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Domestic Formal and Informal Institutions: Their Substitutability and Comparative Advantage

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Abstract

This paper empirically examines how country-specific formal and informal institutions affect export patterns. The index for formal institutional quality evaluates electoral rules, judicial independence, and other constraints on executives. The index for informal institutional quality comprises degrees of trust, control, and obedience. Using the revealed comparative advantage index, I find that countries with high-quality formal and informal institutions tend to have institutional comparative advantage. Results also suggest that formal and informal institutions substitute for one another in generating institutional quality. I find robust results even when controlling for an important potential source of reverse causality.

Keywords: Informal institutions, Formal institutions, Institutional comparative advantage

JEL Classification: F14, D02

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1 Introduction

Institutions shape individual behavior by providing certain rules. Some rules are formally created, enabling people to see what they look like. I refer to them as formal institutions. An electoral system that limits politicians' opportunistic behaviors and a law that declares property rights are examples of formal institutions. Some rules are informally created and rarely documented, disabling people from accurately describing what they look like. I refer to such rules as informal institutions and see them as a different kind of institution, following North (1990). Culture transmitted over generations and a tie formed within a network are examples of informal institutions. Regardless of how institutions are created, they govern individual behavior in everyday life. Particularly, higher-quality institutions better curb individuals' self-interested minds and lead them to cooperate with each other to achieve objectives specified for a group.

Research shows that formal and informal institutions are substitutes in generating institutional quality. For example, Greif (1993) shows that the Maghribi traders in the 11th century used a reputation mechanism in addressing the commitment problem, arising from hiring overseas agents who could embezzle a merchant's capital. Despite the lack of a strong legal system for contract enforcement, the reputation mechanism based on a social tie within a coalition was able to induce honest behaviors (Greif 1989, pp. 865-6, 879; Greif 1993, pp. 529, 535-6).

In this paper, I empirically examine whether domestic formal and informal institutions are a source of comparative advantage in institutionally-intensive industries. While considering each formal and informal institutions as a component that generates institutional quality, I also explore whether they substitute for one another in giving rise to institutional quality. This quality determines export performance in industries that are subject to opportunism, thereby intensively using institutions for production. I incorporate domestic institutional quality into the quasi-Heckscher-Ohlin model of Romalis (2004) and use the revealed comparative advantage index of Balassa (1965) to measure country-industry level export performance. To quantify institutional intensity, I use the contract intensity measure, developed by Nunn (2007), and the Herfindahl index (HI), as

in Levchenko (2007).

To measure informal institutions, I consider how much people trust others, how people feel about their ability to control their own lives, and how important obedience is in peoples' lives. As with many researchers, including Tabellini (2010) and Williamson and Kerekes (2011), I rely on the European Values Study and World Values Survey (EVS and WVS, 2006) to capture these components of informal institutions. To measure formal institutions, following Glaeser et al. (2004), I use the electoral rules of plurality and proportional representation in the Database of Political Institutions, developed by Beck et al. (2001). I also use the measures for judicial independence and constitutional review in La Porta et al. (2004), following Glaeser et al. (2004). I lastly use the measure for executive constraints in the Polity IV dataset, constructed by Marshall et al. (2014). These three constitute the aggregate index for formal institutions. To calculate the revealed comparative advantage index, I use the 2000 trade flows data of Feenstra et al. (2005).

The empirical results reveal that countries with high-quality formal and informal institutions tend to have institutional comparative advantage, meaning that their exports rise as traded goods require institutions more for their production. Furthermore, the results show that there exists the substitution between formal and informal institutions in creating institutional quality. These main results are robust in multiple variations of the model.

To address potential reverse causality, I take into account the persistence of institutions, which stems from high fixed costs, leading to path-dependence (North, 1990). Current trade performance would be less likely to encourage a country to develop formal institutions due to high fixed costs. However, if a country has experienced a great volume of exports over the years, the country might be encouraged to enhance its formal institutions as Milgrom et al. (1990) describe with the evolution of the Law Merchant. Regarding informal institutions, although they feature more persistence than formal institutions, as explained by North (1990) and Roland (2004), it is still possible that trade performance affects values and social ties over time. Therefore, reverse causality would likely occur through past trade performance. I block this channel by including the 1985 revealed comparative advantage index as an independent variable, which would help derive estimates that are

close to capturing causal impacts. Results confirm that both types of institutions have statistically significant impacts on trade patterns, and their substitution exists.

This paper builds on the broad literature on trade and institutions. Formal institutions are known as a mitigator of contractual frictions, determining production workers' behaviors (Levchenko, 2007; Nunn, 2007; Feenstra et al., 2013a) and traders' behaviors (Anderson and Marcouiller, 2002; Berkowitz et al., 2006; Antràs and Foley, 2015). Informal institutions are also known as a mitigator of contractual frictions, and they have mainly been studied in the framework of traders' behaviors that affect trade costs. There is ample evidence that networks shape informal institutions (e.g., a tie) between traders, thereby limiting opportunism and lowering trade costs (Gould, 1994; Rauch, 1999; Kranton and Minehart, 2001; Casella and Rauch, 2002; Rauch and Trindade, 2002). In particular, Bowles and Gintis (2004) and Guiso et al. (2009) focus on bilateral trust in enforcing trade contracts. The evolution of local informal institutions through trade is surveyed by Bisin and Verdier (2014).

Researchers have also paid attention to how formal and informal institutions interact. Tabellini (2008b) provides a theoretical framework in which formal institutions and value coevolve. The relationship between trust and institutions/regulations are studied by many scholars, including Aghion et al. (2010, 2011), Bidner and Francois (2011), and Pinotti (2012). Regarding how formal and informal institutions collectively reduce opportunism, research has shown that there exists the substitutability between them. Guiso et al. (2004) find that social capital enhances financial development by promoting trust, intensively used for financial contracts, and this impact is greater when the legal institutional quality is lower. Johnson et al. (2002) present business ties substituting for effective courts in enforcing contracts. Formal-informal substitutability also exists in enforcing contracts needed to trade goods internationally. Yu et al. (2015) show that trust toward a trading partner's country substitutes for formal institutions in securing international trade. Araujo et al. (2016) find that as a reputation is developed through transactions over time, the importance of formal institutions in facilitating exports diminishes.

This paper contributes to the literature on trade and institutions by providing empirical evidence

that domestic formal and informal institutions determine trade patterns. Particularly, showing domestic informal institutions as a source of institutional comparative advantage is a contribution to the literature in that they have rarely been regarded as a solution to opportunism in the comparative advantage framework.¹ Moreover, this paper provides evidence that there exists the substitution between domestic formal and informal institutions in exerting country-specific institutional quality, which determines how well self-interested workers cooperate with each other for production in an environment that is subject to their opportunism. Lastly, by controlling for the main potential channel through which reverse causality occurs, this paper confirms that both formal and informal institutions and their substitutability explain different export patterns across countries.

The remainder of this paper is organized as follows. Section 2 specifies the estimation equation, and Section 3 describes measures and data. Section 4 discusses empirical results. Section 5 concludes.

2 Empirical Specification

I adopt the quasi-Heckscher-Ohlin model of Romalis (2004) for an empirical analysis of institutional comparative advantage. I specify the model by relating the revealed comparative advantage (*rca*) index to factor intensity:

$$\ln(rca_{iz}) = \beta_0 + \lambda_{1i}d_z + \lambda_{2i}r_z + \lambda_{3i}k_z + \lambda_{4i}s_z + \varepsilon_{iz}, \quad (1)$$

where d_z , r_z , k_z , and s_z denote industry z 's intensity of institutions, raw material, physical capital, and skilled labor, respectively. Following Balassa (1965), variable rca_{iz} is calculated by $(\frac{X_{iz}}{X_{wz}})/(\frac{X_i}{X_w})$, where X_{iz} is country i 's exports of industry z , X_{wz} is world exports of industry z , X_i is country i 's total exports, and X_w is world exports.

This *rca* index prevents the potential issue that the size of an exporter might affect λ . If exports are used as a dependent variable, a big country's exports might capture a great portion of world exports in an industry regardless of whether it has comparative advantage in that industry. There-

¹ Tabellini (2008a, pp.279-83) is an exception.

fore, rca_{iz} , which is the exports share scaled by the size of an exporter, helps capture the degree of comparative advantage in an industry as it is.

Coefficients λ_{1i} , λ_{2i} , λ_{3i} , and λ_{4i} are determined by factor abundance:

$$\lambda_{1i} = \beta_1 + \beta_{2F} \ln F_i + \beta_{2I} \ln I_i + \beta_{2FI} \ln F_i \ln I_i, \quad (2)$$

$$\lambda_{2i} = \beta_3 + \beta_4 \ln R_i, \quad (3)$$

$$\lambda_{3i} = \beta_5 + \beta_6 \ln K_i, \quad (4)$$

$$\lambda_{4i} = \beta_7 + \beta_8 \ln S_i, \quad (5)$$

where F_i and I_i denote country i 's qualities of formal and informal institutions, respectively. I treat institutional quality as a country's abundance of institutions. That is, as a country has higher-quality institutions, the country is considered to have more institutions that mitigate opportunism. Variables R_i , K_i , and S_i denote country i 's abundance of raw material, physical capital, and human capital, respectively.

How factor abundance affects comparative advantage can be understood through the mechanism of local factor price, as in Romalis (2004). If a country is abundantly endowed with a factor, the impact of an increase in that factor's intensity of an industry on the country's exports share of the industry will be positive because the abundance causes a low local factor price. For this country, $\lambda_{1i}, \dots, \lambda_{4i}$ should be positive. Since these coefficients are expected to be greater as a country is endowed with more of a factor, β_{2F} , β_{2I} , β_4 , β_6 , and β_8 should be positive. Conversely, if a country is scarcely endowed with a factor, then the impact of the rise in that factor intensity on the export share will be negative because the scarcity of the factor leads to a high local factor price. For this country, $\lambda_{1i}, \dots, \lambda_{4i}$ should be negative. This implies that β_1 , β_3 , β_5 , and β_7 should also be negative if the natural logs of factor abundance, including institutional quality that considers the formal-informal interaction, are positive.

In particular, equation (2) characterizes that institutional quality is determined by not only individual formal and informal institutions but also their interaction. Suppose that a country is endowed with rich informal institutions but scarce formal institutions, resulting in the low local price of informal institutions and the high local price of formal institutions. Then, when the insti-

tutional intensity of an industry rises, the negative impact of the high price of formal institutions on the export share of that industry will not be as great as the case where no substitution effect is considered. Since informal institutions can substitute for formal institutions, the low local price of informal institutions will offset the negative impact on export share. That is, when the institutional intensity of an industry changes, the effect of the abundance of formal (informal) institutions on the export share of the industry decreases with the abundance of informal (formal) institutions. Therefore, β_{2FI} is expected to be negative with the substitutability between formal and informal institutions.

By plugging equations (2)–(5) into equation (1), the estimation equation is derived as follows:

$$\begin{aligned} \ln(rca_{iz}) = & \beta_0 + d_z \left(\beta_1 + \beta_{2F} \ln F_i + \beta_{2I} \ln I_i + \beta_{2FI} \ln F_i \ln I_i \right) + r_z \left(\beta_3 + \beta_4 \ln R_i \right) \\ & + k_z \left(\beta_5 + \beta_6 \ln K_i \right) + s_z \left(\beta_7 + \beta_8 \ln S_i \right) + u_{iz}. \end{aligned} \quad (6)$$

The main coefficients are β_{2F} , β_{2I} , and β_{2FI} , which will be of focus in analyzing the empirical results in Section 4.

3 Measures and Data

This section discusses measures and data needed for the empirical analysis. The *rca* index is calculated using the data on bilateral world trade flows in 2000, given by Feenstra et al. (2005). The measures and data for the other variables are described in the following sub-sections.

3.1 Factor Intensity of Industry

Institutional intensity, d_z , is measured by the contract intensity of Nunn (2007). His measure I adopt classifies an input that is neither traded on an organized exchange nor reference priced in trade publications as an input that requires a relationship-specific transaction. I obtain Nunn's contract intensity data from his website. I also use the Herfindahl index (HI) to measure d_z , following Levchenko (2007), in that a complex good is subject to opportunism (Cowan and Neut, 2007). The

1997 U.S. I-O Use Table, given by the Bureau of Economic Analysis (BEA), is used to calculate the HI. Since a lesser complex good has a higher HI, 1 minus the HI is calculated to capture complexity, as in Blanchard and Kremer (1997). I use this adjusted HI as another measure for d_z .

Nunn's measure more directly captures the situations where opportunism is likely to occur than does the HI. How much a transaction involves opportunism is more directly related to how thick a market is, which can be measured by organized exchanges and reference prices. Regarding a complex good, institutions would be required more for production to facilitate cooperation between many firms that are engaged. However, the production of a complex good might not actually need institutions if transactions between firms occur in a thick market that would less likely entail relationship-specificity. Therefore, I use Nunn's measure for a baseline analysis and employ the HI for a robustness check.

Nunn's measure and the HI are listed by the Input-Output (I-O) commodity classification, and trade flows are listed by the 4-digit Standard International Trade Classification (SITC) revision 2. For a baseline analysis, I organize the trade flow data with respect to the I-O levels by choosing a dominant I-O code for each SITC code. In this way, the original values for the main variable d_z are not split throughout the SITC codes. Appendix A.1.1 discusses the detailed mapping methodology. For a robustness check, I organize data on d_z with respect to the SITC by considering industry shares for each SITC code, as described in Appendix A.1.2. Thus, the baseline analysis is conducted based on the I-O classification, whereas a robustness check is conducted based on the SITC.

The measures for skilled labor intensity, s_z , and capital intensity, k_z , are constructed using the 2000 NBER-CES Manufacturing Industry Database, given by Becker et al. (2013). This dataset is listed by the 1987 Standard Industrial Classification (SIC). Following Nunn (2007), s_z and k_z are measured by non-production worker wages divided by total wages in industry z and total real capital stock divided by total value added in industry z , respectively. To organize the calculated s_z and k_z by the I-O levels, I choose one dominant SIC code for each I-O code, which prevents the original values of s_z and k_z from splitting over the I-O levels. The mapping methodology to link

the 1987 SIC to the I-O classification is described in Appendix A.2.

Raw material intensity, r_z , is measured by the ratio of the value of raw material inputs to the sum of the value of raw material inputs and value added in industry z , following Romalis (2004). By considering agriculture, forestry, fishing, hunting, and mining as raw material inputs, I calculate r_z using the 1997 I-O Use Table from the BEA.

3.2 Institutions

The measures for the country-specific qualities of informal and formal institutions are consistent with Park (2021).

Specifically, to measure informal institutions, I use the European and World Values Surveys (EVS and WVS, 2006), allowing for capturing the following three traits of culture: trust, control, and obedience.² I use the survey data from 1995-2001.

Trust can help lower transaction costs by mitigating opportunism, as shown by Zak and Knack (2001). The following survey question is used to measure trust: “Generally speaking, would you say that most people can be trusted or that you can’t be too careful in dealing with people?” The measure for trust is the ratio of the number of respondents who chose “most people can be trusted” to the number of respondents who chose either option, multiplied by 10.

Control refers to how individuals feel about their ability to control their lives. When individuals believe more that their lives are controlled by themselves rather than luck, they would be more cooperative with one another in pursuing economic profits. Control is measured with the following survey question: “Some people feel they have completely free choice and control over their lives, while other people feel that what we do has no real effect on what happens to them. Please use this scale where 1 means ‘none at all’ and 10 means ‘a great deal’ to indicate how much freedom of choice and control you feel you have over the way your life turns out.” I average the respondents’ answers to measure control.

Obedience is typically stressed in a coercive and hierarchical country where the levels of trust

²These cultural components have been used by many researchers, including Tabellini (2010) and Williamson and Kerekes (2011).

and respect for others are low. In such societies, citizens are considered as ones who behave based on instinct. Hence, suppressing the negative instinct of each individual by coercion is emphasized to draw out good behavior (Tabellini, 2010, p. 685). People in this coercive society would be less likely to seek innovation and economic profits, discouraging cooperation. The following survey question allows me to measure obedience: “Here is a list of qualities that children can be encouraged to learn at home. Which, if any, do you consider to be especially important?” The degree of obedience is measured by the share of the respondents who chose “obedience,” multiplied by 10.

Each measure of trust, control, and obedience is averaged over the time span of 1995-2001. I adjust the obedience measure as “10 minus obedience” since a lower obedience is expected to better promote cooperation. The aggregate index for informal institutions is calculated by the sum of trust, control, and the adjusted obedience. This sum is scaled in such a way that the maximum of the aggregate index reaches 10.

To measure the country-specific quality of formal institutions, I first use the Database of Political Institutions (DPI) of Beck et al. (2001). Following Glaeser et al. (2004), I consider plurality and proportional representation in the dataset. As Williamson and Kerekes (2011, p. 545) point out, these two electoral rules could facilitate competition between legislators and constrain their own interest. I multiply the observations for each electoral dummy variable by 10. With the average of the two adjusted observations for each year and country, the DPI measure is constructed by further averaging the country-specific values from 1995-2000.

I secondly use the dataset given by La Porta et al. (2004). As in Glaeser et al. (2004), I employ the data on judicial independence and constitutional review. The measure for judicial independence, ranging from 0 to 1, accounts for the tenures of Supreme Court judges and the highest ranked judges as well as whether case law exists. The measure for constitutional review, ranging from 0 to 1, was developed based on the ability of judges to review the constitutionality of laws and the rigidity of a constitution, limiting the self-interested behaviors of the legislative and executive branches (La Porta et al., 2004, pp. 447, 451). These two measures are multiplied by 10 and then averaged.

Table 1: Qualities of Domestic Informal and Formal Institutions

| Country | Informal | Formal | Country | Informal | Formal |
|-------------|----------|--------|--------------|----------|--------|
| Denmark | 10.00 | 8.29 | UK | 6.80 | 6.86 |
| Sweden | 9.86 | 7.57 | Spain | 6.79 | 9.00 |
| Norway | 9.36 | 8.29 | Jordan | 6.75 | 5.90 |
| New Zealand | 9.11 | 8.57 | Mexico | 6.72 | 7.88 |
| Netherlands | 8.95 | 7.14 | France | 6.63 | 6.22 |
| Finland | 8.88 | 7.14 | Venezuela | 6.45 | 6.20 |
| Japan | 8.71 | 9.71 | Portugal | 6.40 | 7.43 |
| Germany | 8.56 | 10.00 | Chile | 6.35 | 7.29 |
| Austria | 8.44 | 7.43 | Colombia | 6.21 | 6.37 |
| Australia | 8.30 | 10.00 | Egypt | 6.18 | 5.76 |
| Korea Rep. | 8.27 | 8.94 | India | 6.11 | 10.00 |
| Greece | 8.11 | 9.14 | Pakistan | 5.89 | 7.00 |
| Canada | 8.11 | 7.86 | Philippines | 5.86 | 8.37 |
| Switzerland | 8.10 | 8.29 | South Africa | 5.72 | 7.13 |
| Indonesia | 7.58 | 5.43 | Turkey | 5.68 | 7.57 |
| Italy | 7.45 | 9.14 | Peru | 5.44 | 6.04 |
| Bangladesh | 7.32 | 7.02 | Nigeria | 5.32 | 6.42 |
| USA | 7.25 | 8.29 | Brazil | 5.23 | 8.65 |
| Ireland | 7.15 | 8.29 | Uganda | 4.72 | 6.04 |
| Belgium-Lux | 7.03 | 7.29 | Zimbabwe | 4.52 | 5.90 |
| Argentina | 6.85 | 7.18 | | | |

I thirdly use the Polity IV dataset, developed by Marshall et al. (2014). In this dataset, I use the data on executive constraints, measuring “the extent of institutionalized constraints on the decision making powers of chief executives, whether individuals or collectivities.” This measure ranges from 1 to 7. For each country, I average the observations over the years of 1995-2000. Then, I scale the average values for the countries so that their maximum reaches 10.

Finally, by averaging the three measures from DPI, La Porta et al., and Polity IV and by scaling the averages again in such a way that the maximum average reaches 10, I construct an aggregate index for the quality of formal institutions. Now, both measures for formal and informal institutional qualities range from 0 and 10, allowing these measures to be easily comparable.

Table 1 presents the aggregate indexes for the qualities of informal and formal institutions of 41 countries. Note that the countries are listed in the order of informal institutional quality. The data in these countries, except Nigeria, will be employed in the regressions in Section 4.

3.3 Raw Material, Physical Capital, and Human Capital

The abundance of raw material is proxied by total land area divided by total labor force, as in Romalis (2004). I use the 2000 World Bank’s data on land area and total labor force. Physical capital endowment is proxied by the capital stock per worker, following Nunn (2007). I use the data on physical capital stock at current PPP and employment in 2000 in the Penn World Table version 8.0 (PWT 8.0), developed by Feenstra et al. (2013b). Human capital endowment is proxied by the index of human capital in 2000, which is also from PWT 8.0. This index was developed based on the data on the years of and the returns to schooling, given by Barro and Lee (2013) and Psacharopoulos (1994).³

3.4 Additional Controls

I consider the possibility that countries with a greater financial system have a comparative advantage in the industries that depend relatively more on external finance, suggested by Beck (2003). To measure the quality of financial system, I rely on the Financial Development and Structure Dataset, constructed by Beck et al. (2000, 2009) and Cihak et al. (2012). Specifically, I use the data on the share of private credit in GDP, following Beck (2003). Regarding the dependence on external finance, its measure and data are from Klingebiel et al. (2007). They measured the dependence on external finance by capital expenditure minus cash flow, divided by capital expenditure. US firm-level data from 1980-1999 were used for the calculation. The data are listed by the International Standard Industrial Classification (ISIC) revision 2. Specifically, 27 observations are at the 3-digit ISIC levels, and nine observations are at the 4-digit ISIC levels. The mapping methodology to reorganize the data by the I-O levels is described in Appendix A.3.

In addition, as Nunn and Trefler (2014, pp. 273-4) point out, there is a possibility that intermediate good suppliers of a complex good might rely more on infrastructure to take order and ship the inputs to a final good supplier. Taking this into consideration, I include infrastructure multiplied

³See Inklaar and Timmer (2013) for the detailed description of the physical capital stock measure and human capital index in PWT 8.0.

by institutional intensity in the regression. As a proxy for infrastructure, I use the 2000 data on road density per 100 sq. km of land area, which come from the World Development Indicators of the World Bank.

Nunn (2007) additionally points out that high income countries might have a comparative advantage in producing goods that require technological development and a high level of division of production that entails a great volume of intra-industry trade. They might also have a comparative advantage in high value-added goods. Therefore, I add the controls of real GDP per capita interacted with TFP growth, the Grubel-Lloyd index of intra-industry trade, and value added in 2000. Data on TFP growth and value added are from the NBER-CES Manufacturing Industry Database, collected by Becker et al. (2013). Following Nunn (2007), I use the average of 4-factor TFP yearly growth over the years of 1980–2000 and total value added divided by total value of shipments. The Grubel-Lloyd intra-industry trade index is calculated using the 2000 U.S. trade flows data of Feenstra et al. (2005). Data on PPP adjusted real GDP and population come from PWT 8.0.

4 Empirical Results

Prior to getting into the empirical results, I present the descriptive statistics of the three levels of variables in Table 2. For the industry-level data, whose descriptive statistics are based on the I-O classification, I include the variable definition.

Estimation employs industry and country-industry level data, summarized in the first and third panel in the table. However, it is important to check country-level descriptive statistics as well since for the countries that are scarcely endowed with a factor, the negative expected sign of the estimates on β_1 , β_3 , β_5 , and β_7 in equations (2)–(5) hinges on the positive factor abundance expressed as the natural logarithm. As the second panel shows, raw material abundance ranges from -8.07 to 0.49, and its average is less than 0, implying that the estimate for β_3 could be positive.

In the following sub-sections, I discuss the OLS results obtained based on the quasi-Heckscher-Ohlin model, expressed in equation (6).

Table 2: Descriptive Statistics

| 1. Industry Level | | | | | |
|---|--------|-------|------|--------|-------|
| Variable | obs | mean | sd | min | max |
| dz: Nunn's measure | 215 | 0.49 | 0.23 | 0.02 | 0.98 |
| dz: 1 - Herfidahl Index (HI) | 248 | 0.89 | 0.09 | 0.38 | 0.97 |
| rz: raw material intensity | 248 | 0.09 | 0.18 | 0.00 | 0.91 |
| kz: capital intensity | 224 | 0.92 | 0.67 | 0.16 | 6.00 |
| sz: skilled labor intensity | 224 | 0.40 | 0.13 | 0.15 | 0.77 |
| va: value added | 224 | 0.50 | 0.13 | 0.17 | 0.90 |
| dtfp: TFP growth | 229 | 0.00 | 0.02 | -0.04 | 0.17 |
| ed: dependence on external finance | 222 | -0.03 | 0.33 | -1.14 | 2.43 |
| iit: intra-industry trade index | 247 | 0.62 | 0.27 | 0.04 | 1.00 |
| 2. Country Level | | | | | |
| ln(Informal) | 72 | 1.94 | 0.18 | 1.38 | 2.30 |
| ln(Formal) | 63 | 1.93 | 0.27 | 0.79 | 2.30 |
| ln(GDP per capita) | 149 | 8.48 | 1.34 | 5.36 | 10.98 |
| ln(Physical capital) | 150 | 10.50 | 1.37 | 7.42 | 12.79 |
| ln(Human capital) | 125 | 0.85 | 0.27 | 0.14 | 1.26 |
| ln(Financial development) | 141 | 3.22 | 1.09 | 0.13 | 5.40 |
| ln(Infrastructure) | 139 | 3.19 | 1.51 | -0.75 | 7.89 |
| ln(Raw material) | 162 | -3.13 | 1.49 | -8.07 | 0.49 |
| 3. Country-Industry Level | | | | | |
| ln(rca) | 22,647 | -1.20 | 2.08 | -12.04 | 8.01 |
| dz ln(Informal), where dz = Nunn's measure | 14,154 | 1.75 | 0.23 | 0.52 | 2.23 |
| dz ln(Informal), where dz = 1-HI | 12,389 | 0.96 | 0.45 | 0.03 | 2.26 |
| dz ln(Formal), where dz = Nunn's measure | 10,068 | 0.98 | 0.46 | 0.03 | 2.26 |
| dz ln(Formal), where dz = 1-HI | 11,495 | 1.78 | 0.26 | 0.35 | 2.23 |
| dz ln(Formal) ln(Informal), where dz = Nunn's measure | 7,761 | 1.97 | 0.96 | 0.06 | 4.85 |
| dz ln(Formal) ln(Informal), where dz = 1-HI | 8,902 | 3.60 | 0.62 | 1.01 | 4.78 |
| rz ln(Raw material) | 21,277 | -0.30 | 0.68 | -7.30 | 0.42 |
| kz ln(Physical capital) | 18,718 | 10.12 | 7.10 | 1.21 | 76.73 |
| sz ln(Human capital) | 17,184 | 0.38 | 0.15 | 0.02 | 0.97 |
| ed ln(Financial development) | 17,457 | -0.08 | 1.28 | -6.16 | 13.13 |
| iit ln(GDP per capita) | 20,584 | 5.66 | 2.57 | 0.23 | 10.92 |
| va ln(GDP per capita) | 18,689 | 4.47 | 1.31 | 0.91 | 9.66 |
| dtfp ln(GDP per capita) | 19,114 | 0.01 | 0.18 | -0.39 | 1.86 |

4.1 Quasi-Heckscher-Ohlin Prediction with Institutions

Table 3 presents the OLS results using Nunn's measure. Some of the estimated coefficients on factor intensity are negative, which captures countries with scarce factor endowments. The positive sign of the estimated coefficient on r_z might be due to the negative values of the natural log of

Table 3: The Quasi-Heckscher-Ohlin Prediction I

| Variable | Dependent variable is $\ln(rca)$, d_z : Nunn's measure | | | |
|------------------------------|---|------------------------|------------------------|------------------------|
| | (1) | (2) | (3) | (4) |
| dz | -54.268*** (14.461) | -54.337*** (14.477) | -53.089*** (14.283) | -44.776*** (14.952) |
| rz | 2.168*** (0.407) | 2.245*** (0.405) | 2.345*** (0.415) | 2.158*** (0.411) |
| kz | 0.112 (0.655) | 0.135 (0.600) | 0.308 (0.608) | 0.388 (0.567) |
| sz | -5.567*** (1.449) | -5.623*** (1.491) | -5.741*** (1.408) | -5.492*** (1.495) |
| iit | | -6.968*** (1.548) | -6.995*** (1.599) | -5.646*** (1.665) |
| va | | | 2.405 (3.316) | 2.335 (3.632) |
| dtfp | | | -2.529 (18.085) | -4.598 (17.153) |
| ed | | | | -1.418** (0.565) |
| dz ln(Informal) | 24.165*** (7.272) | 24.214*** (7.290) | 23.577*** (7.197) | 20.469*** (7.553) |
| dz ln(Formal) | 23.415*** (7.017) | 23.551*** (7.053) | 22.923*** (6.968) | 19.560*** (7.316) |
| dz ln(Formal) ln(Informal) | -10.473*** (3.520) | -10.550*** (3.543) | -10.228*** (3.501) | -9.029** (3.686) |
| rz ln(Raw material) | 0.705*** (0.113) | 0.707*** (0.111) | 0.706*** (0.111) | 0.663*** (0.113) |
| kz ln(Physical capital) | -0.022 (0.056) | -0.024 (0.051) | -0.037 (0.052) | -0.045 (0.049) |
| sz ln(Human capital) | 5.323*** (1.380) | 5.387*** (1.413) | 5.514*** (1.349) | 5.279*** (1.411) |
| iit ln(GDP per capita) | | 0.751*** (0.157) | 0.752*** (0.162) | 0.617*** (0.167) |
| va ln(GDP per capita) | | | -0.218 (0.340) | -0.218 (0.370) |
| dtfp ln(GDP per capita) | | | 0.048 (1.820) | 0.268 (1.719) |
| ed ln(Financial development) | | | | 0.335*** (0.120) |
| Exporter dummies | Y | Y | Y | Y |
| No. of exporters | 40 | 40 | 40 | 38 |
| No. of industries | 191 | 190 | 190 | 180 |
| Observations | 6,872 | 6,865 | 6,865 | 6,176 |
| R-squared | 0.221 | 0.237 | 0.238 | 0.222 |

Notes: Estimates for a constant are not reported. Standard errors are clustered at the industry level. Cluster-robust standard errors are in parentheses. ***, **, and * represent the estimates that are significant at the level of 1%, 5%, and 10%, respectively.

raw material abundance, as explained earlier. The estimated coefficient on each type of institutions multiplied by d_z is positive and statistically significant at the 1% level in every column, implying that countries with high-quality formal and informal institutions tend to have institutional comparative advantage.

An important finding is that the estimated coefficient on $d_z \ln F_i \ln I_i$ is negative and statistically significant in every column, showing that formal and informal institutions substitute for each other in giving rise to institutional quality that governs local production. Thus, the impact of a rise in the quality of formal (informal) institutions on exports increases with institutional intensity, but this impact decreases with the quality of informal (formal) institutions.

Taking account of this substitution, the impacts of informal and formal institutions can be quantified using the estimates in column (3) whose R-squared is the highest. When $\ln F_i$ and d_z are fixed at their median values, 1.97 and 0.46, a 1% rise in the informal institutional quality is associated with a 1.58% ($=23.577 \times 0.46 - 10.228 \times 0.46 \times 1.97$) rise in the rca in the industry whose d_z is 0.46. Similarly, when $\ln I_i$ is fixed at its median, 1.93, a 1% rise in the formal institutional quality is associated with a 1.46% rise in the rca in that industry. Although this way of quantification might not capture an accurate impact of institutions, it allows for not only seeing whether the quality of each type of institutions is positively associated with export performance but also comparing the magnitudes of institutional impacts across variations of the estimation equation.

The estimation results in the table support the Heckscher-Ohlin predictions regarding raw material, human capital, and financial development. Data also reveal that high-income countries tend to have a comparative advantage in industries that rely greatly on intra-industry trade. Capital intensity, value added, and TFP growth, interacted with their corresponding endowments, do not have a statistically significant effect on trade patterns.

Next, I test if these findings hold when institutions and institutional intensity are interacted with different types of factor intensity and abundance, as in Levchenko (2007), while including industry dummies rather than individual factor intensity. As shown in Table 4, in every column, the estimated coefficient on individual institutions multiplied by d_z is positive and statistically significant,

Table 4: The Quasi-Heckscher-Ohlin Prediction II

| Variable | Dependent variable is $\ln(rca)$, d_z : Nunn's measure | | | | | |
|------------------------------|---|-----------------------|-----------------------|-----------------------|-----------------------|----------------------|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| dz ln(Informal) | 24.615*** (7.131) | 25.730*** (7.866) | 23.466*** (7.322) | 27.499*** (9.380) | 24.965*** (6.986) | 22.916** (10.263) |
| dz ln(Formal) | 23.770*** (6.887) | 25.467*** (7.613) | 22.838*** (7.043) | 27.577*** (8.946) | 24.147*** (6.786) | 23.809** (9.914) |
| dz ln(Formal) ln(Informal) | -10.659*** (3.452) | -11.994*** (3.875) | -10.111*** (3.491) | -13.213*** (4.525) | -10.826*** (3.410) | -11.361** (5.001) |
| rz ln(Raw material) | 0.724*** (0.114) | 0.579*** (0.119) | 0.715*** (0.114) | 0.701*** (0.114) | 0.724*** (0.114) | 0.643*** (0.140) |
| kz ln(Physical capital) | -0.020 (0.057) | 0.008 (0.059) | -0.078 (0.061) | -0.002 (0.057) | -0.036 (0.053) | -0.017 (0.055) |
| sz ln(Human capital) | 5.309*** (1.392) | 4.531*** (1.575) | 4.282*** (1.462) | 4.768*** (1.570) | 5.410*** (1.358) | 3.818** (1.893) |
| dz ln(Raw material) | | -0.368*** (0.091) | | | | -0.326** (0.158) |
| dz ln(Physical capital) | | 0.072 (0.176) | | | | -0.074 (0.344) |
| dz ln(Human capital) | | 2.609** (1.045) | | | | 0.060 (1.370) |
| rz ln(Formal) | | | -1.124 (0.851) | | | -1.402 (0.867) |
| kz ln(Formal) | | | 0.096 (0.205) | | | 0.164 (0.193) |
| sz ln(Formal) | | | -1.514 (0.965) | | | -0.881 (1.010) |
| rz ln(Informal) | | | 0.127 (1.595) | | | 1.567 (1.997) |
| kz ln(Informal) | | | 0.508 (0.309) | | | -0.094 (0.260) |
| sz ln(Informal) | | | 2.405** (1.048) | | | 2.671** (1.072) |
| dz ln(Financial development) | | | | 0.865*** (0.226) | | 0.640** (0.284) |
| dz ln(Infrastructure) | | | | 0.053 (0.066) | | -0.128 (0.085) |
| dz ln(GDP per capita) | | | | 0.077 (0.268) | | 0.315 (0.331) |
| iiit ln(Formal) | | | | | 1.846*** (0.407) | 1.597*** (0.426) |
| va ln(Formal) | | | | | -1.128 (1.094) | -1.501 (1.228) |
| dtfp ln(Formal) | | | | | 2.066 (5.152) | 2.445 (4.998) |
| iiit ln(Informal) | | | | | 2.440*** (0.674) | 1.907*** (0.710) |
| va ln(Informal) | | | | | -1.197 (1.645) | -0.742 (1.778) |
| dtfp ln(Informal) | | | | | 0.177 (5.905) | -0.625 (6.882) |
| ed ln(Financial development) | | | | | | 0.264* (0.134) |
| No. of exporters | 40 | 40 | 40 | 33 | 40 | 33 |
| No. of industries | 191 | 191 | 191 | 191 | 190 | 180 |
| Observations | 6,872 | 6,872 | 6,872 | 5,859 | 6,865 | 5,536 |
| R-squared | 0.277 | 0.281 | 0.278 | 0.256 | 0.286 | 0.281 |

Notes: Estimates for a constant are not reported. Standard errors are clustered at the industry level. Cluster-robust standard errors are in parentheses. ***, **, and * represent the estimates that are significant at the level of 1%, 5%, and 10%, respectively. Exporter and industry dummies are included.

and the estimated coefficient on $d_z \ln F_i \ln I_i$ is negative and statistically significant. This result supports that formal and informal institutions are a source of comparative advantage in institutionally-intensive goods, and they substitute for one another in generating institutional quality.

For quantification, I choose column (2) because it has the highest R-squared in the regressions that have no interaction terms of institutions and another factor intensity, such as s_z and r_z . By using one of those regressions, we do not need to assume that other factor intensities are constant at their medians. With the same methodology used before for quantification, a 1% rise in informal and formal institutional qualities is associated with a 0.97% and 1.07% rise in the rca in the industry whose d_z is 0.46, respectively.

An interesting finding is that countries with rich informal institutions tend to have a comparative advantage in skill-intensive goods, as shown by the positive and statistically significant coefficient on $s_z \ln I_i$. This contrasts with the negative yet non-statistically significant impact of formal institutions on producing skill-intensive goods. This implies that informal institutions play a role in lowering the local price of skill-intensive goods, while formal institutions do not. This might be because producing skill-intensive goods requires a high degree of cooperation, and what matters for promoting cooperation between high-skilled labor is informal institutions, rather than formal institutions. Moreover, results show that countries with high-quality formal and informal institutions tend to have a comparative advantage in goods requiring a high division of production that involves a great volume of intra-industry trade.

Countries with abundant raw materials turn out to have a comparative advantage in industries that require less relationship-specific transactions, as shown by the negative, statistically significant coefficient on $d_z \ln(Raw\ material)$. Contrarily, financially-developed countries tend to have a comparative advantage in industries that are more dependent on relationship-specific transactions, as shown by the positive, statistically-significant coefficients on $d_z \ln(Financial\ development)$. This implies that opportunism can be better reduced when financing is easier.

4.2 Robustness Checks

As a robustness check, I repeat the estimation using “1 minus the HI” as a measure of d_z with all controls employed in Tables 3 and 4. Table 5 reports the estimation results. Regarding the main coefficients on $d_z \ln I_i$, $d_z \ln F_i$, and $d_z \ln F_i \ln I_i$, the signs of the estimates are consistent with the predictions, although the significance levels are weaker than the corresponding levels for the estimates using Nunn’s measure.

Other estimates are consistent overall with the previous results with Nunn’s measure. In particular, the estimate for informal institutions multiplied by skill intensity and the estimates for individual institutions multiplied by intra-industry trade are still positive and statistically significant. This confirms that it is important to overcome opportunism for the production that intensively uses skilled labor and involves a great degree of division.

For an additional robustness check, I use a different mapping methodology between the 4-digit SITC revision 2 and I-O classification, described in Appendix A.1.2. This methodology is based on industry shares over the I-O levels for each SITC code. By organizing data by the SITC, more variation in observations can be utilized. The mapping methodology that considers industry shares is also used for other factor intensities, such as s_z and k_z , which are classified by the 1987 SIC. The specific mapping methodology for the SIC and SITC is explained in Appendix A.4.

Table 6 shows the OLS estimates obtained with Nunn’s measure for d_z when data are organized by the SITC. The signs of the estimated coefficients on d_z , $d_z \ln I_i$, $d_z \ln F_i$, and $d_z \ln F_i \ln I_i$ are as expected, and these estimated coefficients are all statistically significant at the 1% level in each column. The estimates for the other variables are also consistent with the previous estimates obtained with the data organized by the I-O codes. Particularly, the estimates for raw materials, human capital, and financial development, each of which is interacted with its corresponding factor intensity, are all positive and statistically significant.

In Table 3, I chose column (3) to quantify the effects of informal institutions. To see how this impact changes by employing another mapping methodology, I use column (3) again. Holding

Table 5: Robustness Check with the Herfindahl Index

| Variable | Dependent variable is $\ln(rca)$, d_z : 1 - HI | | | | | | |
|------------------------------|---|----------------------|----------------------|----------------------|---------------------|---------------------|---------------------|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| dz ln(Informal) | 36.350* (19.098) | 36.831* (19.094) | 37.744** (19.143) | 26.408 (22.013) | 29.730 (21.152) | 43.889* (24.504) | 35.367* (19.520) |
| dz ln(Formal) | 36.435* (18.725) | 37.358** (18.670) | 38.055** (18.897) | 26.672 (21.723) | 29.439 (19.966) | 43.113* (24.349) | 36.352* (18.825) |
| dz ln(Formal) ln(Informal) | -16.308* (9.281) | -16.833* (9.280) | -17.598* (9.418) | -11.456 (11.069) | -13.619 (9.858) | -20.316 (12.309) | -16.158* (9.361) |
| rz ln(Raw material) | 0.756*** (0.116) | 0.755*** (0.113) | 0.689*** (0.114) | 0.594*** (0.132) | 0.724*** (0.114) | 0.741*** (0.125) | 0.755*** (0.115) |
| kz ln(Physical capital) | -0.093* (0.053) | -0.110** (0.052) | -0.099* (0.051) | -0.093* (0.054) | -0.076 (0.057) | -0.091* (0.055) | -0.112** (0.051) |
| sz ln(Human capital) | 7.415*** (1.291) | 7.146*** (1.245) | 6.399*** (1.286) | 7.599*** (1.300) | 4.640*** (1.298) | 7.185*** (1.283) | 7.064*** (1.243) |
| iit ln(GDP per capita) | | 0.783*** (0.158) | 0.631*** (0.159) | | | | |
| va ln(GDP per capita) | | -0.200 (0.311) | -0.222 (0.335) | | | | |
| dtfp ln(GDP per capita) | | 1.320 (1.129) | 1.151 (1.026) | | | | |
| ed ln(Financial development) | | | 0.378*** (0.121) | | | | |
| dz ln(Raw material) | | | | -0.677*** (0.198) | | | |
| dz ln(Physical capital) | | | | 0.100 (0.484) | | | |
| dz ln(Human capital) | | | | -0.948 (2.908) | | | |
| rz ln(Formal) | | | | | -1.102 (0.986) | | |
| kz ln(Formal) | | | | | -0.305 (0.206) | | |
| sz ln(Formal) | | | | | 0.883 (0.955) | | |
| rz ln(Informal) | | | | | -0.166 (1.764) | | |
| kz ln(Informal) | | | | | 0.048 (0.251) | | |
| sz ln(Informal) | | | | | 3.993*** (0.995) | | |
| dz ln(Financial development) | | | | | | 2.194*** (0.490) | |
| dz ln(Infrastructure) | | | | | | -0.090 (0.216) | |
| dz ln(GDP per capita) | | | | | | -1.080* (0.589) | |
| iit ln(Formal) | | | | | | | 1.879*** (0.434) |
| va ln(Formal) | | | | | | | -0.981 (1.130) |
| dtfp ln(Formal) | | | | | | | 8.756* (5.162) |
| iit ln(Informal) | | | | | | | 2.766*** (0.683) |
| va ln(Informal) | | | | | | | -0.536 (1.539) |
| dtfp ln(Informal) | | | | | | | 8.895** (4.117) |
| Exporter dummies | Y | Y | Y | Y | Y | Y | Y |
| Industry dummies | Y | Y | Y | Y | Y | Y | Y |
| No. of exporters | 40 | 40 | 38 | 40 | 40 | 33 | 40 |
| No. of industries | 224 | 223 | 213 | 224 | 224 | 224 | 223 |
| Observations | 8,003 | 7,996 | 7,253 | 8,003 | 8,003 | 6,829 | 7,996 |
| R-squared | 0.280 | 0.293 | 0.279 | 0.281 | 0.282 | 0.256 | 0.291 |

Notes: Estimates for a constant are not reported. Standard errors are clustered at the industry level. Cluster-robust standard errors are in parentheses. ***, **, and * represent the estimates that are significant at the level of 1%, 5%, and 10%, respectively.

Table 6: Robustness Check with the SITC and Nunn's Measure

| Variable | Dependent variable is $\ln(rca)$, d_z : Nunn's measure | | | |
|------------------------------|---|------------------------|------------------------|------------------------|
| | (1) | (2) | (3) | (4) |
| dz | -71.433*** (10.781) | -71.570*** (10.718) | -70.882*** (10.625) | -64.528*** (11.900) |
| rz | 2.157*** (0.311) | 2.211*** (0.310) | 2.303*** (0.317) | 1.845*** (0.324) |
| kz | -0.518 (0.482) | -0.474 (0.463) | -0.447 (0.480) | -0.120 (0.484) |
| sz | -8.423*** (1.074) | -7.571*** (1.056) | -7.065*** (1.012) | -6.443*** (1.104) |
| iit | | -8.106*** (0.911) | -8.149*** (0.908) | -8.372*** (0.962) |
| va | | | -2.431 (2.074) | -1.298 (2.255) |
| dtfp | | | -28.894*** (8.343) | -29.865*** (8.075) |
| ed | | | | -1.528*** (0.489) |
| dz ln(Informal) | 33.238*** (5.399) | 33.277*** (5.375) | 32.957*** (5.330) | 30.217*** (5.990) |
| dz ln(Formal) | 32.095*** (5.168) | 32.256*** (5.153) | 32.022*** (5.113) | 29.776*** (5.720) |
| dz ln(Formal) ln(Informal) | -15.014*** (2.582) | -15.083*** (2.578) | -14.974*** (2.559) | -14.083*** (2.872) |
| rz ln(Raw material) | 0.704*** (0.074) | 0.681*** (0.074) | 0.679*** (0.075) | 0.613*** (0.076) |
| kz ln(Physical capital) | 0.027 (0.042) | 0.022 (0.040) | 0.020 (0.042) | -0.008 (0.042) |
| sz ln(Human capital) | 7.629*** (1.045) | 6.726*** (1.023) | 6.186*** (0.991) | 5.805*** (1.071) |
| iit ln(GDP per capita) | | 0.883*** (0.093) | 0.886*** (0.093) | 0.903*** (0.097) |
| va ln(GDP per capita) | | | 0.282 (0.211) | 0.138 (0.230) |
| dtfp ln(GDP per capita) | | | 2.833*** (0.839) | 2.910*** (0.832) |
| ed ln(Financial development) | | | | 0.356*** (0.105) |
| Exporter dummies | Y | Y | Y | Y |
| No. of exporters | 40 | 40 | 40 | 38 |
| No. of industries | 594 | 590 | 590 | 492 |
| Observations | 18,752 | 18,714 | 18,714 | 15,201 |
| R-squared | 0.145 | 0.168 | 0.169 | 0.169 |

Notes: Estimates for a constant are not reported. Standard errors are clustered at the industry level. Cluster-robust standard errors are in parentheses. ***, **, and * represent the estimates that are significant at the level of 1%, 5%, and 10%, respectively.

$\ln F_i$ and d_z constant at their median values, 1.97 and 0.42, a 1% increase in informal institutions is associated with a 1.45% ($= 32.957 \times 0.42 - 14.974 \times 0.42 \times 1.97$) rise in rca in the industry whose d_z is 0.42. Similarly, with the median of $\ln I_i$ of 1.93, a 1% rise in formal institutions is associated with a 1.31% rise in rca in that industry. These magnitudes are close to the corresponding magnitudes for the impacts of informal and formal institutions, 1.58% and 1.46%, calculated with the baseline estimation result in Table 3.

Note that with the additional controls and industry dummies, as in Table 4, the main estimates regarding institutional comparative advantage and the formal-informal substitutability are statistically significant at the 1% significance level. These estimation results are reported in Table 10 in Appendix B. Note also that I report Table 11 in Appendix B, which shows the estimation results obtained using the HI to measure d_z when data are organized by the SITC. Compared to the estimates in Table 5 derived based on the dataset organized by the I-O classification, the estimates for the main variables, $d_z \ln I_i$, $d_z \ln F_i$, and $d_z \ln F_i \ln I_i$, tend to be statistically more significant.

To summarize, the estimation results are robust overall with the different measure of institutional intensity and the different mapping methodology that considers industry shares in calculating factor intensity. The statistical significance levels for the estimated coefficients on the main variables are stronger with Nunn's measure than the HI. This might be due to the fact that Nunn's measure more directly captures institutional intensity than the HI, as explained in Section 3.1.

In addition to institutional comparative advantage, the estimation results support that countries with abundant raw materials and human capital tend to have a comparative advantage in the industries that intensively use raw materials and skilled labor, respectively. Skill-intensive industries turn out to rely on informal institutions, as well as human capital, for production. Physical capital abundance does not seem to be a significant determinant of trade patterns.

4.3 Reverse Causality

The main estimates examined so far might capture the reverse causality impact, i.e., having a comparative advantage in institutionally-intensive goods leads countries to have better institutions.

Table 7: Estimation I with the Control of Past Revealed Comparative Advantage

| Variable | Dependent variable is $\ln(rca)$, d_z : Nunn's measure | | | |
|---|---|------------------------|------------------------|-----------------------|
| | (1) | (2) | (3) | (4) |
| $\ln(1985\ rca)$ | 0.619*** (0.013) | 0.614*** (0.014) | 0.615*** (0.014) | 0.609*** (0.015) |
| d_z | -38.317*** (13.796) | -38.192*** (13.837) | -38.155*** (13.765) | -33.769** (14.232) |
| rz | 0.863*** (0.199) | 0.938*** (0.201) | 0.918*** (0.210) | 0.809*** (0.214) |
| kz | 0.782* (0.436) | 0.780* (0.431) | 0.881** (0.423) | 0.870** (0.412) |
| sz | -3.428*** (1.068) | -3.441*** (1.079) | -3.662*** (1.088) | -3.445*** (1.131) |
| iit | | -1.840* (1.050) | -1.681 (1.078) | -1.572 (1.133) |
| va | | | 2.709 (2.435) | 1.469 (2.676) |
| $dtfp$ | | | 10.312 (13.826) | 10.873 (14.599) |
| ed | | | | -0.607 (0.391) |
| $d_z \ln(\text{Informal})$ | 19.145*** (6.997) | 19.058*** (7.022) | 19.040*** (6.986) | 17.066** (7.262) |
| $d_z \ln(\text{Formal})$ | 17.965*** (6.668) | 17.905*** (6.691) | 17.836*** (6.653) | 15.893** (6.888) |
| $d_z \ln(\text{Formal}) \ln(\text{Informal})$ | -9.016*** (3.379) | -8.975*** (3.393) | -8.939*** (3.373) | -8.055** (3.510) |
| $rz \ln(\text{Raw material})$ | 0.283*** (0.063) | 0.288*** (0.064) | 0.284*** (0.064) | 0.260*** (0.066) |
| $kz \ln(\text{Physical capital})$ | -0.071* (0.037) | -0.071** (0.036) | -0.079** (0.036) | -0.078** (0.035) |
| $sz \ln(\text{Human capital})$ | 3.332*** (1.020) | 3.353*** (1.034) | 3.626*** (1.041) | 3.400*** (1.094) |
| $iit \ln(\text{GDP per capita})$ | | 0.212** (0.106) | 0.192* (0.109) | 0.185 (0.115) |
| $va \ln(\text{GDP per capita})$ | | | -0.294 (0.246) | -0.179 (0.270) |
| $dtfp \ln(\text{GDP per capita})$ | | | -1.317 (1.391) | -1.348 (1.467) |
| $ed \ln(\text{Financial development})$ | | | | 0.131 (0.089) |
| Exporter dummies | Y | Y | Y | Y |
| No. of exporters | 39 | 39 | 39 | 37 |
| No. of industries | 191 | 190 | 190 | 180 |
| Observations | 5,821 | 5,818 | 5,818 | 5,302 |
| R-squared | 0.566 | 0.570 | 0.571 | 0.557 |

Notes: Estimates for a constant are not reported. Standard errors are clustered at the industry level. Cluster-robust standard errors are in parentheses. ***, **, and * represent the estimates that are significant at the level of 1%, 5%, and 10%, respectively.

However, this is unlikely to be an immediate response of institutional quality considering that institutions require high fixed costs, which leads to the path-dependence of institutions (North, 1990). What helps overcome high fixed costs would be a need for better institutions, arising from trade experience. That is, a great volume of trade over time might give countries enough incentive to pay high fixed costs for constructing better formal institutions in a way that greater production is supported. Regarding informal institutions, they tend to be persistent and tenacious because values are transmitted from our ancestors over generations (North, 1990; Roland, 2004). Even if trade affects informal institutions, it would be presumably through trade experience over the years. Regardless of the type of institutions, past trade performance seems to be the main channel through which reverse causality occurs.

To block this main potential channel, I include an exporter's *rca* in 1985 as an independent variable, allowing for exploiting the variation in the current *rca* that is not related to the past *rca*. This might underestimate the impact of institutions because not every variation in the past *rca* generates reverse causality. Some of the variation in the current *rca* that is related to the past *rca* could capture the variation that explains the causal impact of institutions. Nonetheless, this approach allows for deriving more conservative estimates. Furthermore, by controlling for reverse causality, estimates would be closer to capturing the causal impact of institutions than the estimates without controlling for reverse causality.

Table 7 presents the OLS estimates with the control of *rca* in 1985. For each column, the estimates for each type of institutions multiplied by d_z and the interaction term of formal and informal institutions and d_z are all consistent with the predictions and statistically significant. To quantify the impact of institutions, I use the same column (3), which was selected for quantification before, and hold d_z and the natural log of the other institutions, which are not quantified, constant at their median values. Then, a 1% rise in informal and formal institutions contributes to a 0.66% and 0.27% rise in a comparative advantage in the industry, whose d_z is the median, respectively.⁴ These

⁴When using the *rca* in 1990, the main estimates are still statistically significant and consistent with the predictions. As less variation in *rca* is exploited with the 1990 *rca* due to the higher correlation of the current *rca* with the 1990 *rca* than with the 1985 *rca*, the quantified impacts of institutions are reduced.

Table 8: Estimation II with the Control of Past Revealed Comparative Advantage

| Variable | Dependent variable is $\ln(rca)$, d_z : Nunn's measure | | | | | |
|--|---|---------------------|----------------------|----------------------|----------------------|----------------------|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| $\ln(1985\ rca)$ | 0.620*** (0.014) | 0.619*** (0.014) | 0.622*** (0.014) | 0.623*** (0.015) | 0.617*** (0.014) | 0.616*** (0.016) |
| $dz\ \ln(\text{Informal})$ | 19.575*** (7.063) | 17.396** (7.493) | 18.874*** (7.078) | 17.414** (7.961) | 19.831*** (6.938) | 16.197* (9.659) |
| $dz\ \ln(\text{Formal})$ | 18.387*** (6.732) | 16.224** (7.226) | 17.955*** (6.731) | 15.731** (7.431) | 18.803*** (6.614) | 14.820 (9.034) |
| $dz\ \ln(\text{Formal})\ \ln(\text{Informal})$ | -9.230*** (3.412) | -8.132** (3.683) | -8.893*** (3.413) | -8.006** (3.805) | -9.330*** (3.358) | -7.496 (4.636) |
| $rz\ \ln(\text{Raw material})$ | 0.290*** (0.065) | 0.224*** (0.072) | 0.282*** (0.064) | 0.309*** (0.072) | 0.294*** (0.065) | 0.271*** (0.078) |
| $kz\ \ln(\text{Physical capital})$ | -0.070* (0.036) | -0.077** (0.038) | -0.112*** (0.035) | -0.105*** (0.036) | -0.078** (0.035) | -0.153*** (0.042) |
| $sz\ \ln(\text{Human capital})$ | 3.208*** (1.031) | 3.369*** (1.137) | 1.364 (1.302) | 3.864*** (1.144) | 3.321*** (1.041) | 2.262 (1.749) |
| $dz\ \ln(\text{Raw material})$ | | -0.137** (0.063) | | | | -0.160* (0.083) |
| $dz\ \ln(\text{Physical capital})$ | | -0.063 (0.144) | | | | -0.351 (0.282) |
| $dz\ \ln(\text{Human capital})$ | | 0.069 (0.884) | | | | 1.148 (1.221) |
| $rz\ \ln(\text{Formal})$ | | | 0.311 (0.644) | | | 0.093 (0.851) |
| $kz\ \ln(\text{Formal})$ | | | 0.305* (0.176) | | | 0.327 (0.216) |
| $sz\ \ln(\text{Formal})$ | | | 1.333* (0.771) | | | 1.237 (0.852) |
| $rz\ \ln(\text{Informal})$ | | | 0.885 (0.678) | | | 1.344* (0.806) |
| $kz\ \ln(\text{Informal})$ | | | 0.180 (0.166) | | | 0.267 (0.215) |
| $sz\ \ln(\text{Informal})$ | | | 2.680*** (0.928) | | | 1.898* (1.134) |
| $dz\ \ln(\text{Financial development})$ | | | | 0.078 (0.188) | | -0.046 (0.218) |
| $dz\ \ln(\text{Infrastructure})$ | | | | 0.024 (0.061) | | -0.068 (0.056) |
| $dz\ \ln(\text{GDP per capita})$ | | | | -0.170 (0.227) | | 0.112 (0.363) |
| $iit\ \ln(\text{Formal})$ | | | | | 0.828** (0.341) | 0.764* (0.416) |
| $va\ \ln(\text{Formal})$ | | | | | -1.493* (0.786) | -0.824 (1.181) |
| $dtfp\ \ln(\text{Formal})$ | | | | | 5.554 (4.164) | -0.239 (4.623) |
| $iit\ \ln(\text{Informal})$ | | | | | 0.639 (0.425) | 0.829* (0.427) |
| $va\ \ln(\text{Informal})$ | | | | | -0.697 (1.059) | 0.378 (1.256) |
| $dtfp\ \ln(\text{Informal})$ | | | | | -0.632 (4.755) | -0.112 (5.233) |
| $ed\ \ln(\text{Financial development})$ | | | | | | 0.140 (0.106) |
| Exporter dummies | Y | Y | Y | Y | Y | Y |
| Industry dummies | Y | Y | Y | Y | Y | Y |
| No. of exporters | 39 | 39 | 39 | 32 | 39 | 32 |
| No. of industries | 191 | 191 | 191 | 191 | 190 | 180 |
| Observations | 5,821 | 5,821 | 5,821 | 5,040 | 5,818 | 4,753 |
| R-squared | 0.595 | 0.596 | 0.597 | 0.588 | 0.597 | 0.586 |

Notes: Estimates for a constant are not reported. Standard errors are clustered at the industry level. Cluster-robust standard errors are in parentheses. ***, **, and * represent the estimates that are significant at the level of 1%, 5%, and 10%, respectively.

values are much lower than the corresponding ones, 1.58% and 1.46%, obtained from Table 3. Using column (4), the impacts become even lower. In the same industry, a 1% rise in informal and formal institutions leads to a 0.55% and 0.16% rise in *rca*, respectively. Regarding the estimates for the other variables, their signs tend to remain similar, while their magnitudes tend to fall.

When more controls and industry dummies are added without factor intensity variables, the magnitudes of the estimates for the main regressors stay similar, as shown in Table 8. The main estimates also tend to be statistically significant. In column (6), with all of the controls, the estimated coefficient on informal institutions multiplied by d_z is still statistically significant. For the quantification of the institutional impacts, I use column (2), as before, and the median values of each type of institutions and d_z . Then, a 1% rise in informal and formal institutions leads to a 0.63% and 0.24% rise in *rca* in the industry, whose d_z is the median, respectively. These values are smaller than their corresponding ones, 0.97% and 1.07%, in Table 4. The signs for the impacts of the other control variables stay similar, although their statistical significances tend to get weaker.

When data are organized by the SITC, which allows for employing more observations, the main estimates are all statistically significant in every column, as reported in Table 9. The magnitudes of the estimated coefficients for the main regressors are generally similar to the magnitudes of the main estimates in Table 8, except column (4). With the estimates in column (4), quantifying institutional impacts using the same method, the impact of formal institutions significantly drops with the control of the past *rca*. Specifically, a 1% rise in the quality of informal and formal institutions increases a comparative advantage in the industry, whose d_z is the median value, by 0.36% and 0.02%, respectively. Without the control of the 1985 *rca*, the corresponding impacts of informal and formal institutions are 0.81% and 0.89%, calculated with the estimates in Table 10 in Appendix B. The signs for the estimated coefficients on the control variables remain similar with this dataset organized by the SITC.

These estimation results confirm that different informal and formal institutional qualities across countries are an important determinant of trade patterns. Specifically, results show that high-quality formal and informal institutions are conducive to achieving institutional comparative advantage

Table 9: Estimation III with Past Revealed Comparative Advantage and SITC

| Variable | Dependent variable is $\ln(rca)$, d_z : Nunn's measure | | | | | |
|--|---|----------------------|----------------------|---------------------|----------------------|----------------------|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| $\ln(1985\ rca)$ | 0.600*** (0.009) | 0.600*** (0.009) | 0.601*** (0.009) | 0.603*** (0.010) | 0.597*** (0.009) | 0.597*** (0.011) |
| $dz\ \ln(\text{Informal})$ | 17.890*** (5.510) | 18.486*** (5.715) | 18.686*** (5.428) | 11.812* (6.489) | 18.042*** (5.437) | 14.723** (7.147) |
| $dz\ \ln(\text{Formal})$ | 17.104*** (5.260) | 17.560*** (5.506) | 17.726*** (5.171) | 10.780* (6.137) | 17.468*** (5.210) | 13.988** (6.797) |
| $dz\ \ln(\text{Formal})\ \ln(\text{Informal})$ | -8.654*** (2.645) | -8.915*** (2.774) | -8.825*** (2.600) | -5.565* (3.104) | -8.753*** (2.621) | -6.784** (3.445) |
| $rz\ \ln(\text{Raw material})$ | 0.175*** (0.051) | 0.157*** (0.055) | 0.179*** (0.051) | 0.211*** (0.056) | 0.175*** (0.052) | 0.150** (0.069) |
| $kz\ \ln(\text{Physical capital})$ | -0.054* (0.030) | -0.074** (0.034) | -0.090*** (0.030) | -0.077** (0.034) | -0.064** (0.030) | -0.134*** (0.040) |
| $sz\ \ln(\text{Human capital})$ | 4.434*** (0.833) | 4.464*** (0.883) | 3.470*** (0.913) | 4.747*** (0.925) | 4.313*** (0.801) | 4.216*** (1.252) |
| $dz\ \ln(\text{Raw material})$ | | -0.046 (0.046) | | | | -0.160** (0.068) |
| $dz\ \ln(\text{Physical capital})$ | | -0.230** (0.113) | | | | -0.508** (0.221) |
| $dz\ \ln(\text{Human capital})$ | | 0.784 (0.619) | | | | 2.138** (0.953) |
| $rz\ \ln(\text{Formal})$ | | | -0.144 (0.609) | | | 0.328 (0.803) |
| $kz\ \ln(\text{Formal})$ | | | 0.405** (0.183) | | | 0.362* (0.193) |
| $sz\ \ln(\text{Formal})$ | | | 1.301* (0.692) | | | 0.693 (0.757) |
| $rz\ \ln(\text{Informal})$ | | | 1.411*** (0.494) | | | 2.067*** (0.710) |
| $kz\ \ln(\text{Informal})$ | | | 0.128 (0.148) | | | 0.287* (0.157) |
| $sz\ \ln(\text{Informal})$ | | | 1.322* (0.708) | | | 0.462 (0.878) |
| $dz\ \ln(\text{Financial development})$ | | | | -0.048 (0.133) | | -0.164 (0.165) |
| $dz\ \ln(\text{Infrastructure})$ | | | | 0.010 (0.043) | | -0.037 (0.049) |
| $dz\ \ln(\text{GDP per capita})$ | | | | -0.117 (0.148) | | -0.004 (0.255) |
| $iit\ \ln(\text{Formal})$ | | | | | 0.827*** (0.269) | 0.899*** (0.294) |
| $va\ \ln(\text{Formal})$ | | | | | -1.250* (0.739) | -0.704 (1.030) |
| $dftp\ \ln(\text{Formal})$ | | | | | -5.215 (5.926) | -10.827* (6.540) |
| $iit\ \ln(\text{Informal})$ | | | | | 0.952*** (0.286) | 1.084*** (0.305) |
| $va\ \ln(\text{Informal})$ | | | | | -0.145 (0.751) | 1.138 (1.124) |
| $dftp\ \ln(\text{Informal})$ | | | | | 11.810** (5.091) | 15.260*** (5.100) |
| $ed\ \ln(\text{Financial development})$ | | | | | | 0.142* (0.081) |
| Exporter dummies | Y | Y | Y | Y | Y | Y |
| Industry dummies | Y | Y | Y | Y | Y | Y |
| No. of exporters | 39 | 39 | 39 | 32 | 39 | 32 |
| No. of industries | 594 | 594 | 594 | 594 | 590 | 492 |
| Observations | 14,546 | 14,546 | 14,546 | 12,731 | 14,527 | 10,769 |
| R-squared | 0.525 | 0.526 | 0.527 | 0.525 | 0.526 | 0.526 |

Notes: Estimates for a constant are not reported. Standard errors are clustered at the industry level. Cluster-robust standard errors are in parentheses. ***, **, and * represent the estimates that are significant at the level of 1%, 5%, and 10%, respectively.

and that the two types of institutions substitute for one another in inducing this outcome. In particular, informal institutions turn out to have a higher impact on export performance than formal institutions. Of the other variables, the estimated coefficient on the interaction term of raw material and its intensity is positive and statistically significant in every variation of the estimation, strongly supporting the quasi-Heckscher-Ohlin prediction in regard to raw material abundance.

5 Concluding Remarks

This paper empirically shows that countries with better formal and informal institutions tend to have a comparative advantage in industries that intensively use institutions in mitigating opportunism, arising from relationship-specific transactions. An important finding is that there exists the substitutability between formal and informal institutions in promoting exports in such industries. Even with low-quality formal institutions, high-quality informal institutions can substitute for formal ones, and vice versa.

These results evidence that formal and informal institutions collectively give rise to institutional quality with some degree of substitution. High-quality institutions limit self-interested behaviors of individuals, encouraging their cooperation toward the production of goods that are subject to opportunism. By controlling for the main potential channel through which reverse causality occurs, this paper uncovers that how well institutions facilitate cooperation for such production is one of the main determinants of international trade patterns.

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Appendix A Mapping Methodologies

A.1 Mapping between the I-O Classification and SITC Rev. 2

A.1.1 Baseline Methodology

To construct a mapping between the I-O classification and the Standard International Trade Classification (SITC) rev. 2, I first use the concordance between the 10-digit Harmonized System (HS10) and SITC rev. 2, constructed by Feenstra (1996). The 5-digit SITC codes in this concordance are truncated to the 4-digit codes, which is further mapped to the I-O classification by the Bureau of Economic Analysis (BEA)'s concordance of HS10 and I-O classification. Then, each HS10 has a matching I-O and SITC code, which allows for counting the number of HS10 codes for each I-O code. For each SITC category, I choose one I-O code with the highest number of HS codes.

A.1.2 Additional Mapping for Robustness Check

For a robustness check, I consider the I-O level industry shares for each SITC category, rather than choosing one dominant I-O code. Specifically, I calculate the shares of I-O codes according to their matching HS10 numbers for each SITC level. Then, Nunn's contract intensity measure for each I-O classification is multiplied by its corresponding industry share. Finally, by adding up these weighted intensities for each SITC code, the institutional intensity measure is listed by the SITC. The HI and raw material intensity listed in the I-O classification are also reorganized by the SITC levels using the same methodology.

A.2 Mapping between the I-O Classification and 1987 SIC

The skill and capital intensities, TFP growth, and value added are organized by the 1987 4-digit Standard Industrial Classification (SIC) in Becker et al. (2013). The SIC is linked to the I-O classification by Feenstra (1997)'s concordance between the HS10 and 1987 SIC and the BEA's concordance between the I-O codes and HS10. For each I-O code, I choose one SIC code that has

the highest number of HS10. When an I-O code is matched to two or more SIC codes that have the same number of HS10, I use the average value of the intensities in the SIC codes. Choosing one dominant SIC code for each I-O level is used as a baseline mapping methodology.

A.3 Mapping between the I-O Classification and ISIC Rev. 2

The mapping between the I-O classification and 4-digit SITC rev. 2, described in Appendix A.1.1, is further linked to the International Standard Industrial Classification (ISIC) using the concordance between the 4-digit SITC and 3-digit ISIC, constructed by Muendler (2009). Then, each HS10 code has a matching I-O and ISIC code.

To organize the dependence on external finance in terms of the I-O classification, for each I-O code, I choose one ISIC code that has the highest number of HS10. For the I-O codes with two or more ISIC codes, which contain the same number of HS10, I use the average value of the external financial dependences. For the data on external dependence in the 4-digit ISIC levels, I choose the I-O codes that are matched to the industry description of the 4-digit levels. Since the ISIC is in a higher level than the I-O classification, the same values of the external dependence can be matched to different I-O codes. Note that for a robustness check, the data on the external finance dependence listed by the ISIC are directly matched to the SITC by Muendler (2009)'s concordance.

A.4 Mapping between the 1987 SIC and SITC Rev. 2

The SIC codes are matched to the HS10 and SITC codes by Feenstra (1997)'s concordance between the HS10 and 1987 SIC and Feenstra (1996)'s concordance between the HS10 and 4-digit SITC. Then, each HS10 has a corresponding SITC and SIC code. Since one or more SIC codes are matched to a SITC level, I use the same methodology described in Appendix A.1.2. That is, by calculating the portions of SIC codes according to their matching HS10 numbers within a SITC level and by adding up the factor intensities weighted by these shares, factor intensities, including s_z and k_z , are recalculated and reorganized by the SITC. These factor intensities are used for a robustness check.

Appendix B Additional Robustness Checks

Table 10: Robustness Check with the SITC and Nunn's Measure

| Variable | Dependent variable is $\ln(rca)$, d_z : Nunn's measure | | | | | |
|------------------------------|---|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| dz ln(Informal) | 34.238*** (5.389) | 37.830*** (5.717) | 33.627*** (5.415) | 23.023*** (6.585) | 34.302*** (5.264) | 20.737*** (7.122) |
| dz ln(Formal) | 33.033*** (5.158) | 36.798*** (5.488) | 31.914*** (5.217) | 22.803*** (6.227) | 32.924*** (5.045) | 21.308*** (6.802) |
| dz ln(Formal) ln(Informal) | -15.467*** (2.579) | -17.633*** (2.766) | -15.180*** (2.576) | -10.712*** (3.134) | -15.563*** (2.529) | -10.125*** (3.420) |
| rz ln(Raw material) | 0.700*** (0.079) | 0.613*** (0.086) | 0.688*** (0.080) | 0.691*** (0.083) | 0.674*** (0.080) | 0.545*** (0.105) |
| kz ln(Physical capital) | 0.024 (0.043) | 0.040 (0.048) | 0.002 (0.046) | 0.066 (0.046) | 0.019 (0.041) | 0.009 (0.052) |
| sz ln(Human capital) | 7.739*** (1.058) | 7.176*** (1.168) | 6.543*** (1.108) | 6.994*** (1.172) | 7.065*** (1.017) | 5.540*** (1.435) |
| dz ln(Raw material) | | -0.199*** (0.065) | | | | -0.270** (0.105) |
| dz ln(Physical capital) | | -0.144 (0.143) | | | | -0.653*** (0.247) |
| dz ln(Human capital) | | 2.358*** (0.678) | | | | 0.927 (0.965) |
| rz ln(Formal) | | | -1.789** (0.707) | | | -0.978 (0.892) |
| kz ln(Formal) | | | 0.144 (0.225) | | | 0.086 (0.204) |
| sz ln(Formal) | | | 0.475 (0.812) | | | -0.354 (0.855) |
| rz ln(Informal) | | | -0.073 (0.682) | | | 1.634 (1.022) |
| kz ln(Informal) | | | 0.183 (0.223) | | | -0.130 (0.251) |
| sz ln(Informal) | | | 1.460* (0.820) | | | 1.493 (1.041) |
| dz ln(Financial development) | | | | 0.466*** (0.142) | | 0.180 (0.189) |
| dz ln(Infrastructure) | | | | 0.059 (0.047) | | -0.037 (0.060) |
| dz ln(GDP per capita) | | | | -0.014 (0.186) | | 0.608** (0.239) |
| iit ln(Formal) | | | | | 1.872*** (0.308) | 1.991*** (0.327) |
| va ln(Formal) | | | | | 1.098 (0.838) | -0.007 (1.029) |
| dtfp ln(Formal) | | | | | -0.059 (4.044) | -1.036 (4.128) |
| iit ln(Informal) | | | | | 2.605*** (0.381) | 2.169*** (0.408) |
| va ln(Informal) | | | | | 0.076 (0.924) | 0.851 (1.368) |
| dtfp ln(Informal) | | | | | 6.035* (3.596) | 7.002* (4.086) |
| ed ln(Financial development) | | | | | | 0.341*** (0.112) |
| Exporter dummies | Y | Y | Y | Y | Y | Y |
| Industry dummies | Y | Y | Y | Y | Y | Y |
| No. of exporters | 40 | 40 | 40 | 33 | 40 | 33 |
| No. of industries | 594 | 594 | 594 | 594 | 590 | 492 |
| Observations | 18,752 | 18,752 | 18,752 | 16,220 | 18,714 | 13,666 |
| R-squared | 0.219 | 0.220 | 0.220 | 0.207 | 0.228 | 0.228 |

Notes: Estimates for a constant are not reported. Standard errors are clustered at the industry level. Cluster-robust standard errors are in parentheses. ***, **, and * represent the estimates that are significant at the level of 1%, 5%, and 10%, respectively.

Table 11: Robustness Check with the SITC and the Herfindahl Index

| Variable | Dependent variable is $\ln(rca)$, d_z : 1-HI | | | | | | |
|------------------------------|---|----------------------|----------------------|----------------------|----------------------|---------------------|----------------------|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| dz ln(Informal) | 36.827** (15.539) | 37.145** (15.219) | 35.010** (15.706) | 31.655* (16.568) | 35.063** (15.994) | 21.995 (17.850) | 36.219** (15.546) |
| dz ln(Formal) | 35.247** (14.824) | 36.670** (14.515) | 33.384** (15.013) | 31.427** (15.886) | 29.882** (14.976) | 23.333 (16.794) | 33.117** (14.708) |
| dz ln(Informal) ln(Formal) | -15.422** (7.465) | -16.436** (7.300) | -15.338** (7.566) | -13.868* (8.073) | -14.344* (7.502) | -10.406 (8.534) | -15.585** (7.393) |
| rz ln(Raw material) | 0.713*** (0.080) | 0.696*** (0.080) | 0.617*** (0.081) | 0.601*** (0.105) | 0.696*** (0.080) | 0.709*** (0.091) | 0.697*** (0.080) |
| kz ln(Physical capital) | -0.041 (0.042) | -0.056 (0.043) | -0.052 (0.044) | -0.035 (0.042) | 0.007 (0.045) | 0.010 (0.043) | -0.052 (0.041) |
| sz ln(Human capital) | 8.422*** (1.031) | 7.416*** (0.983) | 6.736*** (1.026) | 8.256*** (1.034) | 6.343*** (1.045) | 7.468*** (1.051) | 7.954*** (0.987) |
| iit ln(GDP per capita) | | 0.844*** (0.096) | 0.849*** (0.100) | | | | |
| va ln(GDP per capita) | | 0.055 (0.225) | -0.128 (0.244) | | | | |
| dtfp ln(GDP per capita) | | 2.061* (1.080) | 1.882* (1.064) | | | | |
| ed ln(Financial development) | | | 0.380*** (0.106) | | | | |
| dz ln(Raw material) | | | | -0.429* (0.221) | | | |
| dz ln(Physical capital) | | | | 0.602 (0.394) | | | |
| dz ln(Human capital) | | | | 0.226 (1.837) | | | |
| rz ln(Formal) | | | | | -1.782** (0.865) | | |
| kz ln(Formal) | | | | | -0.256 (0.181) | | |
| sz ln(Formal) | | | | | 1.596** (0.725) | | |
| rz ln(Informal) | | | | | 0.860 (0.939) | | |
| kz ln(Informal) | | | | | -0.309 (0.221) | | |
| sz ln(Informal) | | | | | 2.546*** (0.765) | | |
| dz ln(Financial development) | | | | | | 1.509*** (0.426) | |
| dz ln(Infrastructure) | | | | | | -0.022 (0.161) | |
| dz ln(GDP per capita) | | | | | | 0.225 (0.560) | |
| iit ln(Formal) | | | | | | | 1.796*** (0.317) |
| va ln(Formal) | | | | | | | 1.437 (0.897) |
| dtfp ln(Formal) | | | | | | | 2.955 (4.015) |
| iit ln(Informal) | | | | | | | 2.426*** (0.392) |
| va ln(Informal) | | | | | | | -0.697 (1.027) |
| dtfp ln(Informal) | | | | | | | 7.574** (3.786) |
| Exporter dummies | Y | Y | Y | Y | Y | Y | Y |
| Industry dummies | Y | Y | Y | Y | Y | Y | Y |
| No. of exporters | 40 | 40 | 38 | 40 | 40 | 33 | 40 |
| No. of industries | 609 | 605 | 505 | 609 | 609 | 609 | 605 |
| Observations | 19,201 | 19,163 | 15,591 | 19,201 | 19,201 | 16,610 | 19,163 |
| R-squared | 0.215 | 0.229 | 0.230 | 0.216 | 0.217 | 0.206 | 0.223 |

Notes: Estimates for a constant are not reported. Standard errors are clustered at the industry level. Cluster-robust standard errors are in parentheses. ***, **, and * represent the estimates that are significant at the level of 1%, 5%, and 10%, respectively.