Corruption, Financial Resources and Exports

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Abstract

This paper argues that a country's comparative advantage in exports depends on both the factor abundance and the allocation efficiency of the endowments. However, the latter is not considered in the traditional Heckscher-Ohlin model. Based on the "sand" view of corruption from the perspective of efficiency, this paper examines the role of corruption in shaping a country's export patterns by distorting the financial resource allocation. Using data of 82 countries, 27 3-digit ISIC manufacturing industries from 1982 to 1997, we find that the resource misallocation resulting from corruption undermines the export growth promoted by the positive external financial shock. The differential impact of corruption is stronger in the subsample of sectors with less-tangible assets. In addition, the effect of corruption is mainly realized by the extensive margins instead of the intensive margins of heterogeneous firms.

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1. Introduction

An implicit but crucial assumption in the traditional Heckscher-Ohlin model is that all countries can allocate their abundant resources efficiently and gain comparative advantage from the factor endowments. However, an emerging literature has shown that there is significant resource misallocation resulting from institutions or policies, which vary across countries (Hsieh and Klenow, 2009; Banerjee and Moll, 2010; etc.). Therefore, the production possibility frontier and the export patterns of a country are determined by both the resource endowments and the factors that influence the allocation efficiency of the endowments.

Corruption has been regarded as an important institutional factor that influences the efficiency of the resource allocation. Da-Hsiang Donald Lien (1990) considers a case in which two firms compete via bribery of a corrupt government official for a to-be-awarded project and shows that the economy suffers allocation inefficiencies due to corruption. Shleifer and Vishny (1993) argue that corruption is distortionary and detrimental to economic development. Li (2001) uses detailed transaction data from a panel of 769 Chinese state-owned enterprises and finds that corruption has a significant impact on the allocation of both in-plan and outside-plan resources under the dual-track system in China.

On the other hand, financial development has been interpreted as a factor endowment in the context of the Heckscher-Ohlin model. Kletzer and Bardhan (1987) argue that even with identical technology and endowments between countries, comparative costs may differ in a world of credit market imperfection. Beck (2003) shows that financial development can be translated into a comparative advantage in industries that use more external finance. Beck (2002) and Svaleryda and Vlachosb (2005) find that the financial sector is a source of comparative advantage in a way consistent with the Hecksher–Ohlin–Vanek model.

Motivated by the two strands of literature on corruption and financial endowments, this paper empirically examines whether and how corruption affects trade flows by distorting a country's distribution of financial resources. We contribute to the literature by considering the capital allocation inefficiency via corruption in the standard Heckscher-Ohlin model. In spite of a positive shock on the available financial resources, e.g. equity market liberalization, exports do not rise much in the more corrupt countries because resources are distributed inefficiently, which essentially weakens the newly gained comparative advantage. We are interested in the *differential impact* of equity market liberalization on exports across countries with different corruption levels. As a result of corruption, financial resources may not be obtained by the "right" firms that can utilize them most efficiently. Therefore, the more corrupt country will gain less from a positive shock on the capital inflows.

Based on Manova (2008 & 2013), we apply the triple difference-in-difference estimation strategy to test the effect of corruption. Manova (2008) shows that equity market liberalization increases exports disproportionately more in financially vulnerable sectors that require more outside finance or employ fewer collateral assets. In this paper, we find that the Manova effect is significantly smaller in the more corrupt countries due to resource misallocation caused by corruption.

Moreover, this finding is particularly true in the sample of sectors with less-tangible assets. As firms can use their tangible assets as the collateral of loans, it is always easier for firms with high asset tangibility to obtain credits, *given the resource availability and the level of allocation distortion in the economy* (Kiyotaki and Moore, 1997). Therefore, firms with low asset tangibility are more sensitive to corruption than firms with high asset tangibility. In our benchmark regressions, if the corruption level of a country drops from 6.67 (75^{th} percentile of corruption) to 2.67 (25^{th} percentile of corruption), the export growth promoted by equity market liberalization (the coefficient of the interaction term of equity market liberalization and the financial vulnerability of a sector) will rise by twice and 25 times separately in the whole sample of all industries and the sample of industries with low asset tangibility.

To identify the channels through which corruption leads to the misallocation of financial resources and thus the restrained export growth, we further investigate the extensive and intensive margins of heterogeneous firms. We ask whether corruption impedes the growth of sectoral production as well as exports by restricting the entry of new firms or by limiting the expansion of existing productive firms in the industry. Both types of firms are potential exporters and faced with credit constraints. Manova (2013) incorporates financial frictions into a heterogeneous-firm model and identifies three mechanisms through which financial market imperfections restrict international trade flows: the selection of heterogeneous firms into domestic production, the selection of domestic manufacturers into exporting, and the level of firm exports. This paper explores the role of corruption in the first mechanism of Manova (2013). We show that corruption reduces sectoral total output mainly through reducing new entry, which is consistent with previous literature in the relationship of corruption and firm entry, such as Shleifer and Vishny (1993), Romer (1994), and Djankov, et. al. (2002).

We employ the International Country Risk Guide (ICRG) index from Political Risk Services to measure corruption and borrow the equity market liberalization data from Bekaert, Harvey and Lundblad (2005). Our analysis is available for 82 countries, 27 3-digit ISIC manufacturing industries from 1982 to 1997. The above findings are robust when we control for other factor endowments, e.g. development of domestic stock market, physical capital stock, human capital stock, and natural resources. To cope with the endogeneity concern, we use the corruption value in 1982 (the first year in the data series) to measure corruption for all years. Moreover, we also test the sensitivity of our results in the subsamples of less developed countries and countries switching their equity market regimes during the available years. Our results consistently confirm that corruption restrains the export growth driven by equity market liberalization.

Our paper is related to the growing literature on the effects of corruption on bilateral trade. Anderson and Marcouiller (2002) develop a structural model of import demand in which corruption and imperfect contract enforcement act as a hidden tax on trade and find that they dramatically reduce international trade as much as tariffs do. Dutt and Traca (2010) derive a corruption-augmented gravity model and view corruption as an institutional facilitator of the extraction of bribes by customs officials. Their empirical work shows that corruption impedes trade in an environment of low tariffs but enhances trade when nominal tariffs are high. Differing from the above studies, we investigate a conceptually different mechanism, that is, corruption

influences trade flows via financial resource allocation.

The remainder of the paper is organized as follows. We present the estimation strategy in Section 2 and describe data sources in Section 3. Section 4 reports the empirical results and addresses other estimation issues. Section 5 investigates the extensive and intensive channels of heterogeneous firms through which corruption makes an impact. Section 6 concludes.

2. Theoretical Foundation and Empirical Specification

In the past decades, research on corruption as an important factor affecting resource allocation has received much attention. Traditionally, there are two views from the efficiency perspective. The grease view argues that corruption improves the efficiency of resource allocation (Leff, 1964; Huntington, 1968; Lui, 1985; Beck and Maher, 1986; Shleifer and Vishny, 1994). The sand view argues that corruption sands the wheels of the economy and distorts resource allocation (Farrell, 1987; Murphy, Shleifer and Vishny, 1991; Shleifer and Vishny, 1993; Boyko, Shleifer and Vishny, 1996). For instance, Mankiw and Whinston (1986) and Rose-Ackerman (1997) argue that agents paying the highest bribe are not always the most efficient from the perspective of social welfare maximization. Corrupt officials may have incentives to create more distortions in the economy to extract rents (Myrdal, 1968; Kurer, 1993). Nonetheless, there is a general consensus among economists that the sand view is more empirically relevant.[4] Hence, we take the sand view and examine the role of corruption in the financial resource allocation.

2.1 Basic Regression

We start from Manova (2008) who uses a difference-in-difference approach to test the hypothesis that equity market liberalization increases exports relatively more in sectors intensive in external finance. In this paper, our reasoning on corruption is that corruption distorts the financial resource allocation which will undermine the positive effects of equity market liberalization on export flows. The original specification in Manova (2008) is as follows:[5]

$$Export_{cit} = \beta Lib_{ct} \cdot ExtFinDep_i + \gamma_1 \cdot Lib_{ct} + \gamma_2 \cdot GDP_{ct} + f_c + f_i + f_t + \varepsilon_{cit}, \qquad (1)$$

where $Export_{cit}$ denotes the logarithm value of exports of country c in industry i in year t. Lib_{ct} is a dummy variable indicating equity market liberalization, which equals one in the year of or after the equity market being liberalized and zero otherwise. This event draws capital flows into the domestic market, which thus serves as an exogeneous, positive shock to the available financial resources. $ExtFinDep_i$ denotes the degree of external finance dependence of industry i. f_c, f_i,

[4] Empirical studies have been conducted on the effect of corruption on domestic investment and growth (Mauro, 1995), on the size and composition of government expenditure (Tanzi and Davoodi, 1997), on the effective red tape (Kaufmann and Wei, 1999), on foreign direct investment (Wei, 2000), and in other circumstances that implicate allocation efficiency (Bertrand, et. al. 2007, etc.). See surveys in Bardhan (1997), Jain (2001), Wei (2001) and Aidt (2003).

[5] Note that we have dropped $Lib_{ct} \cdot Tang_i$, the interaction of equity market liberalization and asset tangibility, in Equation (1) of Manova (2008) to focus on the key variables in our paper. We will take care of the asset tangibility issue in Section 2.2.

and f_t are the country, industry, and year fixed effects, respectively. The coefficient of Lib_{ct} and the difference-in-difference coefficient β are predicted to be positive. However, this may not hold if countries could not allocate the capital inflows (or the abundant endowments in the Hecksher–Ohlin context) efficiently. If the allocation efficiency varies across countries with different corruption levels, β will be larger in the less corrupt countries where resources are more likely to be obtained by the efficient users. In other words, β should be *heterogeneous* as a function of the corruption level of country c in year t ($Corr_{ct}$):

$$\beta = \beta_1 + \beta_2 Corr_{ct}, \tag{2}$$

Since theories (the sand view) indicate that corruption decreases allocation efficiency, we present our core hypothesis:

Hypothesis 1: *By distorting of the financial resource allocation, corruption dampens the export growth driven by equity market liberalization, i.e.* $\beta_2 < 0$.

Substituting Equation (2) into Equation (1), we estimate Equation (3):

$$\begin{aligned} Export_{cit} = {} & \beta_1 Lib_{ct} \cdot ExtFinDep_i + \beta_2 Lib_{ct} \cdot ExtFinDep_i \cdot Corr_{ct} \\ & + \gamma ExtFinDep_i \cdot Corr_{ct} + f_{ct} + f_i + \varepsilon_{cit}, \end{aligned} \tag{3}$$

Since we do not focus on the correlation of exports and equity market liberalization, we drop Lib_{ct}, which allows us to control for the country-year fixed effects f_{ct} that accounts for the country-year variations that may affect exports, e.g. Lib_{ct}, $Corr_{ct}$, GDP_{ct} and other macro factors that change over time.

We employ the triple difference-in-difference strategy (see Gruber, 1994; Joyce, 2009) to test Hypothesis 1. In the above specification, β_1 represents the effect of equity market liberalization in industries with different levels of finance dependence. We add in the interaction term $ExtFinDep_i \cdot Corr_{ct}$ as a control. With finance dependence varying across sectors, the overall effect of equity market liberalization on exports is captured by $\beta_1 + \beta_2 Corr_{ct}$, while the key interest, the differential impact of corruption, is captured by β_2.

It is worth noting that we did not use the level of domestic financial development to measure a country's financial resources. Since corruption and domestic financial development, to a great extent, are jointly determined by factors such as legal origins (La Porta, Lopez-de-Silanes and Shleifer, 2008), it is hard to distinguish the effect of one from the other. In addition, though Ju and Wei (2008) show that there may be reverse causality between domestic financial development and exports, Manova (2008) argues that equity market liberalization is a product of complex political processes and thus can be viewed as an exogenous shock to the availability of external finance.

2.2 Asset Tangibility

Besides finance dependency, asset tangibility also plays a part on how the positive shock of

outside capital flows enhances exports. It is easier for firms with more tangible assets to obtain external finance because they can at least use the hard assets as collateral (Kiyotaki and Moore, 1997). Therefore, firms with higher asset tangibility can maintain their share of external capital flows in spite of the distortion of resource allocation in the domestic market. When asset tangibility is considered in the corruption mechanism described above, higher tangibility will offset the distortion effects of corruption on the interplay of equity market liberalization and exports. In other words, β_2 is not homogeneous across industries with different asset-tangibility levels. We formalize the reasoning in the following hypothesis:

Hypothesis 2: *The misallocation effects of corruption on the interplay of equity market liberalization and exports will be stronger in the industries with low asset tangibility.*

We will test Hypothesis 2 by running regressions according to Equation (3) in the subset of industries with low asset tangibility. We expect a larger β_2 in this subsample sample.[6]

3. Data

We describe the construction of the variables and data sources in this section. We use the International Country Risk Guide (ICRG) index constructed by Political Risk Services, a private international investment risk service, to measure the country-level corruption.[7] Based on experts' opinions of the bureaucratic corruption level of 82 countries, this index is available every year since 1982. A country is corrupt if the bureaucracy is likely to award contracts, business and trade licenses, policy protection and so forth on the basis of criteria other than those of allocative and technical efficiency, and if illegal payments are generally expected throughout lower levels of government in the form of bribes connected with import and export licenses, exchange controls, tax assessment, police protection, or loans. For better understanding, we rescale the ICRG corruption index within the range of [1 11], such that larger number means higher level of corruption.

Similar to Manova (2008), we employ the export data from the World Trade Database by Feenstra (2000) and aggregate them into the 3-digit ISIC industry level using the Haveman's concordance table. Bekaert, Harvey and Lundblad (2005) compile the equity market liberalization data for 91 countries from 1980 to 1997, using both the official year and the first-sign year of equity market liberalization. The official year corresponds to the date of the formal regulatory change after which foreign investors can invest in domestic equities legally; while the first-sign year is associated with the earliest of three dates: official liberalization, first American Depositary Receipt (ADR) announcement, and first country fund launch. Accordingly, we use two dummy variables to

[6] The other approach to test Hypothesis 2 is to assign $\beta_2 = \beta_2' + \beta_3' \mathrm{AssTan_i}$, where $\mathrm{AssTan_i}$ denotes asset tangibility. Substituting this equation into Equation (3), we run regressions in the whole sample. The key interest will then be β_3', the coefficient of a quadruple interaction term. As estimating and interpreting quadruple interaction are very dependent on which double and triple interactions have been included, we prefer the split-sample approach.

[7] Other corruption indexes are available either from late 1990s or for fewer countries. In fact, the ICRG index is highly correlated with alternative indices in the overlapping years and countries. See Wei (2001) for a survey.

measure equity market liberalization. Merging the equity market liberalization data and the corruption data, we end up with 82 countries from 1982 to 1997. According to the official year, there are 38 countries liberalizing their stock markets during the period, 30 countries always closed, and 14 countries always open. The corresponding numbers are 37, 29, and 16 according to the first-sign year.[8]

Rajan and Zingales (1998) define the external finance dependence ($ExtFinDep_i$) as the ratio of the capital expenditures minus cash flow from operations to capital expenditures of firms. Braun (2003) defines asset tangibility as net property, plant, and equipment divided by the book value of firms' assets. Using the annual industrial files from Compustat in 1980s (for external finance index) and from 1986 to 1995 (for asset tangibility index), these two variables are calculated as the median value of all active U.S.-based publicly listed companies in the industry and averaged over the above periods, respectively. The merged data are available for 27 3-digit ISIC manufacturing industries. Taking a glance at the data, we report that the least external-finance dependent industries include tobacco (-0.4512), pottery/china/earthenware (-0.1459), and leather products (-0.1400), while the most dependent industries include plastic products (1.1401), professional and scientific equipment (0.9610), and electric machinery (0.7675). The industries with the lowest asset tangibility are pottery/china/earthenware (0.0745), leather products (0.0906), footwear except rubber or plastic (0.1167), and wearing apparel (0.1317), while the ones with the highest asset tangibility are petroleum refineries (0.6708), paper and products (0.5579), and iron and steel (0.4581).

Note that the correlation between the external finance dependence and the asset tangibility is low (0.0096), which implies that they capture different aspects of industry characteristics. Specifically, they represent the *need* and the *ability* of borrowing loans. Moreover, we use the setoral data in the U.S. because there is data limitation in many other economies. However, the U.S. data are good for *ranking* industries in the *relative* external finance dependence and the *relative* asset tangibility over time and across countries (Manova, 2008).

Data sources for other control variables are as below. Physical capital stock per capita and human capital stock per worker are from Caselli (2005).[9] The natural resource endowment per capita comes from the World Bank (1997).[10] The industry-level physical capital intensity, human capital intensity, and natural resource intensity are from Braun (2003).[11] Data on the size and activities of

[8] The 38 countries that liberalized equity markets during the period are: Argentina, Bangladesh, Brazil, Chile, Colombia, Cote d'Ivoire, Ecuador, Egypt, Ghana, Greece, Iceland, India, Indonesia, Israel, Jamaica, Japan, Jordan, Kenya, Malaysia, Malta, Mexico, Morocco, New Zealand, Nigeria, Pakistan, Peru, Philippines, Portugal, South Africa, South Korea, Spain, Sri Lanka, Thailand, Trinidad and Tobago, Tunisia, Turkey, Venezuela, and Zimbabwe. The 30 countries that remained closed are: Algeria, Burkina Faso, Cameroon, Congo, Costa Rica, Dominican Republic, El Salvador, Gabon, Gambia, Guatemala, Guyana, Haiti, Honduras, Iran, Kuwait, Madagascar, Malawi, Mali, Nicaragua, Niger, Norway, Oman, Paraguay, Saudi Arabia, Senegal, Sierra Leone, Syria, Togo, Uruguay, and Zambia. The 14 countries which liberalized before 1982 are: Australia, Austria, Canada, Denmark, Finland, France, Ireland, Italy, Netherlands, Singapore, Sweden, Switzerland, United Kingdom, and United States.

[9] Physical capital stock per capita is constructed from Penn World Table 6.1 using the perpetual inventory method, while human capital stock per worker is measured by the average years of schooling in a country using the non-linear Mincer model.

[10] The natural resource endowment per capita computed by the World Bank includes minerals and fossil fuels, timber, non-timber forests, cropland and pastureland.

[11] The natural resource intensity is a dummy that equals 1 for the following industries (and 0 otherwise): wood

domestic capital market are from Beck, Demirguc-Kunt and Levine (2000). The industry-level data for *each country (not only the U.S.)* include the number of total establishments, employment, outputs, and gross fixed capital formation, which are from Nicita and Olarreaga (2007) and will be used in Section 5.

4. Empirical Results and Robustness Analysis

4.1 Basic Results

Our empirical model implies that corruption substantially weakens the comparative advantage that a country gains from equity market liberalization. The regression results of Equation (3) are reported in Columns (1) and (2) of Table 1, where liberalization is measured by the official-year dummy and the first-sign dummy, separately. In both regressions, β_2 is significantly negative as predicted. Consistent with the results in Manova (2008), β_1 is significantly positive, meaning that for given corruption levels, countries with liberalized equity markets increase their exports disproportionately in industries more dependent on external finance. That is, countries gain more comparative advantage from equity market liberalization, especially in the financially vulnerable industries. However, the gains are undermined by corruption, as shown by the negative β_2. When the corruption level drops from 6.67 (75^{th} percentile of corruption) to 2.67 (25^{th} percentile of corruption), the export growth resulting from equity market liberalization will rise by 1.86 times using the official-year dummy (1.68 times using the first-sign-year dummy), which verifies Hypothesis 1. In fact, in the most corrupt countries (with corruption level 11), equity market liberalization can hardly raise exports.

[Table 1 above here]

Next, we test Hypothesis 2 by running Regression (3) in the subsample of industries with asset tangibility lower than the median level. The larger absolute values of β_2 in Columns (3) and (4) of Table 1 confirm the stronger effects of corruption in the less-tangible industries. When the corruption level drops from 6.67 to 2.67, β_2 is 25.4 times higher in the sample of low-tangible industries than that in the whole sample using the official-year dummy (4.32 times higher using the first-sign-year dummy).

Though we emphasize the channel that corruption diminishes exports by distorting the financial resource allocation, we caution that the corruption may also reduce exports by decreasing the size of capital inflows after the positive shock of the external financial resources. Our estimates are biased upwards as we did not distinguish the effects of corruption on the size and the allocation efficiency of external capital inflows. Other concerns include the endogeneity problem of corruption and trade, the omitted variables issues in the context of estimating bilateral trade, etc. Next, we will perform robustness analysis to address these concerns.

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products, except furniture; paper and products; petroleum refineries; miscellaneous petroleum and coal products; other nonmetallic mineral products; iron and steel; and nonferrous metals.

4.2 Endogeneity

Ades and Di Tella (1999) and Treisman (2000) find that exposure to imports may cut down corruption. One may be concerned with the reverse causality between exports and corruption. To eliminate the possible endogeneity concern, we use the first-year corruption level of the sample period and rerun Regression (3).[12] As we can see in Table 2, all results are similar to those in Table 1.

[Table 2 above here]

4.3 Subsamples of non-OECD countries and countries switching the openness status during 1982-1997

The degree of resource misallocation caused by corruption may vary across countries. We first consider the development level of a country. Consistent with the grease view, corruption may promote exports in the underdeveloped countries in which there are preexisting institutional distortions. To test this possibility, we run Regression (3) in the subsample of the 59 non-OECD countries, because the non-OECD countries are generally less developed and weaker in market institutions than the OECD countries. Since credit constraints are severer in the non-OECD countries than in the OECD countries, we expect stronger effects of corruption in this subsample.

[Table 3 above here]

The results in the first four columns of Table 3 show that the coefficients of the triple interaction term are consistently negative and statistically significant. The stronger effect of corruption in the non-OECD subsample is also confirmed.

Secondly, we focus on the countries switching their openness status of the equity market during the period considered. On the one hand, using these countries fits the assumption of "positive exogenous financial shock" better. On the other hand, as Manova (2008) argues, using this subsample ensures that the results in the pooled panel regressions are not driven by purely cross-sectional differences between those financially always-open and always-closed countries that may correlate with other systematic differences. However, there is also a cost of employing the purely time-series variation of these switchers. As the corruption level of each country changes slowly over time, this subsample may not sufficiently demonstrate the role of corruption. There are 38/37 countries (under the official-year/first-sign-year criteria) undergoing policy change of the equity market between 1982 and 1997.

The results of the subsample are reported in Columns (5) ~ (8) of Table 3. The estimated β_2 is

[12] We also tried to employ legal origins as the instrumental variable for corruption (see La Porta, et al, 2008) to address the endogeneity problem and got similar results. However, we did not report the results, because this variable is not perfect to serve as the exclusion restriction. Another desirable approach is to use the propensity score matching technique as in Nunn (2007). However, if we use the ratio of bilateral exports of an industry as the dependent variable, the equity market liberalization dummy will not be well-defined for each country pair.

negative but not significant especially in the whole sample. This outcome may result from the small variation of corruption over time and in a sample of only 38 countries.

4.4 Other Factor Endowments

In this subsection, we check whether our findings are robust to the specification with other factor endowment controls. We first consider the domestic financial development, which is the alternative choice of the financial shock. We then add the traditional Heckscher-Ohlin factors into the regressions.

Both the size and the allocation efficiency of domestic financial resources affect exports. Therefore, we control for both the size and the activities of the domestic financial market. Following Manova (2008), we use the value traded of the stock market relative to GDP to measure the market size ($MktV_{ct}$) and the stock market turnover, the ratio of value traded over the stock market capitalization (the total value of all listed firms), to measure the stock market activities ($MktTurnover_{ct}$). As the domestic stock market may be endogenously influenced by the policy change of the equity market, we use the initial level of the market size/turnover averaged over 1980-1984 for each country. Similarly, we interact the variables of the domestic financial development with the external financial dependence as well as corruption. The triple interaction terms indicates how corruption influences exports by distorting the allocation of domestic financial resources.

Table 4 shows that our results are robust when taking into consideration of the development of the domestic stock market in the industries with low asset tangibility. The negative β_2 is not robustly significant in the whole sample. Note that the coefficients of the triple interaction terms of $MktV_{ct}$, $ExtFinDep_i$, and $Corr_{ct}$ are always significantly positive. The positive sign of the interaction term of $MktV_{ct}$ and $ExtFinDep_i$ means that corruption plays a *grease* role in allocating the domestic financial resources, which acts as a source of comparative advantage and promotes export growth.

[Table 4 above here]

Secondly, according to the traditional Heckscher-Ohlin model, export patterns are determined by factor endowments, including the physical-capital stock ($PhyCap_{ct}$), the human-capital stock ($HumCap_{ct}$), and the natural resources ($NatuRes_{ct}$). We thus add the interactions of these country-level endowments and the corresponding physical-capital/human-capital/natural-resource intensities ($PCIntensity_i$, $HCIntensity_i$, and $NRIntensity_i$), as well as the triple interactions of the products and corruption into the regressions.[13] Table 5 shows that β_2 is robustly significant and negative. The coefficients of the triple interaction terms of the traditional factors and corruption are not significant, which means the allocation role of corruption is ambiguous in the traditional factor endowments.

[13] In Columns (3) and (4), all control variables associated with the natural-resource intensity are dropped, because the natural-resource intensity is zero, which indicates no variation, in all industries of low asset tangibility.

[Table 5 above here]

We also tried to control for both domestic financial development and the Heckscher-Ohlin factor endowments at the same time. The results are similar to those in Table 5 but not reported for the sake of space. They are available upon request.

5. Extensive and Intensive Channels

As we have shown, corruption distorts financial resource allocation and undermines a country's comparative advantage gaining from a positive shock in financial resources. Theoretically, the misallocation may occur through both extensive and intensive margins of heterogeneous firms, that is, resource misallocation could diminish exports from both potential entrants and the existing productive firms. First of all, misallocation will prevent promising potential entrants, which are faced with credit constraints but have not bribed the authorities, from entering the industry, and thus limit the total number of active firms in the industry. Secondly, corruption may drive financial resources away from the most productive market players that can use the capital more efficiently, which would hinder the growth of the efficient firms as well as the size (or production) dispersion of firms in the industry.

Less production is directly associated with fewer exports for a given industry. Recent literature on heterogeneous firms document that only a small fraction of active firms that are most productive can export (Melitz 2003; Bernard and Jensen, 1999, Bernard, et. al. 2003). Therefore, exports are determined by both the extensive margins (the number of firms) and the intensive margins (the fraction of outputs of the most productive firms). Exports are likely to be larger if there are more active firms or if the most productive firms produce more in the industry. The question is: do both channels coexist? If so, which one dominates the effects?

Data on the number of active firms in an industry level are publicly available. As to the outputs of the most productive firms, we use a proxy for the fraction. Previous literature (Axtell, 2001; Helpman, Melitz and Yeaple, 2004; etc.) usually assumes a Pareto distribution for the firm productivity (that is positively related to the firm size), where the fraction of the highly productive firms is positively related to the variance.[14] Meanwhile, the mean and the variance are also positively correlated in the Pareto distribution. Therefore, we use the average firm size as the proxy for the fraction of highly productive firms in the industry. The average firm size of the industry in each country can be measured by the employment per establishment, the output per establishment, or the gross fixed capital formation per establishment. For both the firm number and the firm size measures, data are available for 27 industries and 82 countries.

To answer the question on channel identification, we first show that more active firms and larger average size of the firms yield more exports in an industry. Different measures of the firm size are

[14] In the Pareto distribution, given the lower bound, the larger the variance is, the fatter the right tail is, thus the larger the fraction of highly productive firms is.

used in the regressions in Table 6. Controlling for the country-year and industry-year fixed effects, both the firm number and the firm size are positively related to the logarithm value of exports. In addition, the magnificence of the firm number is similar to the average firm size: a one percent increase of firm number will promote exports by 0.62-0.72 percent, while a one percent increase of average firm size will promote exports by 0.42-0.9 percent.

[Table 6 above here]

As the firm number/size and exports are positive correlated, we next investigate how corruption restricts the firm number/size via financial resource misallocation. The negative coefficients of the triple interaction terms in the first 4 columns of Table 7 show that equity market liberalization increases the firm number (disproportionately more in the industries more dependent on external finance), but corruption weakens this effect, which is particularly true in the industries with lower asset tangibility.

However, we get opposite outcomes on the average firm size. As Columns (5) - (16) of Table 7 show that corruption seems to enhance the effects of equity market liberalization on the average firm size. Though not always significant at the 1% level, the coefficients of the triple interaction terms are positive, which supports the grease view of corruption. A possible explanation is that the most productive firms are more *willing* and *capable* of bribing the authorities so as to maintain the market share they have obtained. Hence the resource misallocation resulting from corruption draws more resources to the most productive firms and raises the production fraction of the highly productive firms in the industry for which we use the average firm size as the proxy. Note that this positive effect of corruption on the firm size is larger than the negative effect on the firm number, which implies the overall negative effect of corruption on exports.

[Table 7 above here]

Based on the output in Table 6 & 7, we conclude that the negative effect of corruption on exports through financial resource misallocation is mainly realized by restricting new entrants into the industry. In fact, corruption contributes to the expansion of the most productive firms in their production. This finding is consistent with the argument that corruption is particularly detrimental to the new entrants in previous literature. As Shleifer and Vishny (1993) have pointed out, innovators are particularly at the mercy of corrupt public officials. Romer (1994) suggests that corruption as a tax on ex post profits may in general stifle the entry of new goods or technology which requires an initial fixed-cost investment. Djankov, et. al. (2002) find that stricter regulation of entry is associated with higher levels of corruption.

6. Conclusions

The export pattern predicted by the Heckscher-Ohlin model is based on the assumption that all countries can allocate their abundant resources efficiently. However, there are large variations of resource allocation efficiency across countries in the real world. In fact, the comparative

advantage and the export patterns are determined by both the resource endowments and the resource allocation efficiency of each economy. In this paper, we focus on the role of corruption in resource misallocation.

Based on Manova (2008), we extend her work on financial development and trade and examine how corruption takes effect on exports by distorting the financial resource allocation in the economy. Our empirical results show that though equity market liberalization gives an impetus to exports disproportionally in the industries dependent on external finance, this effect is substantially weakened in the more corrupt countries. Further, the negative effect of corruption on exports is realized mainly through the channel of preventing new firms entering the industry rather than limiting the production of the existing productive firms.

The analysis of the micro-channel identification is conducted by first proving that the firm number and the size of the productive firms are positively related to exports and then testing the effects of corruption on the two sectoral variables. In the future, we will study the extensive and intensive margins using the firm-level data and investigate if the findings in the current paper hold. In addition, we will put effort on distinguishing the effects of corruption on the size of external capital inflows from corruption's impact on the allocation efficiency of external capital inflows after equity market liberalizations.

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Appendix

Table 1

The effects of corruption on exports: basic results

	Dependent variable: ln(Export)			
	Official liberalization dummy	First sign liberalization dummy	Official liberalization dummy	First sign liberalization dummy
	All ind.		Low asset-tangibility ind.	
	(1)	(2)	(3)	(4)
Lib*ExtFinDep	0.861***	1.042***	1.456***	1.678***
	(0.173)	(0.172)	(0.239)	(0.242)
Lib*ExtFinDep*Corr	-0.076**	-0.083***	-0.213***	-0.213***
	(0.032)	(0.031)	(0.043)	(0.043)
ExtFinDep*Corr	-0.074***	-0.055**	-0.132***	-0.104***
	(0.025)	(0.025)	(0.034)	(0.035)
# of Observations	33,310	33,310	16,141	16,141
R-squared	0.793	0.793	0.840	0.840
# of Countries	82	82	82	82

Note: The dependent variable is the logarithm of exports to the rest of the world at the 3-digit ISIC industry level during 1982-1997. Lib is the dummy variable of equity market liberalization, ExtFinDep is the industrial external finance dependence, Corr is the corruption level. In all regressions, we control for the industry-year and country-year fixed effects. Heteroskedasticity-robust standard errors clustered at country-year are in parentheses. ***, **, * indicate significance at the 1%, 5%, and 10% level.

Table 2

Robustness check: measure corruption by the first-year corruption index

	Dependent variable: ln(Export)			
	Official liberalization dummy	First sign liberalization dummy	Official liberalization dummy	First sign liberalization dummy
	All ind.		Low asset-tangibility ind.	
	(1)	(2)	(3)	(4)
Lib*ExtFinDep	0.970***	1.205***	1.538***	1.835***
	(0.152)	(0.153)	(0.223)	(0.232)
Lib*ExtFinDep*InCorr	-0.081***	-0.100***	-0.195***	-0.215***
	(0.024)	(0.024)	(0.034)	(0.034)
ExtFinDep*InCorr	-0.036*	-0.013	-0.066**	-0.035
	(0.020)	(0.021)	(0.029)	(0.030)
# of observations	33,801	33,801	16,391	16,391
R-squared	0.794	0.794	0.842	0.842
# of countries	82	82	82	82

Note: The dependent variable is the logarithm of exports to the rest of the world at the 3-digit ISIC industry level during 1982-1997. Lib is the dummy variable of equity market liberalization, ExtFinDep is industrial external finance dependence, InCorr is the initial corruption level. In all regressions, we control for the industry-year and country-year fixed effects. Heteroskedasticity-robust standard errors clustered at country-year are in parentheses. ***, **, * indicate significance at the 1%, 5%, and 10% level.

Table 3

Robustness check: subsamples of countries

	Dependent variable: ln(Export)							
	Official liberalization dummy	First sign liberalization dummy	Official liberalization dummy	First sign liberalization dummy	Official liberalization dummy	First sign liberalization dummy	Official liberalization dummy	First sign liberalization dummy
	Non-OECD countries				Switchers			
	All ind.		Low asset-tangibility ind.		All ind.		Low asset-tangibility ind.	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Lib*ExtFinDep	1.153***	1.700***	2.540***	3.209***	0.443	0.507	0.786*	0.703
	(0.371)	(0.376)	(0.521)	(0.516)	(0.341)	(0.334)	(0.451)	(0.440)
Lib*ExtFinDep*	-0.147**	-0.222***	-0.417***	-0.500***	-0.019	-0.001	-0.125*	-0.084
Corr	(0.062)	(0.062)	(0.087)	(0.086)	(0.054)	(0.052)	(0.070)	(0.069)
ExtFinDep*Corr	-0.088***	-0.062**	-0.115***	-0.075*	-0.124***	-0.083**	-0.240***	-0.171***
	(0.031)	(0.030)	(0.041)	(0.040)	(0.037)	(0.038)	(0.047)	(0.049)
# of observations	23,431	23,431	11,386	11,386	16,073	16,071	7,754	7,752
R-squared	0.680	0.681	0.734	0.735	0.712	0.692	0.776	0.755
# of countries	59	59	59	59	38	37	38	37

Note: The dependent variable is the logarithm of exports to the rest of the world at the 3-digit ISIC industry level during 1982-1997. Lib is the dummy variable of equity market liberalization, ExtFinDep is the industrial external finance dependence, Corr is the corruption level. In all regressions, we control for the industry-year and country-year fixed effects. Heteroskedasticity-robust standard errors clustered at country-year are in parentheses. ***, **, * indicate significance at the 1%, 5%, and 10% level.

Table 4

Robustness check: domestic stock markets

	Dependent variable: ln(Export)			
	Official liberalization dummy	First sign liberalization dummy	Official liberalization dummy	First sign liberalization dummy
	All ind.		Low asset-tangibility ind.	
	(1)	(2)	(3)	(4)
Lib*ExtFinDep	0.824***	0.755***	0.962***	0.862***
	(0.160)	(0.152)	(0.173)	(0.176)
Lib*ExtFinDep*Corr	-0.063**	-0.0426	-0.113***	-0.0947***
	(0.027)	(0.0289)	(0.0327)	(0.0331)
ExtFinDep*Corr	-0.112***	-0.119***	-0.265***	-0.272***
	(0.023)	(0.0243)	(0.0270)	(0.0267)
MktV*ExtFinDep	13.620***	9.887***	15.70***	11.12***
	(2.082)	(2.210)	(2.345)	(2.594)
MktTurnover*ExtFinDep	-0.594	-0.105	-1.209	-0.911
	(0.747)	(0.541)	(0.740)	(0.658)
Lib*MktV*ExtFinDep	-15.381***	-13.61***	-19.07***	-16.48***
	(1.471)	(1.989)	(1.866)	(2.222)
Lib*MktTurnover*ExtFinDep	1.018*	1.260***	1.852***	2.322***
	(0.600)	(0.455)	(0.567)	(0.556)
MktV*ExtFinDep*Corr	0.990**	1.654***	1.872***	2.544***
	(0.426)	(0.329)	(0.428)	(0.447)
MktTurnover*ExtFinDep*Corr	0.228**	0.0390	0.243**	0.0397
	(0.109)	(0.0766)	(0.108)	(0.0939)
# of observations	19,335	19335	9314	9314
R-squared	0.783	0.780	0.842	0.841
# of countries	46	46	46	46

Note: The dependent variable is the logarithm of exports to the rest of the world at the 3-digit ISIC industry level 1982-1997. Lib is the dummy variable of equity market liberalization, ExtFinDep is the industrial external finance dependence, Corr is the corruption level. MktV is the stock market value traded relative to GDP, and MktTurnover is the ratio of stock market value traded over stock market capitalization. In all regressions, we control for the industry-year and country-year fixed effects. Heteroskedasticity-robust standard errors clustered at country-year are in parentheses. ***, **, * indicate significance at the 1%, 5%, and 10% level.

Table 5

Robustness check: traditional factor endowments

	Dependent variable: ln(Export)			
	Official liberalization dummy	First sign liberalization dummy	Official liberalization dummy	First sign liberalization dummy
	All ind.		Low asset-tangibility ind.	
	(1)	(2)	(3)	(4)
Lib*ExtFinDep	1.020***	1.014***	1.038***	0.995***
	(0.169)	(0.176)	(0.205)	(0.213)
Lib*ExtFinDep*Corr	-0.110***	-0.091***	-0.142***	-0.107***
	(0.032)	(0.033)	(0.041)	(0.040)
HumCap*HCIntensity	0.054	0.054	-0.290	-0.301
	(0.228)	(0.227)	(0.312)	(0.312)
PhyCap*PCIntensity	1.131	1.127	12.956***	13.073***
	(0.963)	(0.962)	(2.211)	(2.192)
NatuRes*NRIntensity	0.100***	0.100***		
	(0.033)	(0.033)		
HumCap*HCIntensity*Corr	0.135	0.131	-0.522	-0.588*
	(0.143)	(0.143)	(0.344)	(0.342)
PhyCap*PCIntensity*Corr	0.081*	0.082*	-0.035	-0.033
	(0.046)	(0.046)	(0.056)	(0.056)
NatuRes*NRIntensity*Corr	0.009	0.009		
	(0.007)	(0.007)		
HCIntensity*Corr	-0.294	-0.236	6.609	7.586
	(2.407)	(2.411)	(5.756)	(5.712)
PCIntensity*Corr	-0.453***	-0.455***	-0.077	-0.082
	(0.100)	(0.099)	(0.133)	(0.133)
NRIntensity*Corr	-0.035**	-0.036**		
	(0.014)	(0.014)		
ExtFinDep*Corr	-0.116***	-0.116***	-0.029	-0.032
	(0.027)	(0.028)	(0.030)	(0.031)
# of observations	26,715	26,715	12,952	12,952
R-squared	0.816	0.817	0.862	0.862
# of countries	65	65	65	65

Note: The dependent variable is the logarithm of exports to the rest of the world at the 3-digit ISIC industry level during 1982-1997. Lib is the dummy variable of equity market liberalization, ExtFinDep is the industrial external finance dependence, Corr is the corruption level. HumCap is the human-capital abundance, PhyCap is the physical-capital abundance, NatuRes is the natural-resource abundance, and HCIntensity, PCIntensity and NRIntensity are the corresponding factor intensities. In all regressions, we control for the industry-year and country-year fixed effects. Heteroskedasticity-robust standard errors clustered at country-year are in parentheses. ***, **, * indicate significance at the 1%, 5%, and 10% level.

Table 6

The effects of the number of firms and the size of productive firms on exports

	Dependent variable: ln(Export)		
ln(no. of establishments)	0.723***	0.685***	0.620***
	(0.019)	(0.020)	(0.019)
ln(no. of employees per establishment)	0.895***		
	(0.029)		
ln(output per establishment)		0.674***	
		(0.027)	
ln(gross fixed capital formation per establishment)			0.415***
			(0.017)
# of observations	18,845	18,371	14,918
R-squared	0.824	0.817	0.807
# of countries	63	63	58

Note: The dependent variable is the logarithm of exports to the rest of the world at the 3-digit ISIC industry level during 1982-1997. In all regressions, we control for the industry-year and country-year fixed effects. Heteroskedasticity-robust standard errors clustered at country-year are in parentheses. ***, **, * indicate significance at the 1%, 5%, and 10% level.

Table 7

The effects of corruption on the number of firms and the size of productive firms

	Official liberalization dummy	First sign liberalization dummy	Official liberalization dummy	First sign liberalization dummy	Official liberalization dummy	First sign liberalization dummy	Official liberalization dummy	First sign liberalization dummy
	All ind.		Low asset-tangibility ind.		All ind.		Low asset-tangibility ind.	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Dependent variable: ln(no. of establishments)				Dependent variable: ln(no. of employees per establishment)			
Lib*ExtFinDep	0.761***	0.701***	1.103***	0.977***	-0.078	-0.032	-0.021	0.037
	(0.100)	(0.111)	(0.155)	(0.171)	(0.082)	(0.087)	(0.103)	(0.108)
Lib*ExtFinDep*	-0.129***	-0.096***	-0.210***	-0.152***	0.052***	0.048***	0.066***	0.065***
Corr	(0.020)	(0.021)	(0.030)	(0.031)	(0.016)	(0.016)	(0.020)	(0.019)
ExtFinDep*Corr	-0.130***	-0.134***	-0.201***	-0.211***	-0.015	-0.014	-0.044***	-0.045***
	(0.014)	(0.015)	(0.020)	(0.022)	(0.012)	(0.013)	(0.014)	(0.015)
# of observations	18,733	18,733	9,193	9,193	18,515	18,515	9,101	9,101
R-squared	0.865	0.865	0.857	0.856	0.687	0.687	0.720	0.721
# of countries	63	63	63	63	63	63	63	63

	All ind.		Low asset-tangibility ind.		All ind.		Low asset-tangibility ind.	
	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
	Dependent variable: ln(output per establishment)				Dependent variable: ln(gross fixed capital formation per establishment)			
Lib*ExtFinDep	-0.213*	-0.103	-0.267*	-0.161	-0.113	-0.025	-0.142	-0.025
	(0.110)	(0.118)	(0.137)	(0.143)	(0.147)	(0.152)	(0.180)	(0.185)
Lib*ExtFinDep*	0.062***	0.041*	0.105***	0.093***	0.067**	0.054**	0.081**	0.080**
Corr	(0.023)	(0.023)	(0.029)	(0.028)	(0.030)	(0.028)	(0.038)	(0.035)
ExtFinDep*Corr	-0.021	-0.012	-0.064***	-0.061***	-0.016	-0.013	-0.040	-0.037
	(0.017)	(0.019)	(0.019)	(0.021)	(0.021)	(0.022)	(0.024)	(0.026)
# of observations	18,010	18,010	8,853	8,853	14,870	14,870	7,318	7,318
R-squared	0.788	0.788	0.788	0.788	0.716	0.716	0.720	0.721
# of countries	63	63	63	63	58	58	58	58

Note: The dependent variable is the logarithm of exports to the rest of the world at the 3-digit ISIC industry level during 1982-1997. Lib is the dummy variable of equity market liberalization, ExtFinDep is the industrial external finance dependence, Corr is the corruption level. In all regressions, we control for the industry-year and the country-year fixed effects. Heteroskedasticity-robust standard errors clustered at country-year are in parentheses. ***, **, * indicate significance at the 1%, 5%, and 10% level.