Determinants of Export Sophistication

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Abstract

Recent literature indicates the importance of export sophistication on growth. The paper extends the empirical work of Hausmann et al. (2007) to examine the causal effect of FDI stock, geography and institutional quality on export sophistication. Using cross country panel data, the finding shows that FDI has positive effect; and the effect is greater for countries with low institutional quality. Similarly, remoteness from major markets has strong negative effect. In contrast, institutional quality has insignificant effect. The results are robust to alternative measurement of the dependent variable and econometric estimation methods. The findings imply that geographic location and FDI are key determinants, whereas institutional quality does not seem to matter after controlling for other factors.

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1 Introduction

There is a strong consensus that stable and diversified export sector promotes faster economic growth. Studies on export diversification show that Sub-Saharan African countries are at the lowest end in export diversification index (Sun, 2004; Debczuky and Berrettoni, 2006; Nwachukwu, 2008; and Hesse, 2008). While African economies stagnated in primary exports, many countries in Asia and Latin America have undergone major structural transformation in their export sector (Bonaglia and Fukasaku, 2003; and World Bank, 2002). Not only developing countries need to diversify their exports, but also the nature of their diversification is an important determinant for growth. Hausmann et al. (2007) show export sophistication is positively correlated with per capita income and human capital. However, comprehensive work to identify major determinants of export sophistication has been lacking.

The paper broadens the scope and examines the effect of foreign direct investment (FDI), distance from major markets, and institutional quality on export sophistication using panel data. The findings confirm that per capita GDP, human capital, and country size maintain their significant effect. With regard to the variables of interest, we find that FDI has positive effect. The result continues to hold when *international capital control* is used as an instrumental variable for FDI. Similarly, remoteness from major markets has negative effect. The result is robust to alternative estimation methods and sample sizes; and shows the importance of geographic location. As far as institutional quality is concerned, we find negative effects in some of the estimations, although not always significant. It suggests that the finding is driven by presence of many countries, which are attractive FDI destinations despite their low institutional quality. We confirm that FDI has significant effect only for sub-sample of countries with institutional quality below the median. This implies that MNEs could find alternative ways of mitigating the effect of bad institutions (Acemoglu and Johnson, 2005). Finally, we rebase EXPY to control for the change of the average per capita GDP of the exporting countries over time. The findings remain the same as in the above.

Alternatively, we construct EXPY using a measure of product complexity and the result confirms that FDI and REMOT have significant effects.

The paper contributes to the literature on export sophistication by generalizing the role of FDI, showing the importance of remoteness and clarifying the effect of institutions. Besides, we confirm the findings of Huasmann et al. (2007) using panel data. Furthermore, it has indirect contribution to the geography versus institutions debate by supporting the primacy of geography over institutions on export sophistication. It is related to the work of Beatta and Harding (2009), Xu and Lu (2007),and Wang and Wei (2008) on FDI; Dennis and Shepherd (2005) and Parteka and Tamberi (2008) on remoteness; and Acemoglu and Johnson (2005), Cowan and Neut (2007) and Levchenko (2004) on institutions.

The rest of the paper is organized as follows. Section two presents literature review. Section three discusses the construction of export sophistication, as well as other variables and data sources. Descriptive statistics is shown in section four. Section five outlines the empirical strategy and specification. In section six, we present the empirical results and discussion. Finally, section eight concludes.

2 Literature Review

Hausmann and Rodrik (2003) pioneer the literature on export sophistication by presenting a new perspective on the challenges of economic development in developing countries: *learning what a country is good at producing, through 'discovery cost'.* They argue that entrepreneurs have to invest resources to develop new products; and require intellectual and patent rights protection to fully appropriate the return of their investment. However, in many developing countries, the institutional weaknesses do not provide such protection for innovators. Consequently, low-income countries produce very few high-productivity goods that could be exported to world markets.[1] Hausmann et

[1] Using a general-equilibrium framework, they show there is little investment and entrepreneurship ex ante, and duplication of producers ex post as laissez-faire outcome (Hausmann and Rodrik, 2003:612-613).

al. (2007) also claim that specializing in some products brings higher growth than specializing in others because of productivity difference. Their model predicts that expected productivity in the modern sector is determined both by human capital and the number of investors engaged in cost discovery.[2] However, the prediction is difficult to test empirically, instead they developed export sophistication index (EXPY). Lall et al. (2005) also devised a similar sophistication index called 'normalized sophistication index'. The index calculates the average per capita income associated with a country's export bundle. The intuition is that the sophistication of an export good is linked to the per capita income of the countries that export the product.[3] They find that export sophistication is significantly correlated with per capita GDP and human capital. However, there are big outliers in either direction, especially among developing countries such as China, India and some resource rich poor countries.

Rodrik (2006) provides qualitative evidence of the role of favourable government policy in nurturing the development of export sector, such as consumer electronics, in China. He emphasizes the need to design appropriate institutional structures that foster export initiatives. Xu and Lu (2007) find that China's rising export sophistication is significantly explained by increasing presence of wholly foreign owned Multinational Enterprises (MNEs). Wang and Wei (2008) also use a similar measure of export sophistication, export dissimilarity index and unit value exports, to account for the rising sophistication of China's exports. Their findings reveal that improvement in human capital and government policies in the form of tax-favoured high tech zones contributed significantly to the rise in export overlap (similarity) with G+3 economies (US, Japan and EU); while processing trade, MNEs,

[2]The basic building blocks of the model are: each good has a certain productivity level from the distribution of productivity; the maximum productivity is determined by human capital level of the economy; the higher the maximum productivity, the higher the sophistication level; investors have the option of copying an existing maximum productivity good at no cost, or incurring sunk cost of investment (discovery cost) to know the level of productivity associated with new good. There is an inherent uncertainty in cost and profitability of newly discovered goods (Hausmann et al. 2007: 4-8).

[3]The rationale is that products exported by richer countries have characteristics that allow high wage producers to compete in world markets. These characteristics include the embodiment of higher-level technology as an important determinant (Lall et al, 2005:223).

high tech and other policy zones are associated with higher unit value exports. In the next section, we briefly discuss the literature that links export sophistication with the variables of interest.

2.1 Export Sophistication and FDI

There is ample empirical evidence that export diversification and improving the quality of exports are significantly related with growth. Developing countries attempt to escape from dependence on primary exports. One of the strategies is encouraging inflow of FDI to broaden export composition. FDI could potentially have direct and indirect effects on export sophistication. The direct effect is that foreign firms or domestic firms in joint venture with foreign firms are likely to export sophisticated products to international market. Rodrik (2006) provides qualitative evidence on the effect of FDI on Chinese export sophistication. The indirect effect is through the impact of FDI on productivity and innovation of domestic firms.

Harrison and Rodriguez-Clare (2009) survey the literature and document three findings on spillover effects: firms that receive FDI (joint ventures) or are acquired by multinationals generally exhibit higher productivity levels; there is evidence of positive vertical spillovers from foreign buyers to domestic suppliers (backward linkages) and from foreign suppliers to domestic buyers (forward linkages); and there are negative or insignificant horizontal spillovers to firms within the same industry.[4] Using firm-level data from Lithuania, Javorcik (2004) finds positive productivity spillovers from FDI taking place through contacts between foreign affiliates and their local suppliers in upstream sectors. Similar results are found for Indonesia and China by Blomström and Sjöholm (1999) and Li et al.(2002) respectively.

Kokko and Globerman (2000) developed a theoretical framework to un-

[4]Horizontal spillovers measure the extent to which foreign investment in the same sector enhances the productivity of domestic firms. Vertical spillovers measure the extent of positive externalities to domestic suppliers or customers from the presence of foreign enterprises. Forward spillovers occur if foreign firms located in the domestic market supply inputs that embody new technologies or processes. Backward spillovers could occur if domestic suppliers to downstream foreign firms benefit from contacts with the firms to increase productivity (Harrison and Rodriguez-Clare, 2009: 67).

derstand the underlying forces that determine the scope and magnitude of FDI spillovers to host economies. The findings suggest that the competitiveness of host country markets and the technical capability of local firms are among the most important determinants of spillover benefits. A similar study by Girma (2005) empirically explores whether the effect of FDI on productivity growth is dependent on absorptive capacity in UK. His findings show that the productivity benefit from FDI increases with absorptive capacity until some threshold level beyond which it becomes less significant. Markusen and Venables (1998) show how FDI could serve as a catalyst for local industry to become more competitive to the extent of reducing the relative and absolute position of multinationals in the industry. Cheung and Lin (2004) also document how local firms can learn about the products and technologies brought in by foreign investors, by means of reverse engineering, 'stealing' skilled workers from foreign firms, demonstration effect on local R&D activity etc.

Similarly, Harding and Javorcik (2009) find a positive effect of FDI on within-sector unit values in developing countries, while such a relationship is less evident in developed countries.[5] In line with the above findings, we expect FDI to have a positive effect on export sophistication. This relationship is linked through the spillovers effect of FDI on domestic firms and the production of high value products by foreign owned firms.

2.2 Export Sophistication and Remoteness

Transportation costs have a crucial effect on the size and distribution of a country's international trade. Given the scarcity of reliable transport data, often 'geographical distance' is used as a proxy for transport costs in many studies. In the context of bilateral trade, it has become a stylized fact that distance is negatively related with the size of trade flows between countries (Anderson and Van Wincoop, 2004; and Disdier and Head, 2008). Further decomposition of bilateral trade shows that distance reduces trade flows primarily through its effect on extensive margin (the number of commodities),

[5]They proxy for FDI inflows using survey information on sectors treated by national investment agencies as 'priority sectors' for investment (Harding and Javorcik, 2009:6).

as opposed to intensive margin (volume of trade) (Hillberry and Hummels, 2008; and Chaney, 2008).

Another dimension of the literature is the recognition that not only absolute bilateral distance, but the relative distance of a country pair (exporter and importer) from their respective major trading partners has an effect on trade flows. Wei (1996) developed an index to measure such effect on bilateral export, called remoteness index. Remoteness index is used in many empirical papers both as a control variable and variable of interest.[6] In addition to that, geographic location of a country matters as it could also be a source of comparative advantage. When a country is located far away from the major international market, there is less probability of becoming a competitive exporter in diversified products. Recent research shows that composition of export is negatively affected by distance from international market. Dennis and Shepherd (2005) show that export diversification is lower, the farther an exporting country is from Germany. Similarly, Parteka and Tamberi (2008) find that distance from major markets (New York, Rotterdam and Tokyo) is robust determinants of export diversification.

Similarly, distance from major markets could also have a negative effect on export sophistication. The major market we consider is OECD, a group of high income countries, which have a big import demand for high income products. Eaton and Kortum (2002) introduced geographic barriers to Dornbusch, Fisher and Samuelson (1977) to show the effect of distance on the continuum of goods produced efficiently. Given perfect competition, the importing country buys from the lowest price seller in the market.[7] Their model implies if a country is relatively remote from major markets, it could only export a narrow range of high efficiency goods. When a country does not

[6] Among others, Nitsch (2000), Anderson and Van Wincoop (2003), Rose (2004), Sousa and Lochard (2005), and Iwanov and Kirkpatrik (2007) find remoteness of an exporter from the rest of the world has statistically significant negative effect on bilateral trade flows.

[7] An exporting country provides distribution of prices for its exports to all destination markets, which depends on distance. Assuming that an exporting country's production efficiency distribution is Frechet (type II extreme value distribution), they show that the probability that an exporting country provides a good at the lowest price in a particular importing country is negatively related with distance between them (Eaton and Kortum, 2002: 1745-1750).

export many products that high income countries demand, its export sophistication is low. Besides, there could be indirect effect of distance through its negative effect on FDI. A relatively far away country is less likely to become an attractive destination for FDI. We proxy distance from major markets using remoteness index and investigate whether it significantly affects export sophistication or not.

2.3 Export Sophistication and Institutions

Institutions encompass a wide range of rules, regulations, contracts, procedures and the like that define and enforce the rule of the game necessary for efficient markets (North, 1989, 1994, 1996). In recent years, many studies have been undertaken to understand the role of institutions on economic outcomes. Empirical studies by Mauro (1995), Knack and Keefer (1995), Acemoglu et al. (2001, 2002), Acemoglu and Johnson (2005), Rodrik et al. (2004), Easterly and Levine (2003) show weaker institutions are associated with slow growth or poor economic performance. Besides, institutions also influence specialization patterns. North (2003) argues that institutions, by reducing uncertainty, are the key to facilitating cooperation which allows the realization of the gains from trade and exchange and the advantages of increasing specialization.

Levchenko (2004) investigates whether difference in institutional quality could be the source of comparative advantage in North-South trade.[8] The theoretical implication is that institutional differences across countries are important determinants of specialization patterns. He also tests the prediction using US import data and finds that institutional differences are a significant determinant of the share of trade in complex products. Similarly, Nunn (2007) extends the Dornbusch, Fischer and Samuelson (1977) Ricardian model to show a country's ability to enforce written contracts is an important determinant of comparative advantage. His empirical test con-

[8]He uses two different approaches to model the impact of institutions. The first one emanates from the premise that some sectors rely on institutions more than others. The second approach, considers institutions as established frameworks that govern relationships between factors in production (Levchenko, 2004:3-4).

firms that countries with better contract enforcement export relatively more in industries for which relationship-specific investments are most important.

Martincus and Gallo (2009) also examine whether institutions have significant effect on countries' export patterns; and whether the effect is just direct or there are also indirect effects.[9] They find that better institutions are correlated with both higher relative export share of goods with more complex production processes and more diversified intermediate input linkages across sectors. Similarly, Costinot (2009) finds that better institutional quality and higher level of human capital are complementary sources of comparative advantage in more complex industries. Many empirical studies show that less developed countries specialize in less complex products. However, a comprehensive theoretical model has been lacking. Krishna and Levchenko (2009) complement the findings by developing a theoretical explanation for the pattern of specialization. Their model shows that openness to international trade pushes less developed countries, with low levels of human capital or with lower institutional ability to enforce contracts, to specialize in less complex goods.

The concept of export sophistication is very close to Levchenko (2004), Martincus and Gallo (2009) and Costinot (2009) use of complexity. Complex products require skilled human capital, advanced technology and well organized production system. The findings show that when a country has a high quality institutions, it provides an environment that encourages the production of complex goods, which are high productivity goods. Likewise, export sophistication index measures the level of productivity associated with the basket of exports in a country. Accordingly, we hypothesize that quality of institutions in a country is a significant determinant of export sophistication.

[9] The direct effect means that countries with institutions that ensure a better contracting environment tends to have comparative advantage in sectors with complex production process. The indirect effect is meant to capture whether the degree of intersectoral networking implied by production processes varies across sectors and across countries depending on institutions (Martincus and Gallo, 2009:130).

3 Variables and Data Sources

This section discusses the variables used for empirical estimation and their data source.

3.1 Export Sophistication (EXPY)

The construction of export sophistication index is presented briefly (for details, see Hausmann et al., 2007:9-10). Assume x_i^k represents the exports of country i in product k. Then, total exports of country i is, $X_i = \sum_k x_i^k$. The income/productivity level associated with each good k, $PRODY^k$, is calculated as:

$$PRODY^k = \sum_i \left\{ \frac{(x_i^k/X_i)}{\sum_i (x_i^k/X_i)} Y_i \right\} \tag{1}$$

where Y_i denotes per capita GDP of country i. $PRODY^k$ is weighted average measure of the per-capita GDP of the countries exporting product k, where the weights reflect the revealed comparative advantage of each country in good k. Finally, we construct the income/productivity level that corresponds to a country's export basket.

$$EXPY_i = \sum_k \left\{ \frac{x_i^k}{X_i} PRODY^k \right\} \tag{2}$$

It is an average of the PRODY of country i, weighted by the value share of good k in country i's total exports. Hausmann et al. (2007) call it 'export sophistication index'. We use World Trade Flows dataset from Feenstra et al. (2005) to calculate export sophistication index.

3.2 Institutional Quality

As discussed in the literature, institutions cover a wide range of socio-economic and political dimensions. For the purpose of clarity, we focus on two categories of institutions: *economic* and *political* institutions. Economic institutions represent the rules and regulations that define economic transactions, enforce contracts and protect rights; whereas political institutions define the political structure, decision making process and accountability of political

authorities. We use two commonly used proxies of economic institutions, economic freedom index (EC_FREE) and legal structure and security of property rights (LEGALSEC) (Gwartney and Lawson, 2003; and Dawson, 2003). Similarly, following Glaeser et al. (2004) and Acemoglu and Johnson (2005), we capture political institutions using POLITY2 and executive constraints (XCONST). We briefly describe what each of the indexes specifically measure and its construction.

POLITY2: POLITY score is calculated by subtracting the AUTOCRATIC score from the DEMOCRATIC score of a given country. The score has a range from +10 (strongly democratic) to -10 (strongly autocratic). Institutionalized democracy is measured using three interdependent elements: presence of institutions and procedures through which citizens can express effective preferences; the existence of institutionalized constraints on the exercise of power; and the guarantee of civil liberties. In contrast, institutionalized autocracy is defined in terms of a set of political characterstics: regularized selection of chief executives within political elite; few institutional constraints on executive power, high degree of directiveness over social and economic activity. (POLITY IV, 2009).

XCONST: This variable refers to the extent of institutionalized constraints on the decision-making powers of chief executives such as president, prime minister, king and other monarchies leading the country; and the limitations are imposed by accountability group(s)[10]. These could be: legislative bodies, ruling party in one party state, councils of nobles or advisors in monarchies, the military in coup-prone polities, and independent judiciary. The score is 1 to 7, where higher score mean more constraint (POLITY IV, 2009).

EC_FREE: It is an index score that measures the extent of economic freedom that a country has as measured by several other indexes. The

[10]The accountability group could be, legislative body, ruling party, councils of nobles or powerful advisors in monarchies, the military, or independent judiciary (POLITY IV, 2009:21).

EC_FREE index is a composite measure of size of government (expenditures, taxes, and enterprises), legal structure and security of property rights, access to sound money, freedom to trade internationally, and regulation of credit, labour and business. It is an index score of 0 to 10, with higher score mean better freedom (Economic Freedom of the World, 2009).

LEGALSEC: It is an index score of the extent of legal structure and security of property rights that exist in a country. The sub-component indices used to construct the index are scores of : judicial independence, existence of impartial courts, protection of the property rights, military interference in rule of law and the political process, integrity of the legal system, legal enforcement of contracts, and regulatory restrictions on the sale of real property. The score is similar to EC_FREE (Economic Freedom of the World, 2009).

3.3 Remoteness

According to Wei (1996) remoteness index is a weighted average of the distance of a country from its trading partners, where the weights are trading partners' income (GDP).[11] It is used to capture geographic distance from major markets. We calculate remoteness index of an exporting country from OECD (REMOT_i). The OECD list includes 23 countries which became members before 1994.[12] Bilateral distance data from CEPII database and GDP at ppp from Penn World Tables are used. REMOT_i vary slowly over time because of changing GDP.

3.4 Foreign Direct Investment

Foreign Direct Investment (FDI) measured as stock variable is available in UNCTAD website, and the dataset starts from 1980. FDI per capita

[11] $\text{REMOT}_i = \sum_h w_h \text{Distance}_{hi}$, where w_h is country $h's$ share in OECD's total GDP.

[12] The countries are: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, United Kingdom, and United States.

($FDIpc_{it} = \frac{FDI_{it}}{Pop_{it}}$) values are used to take the relative country size into account.

3.5 Other Variables

We also use the variables used in the Hausmann et al. (2007) specification as control variables. Human capital is proxied by average years of schooling attained (EDUC) from Barro and Lee (2000) international educational attainment dataset. Per capita GDP at ppp and Population data are taken from Penn World Tables.

4 Descriptive Statistics

In this section, we present a descriptive statistics of EXPY. It is important to examine how EXPY varies within a country over time and across countries at a time to understand the pattern of variation. The overall distribution of EXPY for the whole period is presented in table 1.

Table 1: Summary Statistics for the whole period (1965-2000).

Variable		**Mean**	**Std.Dev.**	**Min**	**Max**	**Obs.**
EXPY	Overall	7278.94	3988.05	1469.87	19779.86	N=1125
	Between		1891.93	3383.70	9324.87	T=8
	Within		3626.75	236.66	21789.98	n=140.6

Table 1 shows that there is a high within country and between countries variations for EXPY. Moreover, the standard deviation of within variation is almost twice of the between variation, which shows there is more variation within a country over time than variation across countries. This implies that some countries have succeeded in transforming their export sector from basic primary commodities to more diversified sophisticated products. As a result, their EXPY increased significantly over the period of time. We illustrate the observation using two African and two Asian countries. In 1965, Kenya and Malaysia had equivalent level of EXPY, which were 2,192 and 2,206.6 respectively. By the year 2000, Kenya's EXPY reached 4,764; while Malaysia's EXPY grew dramatically by 530% to be 13,927. Similarly,

Tanzania's EXPY increased from 1,665 to 3,272; whereas Thailand managed to raise its EXPY score from 1,638 to 12,378 during the same period of time.

Table 2: Five-Year Average Statistics for the period 1965 to 2000.

Year	**Obs**	**Mean**	**Std.Dev.**	**Min**	**Max**
1965	103	3383.70	1761.35	1469.87	8440.43
1970	139	5268.82	3893.52	1511.96	19779.86
1975	140	7060.37	4183.06	1874.21	18918.42
1980	140	7922.41	4441.57	2164.98	19600.42
1985	140	7618.93	3446.49	2491.19	13368.30
1990	141	7843.37	3382.83	1993.71	14361.15
1995	161	8301	3360.32	2522.22	15136.65
2000	161	9324.87	3658.66	2282.67	19037.78

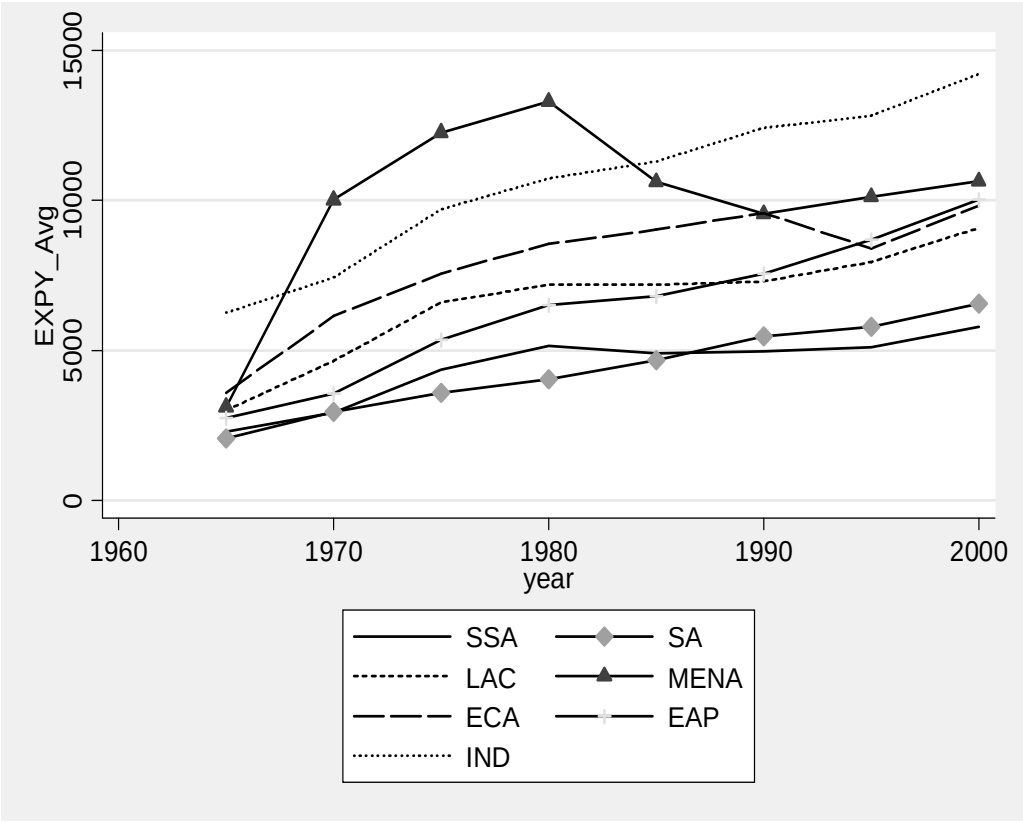
The summary statistics in table 2 shows the mean value has an increasing trend for the whole period. Besides, there is a high variation in EXPY score among countries as evidenced by the high standard deviation. The minimum and maximum EXPY values also reveal important facts. The minimum EXPY shows a steady small increase over time except for interruptions in 1990 and 2000. This could be due to small and/or no per capita GDP growth in many low income economies. The maximum EXPY shows a big jump in 1970 and remained high in the two consecutive periods before dropping drastically in 1985. From 1985 to 1995, there has been a steady rise and afterwards big increase in 2000.

Closer observation reveals that most of the countries in the lowest end of EXPY are African countries. From 1970 to 1980, four of the five countries with smallest EXPY were from Africa. Moreover, since 1985, all five of them were African countries. On the other side, in 1965, European countries (Norway, Sweden, Finland, and Switzerland) were on the top list with largest EXPY. From 1970 to 1985, however, the five countries with the largest EXPY were almost the same Middle East oil exporting countries (Saudi Arabia, Iraq, Oman, Libya, and Qatar). This could probably be due to an increase in demand and price of oil, particularly during the crises periods of 1973 and 1979, and the associated gain for exporting countries. Since 1990, the countries on the top list were again European countries (such as Germany,

Sweden, Finland, and Ireland) and Japan. For the list of countries with the smallest and largest EXPY score in each period, refer to table 6 in appendix.

In the preceding discussion, we observe the existence of regional patterns. To further explore the regional characteristics of EXPY, we average EXPY score by region and plot it over time. Figure 1 shows the graph for the seven regions[13]: Sub-Saharan Africa (SSA), South Asia (SA), Europe and Central Asia (ECA), East Asia and Pacific (EAP), Latin America (LAC), Middle East and Northern Africa (MENA) and Industrialized countries (IND).

Figure 1: Regional EXPY Index for the period, 1965-2000.



As shown in the graph, there is a clear regional pattern where regions are ranked according to their economic growth category in EXPY score. SSA and SA are at the lowest end throughout the period. Over time, there is an increasing trend in EXPY in all regions except in MENA. For MENA, most

[13]According to World Bank regional classification.

of the countries are highly dependent on oil exports. The effect of the oil crises and the subsequent impact on oil price (export value) is reflected in unusually high EXPY score between 1970 and 1985. The EAP region has achieved remarkable growth in EXPY over the whole period. From a similar starting level with SA and SSA in 1965, it became the third highest EXPY score overtaking LAC and ECA. In contrast, LAC and SSA stagnated in their EXPY during the 80's and the stagnation continued until mid 90's for SSA. The 1980's was a period of macroeconomic crises, high inflation, soaring debt problems, declining terms of trade followed by restrictive trade policies in both regions. Later, most LAC countries undertook swift economic reform and embarked on export diversification strategies, while SSA lagged behind. Since 1990, LAC continues to increase its EXPY score. The ECA region has steady EXPY growth till 1990, drifted briefly afterwards and picked up since 1995. Many of the countries in this region are the former socialist countries, which changed to market capitalism after the collapse of the Soviet Union in 1990. The region has become an attractive destination for FDI and relocation of MNE's subsidiaries; and some of them have already joined the European Union.

5 Empirical Strategy and Specification

Hausmann et al. (2007) use per capita GDP, human capital, rule of law and country size (proxied by population and land area) as explanatory variables for EXPY. Using 2001 cross-sectional data, they find per capita GDP and human capital have a significant effect on EXPY. However, human capital loses its significance when they include rule of law, population and land area in the specification. Only per capita GDP and population remain significant. We take the empirical investigation further by modifying the specification and using panel dataset. Specifically, we are interested to examine the effect of FDI, remoteness and institutions on EXPY.

From the literature, we expect REMOT to be negatively related; while FDI ($FDIpc$) and institutional variables to be positively related to EXPY. REMOT is relatively an exogenous variable and we believe that the causation

runs from REMOT to EXPY. Institutional quality (INST) is also determined by a host of socio-cultural, historical, and political factors; and it is likely to have an exogenous effect on EXPY. Finally, there could be potential endogeneity problem with FDI as higher EXPY could also attract FDI. We argue that it is not the high EXPY per se; rather the factors that lead to higher EXPY could also attract FDI. In addition to favourable investment climate, investors also check the available attractions and suitability of a country for their investment motives. For example, resource availability (such as oil and minerals), and quality of institutions not only are sources of higher EXPY, but also factors that attract FDI. Therefore, we consider an alternative identification strategy that allows for the endogeneity of FDI.

The combined panel data is created using all the datasets. However, the coverage of each dataset varies both in terms of the number of countries in each year and the total number of years. This reduces the number of countries with complete information when all the explanatory variables are used at the same time. Besides, some of the variables are only available for every five years. Accordingly, for regression purpose, we focus on the period 1980-2000 for every five years to maximize sample size. But, we also use five year average of those variables available annually, EXPY, GDPpc, FDI, POLITY2, XCONST, to smooth short-run fluctuations.

First, we use ordinary least squares (OLS) estimation and control for region fixed effects or country fixed effects. Later, we address endogeneity concerns using an instrumental variable approach and re-estimate it by using two-stage least squares (2SLS). Finally, we apply generalized method of moments (GMM) estimation to deal with issues related to the inclusion of lagged dependent variable and other econometric problems of panel data.

Some of the variables are used in log format and the benchmark econometric specification is:

$$\begin{aligned} \log(EXPY_{it}) &= \alpha + \gamma_x \log(Z_{it}) + \beta_1 \log(REMOT_{it}) + \\ &\quad \beta_2 \log(FDIpc_{it}) + \beta_3(INST_{it}) + V_i + U_t + e_{it} \end{aligned} \tag{3}$$

where Z_{it} represent control variables - Per capita GDP (GDPpc), Population

(POP), and Educational attainment (TER_EDUC); V_i region or country fixed effects; U_t year dummies; and $INST$ proxied by POLITY2, XCONST, EC_FREE, and LEGALSEC.

6 Results and Discussion

6.1 OLS Estimation

The four columns in table 3 present the results when using the four different institutional variables mentioned above. Two of the control variables, GDPpc and POP, have the expected sign and are statistically significant. As far as the variables of interest is concerned, the results show that REMOT has a significant negative effect on EXPY. The coefficient indicates REMOT elasticity of EXPY. A country's geographic location vis-à-vis OECD has crucial effect on its export sophistication. The farther a country is from OECD the lower its export sophistication score. As indicated in the literature a closely located country has a competitive advantage of exporting many high income products to OECD. Besides, it could also gain from firm relocation and outsourcing by OECD countries, which increases the sophistication of its exports. Likewise, FDIpc has a significant positive effect on EXPY.

As far as institutional variables are concerned, three of them do not have significant effect, but exhibit a negative sign. Moreover, EC_FREE has a significant negative effect. The result suggests that there are many countries with high EXPY, despite low institutional score. The finding casts doubt on the importance of institutions as facilitator of economic transactions. One possible explanation for this could be due to relatively higher level of FDI in resource rich countries, which boosts EXPY. We further investigate the effect of institutions by dividing the sample into two using the median of ECF, and examine the effect of FDI.

As reported in table 7, we find that FDI has positive effect for low ECF score, whereas FDI becomes insignificant for high ECF score. We also find similar results using other measures of institutional quality, LEGALSEC and POLITY2. This justifies the above hypothesis, where there exist many coun-

Table 3: OLS results with region and year fixed effects.

Variable	**log(EXPY)**			
	(1)	**(2)**	**(3)**	**(4)**
log(GDPpc)	0.248***	0.284***	0.302***	0.292***
	(7.17)	*(12.55)*	*(13.95)*	*(13.85)*
log(POP)	0.062***	0.061***	0.061***	0.059***
	(18.07)	*(16.05)*	*(20.1)*	*(20.15)*
EDUC	0.005	0.002	0.008	0.009
	(1.20)	*(0.57)*	*(1.62)*	*(1.44)*
log(REMOT)	-0.154***	-0.155***	-0.178***	-0.168***
	(−9.71)	*(−15.94)*	*(−9.34)*	*(−6.63)*
log(FDIpc)	0.047***	0.035***	0.034***	0.032***
	(3.91)	*(4.11)*	*(3.79)*	*(3.60)*
POLITY2	-0.004			
	(−1.25)			
XCONST		0.005		
		(−0.91)		
EC_FREE			-0.040***	
			(−3.83)	
LEGALSEC				-0.018
				(−1.59)
Fixed effects		*Region and Year*		
Const.	-3.22***	-3.40***	-3.37***	-3.51***
	(−3.76)	*(−4.18)*	*(−4.26)*	*(−4.13)*
Obs	557	510	503	488
R.Square	0.70	0.71	0.70	0.69
Group	5	5	5	5

Note: t-statistics (in bracket) is based on robust standard errors.
***, **, and * indicate significance level at 1%, 5%, and 10%, respectively.

tries whose institutional score is low, but are attractive FDI destinations. It also confirms that MNEs could find alternative ways of mitigating the effect of bad institutions. This is consistent with the finding of Acemoglu and Johnson (2005) on *contracting* institutions. We identify ten countries that are responsible for such anomaly.[14] After excluding them, the coefficient of ECF changes to positive, although insignificant.

Finally, we compare outlier countries with countries of the same average score in ECF. It turns out that the average ECF for outliers and countries with ECF less than 5.5 is the same. But, outlier countries are three points worse in POLIT2 score. Besides, outlier countries have 41% and 189% higher EXPY and FDI respectively.

6.1.1 Robustness

We already discuss the crucial effect of oil exports on EXPY. We show that from 1970 to 1985 the five countries with largest EXPY were oil exporting economies. The trend of EXPY score for MENA region also confirms the importance of oil. Further inspection of the data also shows that oil exporters have relatively large EXPY in all the years and for many of them oil constitutes a big share of their exports. Consequently, their EXPY score is inflated considerably. Although some economies have used oil to diversify their exports to petroleum and other petro-chemical products, others still continue to export crude oil.

In this section, we examine the robustness of our findings by excluding oil exporting economies. Since many countries export oil, we exclude only those countries for which oil is a big share of their exports (around 50% and above). Using information from Alexeev and Conrad (2009), OPEC (2009), and CIA facts book (2009), the following countries are eliminated: Algeria, Bahrain, Iran, Iraq, Kuwait, Libya, Oman, Qatar, Saudi Arabia, Syria, UAE, Equador,

[14] We plot the residual of an estimate (without ECF) with ECF; and identify ouliers of low ECF, but high residual observation in the scatter plot. These are: Congo (Zaire), Sierra Leone, Congo, Syria, Algeria, Central African Republic, Trindad and Tobago, China, Iran and Guyana.

Trindad, Venezuala, Norway, Angola, Gabon and Nigeria. In general, the results in table 8 are similar to the findings in table 3 in terms of sign and significance level of the explanatory variables with two exceptions. FDIpc becomes insignificant in column 3 and 4.[15], indicating that the results are not strongly robust to exclusion of oil exporting economies. It shows the importance of oil sector in attracting considerable share of global FDI, even in insitutionally weak countries. Besides, EDUC also becomes significant, which implies that the excluded countries, on average, have low attainment level.

So far, we only control for region fixed effects. We repeat the estimation using country fixed effects to examine whether the above findings hold. The results in table 9 show that two of the control variables, POP and EDUC, change sign and become negative. GDPpc is still significant, but the coefficient almost halves. With regard to the variables of interest, REMOT maintains a significant negative effect. However, the magnitude of the coefficient increases drastically and the elasticity is very high. In contrast to region fixed effects, FDIpc is no longer significant with country fixed effects, except in column 4. As far as the institutional variables are concerned, POLITY2 and LEGALSEC are still insignificant, but EC_FREE changes signs. Overall, the results are affected due to the possible correlation of country fixed effect with the regressors. In such cases, the coefficient estimates are biased.

In another dimension, looking closer at the construction of EXPY, PRODY of a commodity changes over time when per capita GDP of the exporting countries change, even with the same number of exporting countries. This raises a concern that an increase in EXPY could not only be due to a change in share of exports of an existing export bundle and/or addition of new sophisticated commodity. It could also be a result of an increase in per capita GDP of exporting countries. To separate the effect and control for increasing per capita GDP, we re-base PRODY using the value of year 2000 and re-calculate EXPY for all periods. The result reported in the first two columns of table 10 is similar to the bench mark estimation, except for EDUC. Besides, the

[15]We also find similar result when we calculate EXPY without crude oil (SITC "2789") and crude mineral (SITC "3330").

magnitude of the coefficients also remain similar. It shows that re-basing PRODY does not have an effect. We also find similar result when PRODY is re-based using 1995.

We identify that EXPY is greatly affected by some commodities, such as oil and precious minerals. Consequently, countries that export such type of commodities have high EXPY. This may not be a true reflection of the technology and productivity embedded in an export bundle. We employ a variable that could be a substitute for PRODY and serve as alternative measure of technological difference. Cowan and Neut (2007), Levchenko (2004) use *product complexity* to show institutional dependence and technological difference between commodities . It is an indicator of the number of intermediate goods required in manufacturing a commodity. *Herfindahl index*[16] is one of the measures of complexity, and requires Input-Output (I-O) matrix. Unfortunately, I-O matrix is not readily available for many countries; and even when it exists, it poses great difficulty of comparing it. Instead, similar to the above authors, we use the 2002 U.S I-O matrix as a proxy for 2000 and assume similar intermediate input usage by other countries. We calculate herfindahl index for each commodity and take the inverse to make it vary positively with the number of inputs.[17] The I-O consists of mostly manufactured commodities and there are only 386 SITC4 commodities with a corresponding herfindahl index, which is half of the 772 SITC4 commodities. Using herfindahl as a productivity measure, we calculate EXPY_{compl}. The index measures the level of technology embedded in export bundles of a country.

The results in column 3 and 4 of table 10 also have similarity with the benchmark estimation, but exhibits some key differences. The coefficient of EDUC, REMOT and FDI increases by a considerable factor. In contrast, GDPpc becomes insignificant, while institutional indexes change signs. This is not inconsistent with earlier results, since commodity categories of raw,

[16]Herfindhal index of commodity k, $H_k = \sum_i (S_{ik})^2$, where S_{ik} is the share of intermediate input i used in the production of k.The higher the number of intermediates, the lower the index value.

[17]The result does not change when 1997 U.S. Input-Output matrix is used to proxy for 1995.

primary, and crude minerals are excluded from the calculation of EXPY_{compl}. Accordingly, some of the explanatory variables have stronger effect on export sophistication as proxied by EXPY_{compl}.

6.2 2SLS Estimation

In the OLS regression, we raise endogeneity concerns due to a possible reverse causality from EXPY to FDI. When any of the regressors is endogenous, the OLS estimates of all regression parameters are inconsistent (Cameron and Trivedi, 2005). The identification strategy is to instrument FDI with an exogenous variable.[18] We search for appropriate instrument and propose that *Capital control* can be a valid instrument for FDI (IMF, 2000). It is an index constructed from 13 different types of international capital controls reported by IMF.[19] The index measures the percentage of capital controls not levied as a share of the total number of capital controls; and has 0 to 10 ratings. Although some of the controls do not directly affect foreign firms engaged in production, but often are highly correlated with the other controls. Since all the controls are policy driven, we argue that the index has an exogenous effect on FDI. On the contrary, we believe that the index does not have a causal effect on EXPY as it pertains only to capital transactions. On the other hand, there are other controls that would have direct effect on EXPY.[20]

In this section, we employ 2SLS and re-estimate the following equations simultaneously. The econometric specification is:

[18] A variable z is called an instrumental variable for the regressor x in the regression model $y = \beta x + u$ if z is uncorrelated with the error u and z is correlated with the regressor x (Cameron and Trivedi, 2005:97).

[19] Capital transaction controls on: capital market securities; money market instruments; collective investment securities; derivatives and other instruments; commercial credits; financial credits; guarantees, sureties and financial back up facilities; direct investment; liquidation of direct investment; real estate transactions; provisions specific to commercial banks/credit institutions; provisions specific to institutional investors; and personal capital transactions (IMF, 2000: 6-7).

[20] This include, controls on: exports and export proceeds; imports and import payments; payments for invisible transactions and current transfers; proceeds from invisible transactions and current transfers; arrangement for payment and receipt, exchange arrangements and exchange measures (IMF, 200:2-7)

$$\begin{aligned} \log(FDIpc_{it}) &= \alpha + \gamma \log(Z_{it}) + \beta_1 \log(REMOT_{it}) + \\ & \beta_2(Inst\_Quality_{it}) + \beta_3(Cap\_control_{it}) + V_i + U_t + e_{it} \end{aligned} \tag{4}$$

$$\begin{aligned} \log(EXPY_{it}) &= \alpha + \gamma \log(Z_{it}) + \ \beta_1 \log(REMOT_{it}) + \\ & +\beta_2(INST_{it}) + \beta_3 \log(\widehat{FDIpc_{it}}) + V_i + U_t + e_{it} \end{aligned} \tag{5}$$

where Z_i are the control variables; V_i region fixed effects; U_t year fixed effects; and $INST$ proxied by EC_FREE and POLITY2. We use capital control ($Cap\_control$) as instrument.

Table 4 summarizes the results for 2SLS. In column 1 and 4, cap_control and its square term are used as instruments. The equations are identified and Hansen test indicates that the instruments are valid. The results show that the coefficient size of FDI doubles in comparison with OLS estimates. This indicates that the OLS estimates are downwardly biased due to endogeneity with EXPY. However, there could be weak instrument problem. The weak instrument (identification) test, based on the Stock-Yogo critical values, shows that it is rejected only at 20% maximal IV size distortion. Alternatively, we try different specifications of the instrument. In column 2, the square term of capital control; whereas in column 3, indicator variables of the instrument (low, medium and high). The results are similar as in column 1 and 4, but FDI is not significant. Finally, the result is robust when POLITY2 is used as a measure of institutional quality. Similar to EC_FREE, POLITY2 has negative effect, but not always significant.

6.3 GMM Estimation

We discuss in section 6.2 the possible endogeneity of FDI and solve the identification problem using an appropriate instrumental variable. But, there may also be other econometric problems, similar to those listed in Cameron and Trivedi (2005), and Roodman (2007). Among others, autocorrelation of the disturbances in the panel estimation; time invariant country characteristics

Table 4: 2SLS results using region and year fixed effects.

Variable	log(EXPY)			log($EXPY_{rebased}$)
	(1)	**(2)**	**(3)**	**(4)**
log(FDIpc)	0.112***	0.069	0.077	0.069*
	(2.43)	*(1.43)*	*(1.53)*	*(1.64)*
log(GDPpc)	0.249***	0.279***	0.273***	0.224***
	(6.86)	*(7.38)*	*(7.17)*	*(6.84)*
log(POP)	0.075***	0.067***	0.068***	0.065***
	(6.73)	*(6.11)*	*(6.03)*	*(6.17)*
log(REMOT)	-0.140***	-0.161***	-0.157***	-0.164***
	(−2.36)	*(−2.88)*	*(−2.79)*	*(−2.97)*
EDUC	-0.004	0.003	0.002	0.017**
	(−0.35)	*(0.32)*	*(0.19)*	*(1.94)*
EC_FREE	-0.070***	-0.053**	-0.056**	-0.039*
	(−2.68)	*(−2.00)*	*(−2.07)*	*(−1.68)*
Fixed effects	*Region and Year*			
Obs	502	502	503	502
R.Square	*0.73*	*0.76*	*0.75*	*0.77*
Weak IV test†	8.64	13.36	6.31	8.64
Hansen test (p)	0.10		0.36	0.30

Note: t-statistics (in bracket) is based on robust standard errors.

***, **, and * indicate significance level at 1%, 5%, and 10%, respectively.

† Based on Kleibergen-Paap rk Wald F statistic.

(country specific fixed effects) correlated with the explanatory variables; and some regressors may be predetermined variables[21], and not strictly exogenous. Moreover, we believe that past values of EXPY are expected to have a significant effect on current values. Hence, including lagged values of EXPY changes the econometric specification to a dynamic panel. Consequently, applying OLS leads to 'dynamic panel bias' since the lagged value of EXPY is also endogenous to the fixed effects in the error term (Roodman, 2007).

The Arellano-Bond (1991) GMM estimator is the commonly used method to address the above issues, given the panel has short time (T) and large observation (N).[22] It solves the endogeneity problem by transforming the data using first difference to remove the fixed effects. It also uses lagged values of the dependent and other explanatory variables as instruments for estimating a differenced equation[23] (Arellano and Bond, 1991; and Roodman, 2007). This estimation method is known as 'difference GMM'. However, sometimes the lagged levels of the regressors are poor instruments for the first-differenced regressors. Besides, the transformation method magnifies gaps in unbalanced panels and shrinks sample size as deeper lags are used for instrumenting. The alternative is to use the augmented version, 'system GMM' developed by Arellano and Bover (1995). This estimator augments Arellano-Bond by making an additional assumption: first difference of instrumenting variables are uncorrelated with the fixed effects. It builds a system of two equations using the original equation and the transformed one. Thus, the variables in levels in the second equation are instrumented with their own first differences (Arellano and Bover, 1995; and Roodman, 2007). Besides, it uses different method of transforming the data[24], which avoids the loss

[21] When a variable is uncorrelated with current period error term, but correlated with lagged values (Arellano and Bond, 1991:280; and Roodman, 2007:15).

[22] The panel has a short time dimension (1980-2000) and a large country dimension (120+ countries).

[23] A valid instrument has to be serially uncorrelated with the idiosyncratic shocks(ε_{it}). For dependent variable, it should be lagged two periods or more to be a valid instrument. Likewise, predetermined variables and endogenous variables should be lagged at least one period and two periods respectively to serve as valid instruments (Arellano and Bond, 1991:278-281; and Roodman, 2007:20-22).

[24] The Arellano and Bond (1991) calculate the first difference by subtracting the previous observation from the contemporaneous one. In contrast, Arellano and Bover (1995) use

of observations due to gaps. The methodology enables the introduction of more instruments and maintains a bigger sample size. Consequently, it can significantly improve efficiency (Arellano and Bover, 1995; and Roodman, 2007). Thus, system GMM is preferable for maximizing sample size.

In this section, we use system and difference GMM to estimate a dynamic panel. Recalling the panel specification:

$$\begin{aligned} \log(EXPY_{it}) &= \alpha + \gamma \log(Z_{it}) + \beta_1 \log(EXPY_{it\,-1}) + \\ &\quad \beta_2 \log(REMOT_{it}) + \beta_3 \log(FDIpc_{it}) + \\ &\quad \beta_4(INST_{it}) + V_i + U_t + e_{it} \end{aligned} \tag{6}$$

The disturbance term (e_{it}) has fixed effect component (η_i) and idiosyncratic (ε_{it}) component. That is, $e_{it} = \eta_i + \varepsilon_{it}$. Using the first difference transformation, the country specific fixed effects are removed. The above equation is transformed into:

$$\begin{aligned} \Delta \log(EXPY_{it}) &= \alpha + \gamma \Delta \log(Z_{it}) + \beta_1 \Delta \log(EXPY_{it})_{-1} + \\ &\quad \beta_2 \Delta \log(REMOT_{it}) + \beta_3 \Delta \log(FDIpc_{it}) \\ &\quad + \beta_4 \Delta(INST_{it}) + \Delta U_t + \Delta \varepsilon_{it} \end{aligned} \tag{7}$$

In the preceding benchmark estimation, we only have five period observation, every five years, for the period 1980-2000. However, a panel of five periods is too short to use in GMM estimation, as it limits the use of higher lags for instrumental variable. Instead, we use annual panel data for the same period. The limitation, however, is that we cannot use EC_FREE, LEGALSEC and EDUC variables, since they are only available for every five years.

We treat GDPpc as predetermined variable, and FDIpc as endogenous variable. Accordingly, appropriate lag structure has to be set to determine

alternative way of differencing, more useful in the context of models with predetermined and endogenous variables. The first $(T-1)$ observations are subtracted from the mean of the remaining future observations available in the sample. That is, it uses forward orthogonal deviations operator to transform the data (Arellano and Bover, 1995:31-45; and Roodman, 2007:19-20).

valid instruments for GMM estimation. In both transformation methods (Arellano and Bond, 1991; and Arellano and Bover, 1995) the valid instruments are two lags and above for endogenous variables and lagged dependent variable; and one lag and above for predetermined variables. The consistency of the GMM estimator requires a lack of second-order (or higher order) serial correlation in the residuals of the specification. Moreover, the overall appropriateness of the instruments needs to pass Hansen test of over-identifying restrictions[25] (Roodman, 2007).

Table 5 shows the results for the dynamic panel estimation using system and difference GMM. Since the model is over-identified, we apply a two-step estimator.[26] The estimations fulfil the Arellano-Bond serial autocorrelation test. The first order autocorrelation of the residuals is rejected; but the second order serial autocorrelation is not rejected. The Hansen test shows that the applied instruments are jointly valid as the null hypothesis is not rejected. The estimates also pass a Wald test for the joint significance of the regressors.[27] The results are robust when we treat GDPpc as endogenous variable.

The first two columns show results of the standard EXPY. In system GMM, GDPpc and POP are statistically significant and have the expected sign. Lagged EXPY has a significant positive effect and the coefficient suggests strong persistence behaviour of EXPY. It has a dominant effect in comparison to other explanatory and control variables. Likewise, FDIpc and REMOT have significant positive and negative effects respectively. Likewise, we find similar results using difference GMM. However, the coefficient

[25]For GMM estimates to be valid, the instruments must be exogenous: $E(z\varepsilon) = 0$. In that case, the specification is overidentified. When the system is overidentified, a test statistic for the joint validity of the moment conditions (identifying restrictions) is required. Under the null of joint validity, the vector of empirical moments $\frac{1}{N}Z'\hat{E}$ is randomly distributed around 0.Both Sargan and Hansen tests yield consistent results for "non-robust GMM". If non-sphericity is suspected in the errors, a theoretically superior overidentification test is based on the Hansen statistic from a two-step estimate. (Roodman, 2007: 3, 11-12).

[26]If the model is over-identified, more efficient estimation is possible using optimal GMM, also known as two-step estimator (Cameron and Trivedi, 2009:289).

[27]The Wald statistic is a test of the joint significance of the independent variables asymptotically distributed as χ^2_k under the null of no relationship, where k is the number of coefficients estimated (Arellano and Bond, 1991:290).

Table 5: Dynamic panel estimation using GMM.

Variable	**log(EXPY)**		**log(EXPY$_{rebased}$)**	**log(EXPY$_{compl}$)**
	System	**Diff.**	**System**	**System**
log(EXPY)$_{-1}$	0.49***	0.31***		
	(*11.87*)	(*5.68*)		
log(EXPY$_{rebased}$)$_{-1}$			0.37***	
			(*6.37*)	
log(EXPY$_{compl}$)$_{-1}$				0.35***
				(*5.85*)
log(GDPpc)	0.17***	0.18***	0.20***	0.14
	(*4.47*)	(*3.71*)	(*5.07*)	(*0.79*)
log(POP)	0.06**	0.11	0.05*	0.19
	(*2.31*)	(*1.03*)	(*1.92*)	(*1.25*)
log(FDIpc)	0.03***	0.00	0.03**	-0.03
	(*2.66*)	(*0.40*)	(*2.06*)	(*−0.65*)
log(REMOT$_{OECD}$)	-0.17**	-0.44***	-0.21**	-0.73
	(*−2.06*)	(*−2.72*)	(*−1.97*)	(*−1.63*)
POLITY2	0.00	0.00	0.00	0.03*
	(*−0.96*)	(*1.03*)	(*−1.41*)	(*1.85*)
Fixed effects			*Region*	
Const.	3.80***		4.90***	3.16
	(*4.76*)		(*3.90*)	(*0.71*)
Obs	2068	1774	2339	2325
Group	143	143	143	143
Instruments	138	115	142	142
AB test_2(p)	0.43	0.53	0.65	0.30
Hansen test (p)	0.20	0.07	0.30	0.28
Wald (p)	0	0	0	0

Note: t-statistics (in bracket) is based on robust standard errors..
In system GMM, the instruments used are: 2 lags of log(EXPY) and log(FDIpc);
and 1 lag of GDPpc. Similarly, in difference GMM, the instruments used are:
2 lags of log(EXPY) and log(FDIpc); and 3 lags of FDIpc.
***, **, and * indicate significance level at 1%, 5%, and 10%, respectively.

estimates differ, which could be a consequence of smaller sample size in difference GMM owing to gaps in unbalanced panels. Robustness check using alternative measures of the dependent variable show that column 3 has similar results to column 1, but column 4 is slightly different. Generally, all the estimates show the importance of lagged EXPY, remoteness and FDI as significant explanatory variables to the variation in EXPY. Besides, the results are similar to OLS and 2SLS estimations.

7 Conclusion

Recent literature on trade and growth provide a new perspective on the role of exports. Not only developing countries need to diversify their exports, but also the nature of diversification has important implication for growth. However, the transformation requires aggregate continual investment to learn and identify new high productivity exportable commodities. Hausmann et al. (2007) show that specializing in high productivity products brings higher growth than specializing in others; and provide empirical evidence using newly developed aggregate productivity measure, EXPY.

The paper extends the empirical work to examine the causal effect of FDI, remoteness from major markets and institutional quality on export sophistication. It also examines whether the findings of Hausmann et al. (2007) hold in cross country panel.

The findings confirm that per capita GDP, human capital, country size maintain their significant effect in a panel setting. With regard to the variables of interest, we find that FDI has a positive effect on export sophistication. Interestingly, the effect of FDI is only significant for sub-sample of countries whose institutional score is below the median. It shows that there are many countries, which are attractive FDI destinations despite their low institutional score. This implies that MNEs could find alternative ways of mitigating the effect of bad institutions. Besides, the result continues to hold when an instrumental variable is used to address endogeneity of FDI. Similarly, remoteness from major markets has a negative effect. It implies that remote countries have geographic disadvantage of competitively export-

ing high income products possibly due to a high trade costs involved. In contrast, we do not find robust effect of institutional quality on export sophistication. Finally, the findings are robust to alternative ways of measuring export sophistication.

Overall, the findings imply that once we account for the effect of FDI, geographic location, and other control variables, institutional quality does not have any effect. However, a final caveat is the possibility of failure to capture other dimensions of institutional environment.

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Appendix:

Table 6: List of Countries with Smallest and Largest EXPY score.

Year	**No.**	**Country**	**EXPY**	**Country**	**EXPY**
1965	1	Papua N. Guinea	1469.9	Norway	6858.5
	2	Guinea-Bissau	1490.9	Sweden	6873.1
	3	Sri Lanka	1498.1	Finland	7689.2
	4	Niger	1520.7	Switzerland	8289.6
1970	1	Niger	1511.9	Saudi Arabia	18916.6
	2	Sri Lanka	1756.7	Iraq	18956.7
	3	Guinea-Bissau	1828	Oman	19056.7
	4	Gambia	1870.2	Qatar	19715.2
1975	1	Gambia	1874.2	Iraq	18444.7
	2	Bangladesh	2131.2	Saudi Arabia	18606.5
	3	Niger	2289.8	Oman	18809.1
	4	Rwanda	2303.7	Libya	18882.1
1980	1	Gambia	2164.9	Libya	19199.2
	2	Chad	2484.7	Oman	19238.9
	3	Niger	2617.3	UAE	19280.9
	4	Mali	2677.7	Qatar	19461.2
1985	1	Uganda	2491.2	Saudi Arabia	13208.7
	2	Niger	2521.1	Libya	13279.7
	3	Rwanda	2530.6	Qatar	13317.7
	4	Equa. Guinea	2584.5	Oman	13364.3
1990	1	Chad	1993.7	Austria	13444.6
	2	Equa. Guinea	2448.3	Germany	14012.4
	3	Uganda	2538.8	Sweden	14188.5
	4	Niger	2705.9	Japan	14359.9
1995	1	Niger	2522.2	Finland	14349.8
	2	Chad	2614	Sweden	14439.9
	3	Uganda	2786.4	Germany	14442.3
	4	Rwanda	2789	Ireland	14800.2
2000	1	Chad	2282.6	Sweden	15727.4
	2	Burundi	2478.2	Bermuda	15734.6
	3	Benin	2482.2	Finland	15905.9
	4	Malawi	3077.4	Japan	15907.2

Table 7: OLS results of Sub-samples divided as High and Low institutional scores with region and year fixed effects.

Variable	**log(EXPY)**					
	Low (below median)†			**High (above median)†**		
log(GDPpc)	0.242***	0.305***	0.292***	0.252***	0.342***	0.292***
	(*13.93*)	(*16.91*)	(*12.28*)	(*4.31*)	(*8.35*)	(*12.96*)
log(POP)	0.058***	0.053**	0.061***	0.059***	0.058***	0.042*
	(*7.93*)	(*10.64*)	(*7.85*)	(*6.68*)	(*15.05*)	(*5.07*)
EDUC	-0.003	-0.008	0.005	0.018***	0.015***	0.014***
	(*−0.34*)	(*−0.79*)	(*0.30*)	(*5.66*)	(*4.22*)	(*4.03*)
log(REMOT**)**	-0.195**	-0.214**	-0.161	-0.17***	-0.143***	-0.189***
	(*−2.31*)	(*−2.30*)	(*−1.09*)	(*−7.65*)	(*−6.76*)	(*−7.06*)
log(FDIpc)	0.045***	0.053***	0.066***	0.041	0.014	-0.006
	(*9.02*)	(*7.20*)	(*5.80*)	(*1.51*)	(*1.56*)	(*−0.45*)
POLITY2	0.004			-0.003		
	(*0.45*)			(*−0.35*)		
EC_FREE		-0.037**			-0.047***	
		(*−2.34*)			(*−5.15*)	
LEGALSEC			-0.019			0.013**
			(*−1.32*)			(*2.09*)
Fixed effects	*Region and Year*					
Const.	-3.0***	-3.12***	-3.76***	-3.44***	-4.04***	-3.17***
	(*−3.97*)	(*−3.40*)	(*−2.62*)	(*−11.46*)	(*−27.42*)	(*−14.48*)
Obs	253	247	249	304	256	239
R.Square	0.64	0.66	0.62	0.74	0.74	0.68
Group	5	5	5	5	5	5

Note: t-statistics (in bracket) is based on robust standard errors.

†The median score for ECF, LEGALSEC, and POLITY2 are: 5.82, 5.40 and -0.6 respectively.

***, **, and * indicate significance level at 1%, 5%, and 10%, respectively.

Table 8: OLS results excluding major oil exporting countries with region and year fixed effects.

Variable	**log(EXPY)**			
	(1)	**(2)**	**(3)**	**(4)**
log(GDPpc)	0.224***	0.280***	0.286***	0.277***
	(*5.15*)	(*11.76*)	(*9.90*)	(*11.60*)
log(POP)	0.064***	0.062***	0.059***	0.055***
	(*27.39*)	(*15.87*)	(*23.36*)	(*14.02*)
EDUC	0.011***	0.005	0.017***	0.016***
	(*2.69*)	(*1.54*)	(*10.80*)	(*4.62*)
log(REMOT)	-0.125***	-0.115***	-0.173***	-0.156***
	(*−6.02*)	(*−6.48*)	(*−8.96*)	(*−5.13*)
log(FDIpc)	0.045***	0.028***	0.019	0.018
	(*2.77*)	(*2.83*)	(*1.45*)	(*1.47*)
POLITY2	-0.004			
	(*−1.22*)			
XCONST		-0.005		
		(*−0.85*)		
EC_FREE			-0.019	
			(*−1.30*)	
LEGALSEC				-0.003
				(*−0.49*)
Fixed effects	*Region and Year*			
Const.	-3.56***	-3.99***	-3.47***	-3.54***
	(*−11.12*)	(*−16.78*)	(*−17.81*)	(*−23.45*)
Obs	488	445	448	434
R.Square	0.72	0.72	0.74	0.74
Group	5	5	5	5

Note: t-statistics (in bracket) is based on robust standard errors.
***, **, and * indicate significance level at 1%, 5%, and 10%, respectively.

Table 9: OLS result with country and year fixed effects.

Variable	**log(EXPY)**			
	(1)	**(2)**	**(3)**	**(4)**
log(GDPpc)	0.131***	0.225***	0.118***	0.130***
	(3.62)	*(4.67)*	*(3.09)*	*(3.01)*
log(POP)	-0.310*	-0.198**	-0.334*	-0.294*
	(−1.85)	*(−1.99)*	*(−1.88)*	*(−1.81)*
EDUC	-0.037***	-0.040**	-0.028***	-0.031***
	(−12.61)	*(−2.32)*	*(−5.04)*	*(−5.09)*
log(REMOT)	-2.440***	-2.509***	-3.005***	-2.913***
	(−5.59)	*(−2.85)*	*(−4.40)*	*(−5.08)*
log(FDIpc)	0.008	0.003	0.006	0.014*
	(1.31)	*(0.25)*	*(0.92)*	*(1.84)*
POLITY2	0.00			
	(−0.03)			
XCONST		-0.004		
		(−0.52)		
EC_FREE			0.007	
			(0.66)	
LEGALSEC				-0.006
				(−0.42)
Fixed effects		*Region and Year*		
Const.	24.555***	22.363***	29.997***	28.407***
	(4.71)	*(2.62)*	*(3.53)*	*(3.91)*
Obs	557	510	503	488
R.Square	0.86	0.84	0.82	0.82
Group	5	5	5	5

Note: t-statistics (in bracket) is based on robust standard errors.
***, **, and * indicate significance level at 1%, 5%, and 10%, respectively.

Table 10: OLS result using alternative depedent variable with region and year fixed effects.

Variable	$\log(\text{EXPY}_{rebased})$		$\log(\text{EXPY}_{compl}$	
	(1)	(2)	(1)	(2)
log(GDPpc)	0.206***	0.246***	0.00	0.008
	(10.54)	*(21.26)*	*(−0.01)*	*(0.14)*
log(POP)	0.062***	0.059***	0.057**	0.112***
	(9.45)	*(9.95)*	*(2.03)*	*(3.20)*
EDUC	0.015***	0.022***	0.089***	0.074***
	(2.77)	*(5.70)*	*(6.03)*	*(7.93)*
log(REMOT)	-0.141	-0.179*	-1.215***	-0.977***
	(−7.37)	*(−11.93)*	*(−9.84)*	*(−7.90)*
log(FDIpc)	0.047***	0.038***	0.164***	0.182***
	(3.49)	*(3.43)*	*(7.56)*	*(6.70)*
POLITY2	-0.002		0.027***	
	(−0.66)		*(3.13)*	
EC_FREE		-0.027*		0.074
		(−1.65)		*(1.49)*
Fixed effects		*Region and Year*		
Const.	7.114***	7.226***	7.303***	4.062**
	(28.24)	*(29.12)*	*(7.14)*	*(2.33)*
Obs	557	503	556	503
R.Square	0.76	0.78	0.30	0.29
Group	5	5	5	5

Note: t-statistics (italicized) is based on robust standard errors.
***, **, and * indicate significance level at 1%, 5%, and 10%, respectively.