirical analysis may lead to overestimation of the role GPN plays in explaining the differences in survival rates across different product types.

Unlike previous empirical studies, the purpose of this study is to explore the ways that the emergence of GPN influences the export survival in a developing country. We introduce an indicator of vertical/horizontal differentiation as a proxy for GPN into the regression analysis. The indicator adopted from the intra-industry trade literature is based on a decomposition of trade into vertical and horizontal flows and is constructed as a ratio of the unit values of exports and imports. In this way, it becomes possible to examine the role vertical differentiation plays in the survival of exports."

5. Not well-structured - The paper contains a lot of irrelevant information. For example, in Section 3.1, it discusses a method that is considered NOT appropriate. Why discussing it anyway? There are many paragraphs like this throughout the entire paper.

Our answer to this point is that we are going to address this issue by explicitly stating the contribution of our paper, by improving the section of empirical strategy and by providing more discussions on the different measures of fragmentation. Also we will provide a more comprehensive discussion of the results on the impact of VD on export survival in the revised version of the paper.