The Influence of the Commodity Composition of Trade on Economic Growth

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Abstract *Empirical evidence supports the proposition that national income growth is strongly affected by trade specialization and comparative advantage in eight economic sectors Commercial policy distortions and factor intensity reversals explain why trade does not always fit the skilled labor continuum underlying sectors ranked along the ladder of development Income elasticities with respect to openness imply that economies become less dependent on international markets as they grow This article examines the effects of the commodity composition of trade on economic growth, going beyond previous analytical efforts investigating international trade and domestic growth linkages*

Keywords *Economic growth, comparative advantage, development ladder, growth-producing sectors*

The engine of economic growth during the 19th century was thought to be fueled by trade and industrial growth Trade, viewed as an engine, served simply to transmit growth impulses from developed to developing countries (*19*) [1] This trade engine hypothesis has been criticized because it falsely dichotomizes the world into developed countries, which produce and export industrial manufactured goods, and the developing countries, which produce and export primary products (*24*) In fact, agricultural exports as well as manufactured goods are an important source of revenue for many developed countries Moreover, developing countries have diversified their export portfolios beyond primary commodities to include manufacturing, an increasingly important source of foreign exchange

Most econometric studies that examine the influence of trade on economic growth have sought more sophisticated explanations than that provided by the simple trade engine hypothesis (*1, 2, 3, 4 10, 15, 20, 21, 22, 23, 27*) These studies seem to provide persuasive evidence for linking domestic economic growth to international trade [2] Most restricted attention to exports Some, however, focused exclusively on the newly industrializing or semi-industrial countries (*4, 10, 27*) Excluding imports ignores half of the trade linkages affecting growth Basing conclusions upon analyses of data restricted to the more successful developing countries limits the ability to draw generalizations that are relevant to all countries

Other studies have dissected the relationship between trade and growth by using an accounting framework Kavoussi (*14*) explains country-trade performance in terms of such factors as competitiveness, diversification, and world demand His analysis shows that rapid expansion of export earnings requires both favorable external markets and outward-oriented commercial policies Kavoussi concludes that when world demand is strong, the benefits accruing to developing countries having liberal trade policy regimes (for example, improved allocation of resources, enhanced factor productivities, realization of scale economies, and accumulation of additional capital) clearly outweigh the dangers (possible deterioration in terms of trade, tariff and nontariff restrictions impeding trade flows, and slow growth in the demand for developing-country commodity exports) But, his findings suggest that when external demand is weak, the gains from outward-oriented policies are somewhat offset by their negative effects

Singer and Gray (*25*) extend Kavoussi's analysis by differentiating among developing-country regions They show that the correlation between outward orientation and growth under favorable market conditions is relatively weak for the low-income countries They also show that, in the low-income countries, the gains from openness are offset by its negative effects when external demand is weak

Decomposition analyses, based upon accounting formulae, leave much to be desired They provide little information about the cause-and-effect relationships among economic determinants In this study, we combine the econometric and decomposition traditions in examining linkages between trade and income growth We contend that the trade-growth relationship is not merely determined by trade policies and world economic conditions (as suggested by Kavoussi and Singer and others), but is also affected by comparative advantage The role trade can play in inducing economic growth critically depends upon countries' exploiting their comparative advantages The trade-growth nexus is, therefore, dependent upon global competition and specialization patterns

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[1] Italicized numbers in parentheses cite sources listed in the References section at the end of this article

[2] However, some development economists have questioned whether some basic level of development is necessary before a country can benefit from trade-oriented growth Michaely (*20*) observed "that the positive association of the economy's growth with the growth of the export share appears to be particularly strong among the more developed countries, and not to exist at all among the least developed " Chenery (*9*) believes that the greater role of trade in explaining growth is one of the features that distinguishes developing from developed countries Helleiner (*12*) contends that there is "no evidence to support the proposition that the degree of export orientation is associated with growth performance either in Africa or in poor countries elsewhere "

We examine the relationship between income at various levels of development and country-trade competitiveness patterns across economic sectors Our approach is a source of growth equation that concentrates on trade determinants thought to affect income differentials and economic growth

There are six country classifications,[3] five of which are differentiated by the level of development, and the sixth is an oil export group (OPEC) We look at both low-income (LIC) and high-income (HIC) countries as well as three intermediate groups—the upper low-income (ULIC), middle-income (MIC), and upper middle-income (UMIC) countries [4] Following the Heckscher-Ohlin factor abundance theory, we categorize commodities on the basis of what is known about production processes Commodities with high substitution elasticities are aggregated into eight economic sectors because they embody similar factor requirements

Dynamic Comparative Advantage and the Stages Approach to Development

According to the stages approach to development and dynamic comparative advantage, the composition of a country's trade will change in response to changing relative factor endowments Such change is associated with movement up the ladder of economic development [5] Countries climb this ladder as they accumulate additional physical and human capital per worker Low-income countries, situated on the lowest rung of the development ladder, tend to specialize in the production of commodities that intensively use their relatively abundant unskilled labor As these countries develop, they move progressively to higher rungs, corresponding to increasingly skilled labor

Bowen (7), examining relationships between changes in national resource endowments and changes in the composition of a country's trade structure, found them to be consistent with the dynamic factor proportion explanation of trade

[3]Research is underway to isolate the impact of country movement from one income category to another

[4]The LIC include Burkina Faso, Ethiopia, Ghana, India, Kenya, Madagascar Malawi, Niger, Senegal, Sudan, and Togo The ULIC include Bolivia, Cameroon, Egypt, El Salvador, Honduras, Morocco Pakistan, Philippines, and Sri Lanka The MIC include Colombia, Costa Rica, Dominican Republic, Guatemala, Jordan, Nicaragua, Paraguay, South Korea, Thailand, Tunisia, and Turkey The UMIC include Brazil, Chile, Greece, Ireland, Israel, Italy, Malaysia, Mexico, Portugal, South Africa, Spain, Syria, Trinidad, and Uruguay OPEC includes Algeria, Gabon, Indonesia, Iran, Kuwait, Nigeria, Saudi Arabia, and Venezuela The HIC include Australia, Austria, Canada, Denmark, Finland, France, Iceland, Japan Netherlands, New Zealand, Norway, Sweden, Switzerland, United Kingdom, United States, and West Germany

[5]Balassa (3) concluded that the prospects of economic growth through exports appear much brighter once we understand the character of the changing pattern of comparative advantage because developing countries replace each other as they move up the comparative advantage continuum

Here, we identify three primary sectors (agriculture, mining, fish and forestry) as well as five manufacturing sectors high technology, finished capital goods, intermediate differentiated goods, basic intermediates, and agriculturally linked industries (table 1) These economic sectors, and especially the five manufacturing sectors, symbolize a ladder of development because of their varying needs for skilled labor At the bottom manufacturing rung are the agriculturally linked industries, which use substantial semi-skilled labor relative to other inputs Next come intermediate differentiated goods and basic intermediates These two sectors depend upon moderately skilled labor The top two rungs—finished capital and high-tech industries—require skilled and highly skilled labor

The Econometric Accounting Model

Our theoretical model examines the extent to which income growth, at different stages of economic

Table 1—Sketch of eight economic sectors ,Input-output descriptions

Sector	Typical industries	Factor intensity requirements
High technology	Medical products, optical and medical instruments, telecommunications equipment, organic and inorganic chemicals	Highly skilled labor
Finished capital goods	Automobiles, trucks, buses, boats, ships, aircraft, agricultural machinery, war firearms	Skilled labor and capital
Basic intermediate goods	Iron and steel, electrical energy, processed petroleum and coal, paper, fertilizer, rubber, plastic	Moderately skilled labor and capital
Intermediate differentiated goods	Office supplies, maps, musical instruments, hunting and sporting equipment, watches, clocks, plumbing, heating and lighting equipment	Moderately skilled labor
Agriculturally linked industries	Textiles, yarn, fabrics, clothing, leather, footwear furniture	Semi-skilled labor
Mining	Unprocessed coal and petroleum, crude fertilizer, natural gas, metalliferous ores	Unskilled labor and natural resources
Fish and forestry	Fish and fish preparations, wood, lumber, and cork pulp and waste paper	Unskilled labor, and natural resources
Total agriculture	Food and live animals, beverages and tobacco, animals and vegetable oils	Unskilled to moderately skilled labor, land, and capital

Source Data were obtained from the U S Trade Net System National Institutes of Health Bethesda, MD

development, is affected by trade specialization patterns, government intervention, and world economic conditions

$$y^* = f(wc, op, CA),$$

where

y^* = real per capita income,
wc = global economic conditions,
op = government intervention, and
CA = vector of comparative advantage

We define global economic conditions as the real value of world exports We use Johnston's (*13*) openness index (op) as a proxy for government intervention [6]

$$op = 1/(1+E/T),$$

where E is the total domestic production consumed at home (consumption plus investment plus government expenditures minus imports) and T is total (exports plus imports)

The CA vector needs some elaboration Balassa (*5*) became pessimistic about identifying comparative advantage and explaining trade on the basis of a few general principles derived from various explanations of international trade found in the theoretical literature Moreover, he questioned the usefulness of explicitly accounting for all the influences affecting trade since comparative advantage is the outcome of so many factors, "some measurable, others not, some easily pinned down, others less so " As a practical alternative, Balassa suggested that comparative advantage be "revealed" through examination of country/commodity trade patterns because actual trade "reflects relative costs as well as differences in nonprice factors "

The focus on broad economic sectors in this study entails tracking both exporting and importing behavior We, therefore, use Vollrath's (*29*) revealed competitiveness (RC) index to measure comparative advantage because it accounts for such two-way trade RC [7] is defined as follows

$$RC^{i\ r}_{a,n} = Ln\{[(XS^i_a/XS^r_a)/(XS^i_n/XS^i_n)]/[(MD^i_a/MD^r_a)/(MD^i_n/MD^r_n)]\},$$

where XS refers to exports, MD to imports, subscript a to any particular sector, subscript n to a commodity composite aggregate consisting of all other sectors, and superscripts i and r to the home country and to the rest of the world, respectively

[6] Johnston's index is strictly monotonic and bounded by zero and one, unlike alternative measures of openness used by Leamer (*18*) and Kravis Heston, and Summers (*17*) Zero defines autarky One defines perfect dependency in which all goods produced at home are exported and all domestically consumed goods are imported

[7] A positive value for revealed competitiveness indicates that the country or region in question possesses a relative competitive advantage for the particular commodity being investigated Conversely a negative value indicates a relative competitive disadvantage

RC is thought to be the most reasonable proxy of comparative advantage available (*28*) It is not, however, a perfect measure To be precise, RC reveals relative competitive advantage and not real comparative advantage because it is based upon actual rather than optimal trade flows, the latter not being observable When intrepreting the empirical results in the following section, it is important to keep in mind that RC's embody not just the economic determinants of comparative advantage but also relative distortions

Leading and Lagging Sectors

Comparative advantages differ for countries at dissimilar levels of development, yet countries do not always exploit their natural advantages To underscore the growth benefits of increased efficiency in resource use, we distinguish *leading* from *lagging* economic trade sectors Leading and lagging sectors are determined by the positive correspondence between our theoretically based expectations concerning actual comparative advantage and the signs of the revealed comparative advantage coefficients generated by our empirical model More specifically, a leading (lagging) sector is identified when we anticipate a country/sector comparative advantage (comparative disadvantage) and obtain a positive (negative) RC coefficient from regressing real per capita national income on revealed comparative advantage

It is useful to make a distinction between changes in national and sector incomes and changes in revealed and actual comparative advantages Enhancing revealed comparative advantage always generates additional income in the reference sector But only increases in revealed comparative advantages that are consistent with increases in actual comparative advantage also augment national income Likewise, decreases in revealed comparative advantage always diminish reference sector income But such decreases actually increase overall domestic income if the reference sector is a comparative-disadvantage sector

We rely upon economic theory and knowledge of the real world to identify expectations, summarized in table 2, about the chain of comparative advantage and the ladder of development as developing countries experience economic growth

High-income countries are expected to have comparative advantages in the knowledge-intensive high-tech sector and in the capital- and skilled-labor-intensive finished capital goods sector Upper middle-income countries are also expected to have comparative advantages in both of these areas because our broadly defined sectors include industries where well-established technologies have been transferred to countries possessing relatively inexpensive but highly skilled labor

Table 2—Chain of comparative advantage and the ladder of development Theoretical expectations[1]

Item	Low income countries	Upper low-income countries	Middle-income countries	Upper middle-income countries	High-income countries	OPEC oil exporters
High technology	–	–	–	+	+	–
Finished capital goods	–	–	–	+	+	–
Basic intermediate goods	–	–	+	+	–	+
Intermediate differentiated goods	–	–	+	–	–	–
Agriculturally linked industries	–	+	+	–	–	–
Mining	+	+	–	–	+	+
Fish and forestry	+	+	+	–	–	+
Total agriculture	+	+	+	–	+	–

[1]The chain of comparative advantage is identified by pluses and minuses which indicate comparative-advantage (+) and comparative-disadvantage (–) sectors respectively The shaded area identifies a ladder of economic development

OPEC, upper middle-, and middle-income countries are believed to have comparative advantages in the iron and steel complex and in similar resource-dependent industries Such basic intermediates require capital and moderately skilled labor, resources these country groups have in relative abundance

We contend that middle-income countries have comparative advantages in intermediate differentiated goods because countries at this moderate level of development commonly possess a relative abundance of moderately skilled labor, a resource that these goods use comparatively intensively Expected comparative advantages in both middle- and upper low-income countries for the agriculturally linked industries sector is explained by the correspondence between relative input requirements and relative factor availabilities with respect to semi-skilled labor

Countries at the low end of the development spectrum, specifically those in the upper low- and low-income categories, are expected to possess comparative advantages in primary sectors, such as fish and forestry, mining, and agriculture, where production can take place using unskilled and semi-skilled labor intensively We also contend that middle-income countries have comparative advantages in both agriculture as well as fish and forestry because of the natural resource endowments characterizing this income category where virtually all countries have direct access to ocean fisheries, and most of them have relatively high land-to-labor ratios favoring agriculture We believe that OPEC countries have comparative advantages in the two extractive sectors, namely mining and fish and forestry

We contend that high-income countries have comparative advantages in agriculture because of the capital-(and sometimes land-) intensive technological structure of developed-country agriculture And, we believe that the high-income countries have comparative advantages in mining because of the inclusion of mineral-resource rich countries, such as Australia, Canada, and the United States within this income grouping

Econometric Findings

Table 3 shows the empirical results and table 4 identifies leading and lagging sectors The fact that we obtained so many statistically significant RC coefficients[8] and that the preponderance of these coefficients are consistent with our *a priori* theoretical expectations underscores the importance of comparative advantage in determining international trading patterns

Agriculture, which intensively uses unskilled labor in developing countries, is a leading sector for upper low-income countries and middle-income countries, and is an especially important source of foreign exchange for middle-income countries Agriculture is also a leading sector in high-income countries, a not unexpected result given that worldwide agriculture is characterized by factor-intensity reversals [9] Agriculture is a lagging sector in upper middle-income countries and OPEC The policy implication of this finding is that taking resources out of agriculture and increasing imports of agricultural commodities would actually increase income growth in these two sets of countries

The empirical results for the extractive sectors, mining and fish and forestry, were generally consistent with the stages approach to trade and development Mining is a leading sector in low-income countries, upper low-income countries, and OPEC as well as high-income countries Fish and forestry was a leading sector in low-income countries, middle-income countries, and OPEC and a lagging sector in high-income countries and upper middle-income countries

Agriculturally linked industries are a leading sector for middle-income countries and a lagging sector for

[8]We restrict our attention only to those generated RC coefficients which have t-statistics that suggest a greater than 80-percent confidence interval

[9]In contrast to developing-country agriculture, developed-country agriculture requires a more highly skilled labor force, relatively abundant capital, and in the case of Australia Canada and the United States, considerable land Policies protecting domestic agriculture may also contribute to the positive relationship found in the developed countries between increases in agricultural RC's and increases in per capita income

Table 3—Trade determinants of real per capita income in five income groups and OPEC countries[1]

Item	Low-income countries	Upper low-income countries	Middle-income countries	Upper middle-income countries	High-income countries	OPEC oil exporters
Intercepts	4 61440	50854	– 73235	–1 05422	– 80708	2 86295
	(8 16)	(1 08)	(–1 29)	(–1 99)	(–3 54)	(1 85)
High technology	– 00005	005414	001168	026268	– 002047	018254
	(– 01)	(1 43)	(27)	(5 56)	(– 73)	(1 72)
Finished capital goods	003083	005159	002121	000188	008587	005479
	(1 04)	(2 14)	(60)	(05)	(4 47)	(91)
Basic intermediate goods	– 000353	031920	– 009200	010614	– 02535	029372
	(– 12)	(5 53)	(–1 20)	(1 93)	(–9 79)	(2 04)
Intermediate differentiated goods	002206	– 006432	022913	000159	003110	040375
	(78)	(–1 60)	(5 12)	(03)	(1 42)	(3 77)
Agriculturally linked industries	– 007270	– 007077	053853	– 009648	– 033888	– 007977
	(–2 07)	(–1 67)	(10 68)	(–2 52)	(–8 78)	(– 74)
Mining	015569	013105	001878	– 001326	017298	119446
	(4 27)	(2 94)	(72)	(– 40)	(9 14)	(5 33)
Fish and forestry	012284	– 017825	006135	– 034094	– 021903	012021
	(4 45)	(–3 66)	(1 79)	(–10 06)	(–12 14)	(1 33)
Total agriculture	– 000617	018279	043609	– 033296	010568	– 055972
	(– 09)	(2 83)	(6 02)	(–6 02)	(4 33)	(–3 24)
Government intervention	005852	– 000155	002782	001221	000519	009337
	(11 14)	(– 53)	(4 37)	(3 97)	(2 48)	(6 54)
Global economic conditions	061143	310701	384396	442101	466789	182476
	(2 27)	(13 85)	(14 15)	(17 38)	(42 45)	(2 52)

Note $Ln[y_{jk(0)t}] = \beta_{0j} + \Sigma_i \beta_{ij} Ln[RC_{jk(0)t}] + \beta_{9j} op_{jk(0)t} + \beta_{10j} Ln[wc_{jk(0)t}] + \mu_{jk(0)t}$, where
i = agriculture, fish and forestry, mining, agriculturally linked industries, intermediate differentiated goods, basic intermediates finished capital goods, and high technology,
j = LIC, ULIC, MIC, UMIC, OPEC, HIC,
k_j = country in group j and
t = 1966, 1985
[1]The t-values appear in parentheses beneath the regression coefficients A times-series, cross country statistical program that corrects for serial correlation, heteroskedasticity, and contemporaneous correlation was used to estimate the coefficients

Table 4—Leading and lagging sectors[1]

Item	Low-income countries	Upper low-income countries	Middle-income countries	Upper middle-income countries	High-income countries	OPEC oil exporters
High technology				+		(+)
Finished capital goods		(+)			+	
Basic intermediate goods		(+)		+	–	+
Intermediate differentiated goods		–	+			(+)
Agriculturally linked industries	–	(–)	+	–	–	
Mining	+	+			+	+
Fish and forestry	+	(–)	+	–	–	+
Total agriculture		+	+	–	+	–

[1]With the exception of signs in parentheses, pluses and minuses refer to leading and lagging sectors respectively All pluses (minuses) indicate statistically significant positive (negative) relationships between national income and revealed competitive advantage Blank cells identify statistically insignificant results

high-income countries, upper middle-income countries, and low-income countries Middle-income countries clearly benefit from being suppliers of such semi-skilled labor-intensive light manufactures as textiles, shoes, and furniture The middle-income category is the only country category with a positive income elasticity with respect to revealed comparative advantage in agriculturally linked industries, and this elasticity (0 054) is comparatively very strong As evidenced by the magnitude of corresponding negative elasticities, the high-income countries have the strongest interest in importing light manufactures, followed by upper middle- and low-income countries

The econometric results also show that intermediate differentiated goods is a leading sector for middle-income countries and a lagging sector for upper low-income countries By moving further up the commodity chain of comparative advantage, we find that a source of growth for OPEC, upper low-income countries, and upper middle-income countries occurs in being competitive in such basic intermediate goods as

processed petroleum and coal and iron and steel production, industries that require considerable capital and moderately skilled labor The only trade theory misfit among these groups is upper middle-income countries [10]

Finished capital and high technology were leading sectors in upper middle-income countries and high-income countries, respectively That high technology is a leading sector in upper middle-income countries, and not in high-income countries, is not really surprising given the relatively high level of aggregation in defining this sector, suggesting that the domestic supply (demand) for high-tech products outstrips domestic demand (supply) in the upper middle-income countries (high-income countries) The results affirm Vernon's product cycle explanation of trade, which says that the mass production of new innovative products is quickly transferred (especially in today's increasingly integrated international capital market) to countries possessing less highly skilled labor than in originating countries These transfers often occur as multinational corporations seek foreign sources of cheap but relatively well-educated labor Even though the profits of such investments are partially transmitted to the home country, high-tech commodity exports are recorded on the national account registers of producing countries

With exceptions in the OPEC and upper low-income countries country groupings, the statistically significant RC coefficients conform with our expectations derived from trade and development theory But, increased RC's in the high-tech and intermediate differentiated goods sectors augment national income in OPEC, contrary to the pure chain theory of comparative advantage It is not inconceivable that OPEC has achieved real comparative advantages in these two sectors by targeting specific industries for large subsidies, resulting in the accumulation of human and physical capital

Unlike OPEC, developing countries can ill afford misallocating resources Yet, the probability of mismanagement is especially high among upper low-income countries because many of their decision-makers evidently believe in the efficacy of state planning, advocate self-sufficiency, industrialization, and import substitution, and distrust international market mechanisms [11] Biased interventions that squeeze returns from comparative-advantage sectors induce resource flight, reducing efficiency and income in the overall economy [12]

Our empirical results suggest that upper low-income countries favor both heavy industry and sophisticated manufacturing and discriminate against primary and simple manufacturing ULIC per capita income varied inversely with RC's for fish and forestry and the agriculturally linked sectors but varied directly with the finished capital goods and basic intermediates sectors [13] We have insufficient information to determine how much national income would have increased had upper low-income countries pursued more market-oriented development strategies, permitting them to exploit their natural comparative advantages

The two variables that represent commercial policy and world economic conditions generally supported our expectations Oil-exporting countries come closest to being perfectly open Perfect openness occurs when all domestic production is exported and all domestic consumption is imported Not surprisingly, OPEC has the highest income elasticity with respect to the openness index than any other of our country categories

Excluding OPEC, the income elasticities with respect to openness are positive, indicating that as economies become more open, per capita income increases The openness elasticities, however, are inversely related to the level of development This rank order suggests that domestic income growth is less (more) dependent upon the international market, the higher (lower) the level of economic development The exception to this generalization is the upper low-income countries Here again, we have evidence that these countries are not reaping growth dividends from participating in global markets, most likely due to their adoption of inward-oriented development strategies The pursuit of self-sufficiency and balanced internal growth appears to have a high opportunity cost

The responsiveness of domestic income growth to global economic conditions is generally directly related to the level of development Economists have observed that the relative importance of differentiated products in a country's trade bundle increases as one moves from low- to middle-income countries, from middle- to upper middle-income countries, and from upper middle- to high-income countries In addition, we know that the income elasticities of demand for differentiated products are usually higher than for undifferentiated and primary products The magnitudes of the coefficients for global economic conditions across income groups, therefore, seem reasonable Incomes in high-income countries, outside of OPEC, rise (fall) more than those in low-income countries during global economic upswings (downswings)

Conclusions

This article continues the discussion about the influence of trade on economic growth by adding greater

[10]The drive toward industrialization in many developing countries entailed the adoption of import-substitution development strategies Widespread implementation of this strategy may explain why basic intermediate goods became such an important source of national income growth for upper low-income countries

[11]The World Bank (*29*) considers all countries within our upper low-income country category as being inwardly oriented with the exception of Egypt and Morocco, two countries they did not classify

[12]Our openness measure does not adequately capture all aspects of government intervention

[13]Were RC's unadulterated measures of comparative advantage, these results would be surprising

commodity and country detail than found in other studies, disaggregating the total economy into eight economic sectors, and classifying countries into five categories of real per capita income and an OPEC group

Empirical evidence shows that (1) trade-growth linkages often correspond to dynamic comparative advantage, (2) the makeup of commodity trade affects income growth, and (3) the composition of country trade patterns responds to shifts in relative factor endowments and movements up the income ladder

We found that policy distortions and factor intensity reversals explain why trade does not always fit the skilled-labor continuum Calculated income elasticities with respect to openness imply that economies become less dependent on international markets as they grow Also, the influence of world economic conditions on economic growth is greater for high- than for low-income countries

Improved indicators of commercial policy and development strategy are needed to assess the impact of government intervention more comprehensively

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