Graduate Institute of International and Development Studies

International Economics Department

Working Paper Series

Working Paper N IHEIDWP03-2016

BETTER MORE THAN ONE: PORTFOLIO CURRENCY PRICING AND EXCHANGE RATE HEDGING

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Better More Than One: Portfolio Currency Pricing and Exchange Rate Hedging*

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May 12, 2016

First version: August 2014
This version: March 2016

Abstract

This paper examines the relationship between the composition of exporters' currency pricing portfolio - number and value of product sales in different currencies at a destination - and their success in trade as measured by continuing to their exporting activity. Detailed investigation of currency choice data of Russian exporters between 2005-2009 shows that many exporters use only one currency pricing per destination. Among those who use more than one currency pricing, higher diversification is indeed associated with up to 18% higher odds of survival as an exporter at the product-destination. Nevertheless, many exporters still use only one currency pricing per destination.

This puzzle is explained in this paper by incorporating the concept of "exchange rate hedging costs" into the existent literature on currency choice. These costs are firm-specific and relate to the complexity on the part of the firm of using more than one currency. The firms that have high exchange rate hedging costs will be using only one currency, but still continue exporting to the destination.

Keywords: international currency choice, currency portfolio, exchange rate, export data, vehicle currency, emerging economy, exchange rate hedging

JEL classification: F14, F31, F36, F41, G11

*I am grateful to Cedric Tille, Nicolas Berman, Natalya Volchkova and to session participants at ETSG 2014 in Munich. Financial support from the Swiss National Science Foundation is gracefully acknowledged.

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1 Introduction

The question of which currencies are utilized in international trade has been a question among academics and policy makers for a long time. Theoretically, using one or another currency in its trade, the exporter channels its exposure to the exchange rate changes. There has been a number of studies, both empirical and theoretical, investigating the determinants of the choice of currency applied in trade, but the efficacy of the use of one or more currencies has never been examined. This paper attempts to shed light on whether it really matters for an exporter to have one or more currencies applied in its sales. More precisely, I investigate whether using more than one currency is associated with better exchange rate hedging and thus higher survival probability of an exporter. Building up on the most recent macroeconomic theory and utilizing a unique dataset on exporter currency choice in the Russian Federation, this paper shows that having a more diversified portfolio indeed is indeed more beneficial in terms of survival for the exporters. However, due to the presence of firm-specific exchange rate hedging costs, many exporters find it more profitable to use only one type of currency in their sales.

In the international trade literature, an exporter to a destination can price its good in three possible ways: the exporter's domestic currency (”producer currency pricing” - PCP), destination currency (”local currency pricing” - LCP) or any other currency that is not either of these two trading partners' currencies (”vehicle currency pricing” - VCP). Obviously, as the currency pricing is set before the actual realization of the sale and before the money arrive to the account of the exporter, different pricing will expose the exporter to different exchange rate shocks. While financial hedging is available, it is rarely applied (Martin & Méjean, 2012). As conventional economic theory suggests, a mix of different currencies provides a hedge against the effect of the exchange rate shock, and will result in higher profits. Economists have suggested that exporters ”mix-and-match” in their currency portfolio, so that it hedges them against the exchange rate shock. Although the question of the determinants of the choice of currency has been gaining more attention recently, the studies that look at the effect of having different (or - in the context of this paper - one or more) currencies used in international trade are scarce. This paper aims therefore to contribute to understanding how the realisation of currency choice affects export performance.

Using Goldberg & Tille (2008b) model (hereinafter GT model), I explain how a more diversified portfolio yields higher expected profits for an exporter. But as the highly detailed data on currency choice of Russian exporters shows, most of the exporters tend to use on currency pricing per product-destination. Thus, I extend the model to match the data by incorporating the notion of ”exchange rate hedging costs.” The exchange rate hedging costs are defined as the costs a firm encounters when dealing with more than one currency at the destination. Additional resources are needed to work through the information on the sales at the destination, exchange rates and their changes(to destination and between the currencies used at the destination), to calculate how well it has been doing at the destination and forecast the prices (both of the firm and at the market).The exchange rate hedging costs should not be confused with the transaction costs - transaction costs are the costs of conversion of one currency to another and change with the value of the currency; exchange rate hedging costs are firm-specific costs that are associated with dealing with a currency (second, third - any other after the first) at a destination.

Whatever currency choice is applied by an exporter, any given firm that goes onto the international market is faced with the need to deal with the exchange rates[1]. Making the decisions about exchange rates involves complex economic fundamentals, and in a majority of the cases could be unfeasible for an exporting firm. Of course, there have been necessary financial tools developed that allow the firms to hedge against the exchange rate shocks but these tools end up being unused by the exporters even in developed markets (Martin & Méjean, 2012), leaving them exposed to the exchange rate shocks. This non-utilization of the financial tools puts greater exchange rate pressure on the currency choices of the exporters as there is a greater probability of elimination of profits when the exchange rate shock is realized.

The literature has long debated possible reasons for application of one or another currency by exporters [2], but so far it only had only one common finding - it is a very complex decision that depends on many levels of characteristics of the firms, markets, goods, macroeconomic environment and is contract-specific. Notwithstanding the many contributing factors, the data suggests that there is very high prevalence of a single currency pricing among firms across product destinations and destinations, with a majority of pricing dominated by the USDGopinath (2015). This paper addresses the following questions: whether this dependence on one currency pricing may be explained through the complex nature of international trade and exchange rates that firms have to deal with; and whether this actually has a adverse effect on the international trade flows as proxied by the propensity of a firm to continue exporting to a destination. In the more general terms, I explain that even though there is a positive effect of diversification (negative of concentration), many firms that try to export or actively export, find it too complicated to deal with a basket of different currency pricings and stick to a single currency pricing. Even though they would have been better off diversifying, they still continue exporting using a single currency pricing, as they

[1]Unless they export to the monetary union member, see the effects of the introduction of Euro in (Goldberg, 2005)

[2]See, for example Goldberg & Tille (2008a,b); Bacchetta & van Wincoop (2005), or the companion paper Sokolova (2015)

face firm-specific costs of handling more than one currency.

This argument of the complexity of dealing with multiple currencies and exchange rates can be further extended to the firm-level, as even in Russian data over half of the exporters use single currency pricing in their activities. I keep my discussion at firm-product-destination level in order to make this framework applicable outside of the Russian case, as well as to keep track of the product and destination-specific characteristics.

In recent years, the high prevalence of the United States Dollars (USD) in international trade has been gaining increasing attention, as other countries are trying to get their currencies internationally used and accepted(Devereux & Shi, 2013; Unit, 2015). This paper supports the evidence that the USD is being used in trade between countries that do not trade much with the USA, and not only for commodities which are traditionally believed to use USD. This paper also formulates another channel that explains such dominance which is not directly related to the economic determinants but is rather idiosyncratic: the exchange rate hedging costs will increase the lenience towards one single currency for the exporters. The exchange rate hedging costs signify the additional firm-specific costs that go beyond the transaction or bank costs of a currency, but rather they capture the costs to process and apply information on other currencies. Evidently, the fact that currency choice is done before the exchange rate shock is realised will increase exporter' exposure to the adverse impact of the exchange rates. Having sales set in in any given currency will provide a different expected payoff than the same sale set in another currency.

This paper relates to the literature on exchange rate effects on trade. Up to now, there has been a rich discussion on the effect of exchange rates on the international trade, both in the empirical and theoretical literature, but the findings of this research is quite contradictory, as there has been discrepancy in the empirical literature too[3]. Since the last decade, the question of finding conflicting evidence was explained with sticky prices and the various currency pricing strategies that the exporters apply Gopinath & Rigobon (2008) (Bacchetta & van Wincoop, 2005; Gopinath & Rigobon, 2008; Goldberg & Tille, 2008b). But the empirical evidence has not been able to support fully the existing models (Lewis, 2013). Due to the unique composition of the available data, I shed light on evidence that exchange rate changes indeed affect trade - more precisely, that ability (or inability) to diversify the currency pricings used affects international trade.

Of course, using additional currencies is financially costly (Friberg & Wilander, 2008) and, as described above, in exporting, firms conventionally implement the choice between the three currency pricings, associated therefore with a limited number of currencies[4]. This paper, therefore,

[3]For the survey of recent papers refer to —Auboin & Ruta (2013)

[4]Vehicle currency by definition represents a set of currencies. In international trade though, on average, the majority of vehicle currency pricing is done in USD (about 80%), some in EUR (about 15%) and GBP (3%). Values

is concerned with establishing the empirical link between the number and composition of currency pricing used by a firm (the currency pricing portfolio of a firm) and the probability of the firm to remain exporting at the product-destination channeled through the hedging of the exchange rates.

To my knowledge, this is the first study to model and estimate the link between the portfolio currency pricing, the ability to hedge[5] and the success of the exporting activity. In the empirical part I discuss the role of such a link for the entering firms, as they place higher importance on the information they receive from their first sale (Albornoz *et al.* , 2012; Freund & Pierola, 2012b). I show that entrants that were having a more diversified portfolio were more likely to continue exporting the period after they have entered new destination.

The paper is organized as follows: Section 2 describes the data on currency pricing among Russian exporters in 2005-2009; Section 3 uses the GT model to motivate currency pricing diversification and extends the model to incorporate the exchange rate hedging costs; Sections 4 provides the description of the methodology used to test the implications of the formulated theory; Section 5 provides the results and Section 6 summarizes the main findings.

2 Data

The data is taken from Russian Federation Customs and covers the period between 2005 and 2009. The dataset contains the seller ID, date of the transaction, type of good being sold (using the classification of TNVED3[6]), country of destination, value, the amount of the good being sold and the currency in which the transaction was invoiced. Re-exports and guarantee shipments are excluded from the analysis. The values of goods are converted to the price in USD based on the exchange rate that was provided by the Russian Central Bank on the day of the shipment - the official exchange rate applied to the sale.

The initial composition of data includes transaction-tracked decisions on currency of the sale, but for the purpose of the study this information is aggregated to the firm-product-destination level. Utilizing the data from ISO3166, the destinations are matched with their domestic currencies, and the appropriate currency pricing - PCP, LCP, VCP - is marked. Some countries have changed their currency iduring the period (such as Cyprus and Malta). All statistics presented are for the HS-6 products. Year 2009 is dropped from the descriptive statistics and estimations, as there is no information on the firm survival in 2010. Also, it should be noted that the crisis of 2008-2009 had no effect on the currency pricing patterns for the Russian exporters.

are provided on the basis of the HKIMR and SWIFT estimates.

[5] Here and everywhere further on unless otherwise mentioned, "hedging" refers to the exchange rate hedging, and not the financial hedging.

[6] Harmonized System 8-digit data.

This paper is the first one to document firm-level currency pricing portfolios across destinations for the exporters in an emerging economy. Thus, apart from the generally common statistics in table 4, the basic average pricing statistics per firm are documented. High values of the statistics are contributed to the bounding of the portfolio concentration variable between [0.33; 1], where 1 represents the portfolio of a single currency pricing, and 0.33 represent the fully diversified portfolio of currency pricing since there are only 3 possible choices possible. The shares of the dully diversified currency pricing portfolio cannot go less than 33 per cent. Producer currency pricing (PCP) is represented by the domestic currency - Russian roubles; vehicle currency pricing (VCP) is largely represented by the two major currencies - 85 per cent USD, 14 per cent Euro; local currency pricing (LCP) is specific to the destination of the exports.

The first line of table 4 indicates that a majority of the exporters have highly concentrated currency pricing portfolios, implying that they use only one currency pricing per product destination. Going further into the currency pricing statistics, table 6 summarizes the total number of transactions per each type of currency pricing. A majority of the exporters are pricing in PCP or VCP: using domestic or vehicle currencies in 46% and 48% respectively, while LCP was only used in about 10% of the cases. Looking at the breakdown by ubsample, the currency pricing patterns remain more or less the same with LCP share declining to about 8% in the case of exporters entering new firm-product destinations.

Tracking the currency pricing usage back to the combinations done by firms, table 6(a) presents the cumulative statistics on the combinations of currency pricings among the exporters by product-destination and by destination. In bold are the cumulative frequencies attributed to the single-currency pricing portfolios. As shown in table 6(a), for any type of pricing it is true that when it is used at the product-destination, it is used as a sole choice - from 88% to 90% of the cases are attributed to the single-currency portfolio. Among the combined cases, combinations with VCP are most prevalent - 8% of product-destinations when LCP was applied and 9% of the cases when PCP was applied for the whole sample.

Looking at the application of currency pricing within a firm by destination, in about 85% of cases firms use only one currency-pricing per destination. Among those VCP pricing is most popular constituting 55%(=0.53*0.86), while in 27%(=0.33*0.82) PCP is applied and in 11%(=0.13*0.86) LCP. The information presented in Tables 5 and 6 is based on the count data: while VCP is the most popular currency pricing choice overall, among the entrants PCP choice is more prevalent. Altogether, there is a very high concentration in exporters' currency pricing portfolios among all samples - full sample, entrants, and incumbents.

The statistics above presented the count data and relations. Due to the large size of the data, the value data on currency pricing portfolios is presented graphically, and in more general terms. Figure 4 depicts the average portfolio of the firms by the number of destinations they serve[7]. There is a distinct pattern that diversification decreases with the increase of the number of destinations the firm serves: VCP becomes more prevalent, while the PCP share decreases. This suggests that the greater is the number of destinations the firm serves, the less important is the impact of the portfolio concentration. There is no constant pattern across the number of products the firms serve. This can be explained by the various product-related characteristics of the choice of currency, such as the differences between homogeneous and differentiated goods. [8]

Figure 5 presents the number of currencies (not differentiating between PCP/LCP/VCP for the presentation purposes) used on average by the firms by the number of product-destinations they serve. Conventional trade literature differentiates the one-product-to-many-destinations and many-products-to-one-destination exporters that constitute the majority of exportsFreund & Pierola (2012b). Hence, the spreading pattern in figure 5 after the strictly increasing line until the 25th product-destination - which also captures over 80 per cent of the exporting firms - can be attributed to the different types of "big" exporters.

One of the important considerations throughout the paper are the implications of the currency pricing diversification for the entrants into the new (product-)destinations. As mentioned before, the entrants place greater importance on their expected profits and should be more prone to the exchange rate hedging. The entrants that diversify more should be more likely to survive as they are better hedged against the exchange rate shocks. Figure 7(a) depicts on the Y-axis the diversification of the entering firms to the 40 most popular product-destinations and destinations (in descending order). The surviving firms - defined as the ones that remained exporting a year after the entry year - on average had a more diversified portfolio.

This section described the data on the currency pricing portfolios of the exporting firms in the Russian Federation. Overall, there is a very high prevalence of a single-currency pricing among the exporters of such an emerging country as Russia - an observation that contradicts the conventional concept of the gains of the diversification. Given that on average a Russian exporter uses more than one currency, the following question is asked: are there benefits (losses) for Russian exporters to use more than (only) one currency pricing in their exporting activity? The next section presents the theoretical motivation for the efficacy of portfolio diversification and introduces the exchange rate costs that limit the use of diversification by the exporting firms.

[7]The graph with firm-product destination exhibits on average alike relationship, but is less presentable due to the prevalence of "one-product-to-many-destinations" and "many-products-to-one-destination" exporters. Further is possible explanation of such pattern in the data provided.

[8]Currency choice considerations are outside of the scope of this paper. For a full description of the determinants of the currency choice among Russian firms please regard the companion paper "Strategic Currency Choice in International Trade."

3 Theoretical motivation

The theoretical motivation of this paper lies within the model of currency invoicing (or currency pricing) developed by Goldberg & Tille (2008b) (henceforth referred to as GT model). The model is built in order to establish the optimal currency pricing of the exporters serving a destination. Utilizing second-order approximation around the steady-state, the authors develop a model that determines the optimal currency pricing shares of the exporter at the destination - β_d^d for the destination (local) currency (LCP), β_d^v for the vehicle currency (VCP) and $\beta_d^e = 1 - \beta_d^v - \beta_d^d$ for the home currency of the exporter (PCP).

Individual firm demand (for a single good) is dependent on the firm's price, prices of the competitors at the destination and destination market demand. An exporter is facing influence of the exchange rate shocks through several channels:

1. Through *transaction costs*: the exporter is facing the cost of converting the money. If it prices solely in home currency, no transaction cost is faced.

2. Through inability to perform *coalescing*: if exchange rate shocks are affecting every participant in the market in the same manner, it does not have a real effect on the firm's position. If all of the firms selling in a market have similar currency baskets in their sale, when an exchange rate shock hits, they all are identically affected.

3. Through correlation between input costs and exchange rates - *cost hedging* channel: when the exporter's input price comoves with the movement of the destination exchange rate, it is more likely to price in the destination currency and is less sensitive to the adverse effects of the exchange rate shock. If a firm matches the currency of its imports and exports, it can minimize the adjustment to the exchange rate changes.

The (1) channel can be attributed to the macroeconomic environment and remains unchanged for any market participant. I exclude it from my analysis, as a single or even multiple firms cannot influence the size of the transaction costs. The (3) channel is strictly firm-specific and deals with the possibility of import substitutability and vertical supply chains. This motivation has rather individual micro-foundation for each producer and each product. The exchange rate shock at a destination has little to do with a particular realisation of profits through this channel. This paper is concerned with channel (2): the distribution of the expected profits from a certain market given a currency pricing portfolio of an exporter.

Building on the finding of the GT model and the optimal solution[9] under traditional assump-

[9]Please refer to the Appendix for the technical description of the model and its findings, along with the technical description of the findings of this paper.

tions, the expected payoff is greater for the firm that has a mix of currencies in the basket of currencies. This is due to the fact that the currency composition decision of the exporter is done before the exchange rate shock is realised. As the exchange rates are not collinear, when the currency basket consists of more than one currency, the exporter is able to perform the exchange rate shock hedging. At the same time, the closer is the exporter's currency pricing portfolio to the currency pricing portfolio at the destination market, the higher is the expected profit.

Omitting the transaction costs and leaving two possible choices for currency pricing (PCP and LCP - home and destination currencies), the formal solution following the GT model is as follows[10]:

$$\beta^d = \Omega\eta^d + (1 - \Omega)\,\frac{E(cs_{ed})}{E\left(s_{ed}\right)^2}$$

Coefficient Ω is large when product-substitution is high and decreasing returns to scale are strong; η^d indicates the destination-specific share of local currency in the market. For example, if all of the firms selling the relevant good on the Indian market price the good in rupees, $\eta^d = 1$. Therefore, the first term describes the second channel.

Firm-specific factors (channel (3)) are captured by the second term - c includes firm-specific production factors, s_{ed} represents the exchange rate to the destination currency. The maximization solution to the profit function with respect to β_d is concave, where the maximum point is determined by the destination- and product- specific share of currency at the relevant market. Figure 1 illustrates the solution graphically (for simplicity only the two-currency case is presented), where it becomes obvious that complete concentration ($\beta_d = 0$ or $\beta_d = 1$ brings less expected profits to the firm. The ratio of expected profits in the complete concentration depends on the exchange rate[11] of the respected currencies and how common their use is at the destination market.

This brings us to the first - and the main - testable implication of the paper:

- **Testable Implication I:** Higher diversification in the currency pricing portfolio provides greater expected profit, and thus also higher probability of continuing to exporting to the same destination.

[10]In the model, a market for single good is assumed. The transcripts for time and products are omitted for brevity. All derivations from the model are presented in the Appendix.

[11]Liquidity of the currencies should also be accounted within this parameter. This implies that with a given exchange rate if the liquidity of the currency is low, then the modeled exchange rate goes higher.

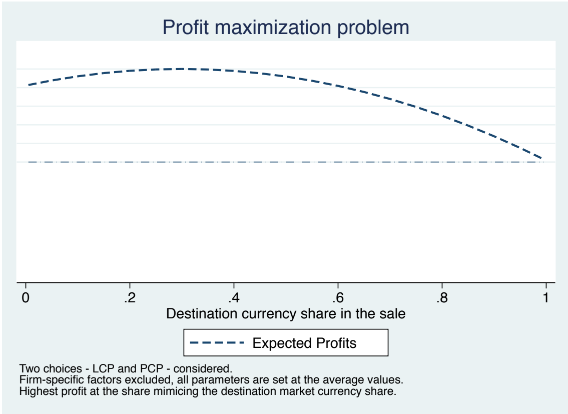

Figure 1: Outcome of the GT model in a two-choice (PCP/LCP) setting

The puzzling question is then, why does the real data indicate that the majority of exporters use only one currency. This perplexity of theory and empirics can be explained through the additional firm-level cost of having to deal with another currency. There is a certain fixed cost for dealing with not just one but a mix of currencies. This fixed cost can be represented as *exchange rate hedging cost* - when a firm deals with more than one currency (without regards to the amount of the currency used), it needs additional human resources to work through the information on the sales to the destination. It will need additional information on the exchange rates and additional calculations to inquire how well it is doing at the destination. Moreover, forecasting of the prices at the destination will also require more resources, as the firm will be dealing with more than one currency. Given this fixed *exchange rate hedging*[12] cost, the majority of firms go for the corner solutions of the problem and would be sticking to using one currency. When a firm observes a positive expected profit when using more than one currency, the highest profitability will be observed for the highest diversification of the portfolio. Given the exchange rate hedging costs, for every exporting firm the solution to the GT model looks the following way:

$$\begin{cases} \beta^d = \Omega\eta^d + (1-\Omega)\,\frac{E(cs_{ed})}{E(s_{ed})^2} - F_d, & \text{if } n\ \beta^d \neq 0,1 \\ \beta^d = \Omega\eta^d + (1-\Omega)\,\frac{E(cs_{ed})}{E(s_{ed})^2}, & \text{if } n\ \beta^d = 0,1 \end{cases}$$

This solution can be represented graphically:

Figure 2 shows that while the expected profit in the corner solutions remains the same (and positive), for all internal solutions, as they are involving more than one currency, the exchange

[12]One can see it as an *additional currency* cost in a certain fixed cost that adds on to the other costs faced by the exporter.

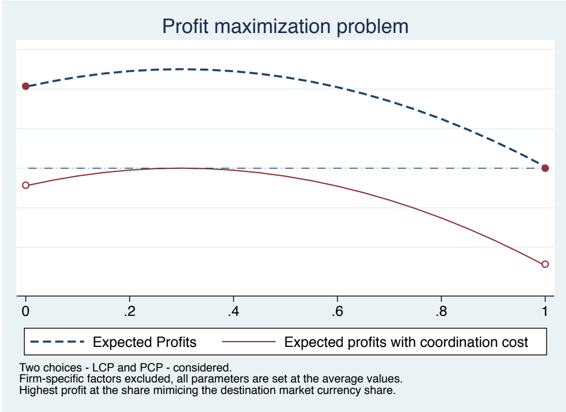

Figure 2: Outcome of the GT model in a two-choice setting (with exchange rate hedging costs)

rate hedging cost pulls the expected profits below zero. While the existence of the exchange rate hedging costs imply that there are positive corner solutions for the profit maximization problem, the exact value of the exchange rate hedging costs, degree of the concavity and the point of local maximum for the internal solution is firm-specific. The existence of these corner solutions results in the data pattern described before and that can be summarized in the following implication:

- **Testable implication II:** The existence of exchange rate hedging costs implies that even taking into account the adverse effect of currency pricing portfolio concentration (see *Hypothesis I*) among the firms that use only one currency, many will still continue exporting in the next period.

The next implication utilizes the fact that the relation of diversification and exchange rate hedging is based on the ability of firms to overcome the general trade costs of international trade. The adverse effect of greater concentration decreases with the improvement of the experience of the firm (as measured by the number of destinations, product-destinations and products at the given destination). The presence of other domestic (Russian) firms at the destination market will also have a positive effect both due to accumulation of internal knowledge of the firms (Albornoz *et al.* , 2012) and the increasing currency-setting ability. [13]

This formulates the next testable implication:

- **Testable implication III:** The adverse effect of the diversification of currency pricing portfolio decreases when the firm gains experience, trades across more destinations, trades to a destination with many home firms.

To test this prediction we build a number of controls that are aimed at capturing firm experience and home country presence. This hypothesis also explains why the adverse effect is expected even

[13] the "coalescing" motive of GT model that is based on (Bacchetta & van Wincoop, 2005)

greater among the entrants to destinations.

Another implication of the fact that the exchange rate hedging costs are firm-specific can be formulated as follows:

- **Testable implication IV:** The exchange rate hedging costs of a firm are correlated with currencies used, but are still firm-specific even when we control for the exchange-rate variation.

When we control for the exchange rate shocks, we still expect to find a negative effect on the firms that had a highly diversified portfolio. It is a result of the fact that even though the diversification is currency-related, it actually relates the currency-firm specific exchange rate hedging costs to the firm-destination specific fixed costs of exporting. Thus, when we control for the exchange rate variation, diversification will still have a positive effect on the probability of remaining an exporter.

In this section I have laid out the main theoretical motivations using and expanding the model developed by Goldberg & Tille (2008a) and formulated four testable predictions. The underlying derivations are presented in the appendix of the paper. The following section presents the empirical strategy and formation of the variables.

4 Methodology

For all calculations, observations that represent firms that have only one transaction in a year at the product-destination are omitted. This is done because with one transaction a firm cannot differentiate its currency pricing, and this will bias the results.

All estimations of the main specification run on the firm-product-destination level but due to the high skewness of the data and concerns for granularity, the results for the firm-destination estimations are also presented. The results indicate that the findings are relevant at both levels, and more so at the destination-level, as more firms tend to differentiate at the destination level.

The full sample of Russian exporters across the timespan of 2005 - 2009 is further split into the subsamples of entrants, the exporters that just start at the product-destinations, and the incumbent exporters, in order to investigate whether the result is driven by one of these groups.

New exporters may indicate higher exposure to the exchange rate shocks, either at home or at the destination. First-time exporters use their first sale at the destination to acquire information about their relative place on the market and therefore their competitivenessAlbornoz *et al.* (2012). At the same time, some of the entrants may not care about the exchange rate hedging, as they are not interested in continuing to supply their product to the given product-destination. As *Testable Implication III* has stipulated, the adverse effect of the currency pricing portfolio concentration should be disappearing when the firm gains experience; therefore, in the subsample of the continuing exporters[14] the higher effect of the increase in experience is expected. Splitting the sample into entrants and incumbents, the effect of currency pricing portfolio concentration is present in both, and indeed is stronger for the entrants. This finding is in line with the main hypothesis and indicates that the entrants which were able to diversify their portfolio, faced higher profits and therefore are more likely to continue exporting to the market.

In this section, the methodology behind the measure for portfolio currency pricing is presented. Then the estimation techniques are discussed. The section concludes with introducing the robustness checks that are performed.

4.1 Portfolio Currency Pricing

The diversification of the portfolio is inverse to its concentration, thus the Herfindahl-Hirshman index for the currency pricing at the product-destination based on the values of the sales will relate the following way to the diversification of the portfolio:

$$Diversification = 1 - HH\_ind$$

The Herfindahl-Hirschman Index is calculated to measure the currency pricing portfolio concentration:

$$HH\_ind = \sqrt{(ShareSales^{LCP})^2 + (ShareSales^{PCP})^2 + (ShareSales^{VCP})^2}$$

For brevity, all subscripts are omitted[15]. $ShareSales^k$ indicates the share of the currency pricing k in the sales of the firm in the period. $k = PCP$ implies the use of rubles in the export, $k = LCP$ use of the destination currency, and $k = VCP$ suggests the use of a currency which is neither of the trading partners' home currencies.

As the currency pricing portfolio measure is calculated as Herfindahl-Hirschman index, the value of hh_ind is bounded between [0:32; 1]. Where $hh_ind = 1$ represents complete concentration - a firm using only one type of currency pricing in its sales at the (product-)destination, and 0.33 represents complete diversification - the portfolio of the firm consists of the three currency pricings symmetrically by 33.3(3) per cent. Following the described above theoretical motivation,

[14] As this sample completely excludes one-destination one-product tryers, which constitute about 30% of exporters every year Freund & Pierola (2012a)

[15] See Appendix for the version with subscripts

$HH\_ind = 1$ should be interpreted as $\beta = 0$ or $beta = 1$ solutions to the profit maximization problem. Then, whenever HH_ind is less than 1, it implies the share of currencies in the portfolio captured by $\beta \in (0, 1)$. Following *Testable Implication I*, greater hh_ind will have a negative effect, as the greater concentration among the companies that use more than one currency leads to lower expected profits, and therefore increases the probability that the firm will not be exporting in $(t + 1)$ period.

The theoretical part has introduced the notion of *exchange rate hedging costs* that infringe on the effect of the currency pricing portfolio concentration. This implies that even though on average we expect to see the adverse effect of higher hh_ind as a proxy for the concentration, there will be cases of extreme concentration $hh\_ind = 1$ where there will be no adverse effect observed. In the estimation methodology this implies that the cases where we fail to predict the exporter remaining at the destination in the next period will be attributed to the exporters that use only one currency.

As the Herfindahl-Hirshman type of index does not differentiate between contributions of different pricings, alternatively we normalize the Herfindahl-Hirschman to 0 being contributed to VCP or PCP concentration (there is no fully LCP exporters). The corresponding results are presented in the in tables 10 and 11.

4.2 Estimation

The main regression estimated is taking a following form (dropping the d, p, f subscripts for brevity):

$$(Export_{t+1}|Export_t) = \beta_0 + \beta_1 sale_t + \beta_2 HH\_ind_t + \beta_3 fpNdest_t + \\ + \beta_4 hh\_ind_t * fpNdest_t + \beta_5 Ntrans_t + \lambda_i + \eta_{dt} + \epsilon^{i,t} \quad (1)$$

$Export_{t+1}$ is a dummy variable that indicates if the exporter has continued serving the product-destination in the $(t + 1)$ period.

$sales_t$ is the log of exports in period t of the firm.

hh_ind_t is the Herfindahl-Hirschman index of the currency pricing portfolio of the firm, described in the previous subsection. In line with *Hypothesis I* we expect a negative coefficient, as the greater index due to the greater concentration, which leads to lower profits and therefore increases the probability of the firm leaving the product-destination.

Further controls added in order to take into consideration the factors that can influence the firm's ability to export in period $(t+1)$:

$fpNdest_t$ serves as a proxy of the experience of the firm as an exporter. This variable indicates the total number of destinations to which the firm exports the given product. The experience of the firm should have a positive influence on the probability of continuing exporting the following period.

$hh\_ind_t * fpNdest_t$[16] indicates the adverse effect of currency pricing portfolio concentration is diminishing with the experience of the firm. The coefficient of this variable tests the *Testable Implication II*, as it shows how the experience of the firm interacts with the adverse effect of concentration.

$Ntrans$ represents the number of transactions the firm has implemented in time period t. The number of transactions stands as a proxy for the number of customers at the destination, and is expected to have a positive effect on the probability of continuing to export.

$dNfirm$ proxies for the market ties between the countries. A number of studies have indicated that such characteristics as having the same language, same colonial history, or other similar traits would have a positive impact on trade between countries. Therefore, I use the number of home companies present at the destination to proxy for the market ties between the countries, as the greater is the number of home companies operating at the destination, the more likely is the successful continuation of the exporting activity. As discussed above, this is in line with study of (Albornoz *et al.* , 2012), where firms use their first sales as an exercise of acquiring information on the market and their relative competitiveness. Therefore, the exporters who utilize the exchange rate hedging more (hh_ind is lower) are more likely to exhibit greater rates of continuing to export to the same destination.

λ_i indicates the individual fixed effects (firm-product-destination), η_t - destination-time fixed effects, $\epsilon^{i,t}$ is the error term.

4.3 Estimation choice

To estimate the stated above regression, I use panel estimations of the linear probability and logistic models. The main choice is for logistic distribution for its econometric properties but, as in the multiple robustness checks for our main hypothesises, I require high-dimensional fixed-effects estimations, the linear probability model estimations are also reported. It should be noted that due to the size and complexity of the data, probit estimations seem to be unfeasible for most of the regressions, and thus are left out. For the subsamples where probit has converged, the estimates

[16] The test for the significance of the interaction has been performed, all are significant at the 10% level. The results of the tests are available upon request.

were close (and as significant) as logistic distribution.

The econometric properties of logistic distribution control better for the granular part of the data. As shown in the section 2, many exporters only use one currency pricing. The estimation sample for logistic distribution is thus limited to exporters that use more than one currency pricing in their activity in order to avoid having the full prediction by the individual fixed effects.

All estimation techniques yield a negative effect of the high concentration of the currency pricing portfolio on the probability of remaining an exporter to the destination next period. It should be noted that as HH_ind has a bounded distribution, one should adjust the coefficients. The adjusted coefficients then represent the change in probability of survival (remaining as an exporter in the period $(t+1)$) associated with the move from complete diversification to complete concentration - from having three currencies with the 33.3(3)% share to having only one currency in the portfolio.

The unadjusted coefficients on log odds are reported in the results tables, and afterwards the adjusted coefficients are calculated. For example, table 9 equations (1) - (3) present the results of the main estimations: linear probability model delivers the lowest coefficient of 0.05, whereas with logistic probability the effect on odds is 0.38 of complete diversification. These coefficients imply the adjusted effects of 3% and 21% accordingly - results reported in the table 7. The skewness of the data supports the decision in favor of logistic estimation but due to the estimation limitations, the linear regression coefficients are also reported.

5 Results

5.1 Main results

Table 9 presents the results of the main specification. Due to the difficulties in convergence, econometric differences of specifications, estimation limitations and cross-sample differences between estimations on such a big dataset, the main discussion of the estimation results should be on the direction and significance of the coefficients, rather their magnitude. I also perform information score analysis (for the main results they are available in table **??**), which is available upon request but does not carry intrinsic meaning.

Column (2) contains the outcome of the main preferred logistic estimation on the full sample. *Testable Implication I* anticipates the negative effect of the currency pricing concentration (positive effect of diversification) on the probability of remaining an exporter. This is supported by the coefficients of HH_ind: the effect of currency pricing portfolio concentration is negative and significant. As we use logistic distribution for this estimation, the odds ratio change associated with the coefficient is 0.82 [17], which implies about 18% positive change in odds of successful stay at the destination the next period for the firm exporting the product p at destination d with equal shares of the three possible currency pricings compared to the firm that uses only 1 currency pricing. When we split the sample into the entrants and incumbents, the odds change for the entrants increases to 29%.

The positive significant coefficients at $fpNdest$ and $HH\_ind_t fpNdest_t$ support the evidence of *Testable Implication III*, as they show that the increase in the number of product-destinations of the firm decreases the negative impact of the complete concentration of the currency pricing portfolio. It also implies that on average after the firm has started exporting to a seventh product-destination, the negative effect of portfolio currency pricing is offset. This is the result of the fact that exchange rate hedging costs are currency-bound by construction, and, by expanding sales to other product-destinations, the exchange rate hedging cost will decline.

When we split the sample into the entrants to the product-destinations and incumbent firms, the adverse effect of the currency pricing portfolio concentration remains negative and significant, so none of the subsamples are exclusively driving the results.

As the variable of interest is a Herfindahl-Hirschman index constructed as described above, it can only take values $(0.33; 1)$. In order to make the results representative of this constraint, we report in Table 7 both the change in odd ratios associated with the shift from complete concentration to complete diversification and the standardized change. We report all the effects of hh_ind indicated in **??**.

An interesting insight is provided when the concentration parameter is normalized. Tables 10 and 11 present the results. While the main inferences about the diversification remain, in general, unchanged, two things should be noted: 1) the results are magnified when normalized to concentration in VCP, implying that full concentration in VCP is more harmful than the average concentration, with the notable exception of firms described in the second inference; 2) firms entering new destinations with the portfolios fully concentrated on PCP are the least likely to survive. This implies that there is - to some extent - a beneficial effect of presence of VCP concentration for the exporters.

To make the investigation more complete, table 12 presents the results of the main regression **??**, where there are first differences taken on all the right-hand-side variables (except for the interaction as it will be impossible to interpret the source of the changes):

[17] The value -0.31 is the log odds. $e^{-0.31} = 0.73$ is the odds ratio change associated with the hh_ind change from 0 to 1 - from complete concentration to the complete diversification of portfolio. Given that there are only 3 possible changes, the actual possible change is $\frac{2}{3}$ of this: $(1 - \frac{2}{3} * (1 - 0.73)) = 0.82$

$$(Export_{t+1}|Export_t) = \beta_0 + \beta_1 sale_{(t)-(t-1)} + \beta_2 HH\_ind_{(t)-(t-1)} + \beta_3 fpNdest_{(t)-(t-1)} + \qquad (2)$$
$$+\beta_4 Ntrans_{(t)-(t-1)} + \eta_t + \epsilon^{i,t}$$

Taking first differences allows to control for the bias of the unobserved variables. The results on linear or multidimensional linear probabilities show that the negative effect of concentration remains. This means that the more concentrated the portfolio becomes, the more likely the exporter is to quit serving that destination the next year. Column (3) - the results of the logit regression - show that there is no significant effect.

5.2 Exchange Rate Hedging Costs

To support the existence and the effect of the exchange rate hedging costs that are developed in the extension of the GT model (see *Hypothesis II* and Figure 2), the following fact needs to be observed in the empirical test:

> The failures to predict success of the exporter the next period in the regressions of the effect of the diversification should be (largely) attributed to the firms that use only one currency pricing ($HH\_ind = 1$).

This follows from the model: the adverse effect of currency pricing portfolio concentration indeed exists, as was shown in the concavity of the expected profits in Figure 1. Due to the existence of exchange rate hedging costs, some firms face the situation when diversification is not profitable - see figure 2 - and are still as likely to succeed at the destination.

To calculate the prediction errors of the model I use the estimation of the logistic regression (column (2) in table 9), controlling for the fixed effects of individual firm-product-destination.

The Figure 3 shows the difference between the predicted probabilities of continuing exporting in period $(t + 1)$ and the actual data. The estimation does relatively well for about a half of the sample, while in 15% it does poorly for the prediction of non-survival for surviving firms. This 15% of the model errors are attributed to the cases when model was prediction 0 probability of continuing to export at the destination, but the exporter remained exporting. Table 1 summarizes the distribution of the concentration index HH_ind of these 15% of data when the model does extremely poorly. For 93% of the cases it is attributed to $HH\_ind = 1$.

The positive values of $fpNdest$ and its interaction with the main variable of interest $fpNdest\#HH\_ind$ support the *Testable Implication III*. The more destinations the firm serves, the lower is the neg-

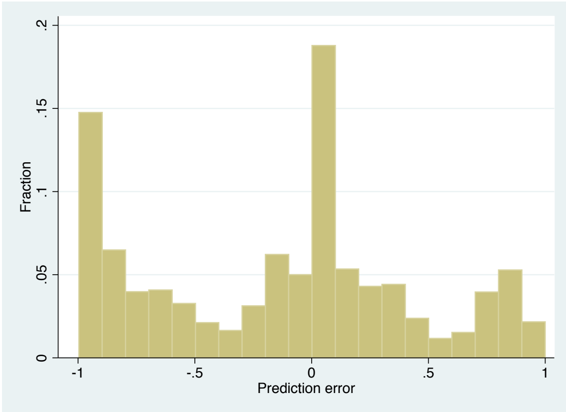

Figure 3: Distribution of the model errors

Table 1: Distribution of HH_ind at -1 errors of prediction

	Frequency	
HH_ind	Error $\in [-1; -0.8]$	
	Count	Frequency
0.3-0.4	1	0.00
0.4-0.5	5	0.00
0.5-0.6	1525	0.03
0.6-0.7	743	0.01
0.7-0.8	625	0.01
0.8-0.9	641	0.01
0.9-1	52979	0.93
Total	56519	1

ative effect of the currency pricing concentration. Though, for the entering firms it seems less relevant as they care more about the information on their general competitiveness at the destination (and thus the profits). If the exporter stays, it still cares about the currency diversification, but less so the more destinations it serves.

Testable Implication IV states that the exchange rate hedging costs are not currency-specific, but rather firm-specific. The negative effect of currency pricing concentration could be driven by the negative shocks to the market of a specific currency that is highly correlated to all other currencies. To control for this, we add different types of time-currency fixed effect dummies that aim at capturing common shocks to the market of the specific currency choice. Table 13 provides results of the estimation with dummies for the type of currency representing over 50% of the currency pricing portfolio of the firm at the given product-destination. Table 14 shows the results of the estimations with the dummies for the type of currencies representing over 30% of the currency pricing portfolio of the firm at the given product-destination. When controlling for the most popular currency, the negative effect of diversification remains across all samples only with the OLS estimations, while logit estimations show that the effect is persistent only for the entrants.

With controls for the two most popular currencies, the negative effect is persistent across all subsamples. These results support the notion that the adverse effect of currency pricing portfolio concentration is firm-specific and is channeled through the exchange rate hedging.

5.3 Robustness checks

I perform various robustness checks. Due to the limitations of the data (customs data from the Russian Federation Customs Service), we do not observe many characteristics of the firm. Therefore, I perform various high-dimensional fixed-effects estimations to control for the omitted variables.

As panel logit estimations are not feasible with high dimensional fixed effects, most of the robustness checks further on are performed with the linear probability models. We assume that linear probability models can be used as a form of robustness check, and they are reported in Table 18. Linear probability model estimations deliver the same direction of the effects on all specifications, with a biased downward coefficient.

According to Goldberg & Tille (2008a), the currency pricing questions are more relevant for the non-homogenous type of goods, as homogenous type of goods are conventionally priced in the same common currency. In order to test the relevance of this argument, I perform two types of sensitivity checks - table 16 presents the results without products relating to all mineral and metal industries (main export line of Russia by value), while tables 15 and 17 present the results with no and with only homogeneous goods respectively (as according to Rauch classification). When the metal and mineral industries are omitted, the magnitude and the significance of the results do not change. As expected, there is no significant effect of diversification on the homogenous goods industries, while the effect is negative and significant and of a bit higher magnitude.

As I have described before, it could also be argued that advanced markets are stable enough that the change in the exchange rate could be considered negligible for the further exporting in the next period and the currency portfolio should not be significant. In other words, that transactions to advanced economies are more sturdy to the effects of the exchange rate, as these economies tend to have stronger market ties and the main determinant of the continuation of the sales at the destination would be the relative competitiveness of the firm's product. On the other hand, the destinations with more unstable exchange rate should indicate greater correlation with the type of portfolio. As all the data is for the Russian Federation, I only control for the type of the destination partner. Tables 19(a) and 19(b) present the results for the subgroups of destinations split by the income type. Firms trading to the advanced economies (Equations (1)-(3)) in table 19(a) appear to not exhibit significant effect of the portfolio currency pricing concentration on average, while trading over more destinations makes them even less detached from the negative influence of currency pricing concentration. This is illustrative of the fact that in the advanced economies exporters face greater competition with lower influence of exchange rate fluctuations: when an exporter tries to enter a market, the most useful information is the market-specific information on how well it could do compared to other competitors. When the firm discovers that it is competitive enough, the relevance of the currency pricing diversification appears to be even more irrelevant.

In the emerging markets (table 19(a) equations (4)-(6)), however, the exchange rate hedging matters only for the entrants, and the number of firm-product destinations served appears to not have a significant effect. This can be explained in that when entering new emerging-market destinations, exporters place higher influence on their profit information, while when they are active on the market, that matters less.

Results on the low-income countries presented in Table 19(b) suggest, at first glance, an odd result. While the negative effect of concentration (positive of diversification) for entrants is present alike to emerging markets, the effect of interaction with the number of destinations served ($hh\_ind * fpNdest$) reverses signs and becomes negative. This peculiar result can be explained through the fact that, while the positive result of serving more destinations pertains, the low-income countries will be the first destinations to drop, when there are unfavorable exchange rate conditions (the firm is exposed to the more negative exchange rate conditions).

As tables 17 and 15 indicate, the effect of currency pricing might be driven by the type of product. The non-homogenous goods are the drivers of the effect, though there is some evidence of positive diversification for the homogenous goods too.

Table 20 presents the results for the destination-level estimations. As expected, the effect of the currency pricing concentration is greater, as it affects the expected profit across the whole destination.

6 Conclusions

This paper has investigated the relevance of firms using more than one currency in their sales to the product-destination market in order to hedge against the exchange rate shock. The conventional macroeconomic and financial theories postulate that having a more diversified portfolio results in higher expected profits when the exchange rate shock is realized, and thus higher probability of continuing to export to the destination. In international trade, this implies that using more than one currency pricing out of three available options- PCP for "producer currency pricing", LCP for "domestic currency pricing" and VCP for the "vehicle currency pricing" - should be associated with a higher survival rate (probability of exporting to the destination in the next period) of the exporters. This is called "exchange rate hedging" and after the evidence that *financial* hedging has been rarely utilized by the exporters even in the developed countries, it was believed to be an active channel for exporters to protect themselves from the exchange rate fluctuations. Until recently, due to the lack of data it was hard to assess whether there really is such a relationship.

Thus, the first contribution of the paper is the investigation of an extremely rare detailed data set on currency pricing patterns of exporters on the basis of the data acquired from Russian Customs. The data for the period 2005-2009 shows that a majority of the exporters tend to use only one currency pricing per product-destination, or to a destination. In contrast to what has been assumed theoretically before, many of those exporters who use only one currency pricing still continue exporting in the next period. Nevertheless, documenting the currency pricing patterns among the exporters who use more than one currency, higher diversification of the portfolio is still leading to a higher probability of survival at the destination. This is consistent with the standard theories but the puzzle of why many successful exporters use only one currency pricing remains. The effect of the full currency pricing diversification compared to a fully concentrated portfolio is estimated to increase the probability of continue exporting at the destination by up to 27%.

The second contribution of the paper is based on extension of the existent model of currency pricing to incorporate this puzzle by adding the concept of the *"exchange rate hedging costs"* to the currency choice of the exporters. These costs imply that to manage more than one currency, an exporter faces the costs of dealing with the more complex information on different currency exchange rates and exchange rates fluctuations. The exchange rate hedging costs are conceptually different from the transaction costs, as transaction costs are associated with the actual price of the conversion between the currencies and not with dealing with a different currency per se. The existence of the firm-specific exchange rate hedging costs imply that albeit using only one currency and therefore being a subject to a greater adverse impact of the exchange rate shocks, such exporters are likely to remain exporting at the destination in the next period.

The empirical investigation of the effect of diversification on the probability of continue exporting provides evidence of the effect of concentration of VCP (traditionally USD or EUR, in Russian data 85% and 14%, accordingly) to be, on average, more detrimental for survival than the concentration on PCP. The effect of full concentration on VCP versus the fully diversified portfolio is estimated to be negative and significant for all subsamples of the exporters, and varying from 3% to 35%. The effect of the full concentration on PCP is only significant and negative across different types of estimations only for the entering firms, and it varies from 12% to 49%. Two insights are drawn: first, supporting evidence to the conventional idea that having PCP pricing eliminates the uncertainty of profits for the exporters, while exposing themselves to other currencies worsens trade; and second, by entering a new market with a domestic currency, the exchange rate shock worsens the initial profit gained and the firm is more likely to quit.

By controlling for the choice of currency and various other determinants, I aim demonstrate that there is indeed an effect of using more than one currency for a firm, and that characteristic is rather firm-specific than currency-specific. I show that diversification of the currency pricing portfolio indeed improves the probability of continuing to export in the next period, but due to the inability (high fixed costs) of handling more than more one currency, the exporters chose to use only one. As this choice is done before the exchange rate shock is realised, the ex-post profits may be lower than they would have otherwise been, resulting in more exits by exporters.

The results also relate to the literature and debate about the role of the USD as the main international trade currency. As the USD is the main vehicle currency, this third choice allows firms with high exchange rate hedging costs to trade with one single currency to many destinations. Facing high exchange rate hedging costs, exporters dealing with multiple destinations that have various currencies, would prefer to have a single currency - most preferably domestic PCP, but as it is only domestic to the home country and harder to deal in foreign countries, they choose another - VCP. The VCP is thus a currency that is commonly used by various trading partner economies. In addition, it has low transaction fees and is widely liquid. Therefore, most commonly, they will opt for using the USD. Such concentration could potentially lead to lower profits due to the exchange rate shocks, as explained before, but it also allows more firms to participate in international trade activity.

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Table 2: Variable statistics, full sample

	Full Sample (Product-Destination)				Main regression sample				Full Sample (Destination)			
	Mean	SD	Min	Max	Mean	SD	Min	Max	Mean	SD	Min	Max
survive	0.485	0.5			0.507	0.5			0.59	0.49		
$survive_{t+1}$	10.147	2.872	-3.505	23.524	9.94	2.65	-3.505	23.4	12.18	2.24	-1.898	24.119
HH_ind	0.98	0.08	0.335	1	0.98	0.09	0.34	1	0.97	0.09	0.341	1
fNdest	0.984	5.793	1	58	5.74	8.41	1	87	7.413	10.12	1	87
Ntrans	18.37	135.11	1	41736	19.57	148.33	1	41736	41736	50.109	375.91	1
dNfirm	36.47	102.89	1	952	51.88	123.56	1	952	1884.66	1983.01	1	6249

Table 3: Variable statistics, entrants and incumbents

	Entrants				Incumbents			
	Mean	SD	Min	Max	Mean	SD	Min	Max
$survive_{t+1}$	0.59	0.49			0.507	0.5		
l_sale	12.18	2.24	-1.898	24.119	9.94	2.65	-3.505	23.4
HH_ind	0.97	0.09	0.341	1	0.98	0.09	0.34	1
fNdest	7.413	10.12	1	87	5.74	8.41	1	87
Ntrans	50.109	375.91	1	84586	19.57	148.33	1	41736
dNfirm	1884.66	1983.01	1	6249	51.88	123.56	1	952

Table 4: Average firm characteristics

	Full Sample	Entrants Sample	Incumbents Sample
Average pricing concentration	0.74	0.99	0.78
Average share LCP	0.10	0.08	0.19
Average share PCP	0.44	0.45	0.43
Average share VCP	0.45	0.46	0.38
Average N products	38	30	27
Average N products	14	12	9
Average N transactions (fpd)	9.8	1.45	16
Average N destinations	9	7	8
Median N destinations	4	3	3
Average N product-destinations	84	56	62
Median N product-destinations	28	20	21

Table 5: Descriptive Statistics

	Number of transactions (by product-destination)			
	LCP	PCP	VCP	Total
All	42,074	189,840	197,489	407,740
	0.10	0.46	0.48	
Entrants	12,321	71,353	69,023	148,085
	0.08	0.48	0.46	
Incumbents	29,753	118,487	128,466	259,655
	0.11	0.45	0.49	

Table 6: Firm Currency Pricing Combination Descriptive Statistics

(a) By product-destination

	Full Sample			Entrants			Incumbents		
	LCP	PCP	VCP	LCP	PCP	VCP	LCP	PCP	VCP
VCP	0.08	0.09	**0.88**	0.05	0.05	**0.93**	0.09	0.12	**0.86**
PCP	0.02	**0.90**	0.09	0.01	**0.94**	0.06	0.02	**0.88**	0.11
LCP	**0.90**	0.003	0.02	**0.93**	0.02	0.01	**0.89**	0.01	0.04
Total freq	0.10	0.46	0.48	0.08	0.48	0.46	0.11	0.45	0.49

(b) By destination

	Full Sample			Entrants			Incumbents		
	LCP	PCP	VCP	LCP	PCP	VCP	LCP	PCP	VCP
VCP	0.10	0.17	**0.86**	0.05	0.10	**0.92**	0.12	0.19	**0.84**
PCP	0.02	**0.82**	0.11	0.01	**0.90**	0.06	0.03	**0.79**	0.12
LCP	**0.86**	0.01	0.03	**0.93**	0.004	0.01	**0.84**	0.01	0.04
Total freq	0.13	0.33	0.53	0.12	0.35	0.52	0.14	0.32	0.53

Figure 4: Average portfolio by the number of destinations firms serve

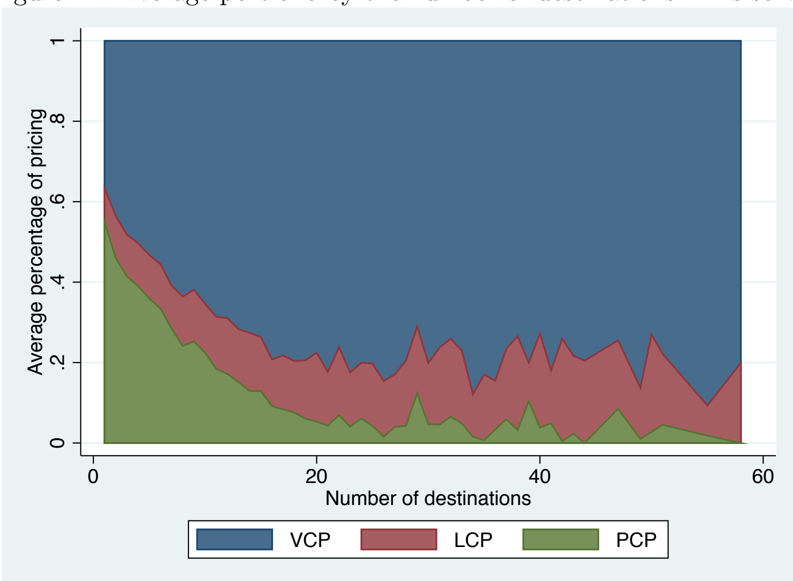


Figure 5: Number of currency pricings used by firms

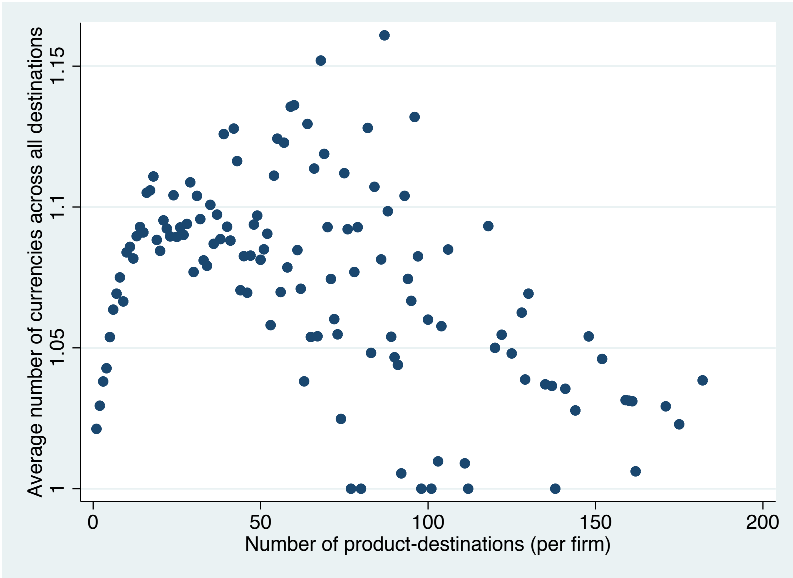
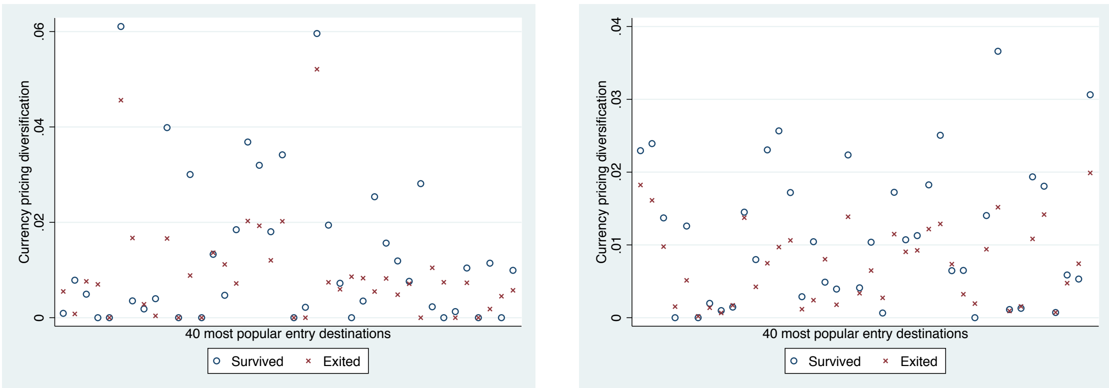


Figure 6: Porfolios among the entering firms



(a) by product-destination

(b) by destination

Table 7: Effect of the diversification (%% of odd increase in diversification)

	Full sample		Entrants		Incumbents	
Table 9: The main regression specification results						
	Coefficient	Odd Change	Coefficient	Odd Change	Coefficient	Odd Change
(xt)lpm	-0.04**	3%	-0.13***	9%	-0.07***	4%
(xt)logit	-0.31*	18%	-0.57***	29%	-0.39*	22%
Table 10: Normalized to PCP concentration						
	Coefficient	Odd Change	Coefficient	Odd Change	Coefficient	Odd Change
(xt)lpm	-0.06	0%	-0.20***	13%	-0.11***	7%
(xt)logit	-0.47	0%	-0.75***	35%	-0.30	0%
Table 11: Normalized to VCP concentration						
	Coefficient	Odd Change	Coefficient	Odd Change	Coefficient	Odd Change
(xt)lpm	-0.05**	3%	-0.10***	7%	-0.08***	6%
(xt)logit	-0.34*	19%	-0.54***	28%	-0.46*	24%
Table 13: Controlling for the dominant currency						
	Coefficient	Odd Change	Coefficient	Odd Change	Coefficient	Odd Change
(xt)lpm	-0.15**	10%	-0.16***	11%	-0.14***	9%
(xt)logit	-0.01	0%	-0.20***	12%	-0.02	0%
Table 14: Controlling for the two most used currencies						
	Coefficient	Odd Change	Coefficient	Odd Change	Coefficient	Odd Change
reg2hdfe	-0.16**	11%	-0.19***	13%	-0.14***	9%

Coefficient - refers to the coefficient in the relevant table, represents the (log) change for the complete diversification. Odd change - the actual odd change associated with going from complete concentration to complete diversification, taking into account 3 choice limitation. Should be read as "X %% higher odds of survival in exporting is associated with a portfolio that consists of 3 currency pricings equally as compared to a fully concentrated portfolio."

Table 8: Coefficient correlations

(a) product destination level sample

$survive_{t+1}$	$sale_t$	HH_ind_t	$fpNdest_t$	$Ntrans_t$	$dNfirm_t$	
1	0.24	-0.07	0.18	0.08	0.04	$survive_{t+1}$
	1	-0.07	0.32	0.17	0.12	$sale_t$
		1	-0.04	-0.02	0.02	HH_ind_t
			1	0.09	-0.11	$fNdest_t$
				1	0.09	$Ntrans_t$
					1	$dNfirm_t$

(b) Entrants sample

$survive_{t+1}$	$sale_t$	HH_ind_t	$fpNdest_t$	$Ntrans_t$	$dNfirm_t$	
1	0.29	-0.04	0.14	0.08	0.07	$survive_{t+1}$
	1	-0.06	0.32	0.17	-0.05	$sale_t$
		1	-0.04	-0.01	0.00	HH_ind_t
			1	0.08	-0.08	$fpNdest_t$
				1	0.13	$Ntrans_t$
					1	$dNfirm_t$

(c) Incumbents sample

$survive_{t+1}$	$sale_t$	HH_ind_t	$fpNdest_t$	$Ntrans_t$	$dNfirm_t$	
1	0.23	-0.07	0.16	0.08	0.03	$survive_{t+1}$
	1	-0.07	0.32	0.18	0.11	$sale_t$
		1	-0.14	-0.01	0.03	HH_ind_t
			1	0.08	-0.12	$fpNdest_t$
				1	0.09	$Ntrans_t$
					1	$dNfirm_t$

Table 9: Main results

	Dependant variable - dummy $survive_{t+1}$ for exporting the in (t+1)					
	(1)	(2)	(3)	(4)	(5)	(6)
	Full sample		Only entrants		Continying firms	
	xtreg (fe)	xtlogit (fe)	lpm	logit	xtreg (fe)	xtlogit (fe)
$sale_t$	0.05***	0.18***	0.04***	0.08***	0.07***	0.30***
	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)	(0.01)
HH_ind_t	-0.04**	-0.31*	-0.13***	-0.57***	-0.07***	-0.39*
	(0.02)	(0.16)	(0.03)	(0.12)	(0.02)	(0.20)
$fpNdest_t$	0.01***	0.06**	0.01***	0.08***	0.01***	0.06**
	(0.00)	(0.02)	(0.00)	(0.02)	(0.00)	(0.03)
$HH\_ind_t\#fpNdest_t$	0.01***	0.04**	-0.00	-0.02	0.01***	0.05*
	(0.00)	(0.02)	(0.00)	(0.02)	(0.00)	(0.03)
$Ntrans_t$	0.00**	0.00***	0.00***	0.02***	0.00**	0.00***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
$dNfirm_t$	0.00***	0.00***	0.00***	0.00***	0.00***	0.01***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Constant	0.25***		0.14***	-1.57***	0.07***	
	(0.04)		(0.17)	(0.03)	(0.02)	
Observations	403,513	143,483	145,994	145,994	257,519	102,790
R-squared	0.23		0.39		0.28	
Number of fpd_id	247,290	57,531			141,281	39,151
Destination-Year FE	YES			YES	YES	YES
Firm FE			YES			
Destination FE		YES	YES			
Year FE		YES	YES			

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 10: Results: normalized to full concentration of PCP

	Dependant variable - dummy $survive_{t+1}$ for exporting in (t+1)					
	(1)	(2)	(3)	(4)	(5)	(6)
	Full sample		Only entrants		Continying firms	
	xtreg (fe)	xtlogit (fe)	lpm	logit	xtreg (fe)	xtlogit (fe)
$sale_t$	0.05***	0.17***	0.04***	0.10***	0.07***	0.30***
	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)	(0.02)
HH_ind_t	-0.06	-0.47	-0.20***	-0.75***	-0.11***	-0.30
	(0.05)	(0.40)	(0.03)	(0.12)	(0.03)	(0.26)
$fpNdest_t$	-0.00	-0.00	0.01*	0.10***	0.00	0.05*
	(0.00)	(0.03)	(0.00)	(0.02)	(0.00)	(0.03)
$HH\_ind_t\#fpNdest_t$	0.02***	0.09**	-0.00	-0.04	0.01***	0.04
	(0.00)	(0.03)	(0.00)	(0.02)	(0.00)	(0.03)
$Ntrans_t$	0.00***	0.00***	0.00***	0.02***	0.00***	0.00***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
$dNfirm_t$	0.00***	0.01***	0.00***	0.00***	0.00***	0.01***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Constant	0.20***		0.39***	-0.77***	-0.54***	
	(0.05)		(0.28)	(0.03)	(0.09)	
Observations	214,077	74,116	78,885	78,885	153,549	58,879
R-squared	0.23		0.41		0.30	
Number of fpd_id	135,118	30,048			86,784	22,702
Destination-Year FE				YES	YES	YES
Firm FE			YES			
Destination FE			YES			
Year FE			YES			

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 11: Results: normalized to full concentration of VCP

	Dependant variable - dummy $survive_{t+1}$ for exporting in (t+1)					
	(1)	(2)	(3)	(4)	(5)	(6)
	Full sample		Only entrants		Continying firms	
	xtreg (fe)	xtlogit (fe)	lpm	logit	xtreg (fe)	xtlogit (fe)
$sale_t$	0.05***	0.16***	0.04***	0.07***	0.07***	0.26***
	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)	(0.02)
HH_ind_t	-0.05**	-0.34*	-0.10***	-0.54***	-0.08***	-0.46*
	(0.02)	(0.20)	(0.03)	(0.13)	(0.02)	(0.27)
$fpNdest_t$	0.01***	0.09**	0.01**	0.06**	0.01***	0.07*
	(0.00)	(0.03)	(0.00)	(0.03)	(0.00)	(0.04)
$HH\_ind_t \# fpNdest_t$	0.01***	0.05	0.00	0.05*	0.01***	0.06*
	(0.00)	(0.03)	(0.00)	(0.03)	(0.00)	(0.04)
$Ntrans_t$	0.00*	0.00**	0.00***	0.03***	0.00*	0.00**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
$dNfirm_t$	0.00***	0.00***	0.00***	0.00*	0.00***	0.01***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Constant	0.33***		-0.07	-0.99	-0.40***	
	(0.03)		(0.22)	(0.83)	(0.03)	
Observations	230,435	79,028	83,099	82,959	147,336	56,193
R-squared	0.23		0.45		0.28	
Number of fpd_id	141,809	31,784			81,100	21,528
Destination-Year FE	YES	YES		YES	YES	YES
Firm FE			YES			
Destination FE			YES			
Year FE			YES			

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 12: Regression on changes

	Dependant variable - dummy $survive_{t+1}$ for exporting in (t+1)				
	(1)	(2)	(3)	(4)	(5)
	lpm	reg2hdfe	xtlogit (fe)		
				Norm. PCP	Norm. VCP
$\Delta Sale_{(t)-(t-1)}$	-0.02***	0.03***	0.07***	-0.00	0.01
	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)
$\Delta HH\_ind_{(t)-(t-1)}$	-0.01	-0.01	-0.01	-0.46***	-0.25***
	(0.01)	(0.01)	(0.15)	(0.09)	(0.10)
$\Delta fpN_{(t)-(t-1)}$	0.01***	0.01***	0.06***	0.11***	0.08***
	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)
$\Delta Ntrans_{(t)-(t-1)}$	0.00**	0.00***	0.00***	0.01***	0.01***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
$\Delta dNfirm_{(t)-(t-1)}$	0.00***	0.00*	0.00***	0.01***	0.01***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Constant	0.41***				
	(0.00)				
Observations	156,223	156,223	46,573	30,769	33,084
R-squared	0.25	0.58			
Number of fpd_id	92,592		20,131	13,330	14,409
Destination-Year	YES				
Product-Year		YES			
Firm-Destination		YES			
Year			YES	YES	YES

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 13: Exchange Rate Hedging Costs: Controlling for currency choice(1)

	Dependant variable - dummy $survive_{t+1}$ for exporting in (t+1)					
	(1)	(2)	(3)	(4)	(5)	(6)
	Full sample		Only entrants		Incumbents	
$sale_t$	0.08***	0.05***	0.06***	0.06***	0.08***	0.07***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
HH_ind_t	-0.15***	-0.01	-0.16***	-0.20***	-0.14***	-0.02
	(0.01)	(0.01)	(0.03)	(0.03)	(0.01)	(0.02)
$fpNdest_t$	-0.00***	0.01***	-0.01***	0.00	-0.00**	0.01***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
$Ntrans_t$	0.00***	0.00***	0.00***	0.00***	0.00	0.00***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
$dNfirm_t$	0.00***	0.00***	0.00***	0.00***	0.00***	0.00***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Observations	407,586	407,586	148,062	148,062	259,524	259,524
R-squared	0.55	0.75	0.76	0.85	0.55	0.74
Firm-Product FE	YES		YES		YES	
Currency-year FE	YES	YES	YES	YES	YES	YES
Firm-Product-Destination FE		YES				YES
Firm-Product-year FE				YES		

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 14: Exchange Rate Hedging Costs: Controlling for currency choice (2)

	Dependant variable - dummy $survive_{t+1}$ for exporting in (t+1)		
	(1)	(2)	(3)
VARIABLES	Full sample	Entrants	Incumbents
		reg2hdfe	
$sale_t$	0.08***	0.06***	0.08***
	(0.00)	(0.00)	(0.00)
HH_ind_t	-0.16***	-0.19***	-0.14***
	(0.02)	(0.04)	(0.02)
$fNdest_t$	-0.00***	-0.01***	-0.00**
	(0.00)	(0.00)	(0.00)
$Ntrans_t$	0.00***	0.00***	0.00
	(0.00)	(0.00)	(0.00)
$dNfirm_t$	0.00***	0.00***	0.00***
	(0.00)	(0.00)	(0.00)
Observations	407,736	148,081	259,655
R-squared	0.55	0.76	0.55
Firm-Product FE	YES	YES	YES
Currency-year FE	YES	YES	YES
Second currency-year FE	YES	YES	YES

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 15: Robustness: No homogenous goods

	Dependant variable - dummy $survive_{(t+1)}$ for exporting the next period					
	(1)	(2)	(3)	(4)	(5)	(6)
	Full sample		Only entrants		Incumbents	
	xtreg (fe)	xtlogit (fe)	lpm	logit	xtreg (fe)	xtlogit (fe)
$sale_t$	0.06***	0.23***	0.05***	0.10***	0.07***	0.36***
	(0.00)	(0.02)	(0.00)	(0.00)	(0.00)	(0.02)
HH_ind_t	-0.06*	-0.31	-0.23***	-1.31***	-0.09**	-0.46
	(0.03)	(0.30)	(0.06)	(0.23)	(0.04)	(0.39)
$fpNdest_t$	-0.00	-0.01	0.01	0.04	-0.00	-0.01
	(0.00)	(0.03)	(0.01)	(0.03)	(0.00)	(0.04)
$HH\_ind_t\#fpNdest_t$	0.01***	0.05*	-0.00	-0.00	0.01***	0.06*
	(0.00)	(0.03)	(0.01)	(0.03)	(0.00)	(0.04)
$Ntrans_t$	0.00***	0.00***	0.00***	0.01***	0.00***	0.00***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
$dNfirm_t$	0.00***	0.01***	0.00***	0.00***	0.00***	0.01***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Constant	0.17***		0.00***	-1.41***	0.00***	0.01***
	(0.00)		(0.00)	(0.40)	(0.00)	(0.00)
Observations	109,691	42,111	33,710	33,658	75,981	31,422
R-squared	0.22		0.45		0.28	
Number of fpd_id	62,550	16,809			39,712	11,982
Destination-Year FE				YES		
Firm FE			YES			
Year FE			YES			

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 16: Robustness: no firms relating to metals and minerals

	Dependant variable - dummy $survive_{t+1}$for exporting the in (t+1)					
	(1)	(2)	(3)	(4)	(5)	(6)
	Full sample		Only entrants		Incumbents	
	xtreg (fe)	xtlogit (fe)	lpm	logit	xtreg (fe)	xtlogit (fe)
$sale_t$	0.05***	0.18***	0.04***	0.09***	0.07***	0.29***
	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)	(0.01)
HH_ind_t	-0.05**	-0.31*	-0.12***	-0.41***	-0.07***	-0.36
	(0.02)	(0.18)	(0.03)	(0.13)	(0.02)	(0.23)
$fpNdest_t$	0.01***	0.07***	0.01***	0.12***	0.01***	0.08***
	(0.00)	(0.03)	(0.01)	(0.03)	(0.00)	(0.03)
$HH\_ind_t\#fpNdest_t$	0.01***	0.06**	-0.00	-0.03	0.01***	0.05
	(0.00)	(0.03)	(0.01)	(0.03)	(0.00)	(0.03)
$Ntrans_t$	0.00*	0.00***	0.00***	0.02***	0.00*	0.00***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
$dNfirm_t$	0.00***	0.00***	0.00***	0.00***	0.00***	0.01***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Constant	0.26***		0.12***	-1.75***	0.06*	
	(0.03)		(0.04)	(0.19)	(0.00)	
Observations	326,228	116,705	119,602	119,602	206,626	83,367
R-squared	0.24		0.41		0.29	
Number of fpd_id	200,943	47,016			114,132	31,927
Destination-Year FE	YES	YES		YES	YES	YES
Firm FE			YES			
Destination FE			YES			
Year FE			YES			

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 17: Robustness: Only homogenous goods

	Dependant variable - dummy $survive_{t+1}$ for exporting in (t+1)					
	(1)	(2)	(3)	(4)	(5)	(6)
	Full sample		Only entrants		Incumbents	
	xtreg (fe)	xtlogit (fe)	lpm	logit	xtreg (fe)	xtlogit (fe)
$sale_t$	0.05***	0.16***	0.04***	0.07***	0.06***	0.26***
	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)	(0.01)
HH_ind_t	-0.03	-0.25	-0.11***	-0.34**	-0.06**	-0.34
	(0.02)	(0.21)	(0.03)	(0.15)	(0.03)	(0.26)
$fpNdest_t$	0.02***	0.13***	0.01	0.12***	0.02***	0.13***
	(0.00)	(0.04)	(0.01)	(0.04)	(0.00)	(0.05)
$HH\_ind_t\#fpNdest_t$	0.00	0.02	-0.00	-0.02	0.01	0.02
	(0.00)	(0.04)	(0.01)	(0.04)	(0.00)	(0.05)
$Ntrans_t$	0.00**	0.00***	0.00***	0.03***	0.00*	0.00***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
$dNfirm_t$	0.00	0.00	0.00***	0.00***	0.00	0.00
	(0.03)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
			0.00	0.00		
Constant	0.30***		0.17***	-1.39***	0.13***	
	(0.00)	(0.03)	(0.15)	(0.03)		
Observations	292,267	100,763	111,546	111,546	180,721	70,949
R-squared	0.23		0.40		0.28	
Number of fpd_id	183,720	40,481			101,125	27,012
Firm FE			YES			
Year FE			YES			

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 18: Product-destination LPM estimations (high dimensional FE)

(a) Regressions on the Full Sample

	Dependant variable - dummy $survive_{t+1}$ for exporting in (t+1)			
	(1)	(2)	(3)	(4)
VARIABLES				
$sale_t$	0.07***	0.08***	0.05***	0.07***
	(0.00)	(0.00)	(0.00)	(0.00)
HH_ind_t	-0.12***	-0.15***	-0.04**	-0.12***
	(0.01)	(0.01)	(0.02)	(0.01)
$fNdest_t$	-0.00***		0.01***	-0.00***
	(0.00)		(0.00)	(0.00)
$dNfirm_t$	0.00***	0.00***	0.00***	0.00***
	(0.00)	(0.00)	(0.00)	(0.00)
$Ntrans_t$	0.00***	-0.00	0.00***	0.00***
	(0.00)	(0.00)	(0.00)	(0.00)
Constant	-0.02	-0.20***	0.23***	
	(0.04)	(0.02)	(0.02)	
Observations	407,740	407,740	407,740	407,740
R-squared	0.56	0.78	0.75	0.56
Firm-Product FE	YES			YES
Destination-Year FE	YES			YES
Firm-Product-Year FE		YES		
Destination FE		YES		
Year FE			YES	
Firm-Product-Destination FE			YES	

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

(b) Regressions on entrants and incumbents subsamples

	Dependant variable - dummy $survive_{t+1}$ for exporting in (t+1)				
	(1)	(2)	(3)	(4)	(5)
VARIABLES	Entrants			Incumbents	
$sale_t$	0.05***	0.06***	0.05***	0.08***	0.08***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
HH_ind_t	-0.14***	-0.19***	-0.14***	-0.12***	-0.12***
	(0.03)	(0.03)	(0.03)	(0.01)	(0.01)
$fNdest_t$	-0.01***		-0.01***	-0.00	-0.00
	(0.00)		(0.00)	(0.00)	(0.00)
$dNfirm_t$	0.00***	0.00***	0.00***	0.00***	0.00***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
$Ntrans_t$	0.00***	0.00***	0.00***	-0.00	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Constant	0.11**	-0.04		-0.06*	
	(0.05)	(0.05)		(0.03)	
Observations	148,085	148,085	148,085	259,655	259,655
R-squared	0.77	0.85	0.77	0.55	0.55
Firm-Product FE	YES		YES		YES
Destination-Year FE	YES		YES		YES
Firm-Product-Year FE				YES	
Destination FE				YES	
Year FE		YES			
Firm-Product-Destination FE		YES			

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 19: By the type of trading partner

(a) Advanced economies and emerging markets

	Advanced Economies			Emerging Economies		
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Full sample	Entrants	Incumbents	Full sample	Entrants	Incumbents
	lpm	logit	lpm	logit	lpm	logit
$sale_t$	0.16***	0.08***	0.32***	0.17***	0.07***	0.26***
	(0.02)	(0.00)	(0.03)	(0.01)	(0.00)	(0.01)
HH_ind_t	-0.48	-0.45	-0.70	-0.36	-0.71***	-0.41
	(0.28)	(0.27)	(0.44)	(0.23)	(0.16)	(0.28)
$fpNdest_t$	-0.00	0.01	0.00	0.04	0.09**	0.04
	(0.03)	(0.04)	(0.04)	(0.04)	(0.04)	(0.05)
$HH\_ind_t\#fpNdest_t$	0.08**	0.03	0.09**	0.07	-0.03	0.07
	(0.03)	(0.04)	(0.04)	(0.04)	(0.04)	(0.05)
$Ntrans_t$	0.01***	0.02***	0.01***	0.00***	0.03***	0.00***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
$dNfirm_t$	0.01***	0.00	0.01***	0.00***	0.00***	0.01***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Constant		-1.23***			-0.84***	
		(0.29)			(0.16)	
Observations	33,997	28,621	25,508	87,365	87,614	62,450
Number of fpd_id	13,597		9,738	34,860		23,680
Year FE	YES	YES			YES	YES
Destination-Year FE			YES	YES		

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

(b) Low-income countries

			&
	Low Income Countries		
	(1)	(2)	(3)
VARIABLES	Full sample	Entrants	Incumbents
	xtreg	logit	xtlogit
$sale_t$	0.20***	0.06***	0.33***
	(0.02)	(0.01)	(0.03)
HH_ind_t	0.27	-0.51**	0.34
	(0.36)	(0.26)	(0.46)
$fpNdest_t$	0.24***	0.28***	0.25***
	(0.06)	(0.06)	(0.07)
$HH\_ind_t\#fpNdest_t$	-0.11*	-0.15***	-0.09
	(0.06)	(0.06)	(0.07)
$Ntrans_t$	0.00	0.01***	0.00
	(0.00)	(0.00)	(0.00)
$dNfirm_t$	-0.01***	0.00***	-0.01***
	(0.00)	(0.00)	(0.00)
Constant		-1.39***	
		(0.26)	
Observations	19,972	27,503	13,404
Number of fpd_id	8,199		5,189
Year	YES		YES
Destination-Year		YES	

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 20: Results for the destinations

	(1)	(2)	(3)	(4)	(5)
	Full sample		Entrants	Incumbents	
	lpm	xtlogit (fe)			xtlogit (fe)
$sale_t$	0.06***	0.26***	0.05***	0.08***	0.39***
	(0.00)	(0.01)	(0.00)	(0.00)	(0.02)
HH_ind_t	-0.05**	-0.45*	-0.21***	-0.05**	-0.61**
	(0.02)	(0.23)	(0.04)	(0.02)	(0.28)
$HH\_ind_t\#fNdest_t$	0.00**	0.04	-0.01	0.00**	0.05**
	(0.00)	(0.02)	(0.01)	(0.00)	(0.02)
$fNdest_t$	0.01***	0.05**	0.01***	0.01***	0.03
	(0.00)	(0.02)	(0.01)	(0.00)	(0.02)
$Ntrans_t$	0.00***	0.00***	0.00***	0.00***	0.00***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
$dNfirm_t$	0.00	0.00***	-0.00	-0.00	0.00***
	(52.55)	(0.00)	(10.53)	(43.36)	(0.00)
Constant	-0.55		0.20	-0.60	
	(99,798.70)		(1,105.18)	(84,105.15)	
Observations	153,946	57,944	42,221	111,725	43,417
R-squared	0.21		0.08	0.25	
Number of fd_id	81,559	22,512		53,937	16,048
Firm-Destination FE	YES	YES		YES	YES
Destination-Year FE	YES	YES	YES	YES	YES

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

8 Appendix

8.1 Goldberg-Tille Model

The Goldberg & Tille (2008b) is used to study the question posed in this paper. As the model needs to be modified to fit the shares in sales as a opposed to the individual transaction, here the full derivation (with adjustments) of the model is performed. The model is solved for the two choice currency choice model for the simplicity.

Specification

Demand for firm i is a function of its price, that of its competitors, and overall demand:

$$Y_i = \left[\frac{P_i^d}{P^d}\right]^{-\lambda} Y$$

where prices are in destination currency. The firm price in destination currency is a composition of the preset price $\tilde{P}_i$ and exchange rate pass-through:

$$P_i^d = \tilde{P}_i \exp\left[\left(\beta^d - 1\right) s_{ed} + \beta^v s_{ev}\right]$$

where s_{ej} is the exchange rate between the exporter's currency and currency j, with an increase being a depreciation of the exporter's currency. Similarly for the price index:

$$P^d = \tilde{P} \exp\left[\left(\eta^d - 1\right) s_{ed} + \eta^v s_{ev}\right]$$

The technology is:

$$Y_i = \frac{1}{\alpha} H_i^{\alpha}$$

Labor is paid a wage W. Overall demand and the wage have steady state values, $\bar{Y}$ and $\bar{W}$, and shocks y and w of expected values zero:

$$Y = \bar{Y} \exp[y] \quad ; \quad W = \bar{W} \exp[w]$$

The firm maximizes expected discounted profits:

$$
\begin{aligned}
\Pi &= ED\left[\exp\left[s_{ed}\right]P_i^d Y_i - W\left(\alpha Y_i\right)^{\frac{1}{\alpha}}\right] \\
&= \left(\tilde{P}_i\right)^{1-\lambda}\left(\tilde{P}\right)^{\lambda}\bar{Y}ED\left[\exp\left[\begin{array}{c}\left[\beta^d-\lambda\left(\beta^d-\eta^d\right)\right]s_{ed} \\ +\left[\beta^v-\lambda\left(\beta^v-\eta^v\right)\right]s_{ev}+y\end{array}\right]\right] \\
&\quad -\bar{W}\left(\alpha\right)^{\frac{1}{\alpha}}\left(\bar{Y}\right)^{\frac{1}{\alpha}}\left(\tilde{P}_i\right)^{-\frac{\lambda}{\alpha}}\left(\tilde{P}\right)^{\frac{\lambda}{\alpha}}ED\left[\exp\left[\begin{array}{c}w-\frac{\lambda}{\alpha}\left(\beta^d-\eta^d\right)s_{ed} \\ -\frac{\lambda}{\alpha}\left(\beta^v-\eta^v\right)s_{ev}+\frac{1}{\alpha}y\end{array}\right]\right]
\end{aligned} \tag{3}
$$

First-order conditions

The FOC with respect to $\tilde{P}_i$ is:

$$
\begin{aligned}
&\left(\tilde{P}_i\right)^{1+\lambda\frac{1-\alpha}{\alpha}}ED\left[\exp\left[\begin{array}{c}\left[\beta^d-\lambda\left(\beta^d-\eta^d\right)\right]s_{ed} \\ +\left[\beta^v-\lambda\left(\beta^v-\eta^v\right)\right]s_{ev}+y\end{array}\right]\right] \\
= \; &\frac{\lambda}{\lambda-1}\bar{W}\left(\alpha\right)^{\frac{1-\alpha}{\alpha}}\left(\bar{Y}\right)^{\frac{1-\alpha}{\alpha}}\left(\tilde{P}\right)^{\lambda\frac{1-\alpha}{\alpha}}ED\left[\exp\left[\begin{array}{c}w-\frac{\lambda}{\alpha}\left(\beta^d-\eta^d\right)s_{ed} \\ -\frac{\lambda}{\alpha}\left(\beta^v-\eta^v\right)s_{ev}+\frac{1}{\alpha}y\end{array}\right]\right]
\end{aligned}
$$

It is useful to write $\tilde{P}_i$ as the steady state value and the deviation from the steady state, and similarly for $\tilde{P}$ and the discount D:

$$
\tilde{P}_i = \bar{P}_i\exp\left[\tilde{p}_i\right] \quad ; \quad \tilde{P} = \bar{P}\exp\left[\tilde{p}\right] \quad ; \quad D = \bar{D}\exp\left[d\right]
$$

We thus get:

$$
\begin{aligned}
&\left(\bar{P}_i\right)^{1+\lambda\frac{1-\alpha}{\alpha}}\exp\left[\left(1+\lambda\frac{1-\alpha}{\alpha}\right)\tilde{p}_i\right]E\exp\left[\begin{array}{c}d+\left[\beta^d-\lambda\left(\beta^d-\eta^d\right)\right]s_{ed} \\ +\left[\beta^v-\lambda\left(\beta^v-\eta^v\right)\right]s_{ev}+y\end{array}\right] \\
= \; &\frac{\lambda}{\lambda-1}\bar{W}\left(\alpha\right)^{\frac{1-\alpha}{\alpha}}\left(\bar{Y}\right)^{\frac{1-\alpha}{\alpha}}\left(\bar{P}\right)^{\lambda\frac{1-\alpha}{\alpha}}\exp\left[\lambda\frac{1-\alpha}{\alpha}\tilde{p}\right]E\exp\left[\begin{array}{c}d+w-\frac{\lambda}{\alpha}\left(\beta^d-\eta^d\right)s_{ed} \\ -\frac{\lambda}{\alpha}\left(\beta^v-\eta^v\right)s_{ev}+\frac{1}{\alpha}y\end{array}\right]
\end{aligned}
$$

In the steady state this is:

$$
\left(\bar{P}_i\right)^{1+\lambda\frac{1-\alpha}{\alpha}} = \frac{\lambda}{\lambda-1}\bar{W}\left(\alpha\right)^{\frac{1-\alpha}{\alpha}}\left(\bar{Y}\right)^{\frac{1-\alpha}{\alpha}}\left(\bar{P}\right)^{\lambda\frac{1-\alpha}{\alpha}} \tag{4}
$$

Therefore the optimalit condition with respect to the price is:

$$\begin{aligned} & \exp\left[\left(1+\lambda\frac{1-\alpha}{\alpha}\right)\tilde{p}_i\right] E\exp\left[\begin{array}{c} d+\left[\beta^d-\lambda\left(\beta^d-\eta^d\right)\right]s_{ed} \\ +\left[\beta^v-\lambda\left(\beta^v-\eta^v\right)\right]s_{ev}+y \end{array}\right] \\ = \; & \exp\left[\lambda\frac{1-\alpha}{\alpha}\tilde{p}\right] E\exp\left[\begin{array}{c} d+w-\frac{\lambda}{\alpha}\left(\beta^d-\eta^d\right)s_{ed} \\ -\frac{\lambda}{\alpha}\left(\beta^v-\eta^v\right)s_{ev}+\frac{1}{\alpha}y \end{array}\right] \end{aligned} \tag{5}$$

The FOC with respect to β^d is (using (5)):

$$\begin{aligned} & \frac{\lambda}{\lambda-1}\exp\left[\left(1+\lambda\frac{1-\alpha}{\alpha}\right)\tilde{p}_i\right] E\left[\exp\left[\begin{array}{c} d+\left[\beta^d-\lambda\left(\beta^d-\eta^d\right)\right]s_{ed} \\ +\left[\beta^v-\lambda\left(\beta^v-\eta^v\right)\right]s_{ev}+y \end{array}\right](1-\lambda)\,s_{ed}\right] \\ = \; & \alpha\exp\left[\lambda\frac{1-\alpha}{\alpha}\tilde{p}\right] E\left[\exp\left[\begin{array}{c} d+w-\frac{\lambda}{\alpha}\left(\beta^d-\eta^d\right)s_{ed} \\ -\frac{\lambda}{\alpha}\left(\beta^v-\eta^v\right)s_{ev}+\frac{1}{\alpha}y \end{array}\right]\frac{\lambda}{\alpha}s_{ed}\right] \end{aligned}$$

which we rewrite as:

$$\begin{aligned} & \exp\left[\left(1+\lambda\frac{1-\alpha}{\alpha}\right)\tilde{p}_i\right] E\left[\exp\left[\begin{array}{c} d+\left[\beta^d-\lambda\left(\beta^d-\eta^d\right)\right]s_{ed} \\ +\left[\beta^v-\lambda\left(\beta^v-\eta^v\right)\right]s_{ev}+y \end{array}\right]s_{ed}\right] \\ = \; & \exp\left[\lambda\frac{1-\alpha}{\alpha}\tilde{p}\right] E\left[\exp\left[\begin{array}{c} d+w-\frac{\lambda}{\alpha}\left(\beta^d-\eta^d\right)s_{ed} \\ -\frac{\lambda}{\alpha}\left(\beta^v-\eta^v\right)s_{ev}+\frac{1}{\alpha}y \end{array}\right]s_{ed}\right] \end{aligned} \tag{6}$$

The FOC with respect to β^v is (using (5)):

$$\begin{aligned} & \exp\left[\left(1+\lambda\frac{1-\alpha}{\alpha}\right)\tilde{p}_i\right] E\left[\exp\left[\begin{array}{c} d+\left[\beta^d-\lambda\left(\beta^d-\eta^d\right)\right]s_{ed} \\ +\left[\beta^v-\lambda\left(\beta^v-\eta^v\right)\right]s_{ev}+y \end{array}\right]s_{ev}\right] \\ = \; & \exp\left[\lambda\frac{1-\alpha}{\alpha}\tilde{p}\right] E\left[\exp\left[\begin{array}{c} d+w-\frac{\lambda}{\alpha}\left(\beta^d-\eta^d\right)s_{ed} \\ -\frac{\lambda}{\alpha}\left(\beta^v-\eta^v\right)s_{ev}+\frac{1}{\alpha}y \end{array}\right]s_{ev}\right] \end{aligned} \tag{7}$$

Expansion of first-order conditions

We take quadratic expansions of the FOC around the steady state with respect to s_{ed}, s_{ev}, y, d, w, $\tilde{p}_i$, bearing in mind that $Es_{ed} = Es_{ev} = Ey = Ed = Ew = 0$. The left-hand side of (6) is expanded as:

$$\begin{aligned}
&\exp\left[\left(1+\lambda\frac{1-\alpha}{\alpha}\right)\tilde{p}_i\right]E\left[\exp\left[\begin{array}{c} d+\left[\beta^d-\lambda\left(\beta^d-\eta^d\right)\right]s_{ed} \\ +\left[\beta^v-\lambda\left(\beta^v-\eta^v\right)\right]s_{ev}+y \end{array}\right]s_{ed}\right] \\
= \;& Eds_{ed}+\left[\beta^d-\lambda\left(\beta^d-\eta^d\right)\right]E\left(s_{ed}\right)^2+\left[\beta^v-\lambda\left(\beta^v-\eta^v\right)\right]Es_{ed}s_{ev}+Eys_{ed}
\end{aligned}$$

The right-hand side of (6) is expanded as:

$$\begin{aligned}
&\exp\left[\lambda\frac{1-\alpha}{\alpha}\tilde{p}\right]E\left[\exp\left[\begin{array}{c} d+w-\frac{\lambda}{\alpha}\left(\beta^d-\eta^d\right)s_{ed} \\ -\frac{\lambda}{\alpha}\left(\beta^v-\eta^v\right)s_{ev}+\frac{1}{\alpha}y \end{array}\right]s_{ed}\right] \\
= \;& Eds_{ed}+Ews_{ed}-\frac{\lambda}{\alpha}\left(\beta^d-\eta^d\right)E\left(s_{ed}\right)^2-\frac{\lambda}{\alpha}\left(\beta^v-\eta^v\right)Es_{ed}s_{ev}+\frac{1}{\alpha}Eys_{ed}
\end{aligned}$$

Thus the quadratic approximation of (6) is:

$$\left[\beta^d-\Omega\eta^d\right]E\left(s_{ed}\right)^2+\left[\beta^v-\Omega\eta^v\right]Es_{ed}s_{ev}=\left(1-\Omega\right)Ecs_{ed} \tag{8}$$

where $c=w+\frac{1-\alpha}{\alpha}y$ and:

$$\Omega=\frac{\lambda\left(1-\alpha\right)}{\alpha+\lambda\left(1-\alpha\right)}$$

Similarly, the quadratic approximation of (7) is:

$$\left[\beta^d-\Omega\eta^d\right]Es_{ed}s_{ev}+\left[\beta^v-\Omega\eta^v\right]E\left(s_{ev}\right)^2=\left(1-\Omega\right)Ecs_{ev} \tag{9}$$

Combining (8) and (9) gives the solution of Golberg and Tille:

$$\begin{aligned}
\beta^d &= \Omega\eta^d+\left(1-\Omega\right)\rho\left(c,s_{ed}\right) \\
\beta^v &= \Omega\eta^v+\left(1-\Omega\right)\rho\left(c,s_{ev}\right)
\end{aligned}$$

where and are the regression coefficients of c on s_{ed} and s_{ev}:

$$\begin{aligned}
\rho\left(c,s_{ed}\right) &= \frac{E\left(s_{ev}\right)^2Es_{ed}c-Es_{ed}s_{ev}Es_{ev}c}{E\left(s_{ed}\right)^2E\left(s_{ev}\right)^2-Es_{ed}s_{ev}Es_{ed}s_{ev}} \\
\rho\left(c,s_{ev}\right) &= \frac{E\left(s_{ed}\right)^2Es_{ev}c-Es_{ed}s_{ev}Es_{ed}c}{E\left(s_{ed}\right)^2E\left(s_{ev}\right)^2-Es_{ed}s_{ev}Es_{ed}s_{ev}}
\end{aligned}$$

Without VCP (8) implies:

$$\beta^d=\Omega\eta^d+\left(1-\Omega\right)\frac{Ecs_{ed}}{E\left(s_{ed}\right)^2}$$

The left-hand side of (5) is expanded as:

$$\begin{aligned}
&\exp\left[\left(1+\lambda\frac{1-\alpha}{\alpha}\right)\tilde{p}_i\right] E\exp\left[\begin{array}{c} d+\left[\beta^d-\lambda\left(\beta^d-\eta^d\right)\right]s_{ed} \\ +\left[\beta^v-\lambda\left(\beta^v-\eta^v\right)\right]s_{ev}+y \end{array}\right] \\
= \quad & \left(1+\lambda\frac{1-\alpha}{\alpha}\right)\tilde{p}_i + E\left[\begin{array}{c} d+\left[\beta^d-\lambda\left(\beta^d-\eta^d\right)\right]s_{ed} \\ +\left[\beta^v-\lambda\left(\beta^v-\eta^v\right)\right]s_{ev}+y \end{array}\right] \\
&+\frac{1}{2}\left[\begin{array}{c} \left(1+\lambda\frac{1-\alpha}{\alpha}\right)^2\left[\tilde{p}_i\right]^2 + E\left[\begin{array}{c} d+\left[\beta^d-\lambda\left(\beta^d-\eta^d\right)\right]s_{ed} \\ +\left[\beta^v-\lambda\left(\beta^v-\eta^v\right)\right]s_{ev}+y \end{array}\right]^2 \\ +2\left(1+\lambda\frac{1-\alpha}{\alpha}\right)\tilde{p}_i E\left[\begin{array}{c} d+\left[\beta^d-\lambda\left(\beta^d-\eta^d\right)\right]s_{ed} \\ +\left[\beta^v-\lambda\left(\beta^v-\eta^v\right)\right]s_{ev}+y \end{array}\right] \end{array}\right] \\
= \quad & \left(1+\lambda\frac{1-\alpha}{\alpha}\right)\tilde{p}_i \\
&+\frac{1}{2}\left[\left(1+\lambda\frac{1-\alpha}{\alpha}\right)^2\left[\tilde{p}_i\right]^2 + E\left[\begin{array}{c} d+\left[\beta^d-\lambda\left(\beta^d-\eta^d\right)\right]s_{ed} \\ +\left[\beta^v-\lambda\left(\beta^v-\eta^v\right)\right]s_{ev}+y \end{array}\right]^2\right]
\end{aligned}$$

The right-hand side of (5) is expanded as:

$$\begin{aligned}
&\exp\left[\lambda\frac{1-\alpha}{\alpha}\tilde{p}\right] E\exp\left[\begin{array}{c} d+w-\frac{\lambda}{\alpha}\left(\beta^d-\eta^d\right)s_{ed} \\ -\frac{\lambda}{\alpha}\left(\beta^v-\eta^v\right)s_{ev}+\frac{1}{\alpha}y \end{array}\right] \\
= \quad & \lambda\frac{1-\alpha}{\alpha}\tilde{p} + E\left[\begin{array}{c} d+w-\frac{\lambda}{\alpha}\left(\beta^d-\eta^d\right)s_{ed} \\ -\frac{\lambda}{\alpha}\left(\beta^v-\eta^v\right)s_{ev}+\frac{1}{\alpha}y \end{array}\right] \\
&+\frac{1}{2}\left[\begin{array}{c} \left(\lambda\frac{1-\alpha}{\alpha}\right)^2\left[\tilde{p}\right]^2 + E\left[\begin{array}{c} d+w-\frac{\lambda}{\alpha}\left(\beta^d-\eta^d\right)s_{ed} \\ -\frac{\lambda}{\alpha}\left(\beta^v-\eta^v\right)s_{ev}+\frac{1}{\alpha}y \end{array}\right]^2 \\ +2\lambda\frac{1-\alpha}{\alpha}\tilde{p}E\left[\begin{array}{c} d+w-\frac{\lambda}{\alpha}\left(\beta^d-\eta^d\right)s_{ed} \\ -\frac{\lambda}{\alpha}\left(\beta^v-\eta^v\right)s_{ev}+\frac{1}{\alpha}y \end{array}\right] \end{array}\right] \\
= \quad & \lambda\frac{1-\alpha}{\alpha}\tilde{p} + \frac{1}{2}\left[\left(\lambda\frac{1-\alpha}{\alpha}\right)^2\left[\tilde{p}\right]^2 + E\left[\begin{array}{c} d+w-\frac{\lambda}{\alpha}\left(\beta^d-\eta^d\right)s_{ed} \\ -\frac{\lambda}{\alpha}\left(\beta^v-\eta^v\right)s_{ev}+\frac{1}{\alpha}y \end{array}\right]^2\right]
\end{aligned}$$

The deviation of preset prices $\tilde{p}_i$ and $\tilde{p}$ are thus second order and can be dropped from the squared terms, so (5) becomes:

$$
\begin{aligned}
&\left(1+\lambda\frac{1-\alpha}{\alpha}\right)\tilde{p}_i+\frac{1}{2}E\left[\begin{array}{c} d+\left[\beta^d-\lambda\left(\beta^d-\eta^d\right)\right]s_{ed} \\ +\left[\beta^v-\lambda\left(\beta^v-\eta^v\right)\right]s_{ev}+y \end{array}\right]^2 \\
= \;& \lambda\frac{1-\alpha}{\alpha}\tilde{p}+\frac{1}{2}E\left[\begin{array}{c} d+w-\frac{\lambda}{\alpha}\left(\beta^d-\eta^d\right)s_{ed} \\ -\frac{\lambda}{\alpha}\left(\beta^v-\eta^v\right)s_{ev}+\frac{1}{\alpha}y \end{array}\right]^2
\end{aligned}
$$

Expansion of profits

We can rewrite (3) as:

$$
\begin{aligned}
\Pi \;=\;& \bar{D}\left(\bar{P}_i\right)^{1-\lambda}\left(\bar{P}\right)^{\lambda}\bar{Y}\exp\left[\left(1-\lambda\right)\tilde{p}_i+\lambda\tilde{p}\right]E\left[\exp\left[\begin{array}{c} d+\left[\beta^d-\lambda\left(\beta^d-\eta^d\right)\right]s_{ed} \\ +\left[\beta^v-\lambda\left(\beta^v-\eta^v\right)\right]s_{ev}+y \end{array}\right]\right] \\
&-\bar{D}\bar{W}\left(\alpha\right)^{\frac{1}{\alpha}}\left(\bar{Y}\right)^{\frac{1}{\alpha}}\left(\bar{P}_i\right)^{-\frac{\lambda}{\alpha}}\left(\bar{P}\right)^{\frac{\lambda}{\alpha}}\exp\left[-\frac{\lambda}{\alpha}\tilde{p}_i+\frac{\lambda}{\alpha}\tilde{p}\right]E\left[\exp\left[\begin{array}{c} d+w-\frac{\lambda}{\alpha}\left(\beta^d-\eta^d\right)s_{ed} \\ -\frac{\lambda}{\alpha}\left(\beta^v-\eta^v\right)s_{ev}+\frac{1}{\alpha}y \end{array}\right]\right]
\end{aligned}
$$

In the steady state we have (using the solution for $\bar{P}_i$):

$$
\begin{aligned}
\bar{\Pi} \;=\;& \left(\bar{P}_i\right)^{-\frac{\lambda}{\alpha}}\bar{D}\left(\bar{P}\right)^{\lambda}\bar{Y}\left[\left(\bar{P}_i\right)^{1+\lambda\frac{1-\alpha}{\alpha}}-\bar{W}\left(\alpha\right)^{\frac{1}{\alpha}}\left(\bar{Y}\right)^{\frac{1-\alpha}{\alpha}}\left(\bar{P}\right)^{\lambda\frac{1-\alpha}{\alpha}}\right] \\
=\;& \frac{\alpha+\lambda\left(1-\alpha\right)}{\alpha\left(\lambda-1\right)}\left(\bar{P}_i\right)^{-\frac{\lambda}{\alpha}}\bar{D}\left(\alpha\right)^{\frac{1}{\alpha}}\bar{W}\left(\bar{Y}\right)^{\frac{1}{\alpha}}\left(\bar{P}\right)^{\frac{\lambda}{\alpha}}
\end{aligned}
$$

Therefore, we write:

$$
\begin{aligned}
\frac{\Pi}{\bar{\Pi}} \;=\;& \frac{\lambda}{\alpha+\lambda\left(1-\alpha\right)}\exp\left[\left(1-\lambda\right)\tilde{p}_i+\lambda\tilde{p}\right]E\left[\exp\left[\begin{array}{c} d+\left[\beta^d-\lambda\left(\beta^d-\eta^d\right)\right]s_{ed} \\ +\left[\beta^v-\lambda\left(\beta^v-\eta^v\right)\right]s_{ev}+y \end{array}\right]\right] \\
&-\frac{\alpha\left(\lambda-1\right)}{\alpha+\lambda\left(1-\alpha\right)}\exp\left[-\frac{\lambda}{\alpha}\tilde{p}_i+\frac{\lambda}{\alpha}\tilde{p}\right]E\left[\exp\left[\begin{array}{c} d+w-\frac{\lambda}{\alpha}\left(\beta^d-\eta^d\right)s_{ed} \\ -\frac{\lambda}{\alpha}\left(\beta^v-\eta^v\right)s_{ev}+\frac{1}{\alpha}y \end{array}\right]\right]
\end{aligned} \tag{10}
$$

A quadratic approximation of the first term in (10) is (recall that $\tilde{p}_i$ and $\tilde{p}$ are second order):

$$\exp\left[(1-\lambda)\tilde{p}_i + \lambda\tilde{p}\right] E\left[\exp\left[\begin{array}{c} d + \left[\beta^d - \lambda\left(\beta^d - \eta^d\right)\right] s_{ed} \\ + \left[\beta^v - \lambda\left(\beta^v - \eta^v\right)\right] s_{ev} + y \end{array}\right]\right]$$

$$= \left[(1-\lambda)\tilde{p}_i + \lambda\tilde{p}\right] + E\left[\begin{array}{c} d + \left[\beta^d - \lambda\left(\beta^d - \eta^d\right)\right] s_{ed} \\ + \left[\beta^v - \lambda\left(\beta^v - \eta^v\right)\right] s_{ev} + y \end{array}\right]$$

$$+\frac{1}{2}\left[\begin{array}{c} \left[(1-\lambda)\tilde{p}_i + \lambda\tilde{p}\right]^2 + E\left[\begin{array}{c} d + \left[\beta^d - \lambda\left(\beta^d - \eta^d\right)\right] s_{ed} \\ + \left[\beta^v - \lambda\left(\beta^v - \eta^v\right)\right] s_{ev} + y \end{array}\right]^2 \\ +2\left[(1-\lambda)\tilde{p}_i + \lambda\tilde{p}\right] E\left[\begin{array}{c} d + \left[\beta^d - \lambda\left(\beta^d - \eta^d\right)\right] s_{ed} \\ + \left[\beta^v - \lambda\left(\beta^v - \eta^v\right)\right] s_{ev} + y \end{array}\right] \end{array}\right]$$

$$= (1-\lambda)\tilde{p}_i + \lambda\tilde{p} + \frac{1}{2}E\left[\begin{array}{c} d + \left[\beta^d - \lambda\left(\beta^d - \eta^d\right)\right] s_{ed} \\ + \left[\beta^v - \lambda\left(\beta^v - \eta^v\right)\right] s_{ev} + y \end{array}\right]^2$$

A quadratic approximation of the second term in (10) is:

$$\exp\left[-\frac{\lambda}{\alpha}\tilde{p}_i + \frac{\lambda}{\alpha}\tilde{p}\right] E\left[\exp\left[\begin{array}{c} d + w - \frac{\lambda}{\alpha}\left(\beta^d - \eta^d\right) s_{ed} \\ -\frac{\lambda}{\alpha}\left(\beta^v - \eta^v\right) s_{ev} + \frac{1}{\alpha}y \end{array}\right]\right]$$

$$= -\frac{\lambda}{\alpha}\tilde{p}_i + \frac{\lambda}{\alpha}\tilde{p} + \frac{1}{2}E\left[\begin{array}{c} d + w - \frac{\lambda}{\alpha}\left(\beta^d - \eta^d\right) s_{ed} \\ -\frac{\lambda}{\alpha}\left(\beta^v - \eta^v\right) s_{ev} + \frac{1}{\alpha}y \end{array}\right]^2$$

(10) thus becomes:

$$\frac{\Pi}{\bar{\bar{\Pi}}} = \frac{\lambda}{\alpha + \lambda(1-\alpha)}\tilde{p} + \frac{\lambda}{\alpha + \lambda(1-\alpha)}\frac{1}{2}E\left[\begin{array}{c} d + \left[\beta^d - \lambda\left(\beta^d - \eta^d\right)\right] s_{ed} \\ + \left[\beta^v - \lambda\left(\beta^v - \eta^v\right)\right] s_{ev} + y \end{array}\right]^2$$
$$-\frac{\alpha(\lambda-1)}{\alpha + \lambda(1-\alpha)}\frac{1}{2}E\left[\begin{array}{c} d + w - \frac{\lambda}{\alpha}\left(\beta^d - \eta^d\right) s_{ed} \\ -\frac{\lambda}{\alpha}\left(\beta^v - \eta^v\right) s_{ev} + \frac{1}{\alpha}y \end{array}\right]^2$$

Notice that this is completely independent from $\tilde{p}_i$, and a quadratic function of the invoicing shares. For instance, if the only choices are LCP and PCP then:

$$\frac{\Pi}{\bar{\bar{\Pi}}} = \frac{\lambda}{\alpha + \lambda(1-\alpha)}\tilde{p} + \frac{1}{2}\frac{\lambda}{\alpha + \lambda(1-\alpha)}E\left[d + \left[\beta^d - \lambda\left(\beta^d - \eta^d\right)\right] s_{ed} + y\right]^2$$
$$-\frac{1}{2}\frac{\alpha(\lambda-1)}{\alpha + \lambda(1-\alpha)}E\left[d + w - \frac{\lambda}{\alpha}\left(\beta^d - \eta^d\right) s_{ed} + \frac{1}{\alpha}y\right]^2$$

This is maximized at:

$$\beta^d = \Omega\eta^d + (1-\Omega)\frac{Ecs_{ed}}{E(s_{ed})^2}$$

i.e. the Goldberg-Tille solution. In addition, the second derivative with respect to β^d is:

$$\begin{aligned}
& \frac{\lambda(\lambda-1)}{\alpha+\lambda(1-\alpha)}\left[\lambda-1-\frac{\lambda}{\alpha}\right]E(s_{ed})^2 \\
= & \frac{\lambda(\lambda-1)}{\alpha+\lambda(1-\alpha)}\frac{(\lambda-1)\alpha-\lambda}{\alpha}E(s_{ed})^2 \\
= & -\frac{\lambda(\lambda-1)}{\alpha}E(s_{ed})^2 < 0
\end{aligned}$$

So the function is clearly concave, and thus the full LCP and full PCP points lead lower profits.

Herfindahl-Hirshman index

The Herfindahl-Hirshman Index for product-destination level:

$$HH_{f,p,d,t} = \sqrt{\left(ShareSales^{LCP}_{f,p,d,t}\right)^2 + \left(ShareSales^{PCP}_{f,p,d,t}\right)^2 + \left(ShareSales^{VCP}_{f,p,d,t}\right)^2}$$

or for destination level:

$$HH_{f,d,t} = \sqrt{\left(ShareSales^{LCP}_{f,d,t}\right)^2 + \left(ShareSales^{PCP}_{f,d,t}\right)^2 + \left(ShareSales^{VCP}_{f,d,t}\right)^2}$$