Differences in Learning: A Study on Learning-by-Exporting Across Heterogeneous Firms

Senior Honors Thesis

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1. Introduction

This paper studies firm efficiency in the context of learning by exporting and how this measure of firm performance is affected by credit constraints. Learning by Exporting (LBE) describes how individual firms improve their performance by accessing export markets. Exporting improves firm performance through two pathways: buyer-seller relationships and increased competition. The first, buyer-seller relationships, improves firm performance because exporting firms come into contact with overseas buyers, from whose knowledge stock exporters can learn innovative production methods, receive general technical assistance, or get information on demand from final consumers that allows them to adapt production accordingly. The second, increased competition, increases firm performance by tossing the exporting firm into an international market that is much more competitive than the domestic one, forcing them to improve performance or exit the market. This paper aims to add to the literature on this subject by studying LBE in the context of credit constraints. Do firm-level credit constraints affect who exports and how much they learn?

LBE generates significant research interest because the policy implications are large. In the presence of large LBE effects, firms could achieve long-run improvements in productivity and output by accessing export markets. Firm performance is a paramount concern for policy-makers in developing countries attempting to replicate the success of the Asian Tiger countries, but LBE is a concern for more developed countries as well. Exports continue to comprise a greater and greater share of world GDP, so any pathway that could potentially improve firm performance and export levels deserves attention.

1.2 Background of Indonesia (for full background see Appendix)

I study LBE in the context of Indonesia. For one, the current literature is mixed but suggests that LBE, when it does exist, is stronger in developing countries than developed. Furthermore, after being under a military dictatorship for several decades, Indonesia began a period of strong growth in the 80s and early 90s as it undertook a series of liberalizing reforms, many focused on the financial sector. Finally, a number of significant exogenous events, primarily the 1997 Asian Financial Crisis and Indonesia's joining of the WTO, occurred during the middle of the data set that will be used. These exogenous events provide opportunities for potential before-and-after empirical analysis of financial constraints that would be difficult to replicate otherwise.

The Asian Financial Crisis, triggered initially by the Thai government's decision to unpeg the bhat and allow it to float, manifested itself in different ways across Southeast Asia, but it escalated arguably most fiercely in Indonesia, where various lingering structural issues from its time spent under a military dictatorship exacerbated the crisis. Five key characteristics of the banking system pre-crisis stood out. There was a rapid rate of credit growth, a proliferation of a large number of poorly capitalized private banks, increased competition among these banks for customers, significant over-exposure of banks to single customers and affiliated customers, and a broad lack of adequate prudential standards and safeguards. Once the crisis began in earnest it escalated quickly. Several broad aspects of the crisis were critical in each country, among them the dumping of Asian assets, free-falling exchange rates, and poor access to new credit. These were all especially acute in Indonesia. The response from the IMF and the Indonesian government was the largest intervention in the banking sector ever until the 2008 Great Recession. Huge cash injections from the government and IMF loans were needed in order to

recapitalize the banking sector and prevent a full-scale collapse, followed by a period of de-levering and reform of the banks left. Coming out of the crisis and the reform that it brought, it becomes important yet difficult to understand what affects the crisis had on Indonesian firms and their lending environment, especially since the survey data being used straddles the crisis with response years of 1996 and 2006. With a credit crunch narrowly defined as demand outpacing supply, there was little evidence of this on the aggregate level due to depressed credit demand and a rise in the loan supply following the recapitalizing of the banks post-crisis. However, there was significant uncertainty about the future coming out of the crisis, both political and legal, creating a lack of investment demand, and high rates also prompted some to seek alternative financing, as seen in the expansion of private sector bond issues. Finally, continued problems of asymmetric information has still made banks focus primarily on preferred debtors or those with known track records, meaning many new debtors are essentially barred from credit access.

1.3 Procedural Overview

To answer these questions, an empirical methodology based on an instrumental variable approach will be employed. The Indonesian government gathers large panel survey data of domestic manufacturing firms with over twenty employees asking them about their business conditions, such as the number of employees and the capital level. This data will be used to categorize and produce matched firms based on possible constraints together with a time dimension to address causality and endogeneity concerns. The two primary measures of whether a firm is constrained or not will be its levels of debt and capital. A consistent relationship between firm performance and exporting will be looked for across different levels of debt and capital in order to hopefully make some causal judgment about learning by exporting in the presence of constraints.

This paper is organized as follows. In Section 2, we review the current literature on the relevant areas. We then discuss the empirical model in Section 3. Section 4 gives an overview of the data used and covers the data cleaning and manipulation necessary to run the regressions and analysis. Section 5 covers the results, and Section 6 concludes.

2. Literature Review

This paper examines whether LBE varies across constrained and unconstrained firms, but before we can do so, the existence of LBE effects need to be established in the real world. Numerous studies in the past two decades have established conclusively that exporters outperform non-exporters on a variety of measures such as labor productivity, but there has been debate over whether this is a sign of LBE or just self-selection.

Initial studies found little evidence for LBE, instead concluding that the higher performance of exporters was due to self-selection. A wide variety of developed and still-developing countries were studied. Chung and Roberts (2000) studied the South Korean and Taiwanese cases, examining levels of total factor productivity and the decision to participate in the export market. In their analysis, the Taiwanese case exhibited strong support for self-selection models, while in Korea, other unidentified factors seemed to be more important in the export decision since there was little change in productivity differentials before or after entry into export markets. Bernard and Jensen (1999) addressed this debate between learning and self-selection and found little support for the learning hypothesis in US manufacturing firms. They found additional support that good firms do become exporters, finding higher growth rates and levels of success measures ex-ante for exporters versus non. However, while exporting seemed to aid employment growth and probability of survival, productivity and wage growth were not superior, particularly over a long time span. Finally, Clerides, Lach, Tybout (1998) studied three semi-industrialized economies, Colombia, Mexico, and Morocco, and found once again that

relatively more efficient firms became exporters, while previous export market participation did not affect their costs. The relative difference in development between exporting firms and their end-markets may be of significance, so my paper can contribute to this research by searching for LBE in Indonesia, a country less developed than the semi-industrialized and industrialized countries studied in the papers mentioned above. Therefore, even if variation across constrained and unconstrained firms is not found, this paper will be able to add to the literature by looking for evidence of LBE in an under-developed country.

On the other hand, however, some studies have examined LBE in underdeveloped countries, and their results argue that the difference in development between exporter and the end-market is the most influential factor in determining the presence and size of LBE. De Loecker (2007) studied Slovenian firms coming out of the transition from planned to market economy, and found that new exporters do become more productive, and that this lead on non-exporters widens over time. Furthermore, he found that these gains are higher for firms that export towards high income regions. In a study of Indonesian manufacturing establishments from 1990 to 1996, Blalock, Gertler (2004) estimated production functions using panel dataset of manufacturing firms and did indeed find a productivity jump of about three to five percent following the initiation of exporting. They attributed this to the low level of development in Indonesia, which made the differential in technical expertise between Indonesian producer and oversea buyer much greater and therefore the opportunity for learning much higher. Van Biesebroeck (2005) studied firms in several African countries and found the same, noting that scale economies were a key component of this increase, particularly relevant for this paper since he also found scale economies were hampered by credit constraints in the domestic market. These results were also replicated in a developed context. Lileeva and Trefler (2010) studied exporters in a developed country, Canada, and came to similar conclusions. While for most firms

that decided to export to the US after a cut in tariffs saw no productivity gains, they found that the lower-productivity firms that began exporting not only increased labor productivity but also increased product innovation and adoption rates of advanced manufacturing techniques. This paper aims to add to this body of evidence studying LBE, and to extend Biesebroeck's (2005) line of study on credit constraints. By examining the presence of credit constraints across firms in Indonesia, this paper hopes to find evidence that domestic constraints affect the size of LBE on firm performance.

Identifying credit constraints on individual firms is another crucial problem for this paper. What does it mean to be constrained in Indonesia, and how can a systematic procedure for determining the presence and relative level of the constraint be applied to all the firms in the dataset? Even when looking at detailed firm-level data, it is difficult to determine who wanted a loan and could not get one from those that simply did not want one in the first place. Fortunately, over the past decade firm-level responses to constraints such as inadequate credit have become a hot topic for research, and there is a healthy amount of literature in this field from which we will draw much of the methodology of our own model. First, there is the problem of identifying who is and is not constrained. Arellano, Bai and Zhang (2012) studied less financially developed countries, and found that in these countries, small firms grow fast and use less debt financing than large firms. This result will be important later on when this paper uses firm-level measures such as debt levels to determine if a firm is constrained or not. In addition, two recent papers established strong evidence for a strong causal relationship between firm-level finance and export levels. Manova (2008) showed how loosening credit constraints increased exports, especially in financially vulnerable sectors with higher credit demands or fewer assets. Manova (2013) also studied financial market imperfections and found that these frictions limited total output, firm entry, and overall export sales. This paper aims to add to this literature by

identifying similar types of constraints on firms, but aims to expand its line of inquiry by studying not only how these constraints affect measures like export levels, but how these constraints affect the size of LBE.

3. Empirical Model

3.1 Overview

The benchmark equation used for the regression analysis is as follows:

$$Y_{ft} = \beta_0 + \beta_1 e_{ft} + \beta_2 d_{f(t-1)} + \beta_3 k_{f(t-1)} + \beta_4 p_{f(t-1)} + dummy\ variables + u$$

Each variable is reported for a given observation, an observation here being the survey responses from one specific manufacturing firm f in a given time period t. Because the data only reports results for 1996 and 2006, 2006 will be defined as time period t and 1996 will be time period *t-1.* Y_{ft} is the dependent variable and it represents a measure of performance for firm f in time t. The firm export decision is e_{ft}, a {1, 0} binary variable that takes a {1} if the firm exports, {0} if it does not. All other explanatory variables are for time *t-1.* The next explanatory variable, $d_{f(t-1)}$, is a proxy variable for debt, which in this case is the size of the firm's annual interest payments. $k_{f(t-1)}$ is the firm's capital stock, and $p_{f(t-1)}$ is their labor productivity. The dummy variables are location by province as well as specific firm industry.

The 1996 versus 2006 time dimension is critical. If a cross-sectional regression looked at just one year, there would be serious problems with causality. The measures of firm performance and export decision are both 2006 variables, and with both independent and dependent variables from the same time period, it would be virtually impossible to make any sort of causal claim about what was causing what. To counter this, the other explanatory variables will be lagged.

Regressions will all be run as though firm performance and the export decision were ’06 outcomes based on ’96 variables. Although this opens up other opportunities for error that will be explored later, on the whole it is worthwhile because in this circumstance, the time dimension is necessary before making any sort of causal claims. For this reason, the ‘Y’ variable, the measure of firm performance, and the export decision will always be 2006 variables, and the explanatory variables will all be lagged to 1996.

The β coefficients will be the indication of the effect the explanatory variables have on firm performance. Capital and debt levels will be indicators of possible constraints, and they also provide a useful comparison tool to see how relatively important the export decision is. 1996 labor productivity needs to be included since firms that had high productivity in ’96 will be much more likely to do so in ’06, so this effect needs to be accounted for. However, the most important coefficient is β_1 , the coefficient on the export decision. The experiment is trying to determine if firm-level constraints affect who exports and how much they export, and the coefficient on the export decision will be the primary means to see if this LBE effect is occurring. If it is zero or negative, then the decision to export clearly has had adverse effects on firm performance. However, if it is positive, then this would be support for the claim that exporting improves firm performance.

3.2 Interaction Terms and Firm Constraints

This paper is looking for a consistent pattern between exporting and productivity that might indicate the presence of constraints, but the benchmark regression outlined above cannot alone yield evidence for constraints. To address this, a second main regression was created, a modified version of the equation above except this time, interaction terms were added.

$$Y_{ft} = \beta_0 + \beta_1 e_{ft} + \beta_2 (e_{ft} * d_{ft}) + \beta_3 (e_{ft} * k_{ft}) + \beta_4 d_{f(t-1)} + \beta_5 k_{f(t-1)} + \beta_6 p_{f(t-1)} + dummy\ variables + u$$

All variables here are the same as earlier, except for the presence of the two interaction terms. The first, (e*d) is an interaction between the export decision and the debt proxy, the second, (e*k), between the export decision and capital. In order to interact continuous variables with a binary one, capital and debt proxy were translated into a binary variable {1, 0}, indicating {high, low} debt/capital levels. 'High' debt/capital was defined as above the industry median. These interaction terms are what will indicate the appearance or nonappearance of constraints. Well-capitalized firms with easy access to financing presumably face fewer constraints than smaller, less well-off firms. For these unconstrained firms, all they have to decide when choosing to export is if doing so is profitable. However, constrained firms might face additional costs that need to be accounted for before they choose to export. For this reason, their gain from exporting must be higher to overcome this hurdle. If this is the case, it would show up as a highly negative coefficient on the interaction terms. For instance, a large negative coefficient on the export-capital interaction would indicate that exporting improves firm performance more when the firm's capital stock is small than when it is large. This would suggest that firms with low capital face higher costs than well-capitalized firms, and so when they decide to export their marginal gain from doing so must be higher to overcome those additional costs.

3.3 The Problem of Endogeneity Bias and Instrumental Variables

Endogeneity presents one of the most frequent issues in statistical analyses of this kind, so adequately accounting for this problem is key for meaningful results. Without addressing endogeneity, no causal claims can be made, only correlation. There are several sources of concern in this experiment when it comes to endogeneity bias. For one, there are the problems

raised by the large time gap in the data. The span between 1996 and 2006 is so large that there were numerous events such as the reforms coming out of the Asian Financial Crisis that could have plausibly caused a productivity shock within that time. These could have caused or limited exporting, so the assumption that the unobserved variation is randomly distributed, $E[u_i|export\ decision] = 0$, is almost certainly wrong. The second problem is the reciprocal interaction between exporting and productivity. Up until now, the experiment has assumed more or less that exporting affects productivity, not the other way around. However, firms that are experiencing productivity growth might also lead to export growth, so this needs to be addressed before causal claims can be made.

In order to address these problems, instrumental variable estimation will be used. In order to do this, first a new probit regression will be introduced with an added variable as an instrument, a change in tariffs. This probit will yield a probability of exporting in 2006 based on 1996 variables, a p-hat value which will replace the export decision in the two main regressions. Using an estimated probability of exporting, all based on lagged variables from 1996, will address the time and productivity shock problems. Furthermore, the addition of the tariff variable as an instrument will address the problem of the interaction between productivity and exporting. The new probit equation is as follows:

$$Y_{ft} = \Phi(\beta_0 + \beta_1 k_{f(t-1)} + \beta_2 d_{f(t-1)} + \beta_3 p_{f(t-1)} + \beta_4 t_{f(t-1)} + dummy\ variables + u)$$

The ‘Y’ in this equation is no longer an indicator of firm performance, but is the 2006 export decision. ‘k’, ‘d’, and ‘p’ are all ’96 variables, capital, loan interest, and productivity, same as before. ‘t’ is a variable measuring the ’96 change in tariff, and it will be the instrument. The change in tariff captures a change in incentive that might induce firms to export or export

less. Since Indonesia joined the WTO in 1997, there was a dramatic and widespread lowering of tariffs that can be taken as plausibly exogenous and uncorrelated with the dependent variable of firm productivity. Therefore, since the tariff affects the probability of exporting but does not affect how much a firm might learn from exporting, it fulfills the exclusion restriction for an instrument.

The tariff change as instrument is not foolproof. The main concern is that the general lowering of the tariff might increase revenue or labor productivity which might then be mistaken as LBE effects. Once costs are lowered by a decreased tariff, a firm may export more, increasing sales, or become more productive through economies of scale that come with expansion. This effect cannot easily be disentangled from the data, but at least theoretically, this effect would be less pervasive than the endogeneity problems that the tariff replaces. Because of this, the IV results will need to be interpreted with this in mind, but they are less biased than the OLS regression that they replace.

The instrument variable estimation will be implemented as follows. The ’96 variables mentioned above, including the new tariff variable, will be regressed on the ‘06 export decision. Using the prediction function in STATA, this will then yield a predicted probability of exporting in ’06 for each firm. Next, this new p-hat probability will be used in both original benchmark regressions to instrument each instance of the export decision variable, including the interaction terms between the export decision and the hi/lo capital/debt levels.

3.4 Probit vs. LPM: Problems of Binomial Regression

The regression just described in Section 3.3, done in order to yield a predicted probability of exporting, requires a different method of regression than was used for the main two

regressions, and so this section will briefly address the reasoning behind choosing to do a probit for this process.

Because the dependent variable is a binary variable, the regression could be done with a number of methods, including the Linear Probability Model or Probit Regression. The Linear Probability Model is a relatively simple application of the standard multiple regression model to a binary dependent variable. It assumes that the response variable is linear within the chosen parameters. Probit regression, on the other hand, uses the cumulative distribution function of the standard normal distribution in order to generate the probability that a specific observation will equal one, whatever that may denote within the model.

There are several drawbacks with the LPM that Probit attempts to address. One of the most important disadvantages of the LPM is that the fitted probabilities it generates can be less than zero or greater than one. This will not work for this experiment because it does not make sense for the p-hat value, a predicted probability of exporting, to be greater than one, as was obtained when the benchmark regressions were run in STATA. In addition, for the purpose of the IV regression, the p-hat value needs to replace the {1, 0} binary export decision in the two main regressions, so again, a value greater than one does not work. Another drawback of the LPM is that the partial effects of any explanatory variable in a LPM is constant.

Probit seeks to rectify these faults. It takes a nonlinear function G, in this case the standard normal cumulative distribution function, which is in turn an integral of the standard normal cumulative density function, to yield a value between zero and one. For one, this method is an improvement over the LPM because values are limited between zero and one, an important consideration since this value is taken as a probability of an event occurring. A second improvement is that the partial effects of each independent variable can diminish as opposed to

being held constant. However, the primary cost of these improvements is that the Probit regression is more difficult to interpret. Magnitudes of coefficients by themselves are not entirely useful since the independent variable in question typically does not have a well-defined unit of measurement. The sign of the coefficient can be used, but magnitude has to be determined using partial effects calculations that utilize a common scale factor derived from the regression equation in order to compare apples to apples. However, since the probit is being performed to yield an intermediary value, the p-hat value for the IV regression, ultimately this problem of interpretation is minimal. For these reasons of aiding and streamlining interpretation, the 1st stage regression of the IV estimation will use a probit regression, not the LPM.

4. Data

4.1 Source Overview

The primary source of this data is a series of survey data generated by the Indonesian government. The data retrieved is from a firm-level survey given to the population of manufacturing plants in Indonesia with at least twenty employees. The survey data comes in two sets: one given in 1996, and again in 2006. The survey was identical for the most part for each year, but several significant variables were only asked in the 2006 edition. In addition, several firms only reported in one year, either because they went out of business, came into existence after 1996, or reporting issues.

The Asian Financial Crisis of 1997 provides a unique look into the effect firm level finances have on accessing international markets. Being one of the hardest hit countries, Indonesia went through major economic, social, and financial changes as a result. Without a concrete way to quantify legislative and financial policy, any policy measures that are introduced

into the model will have to be accounted for by dummy variables, IV and other fixed effect techniques.

4.2 Dummy Variable Generation

To control for fixed effects, dummy variables are key. There were two key dummy variables included in the benchmark regressions. Once created, each was included with each subsequent regression.

Different industries have intrinsically different capital requirements and other industry-specific concerns that affect their debt and capital levels, so industry dummy variables were one of the dummies necessary. ISIC codes, the method by which each specific industry and its nested subcategories are specified and reported, changed slightly from 1996 to 2006, with several codes changing and new ones being added or replaced. To fill in this hole, firms that existed in both 1996 and 2006 were used to record any potential changes in their ISIC codes within that time. These changes were catalogued in a new variable and mapped over to the other firms that did not survive, but shared an ISIC code with the signal firm. Each of these individual ISIC codes was then converted into a binary "yes it belongs to this industry, no it does not belong to this industry", variable so that it could be used in the regression analysis.

A location dummy based off of province codes was also included. Lending frequency exhibits location-specific variation, so the province variable in the survey captures these local differences in economies, interest rates, and other factors like personal relations. These factors can be highly influential in a country like Indonesia where personal relations such as local or family connections can determine who gets access to what loans and at what rates. Like the industry codes, the individual province code were converted into a series of binary dummy variables.

4.3 Independent and Dependent Variable Generation

First, to improve the precision and aid interpretation of the results, all data points that were regressed except for the binary variables (the export decision and the dummies) were converted into logs. For whatever reason, be it Indonesia business idiosyncrasies or recording mistakes, many responses were negative or zero and could not be converted to log form. For instance, many firms reported 'zero' in response to loan interest paid, and some capital stock responses were actually negative. These observations were dropped. This process was the primary reason many responses from the survey were lost.

However, the most significant variables were the main independent variables: capital, debt, and the export decision, and the dependent variables measuring firm performance: labor productivity and total revenue. The capital measure was a specific question on the Indonesian government survey, so that statistic is in log form straight from the government data. The export decision was also straight from the data, a simple binary yes or no answer regarding the firm's choice to export. Labor productivity was measured as a fraction of the firm's total sales divided by their number of employees. This is also in log form. The total sales statistic is also in log form in the data.

The interaction terms were generated as follows. Interest payments and capital levels needed to be interacted with the export decision, a binary variable, so they were converted into binary variables of their own. The median level of capital and interest payments were found for each industry, and then each firm was compared to this value. If their capital/interest payments were above the median for their industry, that firm was assigned a {1}, for {high capital/debt}. Below the median was then assigned a value of {0}. This binary result was then multiplied by the export decision for the firm, to achieve a final binary interaction term. For instance, an

example firm that exported and had high capital levels would have a {1} for the export decision, a {1} for the capital stock, and so a {1} for the export decision/capital interaction term.

The debt measure was trickier since it was not reported in the survey. Substantial measures were taken to approximate debt, since it is one of the key explanatory variables. For whatever reason, no debt numbers were taken from the Indonesian firms, and the only suitable proxy found existing in the data was annual loan interest payments. This is problematic for a number of reasons, not least of which is that different firms could obviously have drastically different debt loads but pay the same interest based on different prevailing interest rates. While in the initial regressions logged interest payments did perform admirably and behaved much as could be expected, increasing as exports increased, decreasing as exports decreased, generating another reasonable proxy for debt was still critical. This was arrived at by regression analysis and prediction function to generate an imputed debt level for each firm. The regression equation was as follows:

$$Y_{l(t-1)} = \beta_0 + \beta_1 W_{f(t-1)} + \beta_2 k_{f(t-1)} + \beta_3 E_{f(t-1)} + ind.dummy + loc.dummy + u$$

Where 'Y_l' is the 1996 modified liabilities level, 'W' is whether the firm is foreign owned or not, 'k' is log(capital) level taken directly from the survey, and 'E' is log(employment). 'Modified liabilities' refers to the data cleaning that had to be performed on the variable. In the survey, liabilities were misleadingly reported as being equal to assets at all times, so initial equity and end-year added equity were subtracted from it to reach a more realistic number that could be used to impute debt. Liabilities were also only reported for 1996, so imputed debt was only based off of 1996 liability levels.

An OLS regression was run using this equation, and then the prediction function in Stata was used to generate a new imputed debt level for each firm. However, in the end, this empirical measure was not used to replace interest payments as the proxy for debt because there was not compelling evidence that it was a more accurate proxy. The imputed debt correlated positively and strongly with interest payments, as well as maintained the previous relationships with export levels, but the relationship between interest payments and the dependent variables was still stronger. So in the end, imputed debt did not replace interest payments as a proxy for debt, but it did serve as corroboration of the accuracy of the interest payments since the two correlated so well.

A summary table of the most relevant variables is below:

	variance	mean	std. dev.	max.	min.
capital	4.73	14.3	2.17	22.63	5.2
loan interest	6.53	11.78	2.56	17.98	2.71
export sales	4.39	21.08	2.1	26.01	14.27
labor productivity	4.87	12.47	2.21	20.37	6.71

5 Results

5.1 1st Stage Probit

1st Stage Probit Regression - Export Decision

***, **, * indicate significance at the 1%, 5%, and 10% level

2006 Export Decision	Coeffecient	Std. Error	P>|z|	Observations
Lagged Capital	**0.15*** **	0.02	0.000	3471
Lagged Loan Interest	**0.12*** **	0.02	0.000	
Lagged Labor Prod.	**0.08*** **	0.02	0.000	
Tariff Change	**-0.14***	0.09	0.104	

Above are the results from the 1st stage probit regression that was done to generate a p-hat value, the predicted probability of exporting, that is the instrument for the endogenous variable 'e', the export decision. Overall, the signs of the coefficients and their significances suggest that the probit worked well for this purpose. By the logic of the LBE that we are looking for, capital, loan interest, and labor productivity all should have coefficients greater than zero, and this is exactly the result the regression yielded, at high significance. There are several pathways through which each of these variables might increase the probability of exporting, such as more access to financing allowing access to broader markets, but the main takeaway is that more capital, more debt, and more productivity interacted with the probability of exporting as expected. The tariff variable is slightly different but also behaved as expected, another good sign for the instrument variable process. As tariffs decrease, they incentivize firms to export by lowering costs, so this should be an inverse relationship. The coefficient should be less than zero, and this is indeed what is seen in the results. With all the coefficients behaving as expected and all statistically significant, the 1st stage probit succeeded in yielding a p-hat value that is a defensible replacement for the export decision.

5.2 OLS Regression Results

The OLS regressions are the first results of the paper. These tables were generated by running the two main regressions, the first without interaction terms, and the second with. Each was run on two measures of firm performance: total revenue and labor productivity. The benchmark of the paper, the regression without the interactions, took the results below:

Table One: OLS w/o Interactions

***, **, * indicate significance at the 1%, 5%, and 10% level

Labor Productivity	Coeffecient	Std. Error	P>|z|	Observations
Export Decision	**0.36*** **	0.08	0.000	2279
Lagged Capital	**0.13*** **	0.02	0.000	
Lagged Loan Interest	**0.06*** **	0.02	0.003	
Lagged Labor Prod.	**0.48*** **	0.02	0.000	

***, **, * indicate significance at the 1%, 5%, and 10% level

Total Revenue	Coeffecient	Std. Error	P>|z|	Observations
Export Decision	**0.60*** **	0.06	0.000	4054
Lagged Capital	**0.30*** **	0.02	0.000	
Lagged Loan Interest	**0.19*** **	0.01	0.000	
Lagged Labor Prod.	**0.17*** **	0.02	0.000	

The first thing to note is the size and significance on the export decision coefficient, the primary area of concern for interpreting our results. For both revenue and productivity, this coefficient is large and highly significant. In fact, in the revenue regression, the export decision had a larger effect than all other variables, larger than capital, loan interest, and productivity, suggesting that the export decision had more of an influence on firm performance than all three. This result is in line with the story that the decision to export causes increases in revenue and, most critically for finding evidence of LBE, increases in productivity. Endogeneity concerns mean IV regressions are still needed, but initial results indicate the presence of LBE for firms in Indonesia.

The second aspect of these results to note is the positive coefficients on capital and loan interest, all at high significance as well. This was expected, as capital and debt could cause and

be caused by increasing revenues and productivity for any number of reasons. However, these capital and loan interest results are not enough on their own to indicate evidence that LBE varies across constrained and unconstrained firms. Finding evidence for constraints which affect who exports and how much they learn will require the interaction terms. These results are given next:

Table Two: OLS w/ Interactions

***, **, * indicate significance at the 1%, 5%, and 10% level

Labor Productivity	Coeffecient	Std. Error	P>|z|	Observations
Export Decision	**0.45*** **	0.12	0.000	2279
Exp. Decision w/ High Capital	**-0.11**	0.15	0.437	
Exp. Decision w/ High Debt	**-0.03**	0.14	0.822	
Lagged Capital	**0.14*** **	0.02	0.000	
Lagged Loan Interest	**0.06*** **	0.02	0.004	
Lagged Labor Prod.	**0.48*** **	0.02	0.000	

***, **, * indicate significance at the 1%, 5%, and 10% level

Total Revenue	Coeffecient	Std. Error	P>|z|	Observations
Export Decision	**0.65*** **	0.09	0.000	4054
Exp. Decision w/ High Capital	**-0.17**	0.11	0.112	
Exp. Decision w/ High Debt	**0.10**	0.11	0.365	
Lagged Capital	**0.30*** **	0.02	0.000	
Lagged Loan Interest	**0.19*** **	0.01	0.000	
Lagged Labor Prod.	**0.17*** **	0.02	0.000	

These results mirror the prior regression results on all duplicate variables. However, the new variables, the interaction terms, do not support the claim that firm constraints hinder how much they learn from exporting. If firms were constrained and these constraints raised their costs of exporting or the cost of their financing to export, we would expect to see large negative coefficients at high significance on both interaction terms. However, the coefficients are close to zero and at no level of significance. This seems to indicate that different levels of constraints across firms does not affect how much they learn by exporting. However, this is not the whole story. As previously explored in Section 3.3, these results may be biased due to endogeneity concerns. For this reason we need to move to the IV regression results before any final conclusions can be made.

5.3 IV Regression Results

Table Three: IV w/o Interactions

Generalized Method of Moments

***, **, * indicate significance at the 1%, 5%, and 10% level

Labor Productivity	Coeffecient	Std. Error	P>|z|
Export Decision	**-0.60**	0.38	0.120
Lagged Capital	**0.19*** **	0.03	0.000
Lagged Loan Interest	**0.07*** **	0.02	0.008
Lagged Labor Prod.	**0.51*** **	0.03	0.000

The first IV regression was done on the benchmark regression, the regression without interaction terms. Its results are the same as the original benchmark regression with one difference, the sign and the significance of the export decision. As the export decision is the most critical point of interpretation for our results, this is troubling. The coefficient is large and negative, indicating

that exporting actually decreased productivity. This runs contrary to all previous regressions, and contrary to the logic of LBE. Part of this may be due to exogenous events such as joining the WTO, which lowered tariffs generally in most industries. This lowering of tariffs between 1996 and 2006 could have created an incentive for less productive firms to export by lowering their costs. If this was the case, we would see this effect show up in a lower export decision coefficient. However, the significance is over the 10% level. Because of this, this confounding result will temporarily be put aside unless future regressions corroborate this result.

This brings us to the fourth and final regression, the IV regression with the interaction terms included. It bears emphasizing that this regression carries the most weight relative to the earlier regressions when it comes to making conclusions. The IV regression with interactions accounts for the most variation and fixed effects. In this regression, the cofficient on the export decision gives potential evidence for LBE, the interaction terms provide potential evidence for constraints and their affect on that LBE, and the IV estimation means that these results are less biased than earlier regressions. Therefore, these results hold the most weight when it comes to making a conclusion about whether or not there is LBE, and if it varies across constrained and unconstrained firms. The results are as follows:

Cont. next page

Table Four: IV w/ Interactions

Generalized Method of Moments

***, **, * indicate significance at the 1%, 5%, and 10% level

Labor Productivity	Coeffecient	Std. Error	P>|z|
Export Decision	**6.01*** **	0.70	0.000
Exp. Decision w/ High Capital	**-1.75*** **	0.48	0.000
Exp. Decision w/ High Debt	**0.31**	0.39	0.490
Lagged Capital	**0.03**	0.06	0.660
Lagged Loan Interest	**-0.12*** **	0.04	0.003
Lagged Labor Prod.	**0.26*** **	0.07	0.000

The first coefficient to note is the coefficient on the export decision. At 6.01 this coeffecient is large, much larger than all other coefficients, and much larger than all previous regressions. It is also highly significant. The large size of this coeffecient supports the claim that the productivity effects from lowering the tariff, the confounding result from Table Three, were limited. Lowering the tariff may have improved productivity for some firms by increasing their revenue and improving effeciency through economies of scale, but the large coeffecient on the export decision shows that this is clearly not the only effect going on, and also not the largest and most significant. Furthermore, this result agrees with the previous OLS regression results from Table One and Two, and provides strong support for the presence of LBE. There may have been some selection bias going on due to less productive firms being drawn into the sample by a lowered tariff, but the results are robust and in line with what would be expected if LBE was occuring.

Next, the interaction terms. Here we can draw some meaningful conclusions. The capital interaction term is large, negative, and highly significant. This result is in line with the hypothesized effects of firm constraints. Poorly capitalized firms may face higher hurdle costs when deciding to export that necessitate higher gains from exporting. They also might face the same cost as an unconstrained firm, but then run into higher costs anyway when they try to obtain financing. They may have less collateral to pledge or less existing access to credit. This will drive up their costs, so firms in this situation will again have to obtain higher gains from exporting in order to pay for these additional costs. Therefore, in the presence of constraints, firms must learn more by exporting because they have to in order to even access and succeed in export markets in the first place. Following this line of reasoning, one would expect that the capital interaction term would have a large negative coeffecient since it is a binary variable that is {1} if the firm is an exporter with high capital, which the paper assumes represents relatively less constrained exporters. Indeed, this is exactly the result that we find. The second interaction term, the export decision and loan interest, is less clear. Relative to the export decision and capital interaction, it is much smaller. It is also not statistically significant. However, this does not necessarily contradict the evidence of constraints from the capital interaction or suggest that constraints do not affect LBE. As explored in the literature review and background of Indonesia, firm financing can show unusual characteristics in less-developed countries, especially countries with a complicated legacy of cronyism and illiberal financial practices like Indonesia. While high debt levels are typically see as a negative for US firms, in Indonesia this can sometimes be seen as a positive since typically only the most successful firms can get access to loans. Indonesian banks also rely more on personal relationships when it comes to giving out loans, another confounding problem. Because of this, the results from the loan interest interaction are less

reliable. Therefore, between the two results from the interaction terms, the evidence for constraints that capital provides is more reliable.

6. Conclusion

After concluding the paper, there is strong support for the presence of LBE and some indication that LBE varies across constrained and unconstrained firms as well.

The OLS regressions run on the two main regression equations, one without interactions and the other with, gave support for the presence of LBE in Indonesia manufacturing firms. In the line of thinking suggested by LBE, the decision to start exporting should result in higher revenue and productivity. This would show up as a large, positive coefficient on the export decision variable, and this is indeed what the results yielded. This coefficient was also large relative to other important deciding variables like capital and debt levels, all which were at high statistical significance as well. However, the interaction terms, the intended device to find evidence of influential constraints, initially did not give evidence for variance of LBE effects across different firms. The results were small and statistically insignificant. On the other hand, these results were biased because there were endogeneity problems in the sample and the regression methods that had to be accounted for. For one, there was the large time gap between 1996 and 2006 that opened the door for any number of confounding events to occur. In addition, the reciprocal causal relationship between exporting and productivity was a concern. To counter some of these deficiencies, instrumental variable estimation was used. A change in tariffs was employed as the instrument. This was added to an initial probit regression that generated a predicted probability of exporting that was used to replace the export decision in the final regression. As for providing evidence of LBE, the results of this IV method were largely consistent with the original OLS regression in affirming its presence. The IV results also had

much more significant interaction terms. Although the debt proxy was inconclusive, the capital interaction has the most straightforward and clear effect on the dependent variable of firm performance, and it yielded highly significant results. This capital interaction result supports the hypothesis that LBE does vary across firms, and that constrained firms experience higher LBE effects.

Appendix

Background of Indonesia

With modern developments in technology, transportation, and logistics, the world economy has become increasingly intertwined. “Globalization” has turned into a hot buzzword, and developed and undeveloped economies alike are figuring out as they go how best to compete in the new global marketplace. Competition in this marketplace is critical as exports in the past century have gradually increased as a percentage of the overall economy among developed nations. In efforts to increase the global competitiveness and aid domestic development, increasing exports year to year can be seen as one indicator of a healthy and developing economy. Export-led industrialization has long been championed as the primary driver behind the late 20th century success of the nations making up the “Asian Tigers”, and although some have questioned its effectiveness in certain cases in recent years, it still remains a potent theory. Regardless, large overseas markets represent long term growth opportunities for most firms, and so any capital restructuring or investment strategy that aids in accessing these markets will be beneficial. The question for development economists then becomes how to best achieve this result for firms in developing nations.

The Asian Financial Crisis, triggered initially by the Thai government’s decision to unpeg the bhat and allow it to float, manifested itself in different ways across Southeast Asia, but it escalated arguably most fiercely in Indonesia, where various lingering after effects from its time spent under a military dictatorship exacerbated the crisis. The Indonesian financial system pre-crisis, with its gradual liberalization programs and the country’s overall steady growth, did

not seem ready for collapse, but there were troubling signs. Five key characteristics of the banking system pre-crisis stood out. There was a rapid rate of credit growth, a proliferation of a large number of poorly capitalized private banks, increased competition among these banks for customers, significant over-exposure of banks to single customers and affiliated customers, and a broad lack of adequate prudential standards and safeguards.

Once the crisis began in earnest it escalated quickly. Several broad aspects of the crisis were critical in each country, among them the dumping of Asian assets, free-falling exchange rates, and poor access to new credit. These were especially acute in Indonesia where structural issues accentuated these problems. The initial reaction from the Indonesia government and the IMF had mixed success. The government injected huge amounts of funds into the banking sector, controlling over 70% of banking sector assets at one point and ultimately shuttering numerous underperforming banks with nonperforming loans. Many of these toxic loans were made to affiliated companies far beyond what was permitted under current laws that were not enforced by an inefficient and often corrupt bureaucracy. While the liquidity injection was enough to prevent a full scale collapse among the undercapitalized banking sector, it also depleted government reserves and made it more difficult to maintain the rupiah. Many companies also lent aggressively in the property sector, funding almost 95% of all real estate development in 1996. When this speculation imploded, banks were left with long-term assets in the form of real estate that were incredibly difficult to liquidate due to poor insolvency laws. At the same time, Indonesian government raised short-term rupiah interest rates in order to try to stabilize the free falling rupiah, but this only constricted lending. In one particularly bad week in August, overnight interbank lending rates skyrocketed by over 36%. Bank Indonesia also temporarily

suspended several short-term liquidity vehicles, further complicating matters in the interest of protecting the rupiah.

The second round of government and IMF intervention met much more success. Recalibrating, the government focused on three general areas of reform: greater transparency and oversight of the financial sector, more careful handling of "hot money" through measures like banning certain short-term loans, and a recapitalizing of balance sheets. They began by injecting substantial liquidity accomplished through lowering interest rates, depositing state-owned enterprise funds into selected banks, and reopening government bill discount facilities. Banks under -25% capital adequacy ratio were to be liquidated; those between that and 4% were to present a plan for recapitalization in order to be eligible for government funds. In addition, the Banking Law Amendment of 1998 added additional long-term structural reforms, for instance removing restrictions on foreign parties owning more than 49% of the shares of a domestic bank. The end result was a 37% decline in the number of commercial banks from 1996 to 2000, and the loan to deposit ratio falling by over half over the same time period from a peak of 104%. Through recapitalization and sales of government-held shares, foreign-owned banks emerged as leading actors in the place of business-group-affiliated banks. The central bank, which up to that time had been given only partial authority under the jurisdiction of the Minister of Finance, now gained a full range of authority over banks. Between the central bank's supervision of banks and revamped risk management systems at these individual banks, the Indonesian banking sector took a large step away from the cronyism of its past. This was all radically different from the old financial institutions under the Soharto regime, where banks had little to no incentive to control risks.

Coming out of the crisis and the reform that it brought, it becomes important yet difficult to understand what affects the crisis had on Indonesian firms and their lending environment, especially since the survey data being used straddles the crisis with response years of 1996 and 2006. However, while during the crisis in ’97 there was a significant credit crunch that may have been responsible for forcing out many firms between 1996 and the 2000s, on the aggregate level there is little evidence of a credit crunch, at least a credit crunch narrowly defined as demand outpacing supply. This was due for one by a substantially depressed credit demand, itself due largely to crisis-driven rises interest rates and weak economic activity. In addition, there was actually a rise in loan supply following the crisis. This was driven largely by steady improvements in bank capital. Improved structure in bank assets led by the introduction of trading in government bonds was also significant, as was the gradual unwinding and decline of non-performing loans. Lending rates were also persistently high after the crisis, encouraging expansion of lending at the detriment of individual firms. However, high lending rates were not the only factors constraining loan demand. There was significant uncertainty about the future coming out of the crisis, both political and legal, creating a lack of investment demand. The high rates also prompted some to seek alternative financing, as seen in the expansion of private sector bond issues that hit Rp25.6 trillion in 2003, as compared to Rp6.5 and Rp2.3 trillion in 2002 and 2001, respectively. Finally, continued problems of asymmetric information has still made banks focus primarily on preferred debtors or those with known track records, meaning many new debtors are essentially barred from credit access.

Bibliography

Arrellano, Christina; Bai, Yai; Zhang, Jing. "Firm dynamics and financial development". *Journal of Monetary Economics*. 5/2012.

Alamsyah, Halim; Zulverdi, Doddy; Gunadi, Iman; Idris, Rendra Z.; Pramono, Bambang. "Banking Disintermediation and Its Implication for Monetary Policy". *Journal of Asian Economics.* 01/2007.

Aw, B.Y., Chung, S.& Roberts,M. J. (2000). Productivity and turnover in the export market: Micro-level evidence from the republic of Korea and Taiwan.The World Bank Economic Review, 14(1), 65-90.

Bennett, Michael. "*Banking Deregulation in Indonesia: An Updated Perspective in Light of the Asian Financial Crisis"*, 20 J. INT'L L. 1 (2014)

Bernard, A., & Jensen, J. (1999). "Exceptional exporter performance: Cause, effect or both?" Journal of International Economics, 47 (1), 1-25.

Blalock, G.,& Gertler, P. J. (2004). "Learning from exporting revisited in a less developed setting." Journal of Development Economics, 75(2), 397-416.

Clerides, S., Lach, S., & Tybout, J. (1998). "Is learning-by-exporting important? Micro-dynamic evidence from Colombia, Mexico, and Morocco". Quarterly Journal of Economics, 113 (3), 903-947.

De Loecker, J. (2007). "Do exports generate higher productivity? evidence from Slovenia". Journal of International Economics, 73 (1), 69-98.

Ghosh, Atish R.; Ghost, Swart R. "East Asia in the Afternath – Was There a Crunch?" *IMF Working Paper*. March 1, 1999.

Habir, Manggi; Pangestu, Mari. "The Boom, Bust and Restructuring of Indonesian Banks". *IMF Working Paper*.

Hossain, Akhtar. "Macroeconomic Developments, Policies and Issues in Indonesia, 1950-2005: a Review". (Jun-Dec 2006) **Malaysian Journal of Economic Studies**

IMF Staff. “Recovery from the Asian Crisis and the Role of the IMF”. *IMF Working Paper*.

James, William E. “International Finance and Domestic Financial Market Development: The Case of Indonesia”. (2005) Asian Financial Review

Khambata, Dara. “Bank restructuring in Indonesia”. Journal of International Banking Regulation, 3.1 (Aug 2001).

Lileeva, Alla., & Trefler, Daniel. (2010). “Improved access to foreign markets raises plant-level productivity… for some plants.” Quarterly Journal of Economics, 125 (3), 1051-1059.

Manova, Kalina. “Credit constraints, equity market liberalizations and international trade”. *(2008)*

Manova, Kalina. “Credit Constraints, Heterogeneous Firms, and International Trade”. (2013)

McLeod, RH. “Dealing with Bank System Failure: Indonesia, 1997 – 2003”. *Bulletin of Indonesian Economic Studies*. July 12, 2010.

Sato, Yuri. “Bank Restructuring and Financial Institution Reform in Indonesia”. *The Developing Economies.* March 6, 2007.

Van Biesebroeck, J. (2005). “Exporting raises productivity in sub-Saharan African manufacturing firms”. Journal of International Economics, 67(2), 373-391.