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Export Diversification in Low-Income Countries and Small States: Do Country Size and Income Level Matter?

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Export Diversification in Low-Income Countries and Small States: Do Country Size and Income Level Matter? [1]

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Abstract

Export structure is less diversified in low-income countries (LICs) and especially small states that face resource constraints and small economic size. This paper explores the potential linkages between export structure and economic growth and its volatility in LICs and small states, using a range of indices of export concentration differing in the coverage of industries. The empirical analysis finds that export diversification may promote economic growth and reduce economic volatility in these countries. Furthermore, the analysis demonstrates that the economic benefits of export diversification differ by country size and income level—there are bigger benefits for relatively larger and poorer countries within the group of LICs and small states.

I. INTRODUCTION

The economic gains of greater diversification have been widely studied and are well known—greater resilience to exogenous shocks and stronger long-run growth performance. These are also important policy goals for low-income countries (LICs) including small states.[2] However, the number of studies focused on economic diversification in LICs and small states is relatively limited. LICs and small states face numerous inherent constraints in seeking to diversify their economies, including scarce resources, inadequate economic infrastructure, shortage of skilled labor, and high transportation costs due to geographical isolation from main trading partners (IMF, 2014). They are forced to specialize in a very limited range of goods and services, such as commodities, agricultural products, and tourism—based on their comparative advantages to compete effectively in international markets.

Despite extensive empirical contributions on the linkages between export diversification and economic growth, the empirical literature does not offer conclusive evidence on these linkages.[3] Many studies have looked at the causality from economic development to domestic or export diversification, while similarly to this paper, others have focused on the causality from diversification to growth. The former strand attempts to explain the pattern of diversification and economic development—a hump- or *U*-shaped production and export diversification (i.e., production and exports diversify at earlier stages of development and then they begin to respecialize at higher levels of development (e.g., Imbs and Wacziarg, 2003; Koren and Tenreyro, 2007; Cadot et al., 2011). Cadot et al. (2011) document that extensive margin drives this pattern, implying that countries add products to their export basket during the early stages of economic development while high-income countries remove goods for which they have lost the comparative advantage.

While most existing literature finds a *U*-shaped nonlinear relationship between diversification and development, some studies do not find that there is respecialization (e.g., Easterly et al., 2009; Parteka, 2010). Moreover, most studies focus solely on the two variables, diversification and GDP per capita, although some recent studies explore further determinants of diversification and find that country size or location and trade barriers contribute to observed diversification patterns (e.g., Agosin et al., 2012; Parterka and Tamberi, 2013).

The second strand of literature explores the growth effects of diversification. Earlier studies mostly found that export diversification helped countries to hedge against adverse terms of trade shocks by stabilizing export earnings and domestic outputs (e.g., Jansen, 2004; Cavallo et al., 2008). While external shocks are crucial in accounting for external sources of economic growth and its volatility, they can explain only small part of the long-run variance of GDP per capita (e.g., Ahmed, 2003; Raddatz, 2007). Raddatz (2007) shows that external shocks—which include terms-of-trade shocks, natural disasters, changes in the state of the international economy, and international interest rates, and fluctuations in aid flows—cannot explain more than 11% of the overall variance of real GDP per capita in the long run although they have economically meaningful impact. The remaining part is accounted for by factors that are not within the broad set of exogenous shocks, and which are likely to be associated with endogenous shocks.

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[2] Small states are sovereign countries with a population of 1.5 million people or fewer. See Table A.3 in Appendix A for the list of LICs and small states included in the analysis.

[3] See Cadot et al. (2013), and Mau (2016) for surveys on the empirical literature on export diversification and its linkages with economic growth.

Going further, more recently, Haddad et al. (2013) consider the interaction between trade openness and export diversification. They find that the effect of trade openness on growth volatility declines in more diversified countries, implying that there is a role for export diversification in mitigating the transmission of external shocks. On the growth effects of export diversification, some studies find empirical evidence that export diversification promotes economic growth by including measures of export concentration to the conventional growth regression (e.g., Al-Marhubi, 2000; Herzer and Nowak-Lehnmann, 2006; McIntyre et al., 2018), while the positive relationship between export diversification and economic growth is not observed in other studies (e.g., Michaely, 1977).

Building upon the existing literature, this paper explores the potential linkages between economic structure and economic growth and volatility in LICs and small states. Focusing on LICs and small states, this paper attempts to fill the gap in the existing literature by examining the following questions: (i) are there significant effects of export diversification on economic growth and volatility in less developed and small countries?; and (ii) do the effects vary by country size and income level?[4]

Stylized patterns in the relationship of diversification and economic development make the separate analysis on LICs and small states more promising. First, the economic benefits of export diversification are more pronounced for lower income countries as the export structure becomes more diversified at the earlier stages of development (e.g., Cadot et al., 2011). Second, country size contributes to observed diversification patterns such that small countries are significantly less diversified (e.g., Agosin et al., 2012; Parterka and Tamberi, 2013). On the other hand, Easterly and Kraay (2000) conclude that small states are not much different from large countries in terms of income, growth, and volatility, controlling for important determinants of these variables such as location and trade openness.

A tailored approach is needed to analyze export diversification in LICs and small states given the wide variation in the extent of diversification due to resource constraints and economic size. For this purpose, we propose various concentration indices to measure the degree of export concentration (or diversification) of a particular country which differ in the coverage of industries. For instance, we construct export concentration indices considering only the export shares of a certain number of large industries in a country—departing from the existing literature—as well as using the export shares of all industries—same as in the previous literature. It should also be noted that this paper considers both goods and services exports in measuring the export concentration of the economy. The share of services exports in total exports has risen significantly in many advanced and emerging countries over time and stages of economic development.[5] Furthermore, as some LICs and small states are highly dependent on the tourism

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[4] In addition to country size, the developments of export concentration (or diversification) likely relate to the export or industrial structure of the country. In LICs and small states, goods exports tend to be more concentrated in the country of high dependence on commodity (e.g., crude materials and mineral fuels) while services exports are likely to be more concentrated in tourism-oriented economies. In addition, the industrial structure of the economy may have some implications for the transmission of external shocks which in turn may be associated with the effects of export concentration on economic growth and volatility. However, this paper leaves the potential role of industrial structure in determining the relationships between export concentration and economic growth for a future research.

[5] On the world economy the share of services export in total exports has doubled from 9 percent in 1970 to over 20 percent in 2014 (Loungani et al., 2017).

sector, the analysis of export diversification including both manufacturing and services is important for these countries.

The empirical analysis using various export diversification indices demonstrates that the growth-enhancing and volatility-reducing effects of export diversification are identified regardless of export concentration indices. Interestingly, the gains from export diversification are found to be relatively larger in diversification limited to a small number of large industries than in diversification to a wide range of industries. The findings imply that the economic benefits of export diversification are not limited to advanced and emerging economies and that the importance of export diversification should be recognized for LICs and small states. In addition, diversification to a wide range of industries is not necessarily desirable for some LICs and small states. Instead, export diversification to a few large and competitive industries would produce some benefits to the economy in terms of economic growth and stability, and it may be more important.

The analysis also finds that the economic benefits of export diversification are more pronounced in relatively larger countries and less developed countries within the sample of LICs and small states. Export diversification could help countries at early development stages or small economic size through several channels. First, a more diversified economy offers insurance against idiosyncratic sectoral shocks, especially at low stages of development when countries produce only small number of goods for export, such as agricultural products and natural resources. Export diversification can help a country reduce economic volatility by alleviating the impacts of external shocks like terms of trade shocks (Haddad et al., 2013). Second, countries with greater export diversification at early development stages are more likely to be able to move into new products or sectors (horizontal diversification) and/or into manufacturing from primary products (vertical diversification) through technology spillovers and learning by exporting with more advanced countries (e.g., Grossman and Helpman, 1991; Keller, 2010; De Loecker, 2013). Lastly, lower volatility itself would also lead to higher growth (e.g., Ramey and Ramey, 1995; Martin and Rogers, 2000).

The rest of paper proceeds as follows: Section II presents some stylized facts on export diversification in LICs and small states. Section III analyzes the effects of diversification on economic growth and volatility including the differentiated effects by country size and income level. Section IV summarizes the findings and discusses policy implications. Finally, the appendix includes more detailed explanation on data and some additional estimation results to demonstrate that the results are robust.

II. DATA AND BASIC PATTERNS

A. Data

The export concentration (or diversification) measure is calculated using country-level goods export at SITC 1-digit level from the UN Comtrade database and 1-digit level services exports from the IMF BOP database (see Tables A.1 and A.2 in Appendix A for detailed information on data source and industry classification).[6] We use both goods and services trade data in the

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[6] Although the comparability in the industry classification for goods and services exports cannot be guaranteed among different sources of database, SITC 1-digit level goods exports from the UN Comtrade (10 classifications)

calculation of concentration because services constitute one-fourth of world trade and an increasingly important component of global economy (Loungani et al., 2017).[7] Our analysis covers 84 LICs and small states (51 non-small states LICs and 33 small states) over the period of 2001-2015 (see Table A.3 in Appendix A for the list of countries).

B. Export Diversification

We adopt the Herfindahl index to measure the degree of export concentration (or diversification) using the industry-level share of exports covering both goods and services. It is calculated as the sum of squared export shares of each industry for each country and year:

$$H_{it} = \sum_{j=1}^{n} s_{ijt}^2 \tag{1}$$

where H_{it} denotes an export concentration index in country i and year t; s_{ijt} denotes industry j's export share among total exports in country i and year t. The index varies between $1/n$ and 1, and it will have larger (smaller) values for more concentrated (diversified) export structure.

We also construct an alternative measure of export concentration index. The measure is computed by considering only a certain number of larger export share industries for each country because some countries are not capable of diversifying exports to broad range of industries due to limited resources and small economic size. That is, only top 5 or 3 largest exporting industries are included for the calculation of export concentration index as below:

$$H_{it}^{TOP5} = \sum_{j=1}^{5} s_{ijt}^2 \tag{2}$$

$$H_{it}^{TOP3} = \sum_{j=1}^{3} s_{ijt}^2 \tag{3}$$

where s_{ijt} denotes industry j's export share among the sum of top 5 and 3 exports in Equations (2) and (3), respectively. The indices are expected to capture the degree of export concentration within the country's main exporting industries, but by design they will not be affected by the share of the other industries.

The export structure presented in Figure 1 shows a stark difference across country groups based on country size. The service share in exports is at around 60 percent in small states over the 2000s while it has remained stable at around 25 percent in non-small states LICs (left panel in Figure 1). This fact implies that the importance of service exports should be considered in the analysis on export diversification particularly in small states where the service sector on average accounts for more than half of the country's exports. The right panel of Figure 1 presents the export share of the country's major exporting industries. The shares of largest 5 or 3 industries are high in both small states and non-small states LICs at around 90 and 80 percent, respectively. It should also be noted that the shares of top 5 or 3 industries are higher in small states than in non-small states LICs. This fact motivates our alternative measure of export concentration index considering only each country's key industries.

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and 1-digit level service exports from the IMF BOP database (12 classifications)—the broadest classification—are expected to be largely similar in the size of industry classifications.

[7] Although many LICs and small states heavily rely on agriculture for subsistence which are not captured in our export database, we could not examine the economic structure in broader sense—covering both domestic production and exports—due to substantial inconsistency in the industry classification of national account data across countries.

Figure 1. Export Structure

<Export share of services>   <Export share of largest industry>

Sources: UN Comtrade; IMF BOP database; and Authors' calculations.   Sources: UN Comtrade; IMF BOP database; and Authors' calculations.
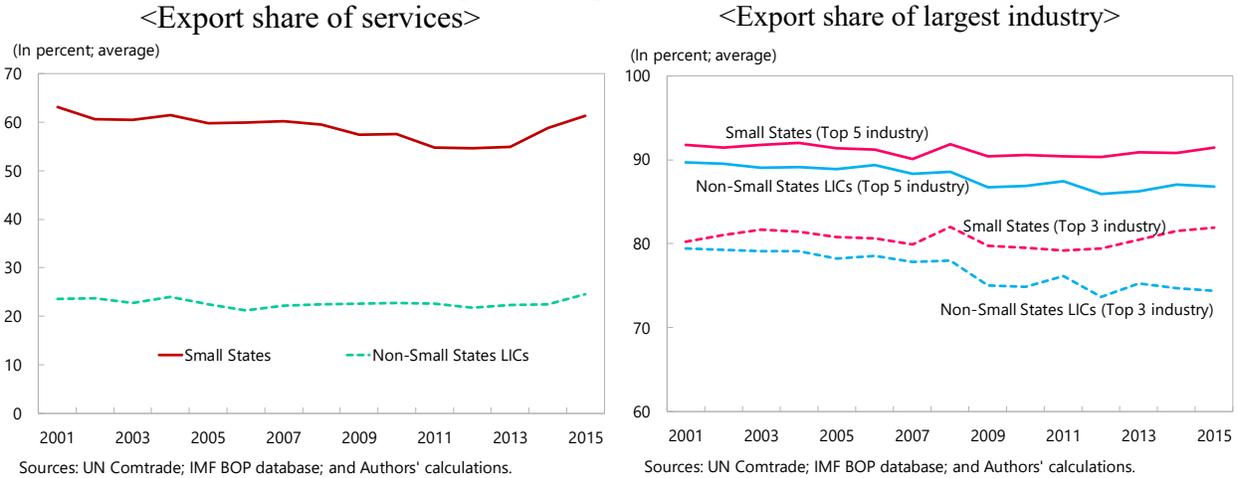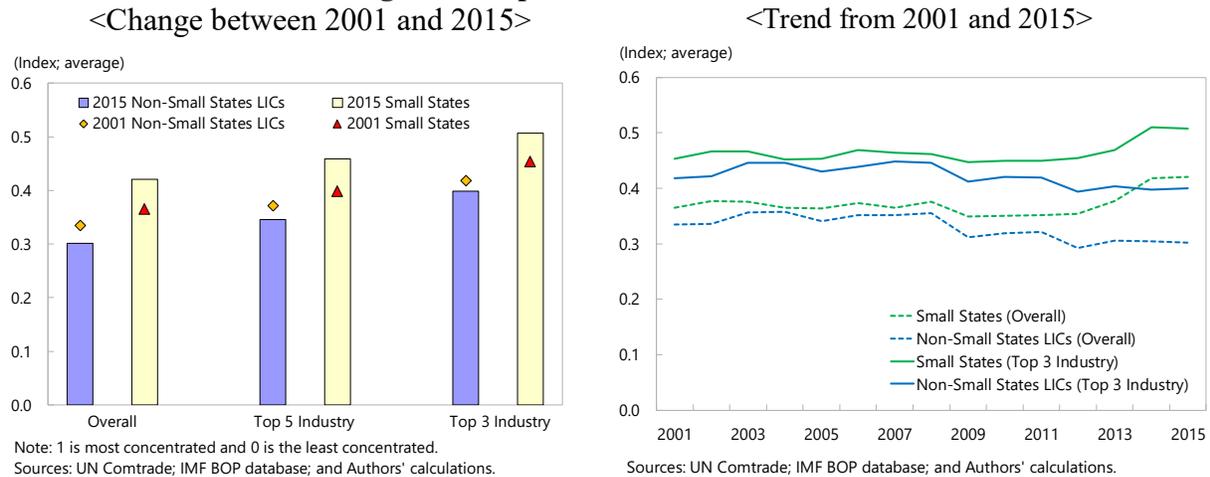
Figure 2 illustrates the average export concentration index separately for small states and non-small states LICs. The left panel of Figure 2 shows that the export concentration indices are more concentrated on average in small states than in non-small states LICs for all different export concentration indices—computed by Equations (1)-(3). Furthermore, the concentration index has risen in small states over the 2000s while it has declined in non-small states during the same periods. In the right panel of Figure 2, the similar patterns are found during the period of 2001-2015 for concentration indices of overall and top 3 industries: that is, (i) small states are more concentrated than non-small states LICs; and (ii) small states have become more concentrated in exports over the 2000s while non-small states LICs have become less concentrated since 2000.[8]

Figure 2. Export Concentration Index

<Change between 2001 and 2015>   <Trend from 2001 and 2015>

Note: 1 is most concentrated and 0 is the least concentrated.
Sources: UN Comtrade; IMF BOP database; and Authors' calculations.   Sources: UN Comtrade; IMF BOP database; and Authors' calculations.

## C. Export Diversification and GDP Growth and Volatility

Scatter charts in Figure 3 illustrates the relationships between export concentration and GDP per capita growth, separately for non-small states LICs and small states: (i) overall export

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[8] The steep increase of the concentration index in 2014 for small states partly reflects significant BOP data revisions in several Caribbean small states.

concentration index (left panel); and (ii) top 3 industry export concentration index (right panel). First, for overall concentration index, GDP per capita growth is lower in the countries of more concentrated export structure although the negative relationship is not clearly observed in small states (left panel of Figure 3). Second, compared to overall index, an alternative concentration index for top 3 industries has a relatively clear negative relationship with GDP growth for both non-small states LICs and small states, implying the potential growth-promotion effects from export diversification with a small number of key industries. The negative relationship between GDP growth and top 3 concentration index implies the potential advantages of an alternative concentration index over a general concentration index in capturing the growth impacts of export concentration.

Figure 3. Export Concentration and GDP Growth

<Overall>   <Top 3>
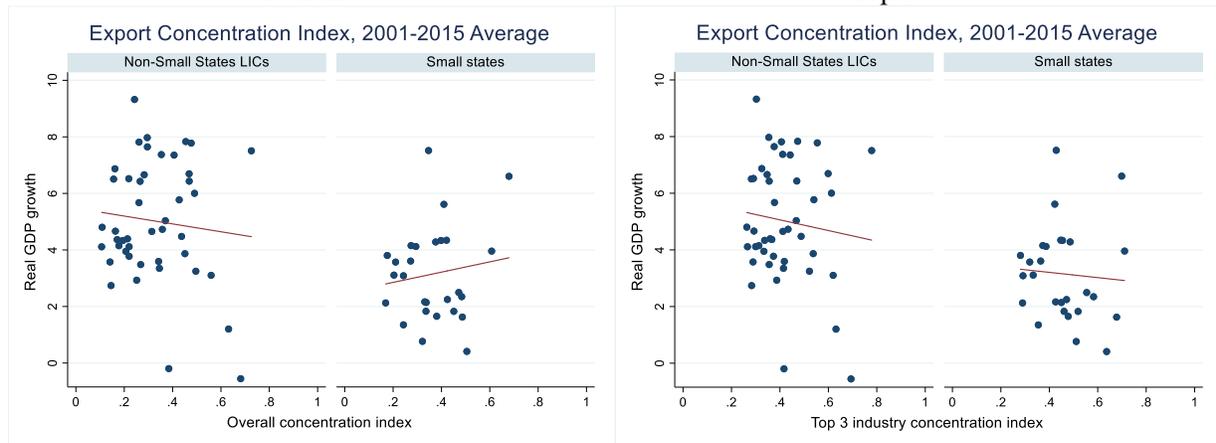
Sources: UN Comtrade; IMF BOP database; and Authors' calculations.

Figure 4 presents the relationships between export concentration and the volatility of GDP growth (measured as a standard deviation during the period of 2001-2015). Both the overall and top 3 export concentration indices have a clear positive relationship with GDP per capita volatility in both non-small states LICs and small states. That is, GDP per capita growth is more volatile in the countries of more concentrated export structure, implying that the potential volatility-reducing effects from export diversification in broad industries or a few key industries.

Figure 4. Export Concentration and GDP Volatility

<Overall>   <Top 3>
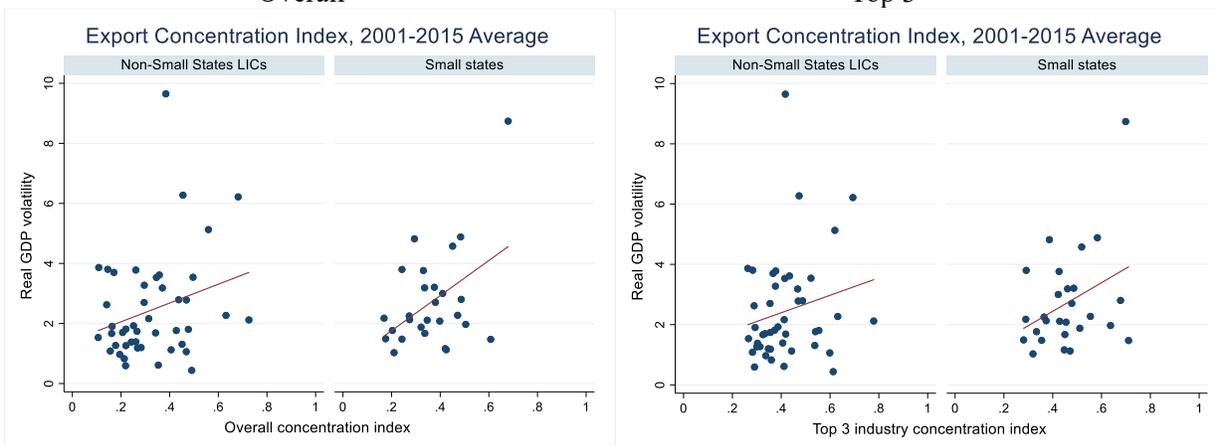
Sources: UN Comtrade; IMF BOP database; and Authors' calculations.

III. ECONOMIC EFFECTS OF EXPORT DIVERSIFICATION

This section explores the economic benefits of export diversification in LICs and small states. The data covers 64 countries and 15 years (2001-2015) at maximum depending on data availability (see Table A.3 in Appendix A for the list of countries included in the empirical estimation).

A. Estimation Strategy

The empirical analysis focuses on the impact of export structure on economic growth and volatility—which was commonly studied in the literature—in the sample of LICs and small states. The empirical relationship between export concentration and economic growth can be examined using the following specification.

$$\Delta Y_{it} = \alpha + \beta_1 Y_{it-1} + \beta_2 \boldsymbol{X}_{it} + \beta_3 H_{it} + \mu_i + \tau_t + \varepsilon_{it} \qquad (4)$$

where ΔY_{it} is real GDP per capita growth, Y_{it-1} is initial real GDP per capita, $\boldsymbol{X}_{it}$ is a set of control variables (e.g., growths of population, government consumption, FDI and credit; trade openness; inflation; natural disaster dummy),[9] H_{it} denotes three different export concentration indices (i.e., overall, top 5 and top 3 industries), and the subscripts i and t denote country and period, respectively (see Table A.1 in Appendix A for detailed data descriptions and sources). For the estimation, all variables except for Y_{it-1} (initial level of real GDP per capita) are measured in non-overlapping 3-year average to identify a medium- or long-run relationship between export concentration and growth instead of a short-term relationship. The control variables included in our specification are commonly considered as important sources of economic growth in the literature (e.g., Loayza et al., 2007; Haddad et al., 2013). We further control for natural disasters which are found to be important sources of adverse growth effects in LICs and small states (e.g., Loayza et al., 2012; Fomby et al., 2013; Lee et al., 2018).[10] It should be noted that we consider both domestic sources of economic growth (credit growth, population growth, government consumption growth, inflation, and natural disasters) and external sources of growth (trade openness and FDI growth).

Similarly, the empirical impact of export concentration on GDP volatility is specified as follows.

$$V_{it} = \alpha + \beta_1 V_{it-1} + \beta_2 \boldsymbol{X}_{it} + \beta_3 H_{it} + \mu_i + \tau_t + \varepsilon_{it} \qquad (5)$$

where V_{it} is the volatility of GDP per capita growth, $\boldsymbol{X}_{it}$ is a set of control variables (e.g., growths of GDP per capita, population, FDI, government consumption; volatilities of inflation, credit growth, exchange rate; trade openness), H_{it} denotes three indices of export concentration. Volatility is measured as the standard deviation of variables over non-overlapping 3-year period. It should be noted that in addition to growth determinants, we further consider second moment analogues of inflation, credit growth, and exchange rate.

To mitigate endogeneity concerns regarding some explanatory variables (e.g., trade openness, export concentration, and government consumption) in the regressions of GDP per capita growth

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[9] Due to data limitation for some LICs and small states, we could not include richer set of control variables on structural, domestic policy and external factors which also may relate to GDP per capita growth and its volatility. Instead country and year fixed effects are expected to capture some of cross-country and time-variant heterogeneity.

[10] Natural disaster dummy variable takes 1 if damage-to-GDP is above 75th percentile, or affected people-to-total population is above 75th percentile for the case that damage data is not available using the data from EM-DAT. See Lee et al. (2018) for more details on definition and construction of this measure.

and volatility, we employ a system GMM estimation method which was developed by Arellano and Bover (1995), and Blundell and Bond (1998). This method combines the regression in differences with the regression in levels to consider dynamics in dependent variables (growth and volatility) as well as to resolve endogeneity problems. However, weak instrument problems remain a concern although they are relatively limited compared to other alternative estimation methods such as first difference GMM, fixed effects and random effects estimation.

B.   Export Diversification and Growth

Table 1 presents the results of two-step system GMM estimations on the effect of export concentration on economic growth by estimating Equation (4) for different choices of export concentration indices. Specifications differ in the measure of export diversification index (i.e., export diversification for overall, top 3 and top 5 industries) and in country coverage (i.e., LICs including or excluding small states). The estimation also conducts the standard statistical tests on the validity of instruments and on autocorrelation in residuals. The results on Hansen test and AR(2) test are presented. In addition, the estimation is carried out computing robust standard error and applying the Windmeijer small sample correction.

The estimation finds that export concentration has a significant negative effect on growth for LICs (both LICs including small states and excluding small states): that is, GDP grows slower in the countries or periods in which their export structure is more concentrated. However, the estimation results for a sample of countries including LICs and non-LIC small states find insignificant coefficients on concentration index even though Hansen test shows overidentification of the specification at the 10 percent significance level (see Table A.3 in Appendix A for the list of countries included in the estimation).[11] These findings may imply that the country size may have some implications for the relationship between export concentration and growth. The results are robust to different specifications across export concentration indices (overall, top 5 and top 3 industries). The results on top 5 and top 3 industries suggest that the growth-enhancing effects from export diversification do not always require a wide range of diversification. Indeed, export diversification to a few or several related industries may also lead to higher growth.

We confirm some significant relationships between GDP per capita growth and control variables. We first find that the positive relation between GDP per capita growth and initial GDP per capita levels is significant at the 5 or 10 percent significance levels in all specifications. This implies some forms of income divergence in GDP per capita terms—GDP per capita has grown faster in more developed countries among LICs and small states over the 2000s. In addition, government consumption, FDI and credit growths are estimated to be positive and statistically significant in determining GDP per capita growth, implying the important roles of fiscal spending, foreign investment, and private credit in promoting growth in LICs and small states.

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[11] The results are not reported in the paper, but they can be provided upon request.

Table 1. Export Diversification and Growth: Baseline Result

Dependent variable: Real GDP per capita growth

Sample country:	LICs: including small states			LICs: excluding small states		
Export concentration index:	Overall	Top 5	Top 3	Overall	Top 5	Top 3
Export concentration	-5.417*	-5.605**	-5.940**	-6.632**	-6.532**	-6.535**
	(2.782)	(2.662)	(2.778)	(2.861)	(2.720)	(2.860)
Initial log(Real GDP per capita)	2.686**	2.745**	2.699*	2.915**	2.933**	2.927**
	(1.345)	(1.358)	(1.431)	(1.192)	(1.223)	(1.329)
Population growth	0.135	0.124	-0.0630	0.548	0.492	0.351
	(1.126)	(1.147)	(1.144)	(1.030)	(0.985)	(1.043)
Trade openness	0.144	0.132	0.235	0.240	0.355	0.544
	(1.032)	(1.139)	(1.322)	(1.049)	(1.120)	(1.421)
Government consumption growth	0.0894***	0.0894***	0.0870***	0.0910***	0.0895***	0.0882***
	(0.0262)	(0.0260)	(0.0269)	(0.0235)	(0.0229)	(0.0236)
FDI growth	0.0005***	0.0005***	0.0005***	0.0006***	0.0005***	0.0005***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Inflation	-0.0177	-0.0197	-0.0187	-0.0417	-0.0391	-0.0303
	(0.0633)	(0.0610)	(0.0607)	(0.0645)	(0.0742)	(0.0809)
Credit growth	0.0427***	0.0425***	0.0419***	0.0436***	0.0425***	0.0410***
	(0.0140)	(0.0140)	(0.0137)	(0.0135)	(0.0138)	(0.0139)
Natural disaster	0.328	0.291	0.238	0.324	0.247	0.145
	(0.384)	(0.406)	(0.419)	(0.508)	(0.535)	(0.565)
Observations	234	234	234	199	199	199
Number of countries	54	54	54	45	45	45
AR(2) *p*-value	0.966	0.972	0.974	0.879	0.876	0.869
Hansen *p*-value	0.479	0.410	0.359	0.579	0.547	0.461

Notes: 1) Windmeijer (2005)-corrected robust standard errors are in parentheses.
2) Period dummies and constant were included in all specifications, but not reported.
3) ***, **, * indicate levels of significance at 1%, 5%, 10%, respectively.

We now turn to looking at the importance of country size and income level in determining the relationship between export concentration and growth. Figure 5 presents that the negative relationship between export concentration and growth is not clear for overall industry index regardless of country size within our sample countries, while it appears relatively clear for top 3 industry index in smaller countries. Figure 6 highlights that the negative relationship is clear in relatively lower income countries within our sample countries. These relationships imply that the country size and/or income level may have some implications for the impacts of export concentration on economic growth. This motivates further empirical estimation for separate country groups depending on country size and income level.

Figure 5. Export Concentration and GDP Growth: Country Size
<Overall>   <Top 3>
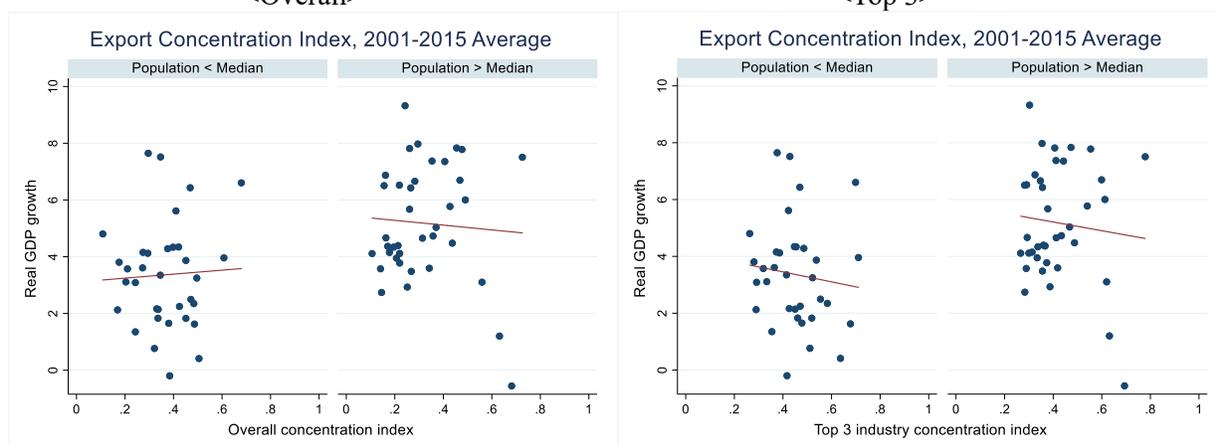
Sources: UN Comtrade; IMF BOP database; and Authors' calculations.

Figure 6. Export Concentration and GDP Growth: Income Level
<Overall>   <Top 3>
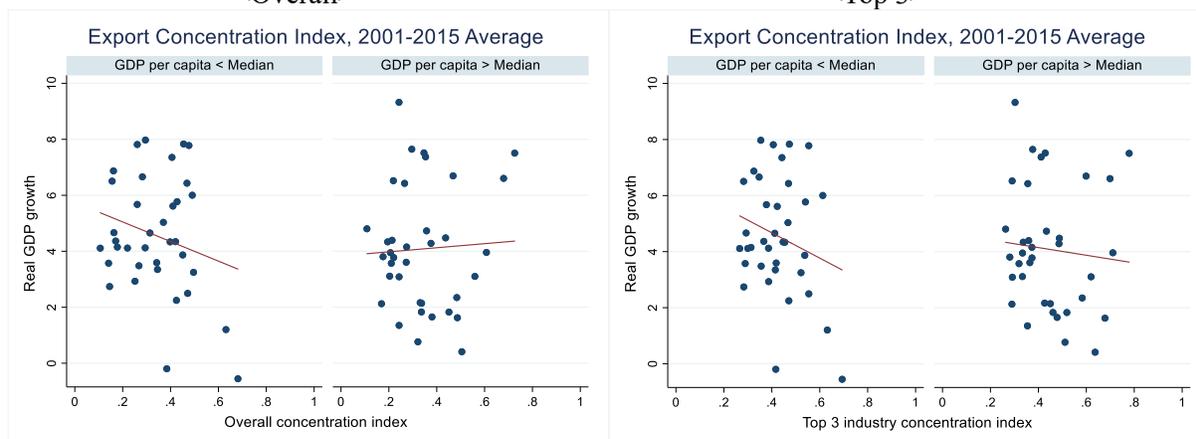
Sources: UN Comtrade; IMF BOP database; and Authors' calculations.

Table 2 presents the results of estimating Equation (4) separately for each country group of lower and higher 75 percentiles in population size.[12] The results find that the coefficients of export concentration are estimated to be negative in all specifications but insignificant for most specifications. However, the coefficient of export concentration is estimated to be significant and negative for the specification of top 3 industry concentration index in smaller LICs and small states, and the estimated coefficient is larger in absolute value than other specifications. The findings can be interpreted that for smaller countries, diversification within a few key industries, rather than diversification to a wide range of industries, would be beneficial for growth. In addition, practically export concentration index measured using the shares of small number of

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[12] Countries of middle 50 percentile are included in the both estimations to ensure that countries are included in sufficient number in each estimation, which calls for cautious interpretation in the comparison of estimation results between two country groups. The results are robust to a specification of different percentiles (e.g., 70 or 60 percentiles), which are not reported in the paper.

industries would be more appropriate in determining the growth effects of export diversification in relatively small countries that is not affordable for diversification to a wide range of industries.

Table 2. Export Diversification and Growth: Country Size

Dependent variable: Real GDP per capita growth

Population:	Bottom 75 Percentile			Top 75 Percentile		
Export concentration index:	Overall	Top 5	Top 3	Overall	Top 5	Top 3
Export concentration	-3.304	-4.276	-5.834*	-3.703	-3.689	-3.579
	(2.755)	(2.731)	(3.157)	(3.226)	(3.271)	(3.607)
Initial log(Real GDP per capita)	0.0960	-0.0807	-0.239	2.283*	2.403*	2.341*
	(1.449)	(1.438)	(1.362)	(1.330)	(1.297)	(1.362)
Population growth	0.288	0.271	0.192	-0.430	-0.401	-0.531
	(0.992)	(1.024)	(1.097)	(0.944)	(0.939)	(0.960)
Trade openness	1.714	1.683	1.610	0.408	0.404	0.493
	(1.161)	(1.172)	(1.197)	(1.081)	(1.013)	(1.084)
Government consumption growth	0.0776	0.0753	0.0727	0.0849***	0.0859***	0.0854***
	(0.0541)	(0.0537)	(0.0522)	(0.0271)	(0.0258)	(0.0263)
FDI growth	0.0004	0.0004	0.0004	0.0005***	0.0005***	0.0005***
	(0.0004)	(0.0004)	(0.0004)	(0.0001)	(0.0001)	(0.0001)
Inflation	-0.0887	-0.0841	-0.0859	-0.0136	-0.0127	-0.0105
	(0.1063)	(0.1096)	(0.1139)	(0.0570)	(0.0601)	(0.0620)
Credit growth	0.0371**	0.0364*	0.0380**	0.0411***	0.0411***	0.0410***
	(0.0184)	(0.0187)	(0.0184)	(0.0130)	(0.0135)	(0.0134)
Natural disaster	0.456	0.409	0.377	0.317	0.291	0.245
	(0.501)	(0.498)	(0.495)	(0.474)	(0.478)	(0.480)
Observations	188	188	188	240	240	240
Number of countries	43	43	43	55	55	55
AR(2) *p*-value	0.504	0.476	0.423	0.963	0.958	0.969
Hansen *p*-value	0.151	0.114	0.093	0.250	0.229	0.221

Notes: 1) Windmeijer (2005)-corrected robust standard errors are in parentheses.
　　　2) Period dummies and constant were included in all specifications, but not reported.
　　　3) ***, **, * indicate levels of significance at 1%, 5%, 10%, respectively.

Table 3 reports the results of estimating Equation (4) separately for lower and higher 75 percentiles in GDP per capita. The results confirm that the significant negative growth effects of export concentration are pronounced in relatively lower income countries within a sample of LICs and small states. That is, the coefficients of export concentration are estimated to be negative and significant at the 5 or 10 percent significance levels in lower-income LICs, while the estimated coefficients of concentration index are positive but insignificant for all concentration indices in higher-income LICs.

This finding may have implications that the gains from export diversification would be larger in the countries at early development stages through several channels. First, a more diversified economy offers insurance against idiosyncratic sectoral shocks, especially at low stages of development when countries produce only few goods for export, such as agricultural products and natural resources. Export diversification can help a country reduce economic volatility by mitigating the impacts of external shocks like terms of trade shocks (e.g., Jansen, 2004; Cavallo, 2008; Haddad et al., 2013). Second, countries with greater export diversification at early development stages are more likely to be able to move into new products or sectors (horizontal diversification) and/or into manufacturing from primary products (vertical diversification)

through technology spillovers and learning by exporting with more advanced countries (e.g., Grossman and Helpman, 1991; Keller, 2010; De Loecker, 2013).

Table 3. Export Diversification and Growth: Income Level

Dependent variable: Real GDP per capita growth

GDP per capita:	Bottom 75 Percentile			Top 75 Percentile		
Export concentration index:	Overall	Top 5	Top 3	Overall	Top 5	Top 3
Export concentration	-4.569*	-4.812*	-5.125*	5.799	6.355	6.664
	(2.651)	(2.638)	(2.975)	(5.152)	(5.609)	(6.151)
Initial log(Real GDP per capita)	1.924	1.987	1.886	-2.740	-3.077	-3.377
	(1.484)	(1.575)	(1.658)	(2.263)	(2.351)	(2.523)
Population growth	-0.410	-0.450	-0.640	-2.327**	-2.411**	-2.521**
	(1.086)	(1.135)	(1.154)	(0.916)	(0.961)	(1.035)
Trade openness	0.602	0.694	0.885	1.455	1.370	1.390
	(0.976)	(1.062)	(1.287)	(0.953)	(1.050)	(1.164)
Government consumption growth	0.0885***	0.0877***	0.0860***	0.0692*	0.0680	0.0663
	(0.0264)	(0.0265)	(0.0273)	(0.0420)	(0.0440)	(0.0476)
FDI growth	0.0005***	0.0005***	0.0005***	-0.0000	-0.0001	-0.0001
	(0.0001)	(0.0001)	(0.0001)	(0.0005)	(0.0005)	(0.0005)
Inflation	-0.0245	-0.0193	-0.0116	-0.1371	-0.1359	-0.1384
	(0.0636)	(0.0659)	(0.0662)	(0.0926)	(0.0995)	(0.1036)
Credit growth	0.0366***	0.0365***	0.0362***	0.0557***	0.0552***	0.0534**
	(0.0136)	(0.0136)	(0.0139)	(0.0192)	(0.0203)	(0.0209)
Natural disaster	0.301	0.277	0.229	0.599	0.592	0.574
	(0.409)	(0.448)	(0.473)	(0.415)	(0.368)	(0.362)
Observations	214	214	214	196	196	196
Number of countries	49	49	49	46	46	46
AR(2) *p*-value	0.938	0.933	0.923	0.160	0.186	0.237
Hansen *p*-value	0.621	0.552	0.480	0.286	0.335	0.358

Notes: 1) Windmeijer (2005)-corrected robust standard errors are in parentheses.
2) Period dummies and constant were included in all specifications, but not reported.
3) ***, **, * indicate levels of significance at 1%, 5%, 10%, respectively.

C. Export Diversification and Volatility

In addition to the growth effects, export diversification may also have an impact on economic volatility through the effects on resilience to domestic and exogenous shocks. The results of estimating Equation (5) are presented in Table 4. It reveals that generally GDP per capita growth is more volatile in the countries or periods in which the export structure is more concentrated. The results apply to LICs either including small states or excluding small states and they are robust across export concentration indices (overall, top 5 and top 3 industries). Moreover, it should be noted that the positive coefficients on export concentration are estimated to be larger and more significant in non-small states LICs. This may imply that the volatility-reducing effects of diversification may not be large for small states.

We find a significant negative relationship between the volatility of GDP per capita growth and government consumption growth. This implies that GDP per capita growth is likely to be less volatile in the countries of higher government consumption growth, implying some roles of fiscal spending in mitigating economic volatility possibly by counter-cyclicality of fiscal policies. Nevertheless, FDI growth and exchange rate volatility are positively associated with GDP per capita volatility with significance. This finding implies that GDP per capita growth is more

volatile in the countries of fast-growing FDI and volatile exchange rate which in turn are more likely exposed to external shocks.

Table 4. Export Diversification and Volatility: Baseline Result

Dependent variable: Real GDP per capita growth volatility

| Sample country:	LICs: including small states			LICs: excluding small states		
Export concentration index:	Overall	Top 5	Top 3	Overall	Top 5	Top 3
Export concentration	3.108*	3.515**	3.848**	4.361**	4.716**	5.187***
	(1.746)	(1.767)	(1.791)	(1.730)	(1.865)	(2.010)
GDP per capita growth volatility (t-1)	-0.085	-0.081	-0.083	-0.145	-0.143	-0.142
	(0.086)	(0.087)	(0.093)	(0.101)	(0.104)	(0.106)
Real GDP per capita growth	-0.093	-0.092	-0.088	-0.219	-0.218	-0.204
	(0.124)	(0.122)	(0.124)	(0.138)	(0.134)	(0.140)
Population growth	0.261	0.246	0.358	0.845	0.860	0.941
	(0.596)	(0.642)	(0.670)	(0.649)	(0.692)	(0.742)
Trade openness	0.564	0.535	0.506	-0.377	-0.406	-0.387
	(0.758)	(0.801)	(0.875)	(0.898)	(0.967)	(1.047)
Government consumption growth	-0.0380*	-0.0367*	-0.0373*	-0.0419**	-0.0397*	-0.0411**
	(0.0208)	(0.0210)	(0.0201)	(0.0197)	(0.0206)	(0.0190)
FDI growth	0.0005**	0.0005**	0.0005**	0.0004	0.0004	0.0004
	(0.0002)	(0.0002)	(0.0002)	(0.0003)	(0.0003)	(0.0003)
Inflation volatility	0.203	0.204	0.216*	0.200	0.204	0.227
	(0.136)	(0.125)	(0.123)	(0.146)	(0.133)	(0.139)
Credit growth volatility	0.014	0.012	0.011	0.014	0.013	0.013
	(0.018)	(0.017)	(0.017)	(0.015)	(0.015)	(0.015)
Exchange rate volatility	0.063*	0.066*	0.070*	0.042	0.044	0.044
	(0.036)	(0.038)	(0.040)	(0.065)	(0.069)	(0.066)
Natural disaster	0.423	0.406	0.398	0.463	0.448	0.440
	(0.318)	(0.326)	(0.314)	(0.487)	(0.484)	(0.451)
Observations	223	223	223	190	190	190
Number of countries	54	54	54	45	45	45
AR(2) *p*-value	0.934	0.959	0.969	0.879	0.932	0.998
Hansen *p*-value	0.597	0.596	0.590	0.693	0.683	0.702

Notes: 1) Windmeijer (2005)-corrected robust standard errors are in parentheses.
2) Period dummies and constant were included in all specifications, but not reported.
3) ***, **, * indicate levels of significance at 1%, 5%, 10%, respectively.

Similar to the relationship between export concentration and growth, we can also consider if there is an important role for country size and income level in the relationship between export concentration and GDP per capita volatility. Figures 7 and 8 illustrate that, for both overall and top 3 industry export concentration indices, there is a relatively clear positive relationship between export concentration and GDP per capita volatility regardless of country size and income level within a group of LICs and small states. Although stylized patterns do not present noticeable differentiation in the relationship depending on country size and income level, we attempt to further investigate if the empirical relationship between export concentration and GDP per capita volatility differs by country size or income level after controlling for other important factors in determining economic volatility.

Figure 7. Export Concentration and GDP Volatility: Country Size

<Overall>   <Top 3>
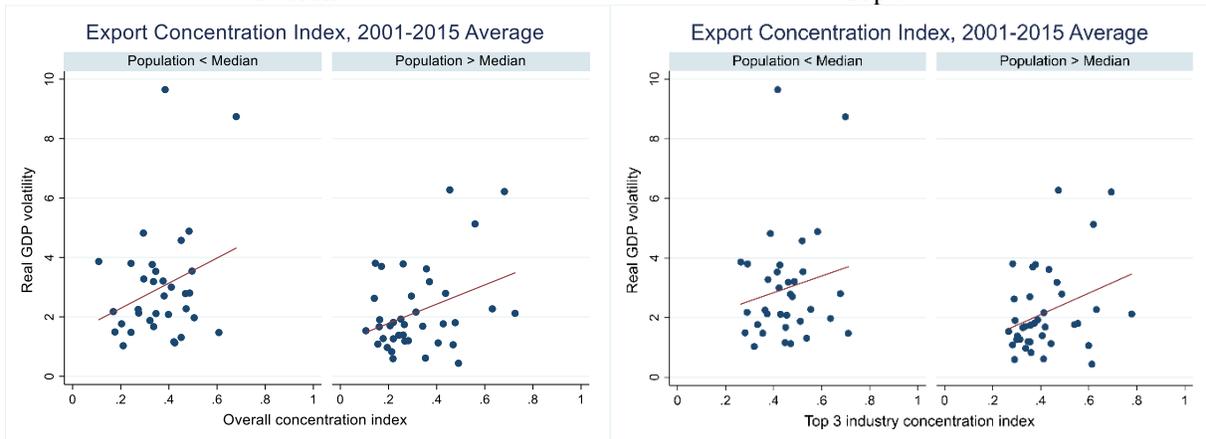
Sources: UN Comtrade; IMF BOP database; and Authors' calculations.

Figure 8. Export Concentration and GDP Volatility: Income Level

<Overall>   <Top 3>
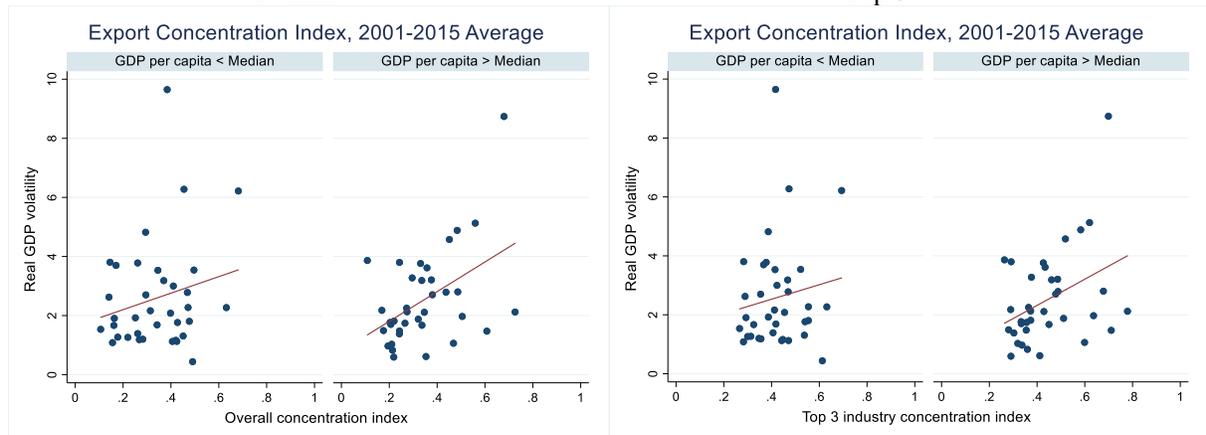
Sources: UN Comtrade; IMF BOP database; and Authors' calculations.

The results of estimating Equation (5) separately for each country group of lower and higher 75 percentiles in population size are presented in Table 5. The results highlight that the volatility-raising effects of export concentration are significant at the 1 or 5 percent significance levels in relatively larger LICs, while the coefficients of export concentration are estimated to be positive but insignificant in relatively smaller LICs and small states. The results may imply that the benefits of diversification for economic stability are expected to be larger in relatively larger LICs which would have sufficient economic size to diversify their economy.

Table 5. Export Diversification and Volatility: Country Size

Dependent variable: Real GDP per capita growth volatility

Population:	Bottom 75 Percentile			Top 75 Percentile		
Export concentration index:	Overall	Top 5	Top 3	Overall	Top 5	Top 3
Export concentration	2.398	2.630	2.578	4.364**	4.825***	5.096***
	(2.076)	(2.240)	(2.373)	(1.698)	(1.753)	(1.714)
GDP per capita growth volatility (t-1)	0.095	0.093	0.090	-0.096	-0.087	-0.082
	(0.107)	(0.108)	(0.110)	(0.081)	(0.084)	(0.085)
Real GDP per capita growth	-0.340**	-0.333**	-0.323**	-0.158	-0.152	-0.137
	(0.157)	(0.156)	(0.160)	(0.125)	(0.124)	(0.122)
Population growth	0.949	0.965	0.919	0.441	0.394	0.504
	(0.796)	(0.805)	(0.771)	(0.652)	(0.699)	(0.685)
Trade openness	1.260	1.414	1.343	0.595	0.556	0.637
	(2.420)	(2.397)	(2.013)	(0.913)	(0.908)	(0.964)
Government consumption growth	-0.0002	-0.0001	-0.0003	-0.0301	-0.0279	-0.0303
	(0.0204)	(0.0203)	(0.0200)	(0.0223)	(0.0232)	(0.0227)
FDI growth	0.0003	0.0003	0.0003	0.0005***	0.0004***	0.0004**
	(0.0003)	(0.0003)	(0.0003)	(0.0002)	(0.0002)	(0.0002)
Inflation volatility	-0.019	-0.008	-0.000	0.113	0.114	0.131
	(0.117)	(0.108)	(0.103)	(0.132)	(0.129)	(0.125)
Credit growth volatility	0.014	0.014	0.013	0.004	0.003	0.002
	(0.020)	(0.020)	(0.018)	(0.014)	(0.015)	(0.015)
Exchange rate volatility	0.174***	0.175***	0.174***	0.059	0.066	0.073
	(0.065)	(0.065)	(0.065)	(0.050)	(0.054)	(0.052)
Natural disaster	-0.191	-0.218	-0.236	0.476	0.456	0.461
	(0.375)	(0.373)	(0.373)	(0.308)	(0.308)	(0.304)
Observations	180	180	180	229	229	229
Number of countries	43	43	43	55	55	55
AR(2) *p*-value	0.222	0.197	0.192	0.619	0.653	0.692
Hansen *p*-value	0.204	0.203	0.197	0.712	0.714	0.731

Notes: 1) Windmeijer (2005)-corrected robust standard errors are in parentheses.
2) Period dummies and constant were included in all specifications, but not reported.
3) ***, **, * indicate levels of significance at 1%, 5%, 10%, respectively.

Table 6 reports the results of estimating Equation (5) separately for lower and higher 75 percentiles in per capita GDP. The results show that the volatility-raising effects of export concentration are estimated to be positive and significant for top 3 industry concentration index in lower-income LICs and small states, while it is insignificant in higher-income LICs and small states. Nevertheless, it should be noted that the estimated coefficients of export concentration for lower-income LICs appear substantially larger than those for higher-income LICs and small states. This may imply that the gains of diversification for economic stability would be larger in relatively lower income LICs which are more likely vulnerable to domestic and external shocks.

Table 6. Export Diversification and Volatility: Income Level

Dependent variable: Real GDP per capita growth volatility

GDP per capita:	Bottom 75 Percentile			Top 75 Percentile		
Export concentration index:	Overall	Top 5	Top 3	Overall	Top 5	Top 3
Export concentration	4.104*	4.717**	5.221**	2.472	2.739	2.354
	(2.316)	(2.323)	(2.446)	(2.098)	(2.180)	(2.411)
GDP per capita growth volatility (t-1)	-0.139*	-0.134*	-0.130	-0.159	-0.162	-0.167
	(0.080)	(0.074)	(0.084)	(0.188)	(0.194)	(0.193)
Real GDP per capita growth	-0.162	-0.153	-0.154	0.107	0.111	0.118
	(0.190)	(0.179)	(0.182)	(0.145)	(0.145)	(0.145)
Population growth	-0.216	-0.335	-0.358	1.009	1.033	0.986
	(0.576)	(0.604)	(0.609)	(1.150)	(1.142)	(1.068)
Trade openness	0.573	0.589	0.655	-0.165	-0.179	-0.249
	(0.518)	(0.549)	(0.655)	(1.277)	(1.339)	(1.316)
Government consumption growth	-0.0174	-0.0175	-0.0161	-0.0539	-0.0512	-0.0536
	(0.0307)	(0.0305)	(0.0308)	(0.0388)	(0.0378)	(0.0381)
FDI growth	0.0004	0.0004	0.0004	0.0007*	0.0007*	0.0007*
	(0.0003)	(0.0003)	(0.0003)	(0.0004)	(0.0004)	(0.0004)
Inflation volatility	0.296	0.308	0.313	0.382*	0.382*	0.388*
	(0.276)	(0.250)	(0.243)	(0.216)	(0.219)	(0.227)
Credit growth volatility	0.023*	0.020	0.019	-0.007	-0.007	-0.007
	(0.013)	(0.013)	(0.014)	(0.015)	(0.015)	(0.015)
Exchange rate volatility	0.082**	0.087**	0.094**	0.134	0.138	0.135
	(0.041)	(0.043)	(0.045)	(0.123)	(0.127)	(0.126)
Natural disaster	0.334	0.274	0.225	-0.314	-0.318	-0.329
	(0.419)	(0.407)	(0.405)	(0.289)	(0.284)	(0.288)
Observations	204	204	204	194	194	194
Number of countries	49	49	49	46	46	46
AR(2) *p*-value	0.778	0.808	0.774	0.179	0.183	0.173
Hansen *p*-value	0.236	0.309	0.302	0.076	0.082	0.068

Notes: 1) Windmeijer (2005)-corrected robust standard errors are in parentheses.
      2) Period dummies and constant were included in all specifications, but not reported.
      3) ***, **, * indicate levels of significance at 1%, 5%, 10%, respectively.

IV. CONCLUSION AND DISCUSSION

This paper explores the potential linkages between export structure and economic growth and volatility in LICs and small states. It also investigates if there is any differentiation in these relationships depending on the country size and income level. First, we propose various concentration indices to measure the degree of export concentration which differ in the coverage of industries. That is, we construct export concentration indices considering only the export shares of small number of large industries as well as using the export shares of all industries. The former measure is motivated by the limited resources and small economic size in LICs and small states. Second, we estimate the effects of export diversification on GDP growth and volatility in LICs and small states, using a range of diversification indices. Lastly, we explore if the growth and volatility effects of diversification rely on the country size and income level within a group of LICs and small states.

The empirical analysis using various export diversification indices demonstrates that the growth-enhancing and volatility-reducing effects of export diversification are identified regardless of export concentration indices. Interestingly, the economic gains of export diversification are

found to be relatively larger in diversification limited to a small number of large industries than in diversification to a wide range of industries. The findings imply that the economic benefits of export diversification are not limited to advanced and emerging economies and thus the importance of export diversification should be recognized for LICs and small states that face limited resources and small economic size. In addition, diversification to a wide range of industries is not necessarily desirable for some LICs and small states. Instead, export diversification to a few large and competitive industries would produce some benefits to the economy in terms of economic growth and stability.

The analysis also finds that the economic gains of export diversification are more pronounced in relatively larger countries and less developed countries within the sample. The results imply that the gains of diversification in economic growth and stability are expected to be larger in relatively larger-size and lower-income LICs which would have sufficient economic size to diversify their economy and/or which are more likely vulnerable to domestic and external shocks.

It should be noted that the economic benefits of export diversification may not apply to all LICs and small states given their different economic situation. In particular, the benefits can be strengthened when the concerted policies are pursued to address common structural challenges in LICs and small states such as infrastructure, human capital, financial development and macroeconomic stability (e.g., Hausman et al., 2008; Agénor, 2016; Rodrik, 2016). The industrial structure of country can also play a role in determining the economic effects of diversification, especially in LICs and small states which faces many challenges of structural transformation. Sectoral transformation in the form of industrialization or deindustrialization can account for a large part of economic growth and volatility (e.g., Samaniego and Sun, 2016; Stock and Watson, 2013; Moro, 2012, 2015). This paper can be further extended to consider the industrial structure and its interaction with export diversification in determining the economic effects of diversification.

Appendix

Table A.1. Data Description and Source

Variable	Description	Source
Export share	Industry export; percent of total exports	UN Comtrade; IMF BOP data
Real GDP per capita	Gross domestic product per capita; constant prices	IMF World Economic Outlook
Population	Total population	World Development Indicators
Trade openness	Total value of exports and imports; percent of GDP	World Development Indicators
Government consumption	General government final consumption expenditure	World Development Indicators
FDI	Foreign direct investment; percent of GDP	World Development Indicators
Inflation	CPI inflation	IMF World Economic Outlook
Credit	Domestic credit to private sector; percent of GDP	World Development Indicators
Exchange rate	Nominal exchange rate	IMF World Economic Outlook
Natural disaster dummy	1 if Damage-to-GDP ratio or population affected-to-total population is above 75th percentile; 0 otherwise	EM-DAT; Authors' calculation

Table A.2. List of Industries

Exports classification	Source	Industry code	Industry description
Goods (10)	UN Comtrade	SITC Rev.3	
		0	Food and live animals
		1	Beverage and tobacco
		2	Crude materials, inedible, except fuels
		3	Mineral fuels, lubricants and related materials
		4	Animal and vegetable oils, fats and waxes
		5	Chemicals and related products
		6	Manufactured goods classified chiefly by material
		7	Machinery and transport equipment
		8	Miscellaneous manufactured articles
		9	Commodities and transactions not classified elsewhere
Services (12)	IMF BOP Statistics	BPM6 1-digit	
		1	Manufacturing services on physical inputs owned by others
		2	Maintenance and repair services
		3	Transport
		4	Travel
		5	Construction
		6	Insurance and pension services
		7	Financial services
		8	Charges for the use of intellectual property
		9	Telecommunications, computer and information services
		10	Other business services
		11	Personal, cultural, and recreational services
		12	Government goods and services

Table A.3. List of Countries

Small states (33)	Non-small states LICs (51)	
Antigua & Barbuda	**Bangladesh**	**Nepal**
Bahamas, The	**Benin**	**Nicaragua**
Barbados	**Bolivia**	**Niger**
Belize	**Burkina Faso**	**Nigeria**
Bhutan	**Burundi**	**Papua New Guinea**
Cape Verde	**Cambodia**	**Rwanda**
Comoros	**Cameroon**	**Senegal**
Djibouti	**Central African Republic**	**Sierra Leone**
Dominica	Chad	**South Sudan**
Fiji	Congo, Democratic Republic of	**Sudan**
Grenada	**Congo, Republic of**	**Tajikistan**
Guyana	**Cote D'Ivoire**	**Tanzania**
Kiribati	**Eritrea**	**Togo**
Maldives	Ethiopia	**Uganda**
Marshall Islands	**Gambia, The**	Uzbekistan
Mauritius	**Ghana**	**Vietnam**
Micronesia, Federated States of	**Guinea**	Yemen
Montenegro	**Guinea-Bissau**	**Zambia**
Palau	**Haiti**	
Samoa	**Honduras**	
Sao Tome and Principe	**Kenya**	
Seychelles	**Kyrgyz Republic**	
Solomon Islands	**Laos**	
St. Kitts and Nevis	**Lesotho**	
St. Lucia	**Liberia**	
St. Vincent and the Grenadines	**Madagascar**	
Suriname	**Malawi**	
Swaziland	**Mali**	
Timor-Leste	Mauritania	
Tonga	**Moldova**	
Trinidad & Tobago	**Mongolia**	
Tuvalu	**Mozambique**	
Vanuatu	**Myanmar**	

Note: Emerging markets (EM) and low-income countries (LICs) in country group correspond to emerging market economies and low income developing countries from the IMF's WEO country groups, respectively. Bolded denotes countries included in the empirical estimation, while non-bolded denotes countries included in stylized facts but not included in the estimation due to data availabilty.

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