Commodity dependence, growth and human development

Background document to the Commodities and Development Report 2017

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ABSTRACT

This study discusses the relationship between commodity dependence, growth and human development. Two dimensions of commodity dependence are considered: the traditional primary commodity export dependence (export share of total merchandise exports) and import dependence (the share of food and oil imports in total merchandise imports). After the examination of commodity dependence over the period 1995-2015, the focus shifts to the discussion of the mechanisms through which commodity dependence affects human development, particularly in commodity-dependent developing countries (CDDCs). Then, the relationship between commodity dependence and human development is investigated through econometric modeling. The study finds that import and export dependence are negatively associated with the level of human development. Many CDDCs are doubly hurt by commodity dependence as they are both export and import-dependent. The negative association between commodity dependence and human development suggests that the question why CDDCs have not been able to put in motion a commodity-led development process remains topical even though most of these countries benefited from higher rates of economic growth owing to the commodity price boom of the 2000s.

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1. INTRODUCTION

A number of countries, especially in developing countries, highly depend on revenues from primary commodity exports making them vulnerable to the vagaries of international commodity markets. In 2014, the number of Commodity-Dependent Developing Countries (CDDCs)--namely countries that derived at least 60 per cent of their merchandise export earnings from primary commodities--stood at 110 out of 202 countries for which data were available.[1] This ratio represents 54 per cent of all the countries covered in this study.[2] In the same year, the number of developing countries with a commodity export ratio in excess of 60 per cent amounted to 94 out of a total of 146 developing countries for which there was data. This means that 64 per cent of developing countries derived more than 60 per cent of their merchandise export earnings from primary commodities.

The main objective of this study is to empirically explore the effect of commodity dependence on human development. It considers commodity dependence not only from the traditional primary commodity export perspective but also import dependence, defined as the value of the sum of food and oil imports over total merchandise imports. Disaggregated data covering the period from 1995 to 2014 are used to explore the relationship between commodity dependence and some development indicators. The choice of the sample period is motivated both by data availability and the need to explore the extent to which the recent commodity price boom of the 2000s might have altered the traditional negative relationship between commodity dependence and development indicators, such as economic growth and the Human Development Index (HDI). HDI combines three different aspects of development: health, education (non-monetary aspects) and living standards (monetary aspect), the latter being measured by Gross National Income (GNI) per capita.[3]

This study contributes to the literature on commodity dependence, growth and development in several respects. First, by updating the analytical period to 2014, the sample period includes a relatively long period of high commodity prices that may have altered the traditional negative relationship between commodity dependence and economic growth. If the negative association between commodity export and indicators of development is confirmed, the result will suggest the persistence of the "commodity curse." Second, the introduction of commodity import dependence is an analytical innovation which is overdue. Traditionally, commodity dependence has been perceived only from an export perspective (Sachs and Warner, 1999; Carmignani and Avom, 2010). Import commodity-dependent countries are those with a ratio of food and fuel imports over total commodity imports in excess of 30 per cent. This threshold is the average import dependence ratio for the full sample of countries over the period 1995–2014.

Nearly half of the countries in the sample were import commodity-dependent. Among developing countries, 85 out of 146 countries (i.e. nearly 60 per cent) were commodity import-dependent. "Double commodity dependence", a combination of export and import-dependence, affected 53 countries or a third of all developing countries. Third, the timing of the study in 2016/2017, when commodity prices have generally been declining for about five years after a relatively long recovery, captures developments where prices were low at the beginning and end of the sample period, and high in between.

High commodity export dependence might not appear as a problem during periods of high commodity prices. Indeed, commodity exporters derive important rents from their commodity sectors during periods of price booms such as the one experienced between 2003 and 2011. For most of these countries, high prices usually imply higher export revenues and faster economic growth.

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[1] The ratio of 0.6 was determined based on an econometric study by Nkurunziza and Cazzaniga (2015). This result is also confirmed by econometric findings of this study. Using a quantile regression of HDI on export commodity dependence (including other controls), the coefficient of export dependence is strongest (higher than the average of -0.2, in absolute value) when HDI is less than 0.6 and this cut-off point corresponds with a commodity dependence ratio of 0.6 .

[2] Unless otherwise specified, data are from UNCTADstat.

[3] See UNDP's Human Development Reports for more details on HDI and its components.

However, due to the failure to smooth spending of commodity windfalls over periods of price booms and busts, or use these resources to invest in economic structural transformation,[4] most countries, especially CDDCs, experience periods of economic growth during booms and long depressions afterwards (Bevan *et al.*, 1993). This dynamic is illustrated by the positive and high correlation coefficient (of + 0.62) between changes in the UNCTAD non-oil commodity price index and GDP growth in developing countries between 1971 and 2014. In these countries, the commodity price boom of the 1970s was followed by a period of low rates of economic growth in the 1980s and 1990s. Thereafter followed a new period of high growth rates associated with the price boom of the 2000s, with a brief interruption in 2008–2009 due to the economic and financial crisis (see Figure 1).

Figure 1. Correlation between the annual growth of developing economies' GDP and the UNCTAD non-oil commodity price index (per cent), 1971–2014
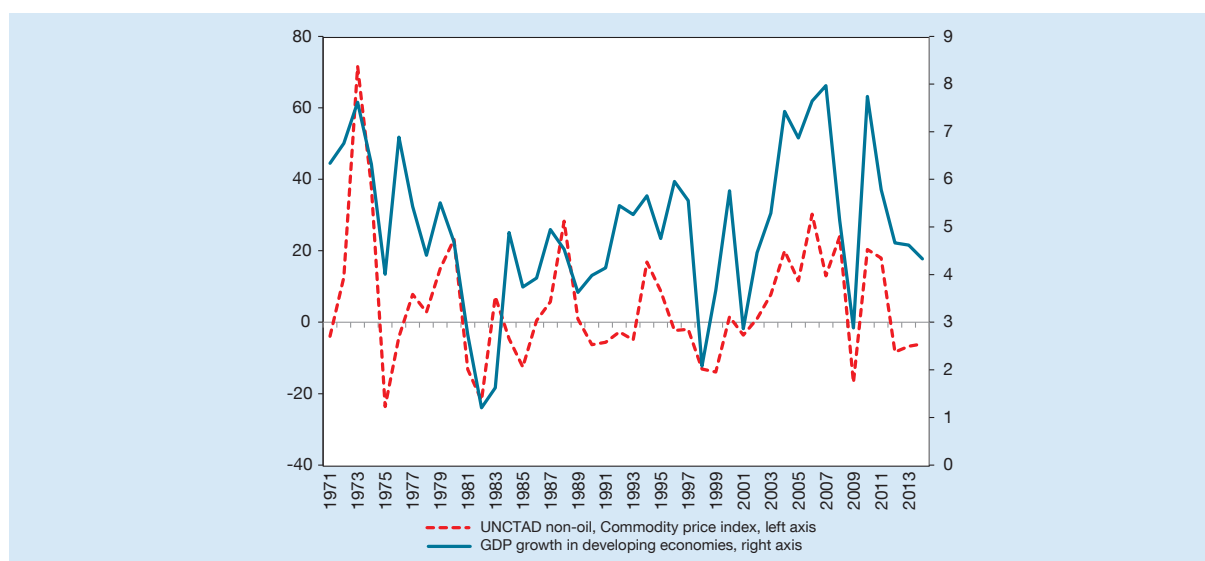
Source: Authors based on UNCTADstat.

Historically, high dependence on primary commodity exports in developing countries has been associated with poor development outcomes and slow growth. As price takers, CDDCs have also been exposed to the vagaries of international commodity markets with a detrimental effect on their macroeconomic performance. In this regard, a number of empirical studies find that natural resource-dependent economies have generally fared worse than other economies in terms of economic performance (van der Ploeg, 2011; Hausmann *et al.*, 2007; Rodriguez and Sachs, 1999). The main channel through which commodity export dependence negatively affects economic performance and development is the so-called "resource curse" discussed in the next section.

Moreover, a number of countries, especially across the developing world, highly depend on food and/or fuel imports to meet domestic demand. Import dependence focuses on these two major groups of products not only because their share represents a significant portion of the import baskets of many developing countries but also because they are vital for socio-economic development. In Africa for example, despite the continent's high agricultural potential, many countries continue to import a high share of food and other agricultural products owing to population growth, low agricultural productivity, policy distortions, weak institutional framework and poor infrastructure (Rakotoarisoa *et al.*, 2011). In other countries, natural constraints or limited resource endowments as well as competitive advantage imply that they must import food and/or fuel to meet domestic consumption.

High food and fuel import dependence has adverse effects on the macroeconomic performance of vulnerable countries through inflationary pressure, deteriorating foreign exchange reserves and large swings in the terms of trade (IMF, 2008; Headey and Fan, 2008). As a result, these countries may not be able to ensure a decent living for their populations, trapping the most vulnerable into poverty.

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[4] For the definition of structural transformation and its implications, see for example AfDB et al. (2013).

The remainder of this paper is organized as follows. The next section briefly discusses the main channels through which commodity dependence may affect economic growth and development. The third section uses disaggregated data and basic statistical analyses to revisit the relationship between commodity dependence and human development. The fourth section is an empirical econometric analysis of the relationship between commodity dependence and human development, in a multivariate framework where many other potential determinants of human development are controlled for. The last section concludes and provides policy recommendations.

2. COMMODITY DEPENDENCE AND DEVELOPMENT: CHANNELS

2.1. Export dependence and development

The channels through which commodity dependence affects socio-economic performance include negative or unstable terms of trade, macroeconomic volatility, Dutch Disease, and political instability (Humphreys et al., 2007). [5]

Commodities' unfavourable terms of trade channel was first discussed in the Prebisch-Singer hypothesis, which posits that primary commodity exporters are penalized by the secular negative terms of trade (Prebisch, 1950; Singer, 1950). The hypothesis has been tested econometrically and found to generally hold despite the occurrence of relatively short periods of high commodity prices (Lutz, 1999; Harvey et al., 2010).[6] The fact that recent developments in the global economy have led to an overall decline in manufacturing export prices (Kaplinsky, 2006), combined with a relatively long commodity boom (UNCTAD, 2015) may suggest that the long-term trajectory of terms of trade has changed in favour if CDDCs. However, a close analysis of the data shows that resource-rich countries do not seem to have gained sustainable benefits from this development. The secular negative terms of trade and commodity price volatility continue to hinder growth and development in CDDCs (Bidarkota and Crucini, 2000; Blattman et al., 2007). A recent study by Cavalcanti et al. (2014), covering the period between 1970 and 2007, confirms that volatility of commodity terms of trade is a major driver of the resource curse often associated with CDDCs' poor socio-economic development.

A second channel associated with the resource curse relates to macroeconomic volatility driven by unpredictable commodity prices. High dependence on primary commodity exports exposes CDDCs to the vagaries of international markets. Successions of upward and downward swings in these markets often increase CDDCs macroeconomic volatility, which in turn worsens their socio-economic performance (Andrews and Rees, 2009; Carmignani and Avom, 2010; Ferreira, 2012). For example, during periods of price booms, many resource-rich countries engage in costly investment projects, often with low returns (Deaton, 1999). When prices decline, countries are unable to maintain the same consumption and investment patterns. Hence, they either abandon their projects or borrow to complete them, sometimes driving debt stocks to unsustainable levels. Therefore, many resource-rich countries are not able to mobilize resources to support socioeconomic policies. In addition, commodity price fluctuations spread economic shocks among commodity-exporting countries leading to economic slowdown in these countries.

The third channel relates to Dutch Disease emanating from the appreciation of CDDCs' currencies due to important increases in commodity export prices and associated large inflows of foreign currency during commodity price

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[5] Discussion in Sub-section 2.1 draws partly from Nkurunziza and Cazzaniga (2015).

[6] Although the results from some studies are mixed, many are based on questionable assumptions about the order of integration of the price variable and they fail to account for structural breaks in their modeling strategies, leading to erroneous conclusions. A recent study by Ertern and Ocampo (2013, p.14) proposes a refinement to the interpretation of the Prebisch-Singer hypothesis. It finds that over the 20th century, non-oil primary commodity prices display a "sequential decline in mean prices through super-cycles" suggesting that the price trends do not necessarily follow a stochastic trend as often hypothesized.

booms. The appreciation of the domestic currency makes non-commodity export sectors, such as manufacturing, less competitive while making imports cheaper. This hampers economic diversification (Frankel, 2010) and could lead to de-industrialization. Moreover, given that commodity price booms are usually followed by periods of busts characterized by low prices, exchange rates fluctuate with commodity price changes which contribute to macroeconomic shocks in CDDCs.

The fourth channel is the political instability that often results from disputes for the control of rents associated with commodity windfalls in natural resource-rich countries (Caselli and Tesei, 2011). Economic analyses of political instability show a close relationship between natural resource dependence, poor governance and conflict (Bannon and Collier, 2003; Berman et al., 2014). Fighting for the control of rents associated with primary commodities not only helps to explain why wars start, particularly in societies where there are also political grievances, but also contributes to prolonging the conflict. In turn, civil wars affect the economy through the destruction of productive resources, disruptions to economic activity, diversion of resources from productive to un-productive sectors, dissaving, and portfolio substitution, as agents tend to move their financial assets outside the country concerned (Collier, 1999). These effects outlast the conflict, so political instability continues to affect the economy for several years after the end of the conflict.

It would be misleading to conclude from this discussion that commodity export dependence is systematically associated with poor socioeconomic development. There are countries that have not become victims of the resource curse despite having an important commodity sector. In these countries, dependence on primary commodities has not compromised socio-economic performance. In fact, some of these countries, including Australia, Canada and Norway are among the world's most developed nations. This suggests that other factors, including the level of institutional development, interact with commodity dependence to produce the negative effect on development indicators.

2.2. Import dependence and development

High commodity import-dependence may also be associated with poor performance in terms of economic growth and human development. Long periods of high commodity import prices, as was the case during the 2000s, negatively affect vulnerable countries through various channels including imported inflation, diminishing foreign exchange reserves, and large swings in the terms of trade (IMF, 2008; Headey and Fan, 2008; Brinkman et al., 2010). Commodity import-dependent countries may find it difficult to meet increasing import bills, failing to provide basic food and other services to segments of their population. Ivanic et al. (2011) estimated that the 2010–2011 surge in food prices generated an additional 44 million poor people in developing countries. The transmission of high global food prices to local prices hurt many developing countries, where people are largely net food-buyers and food expenditures represent a significant portion of household budgets.

For resource rich-countries, dependence on food and/or fuel imports might not be a problem as they are able to build reserves to cover import bills during periods of high food prices. For example, oil and minerals exporters enjoyed improved terms of trade and high foreign currency reserves in the 2000s. As a result, they were able to cope with the adverse impact of high food prices on their macroeconomic performance (Shapouri and Rosen, 2007). However, the depletion of their foreign currency reserves implies that these countries might not be able to meet other needs in sectors such as healthcare, education, research and development, and invest in economic structural transformation. Resource-poor countries may need to rely on external assistance as well as indebtedness, to meet their food and fuel requirements when prices are excessively high. If debt stocks reach unsustainable levels, these countries might plunge into severe macroeconomic instability, leading to higher poverty levels.

These arguments do not imply that food and fuel imports are systematically detrimental to countries' socioeconomic development. Indeed, agricultural food imports permit countries, especially those facing natural constraints, to attain national food security goals through imports, while fuel imports remain globally an important source of energy. As stated earlier, limited capacity or comparative advantages could force some countries to rely on imports of primary commodities including food and fuel. However, high import dependence on these

commodities may hamper growth and development performance, especially during periods of extreme and persistent upward swings in prices.

The discussion under this section suggests that high dependence on primary commodity exports and/or imports (food and fuels) negatively affects the development prospects of many developing countries. In these countries, commodity dependence goes hand in hand with underdevelopment, as shown in the next section.

3. COMMODITY DEPENDENCE AND DEVELOPMENT: STATISTICAL ANALYSIS

3.1. Descriptive analysis

This section is devoted to a statistical analysis of commodity dependence. It explores export and import dependence using yearly data for a sample of 202 countries over the period from 1995 to 2014. From this section onward, a country i's commodity export dependence at time t, denoted CDX_{it}, is defined as the ratio of its export earnings from commodities (agricultural products; minerals, ores, and metals; and energy products, that is: SITC 0 +1+2+3+4+667+68+971) to total merchandise exports. Hence:

$$CXD_{it} = \frac{Commodity\ exports_{it}}{Total\ merchandise\ exports_{it}} \qquad (1)$$

With respect to commodity import dependence, a country i's commodity import dependence denoted CMD_{it}, is defined as the ratio of the value of the country's food (SITC 0+1+22+4) and fuels (SITC 3) imports relative to total merchandise imports. Hence:

$$CMD_{it} = \frac{(Food+Fuel\ imports)_{it}}{Total\ merchandise\ imports_{it}} \qquad (2)$$

We may note that CXD_{it} and $CMD_{it} \in [0,1]$.

Increasing values of the ratios imply increasing dependence on primary commodity exports or food and fuel imports. The values assumed by CXD_{it} and CMD_{it} depend not only on the volume of traded products but also on prices. Therefore, with the same volume of commodities, these ratios may increase or decline depending on the changes in commodity prices. Commodity export or import dependence can also change due to the composition of traded products. Even at the same price and with the same volume of commodity traded, a country's commodity dependence could change if the composition of its total merchandise exports or imports changes. For example, structural transformation in a commodity export-dependent country would normally increase non-commodity merchandise exports, reducing its dependence even as the country exports the same value of commodities. In fact, this is what structural transformation is implicitly expected to achieve. Similarly, if a country improves its food and/or energy self-sufficiency, this will tend to reduce its import dependence, even keeping the same level of food and fuel imports.

Given the definitions above, countries may be grouped into two states in relation to their level of commodity export or import dependence (Table 1).[7] For example, in this study, when a country's export dependence ratio is higher than the sample average, which is 0.55 in the full sample, the country is considered as highly commodity export-dependent. The equivalent value for the import dependence ratio is 0.30.

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[7] Values used to cluster groups of countries according to their export and import dependence ratios are derived from average values of the relevant ratio using a panel data of 202 countries from 1995 to 2014. The average values for primary commodities export and import as a share of total exports and total imports are 0.55 and 0.30, respectively.

Table 1.	States of commodity export (CXD) and import (CMD) dependence			
Export dependence	State 1	CXD ≤ 0.55	Low
	State 2	CXD > 0.55	High
Import dependence	State 1	CMD ≤ 0.30	Low
	State 2	CMD > 0.30	High

Figure 2 shows the evolution of the number of countries falling into the two states of commodity export dependence over the period 1995-2015. The group of countries that derive more than 55 per cent of merchandise exports from primary commodities (State 2) was dominant throughout the sample period. It is worth noting that export dependence seems to mirror the evolution of prices in global commodity markets. Between 1995 and 2005, a period generally characterized by a downward trend in commodity prices, the number of countries with high dependence on primary commodity exports decreased from 128 to 110. Afterwards, led by the boom in global commodity markets, the trend reversed. The number of countries with high dependence on primary commodity exports rebounded to 118 in 2011. However, with the slump in commodity prices, this number dropped to 113 in 2014.

Figure 2.   Number of countries in high and low commodity export dependence groups
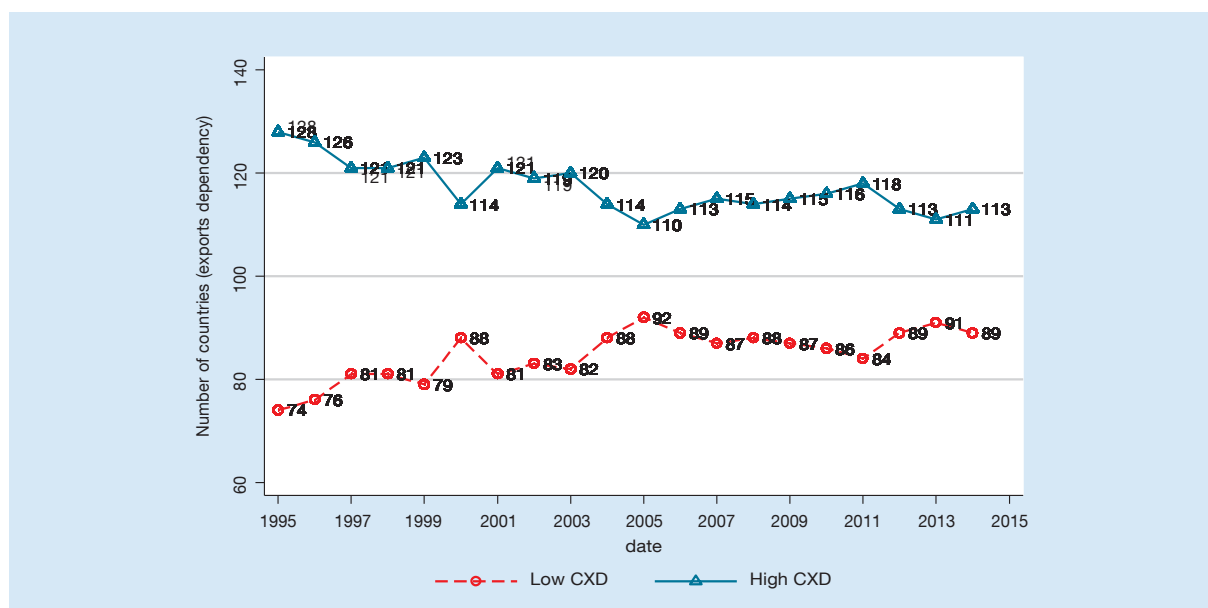
With respect to commodity import-dependence, the number of highly dependent countries oscillated between 58 and 71 before 2004 (Figure 3). Afterwards, driven by price upswings in global commodity markets, this number reached a peak of 112 in 2011. Thereafter, as prices for commodities started to trend down, the number of countries which highly depend on fuel and food imports decreased to 104 in 2014. However, this number remained well above its levels before the onset of the commodity boom. Figure 3 shows that import commodity dependence became a major issue starting from 2005 with the average number of import-dependent countries increasing from 66 in the period 1995–2004 to 97 during the period 2005–2014, an increase of 47 per cent. The food crisis of 2008 corresponded with a jump in the number of highly commodity import-dependent countries, and their number remained higher than in the pre-crisis period.

Figure 3.   Number of countries in high and low commodity import dependence groups
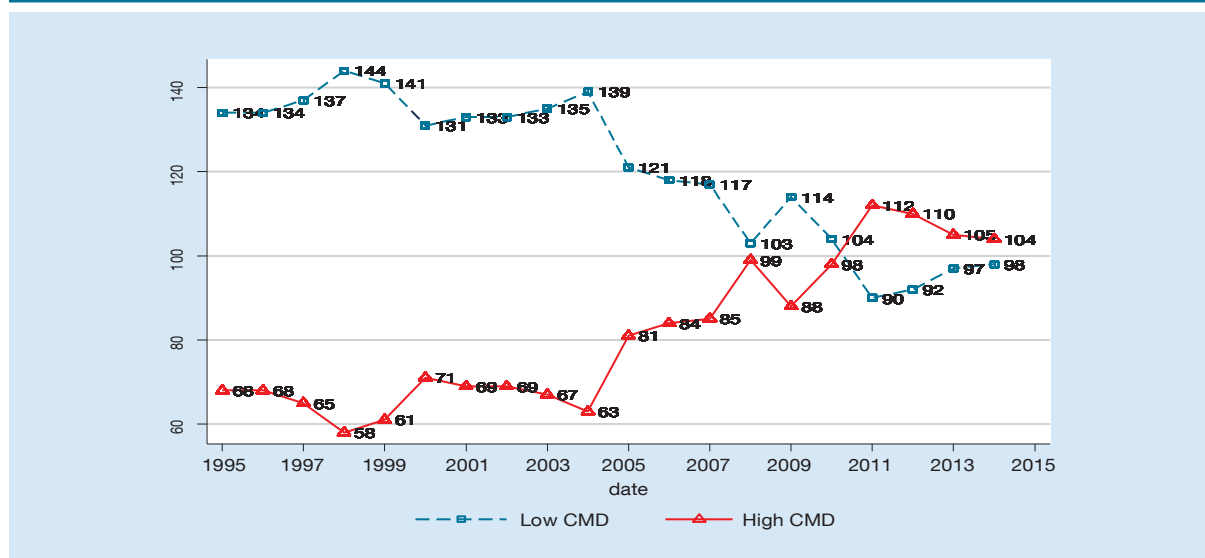
The two dimensions of commodity dependence have been, so far, analyzed separately. In what follows, these two aspects of dependence are explored jointly grouping countries in four categories (see Table 2). For example, a country classified in the first quadrant (Low$_X$; Low$_M$) has export and import dependence ratios below 55 and 30 per cent, respectively.[8]

Table 2.   Classification of countries based on their states of export and import dependence

| Export dependence / Import dependence	Low export dependence	High export dependence
Low import dependence	CMD ≤ 0.30; CXD ≤ 0.55	CMD ≤ 0.30; CXD > 0.55
High import dependence	CMD > 0.30; CXD ≤ 0.55	CMD > 0.30; CXD > 0.55

The distribution of countries according to Table 2 is given in Figure 4.

All 48 countries that are highly dependent on primary commodity exports and food and fuel imports (that is, countries characterized by High$_X$ and High$_M$) are developing countries (they include Afghanistan, Benin, Burkina Faso, Cameroon, Cabo Verde, Côte d'Ivoire, Kenya, Madagascar, Mali, Niger, Togo and Yemen); or transition economies (3 countries), namely Armenia, Kyrgyzstan and Tajikistan. No developed country is found in this category. At the other extreme, countries with both low export and import dependence (Low$_X$; Low$_M$) are mostly developed (31 out of the 41 developed countries in the sample). This category also includes a number of middle-income countries, such as Brazil, China, Costa Rica India, Indonesia, Malaysia, Mexico, South Africa, and Thailand. Economies where clothing and textiles account for a large share of total merchandise exports, such as Bangladesh, Cambodia and Lesotho, also belong to this group.

The category of countries with high dependence on exports and low dependence on imports (High$_X$; Low$_M$) comprises a number of resource-rich countries. These include 42 developing countries, among which some major exporters of oil and gas, such as Algeria, Angola, Gabon, Kuwait and Nigeria, and minerals and metals, such as Bolivia, Chile, Peru and Zambia. This category also includes some natural resource-abundant developed countries, such as Australia, New Zealand and Norway. These countries' imports of oil and/or food products

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[8]   The ratios CXD and CMD are calculated as average values over 1995-2014 for each country.

Figure 4.   Distribution of countries according to their average export and import dependence (average values over the period 1995-2015)
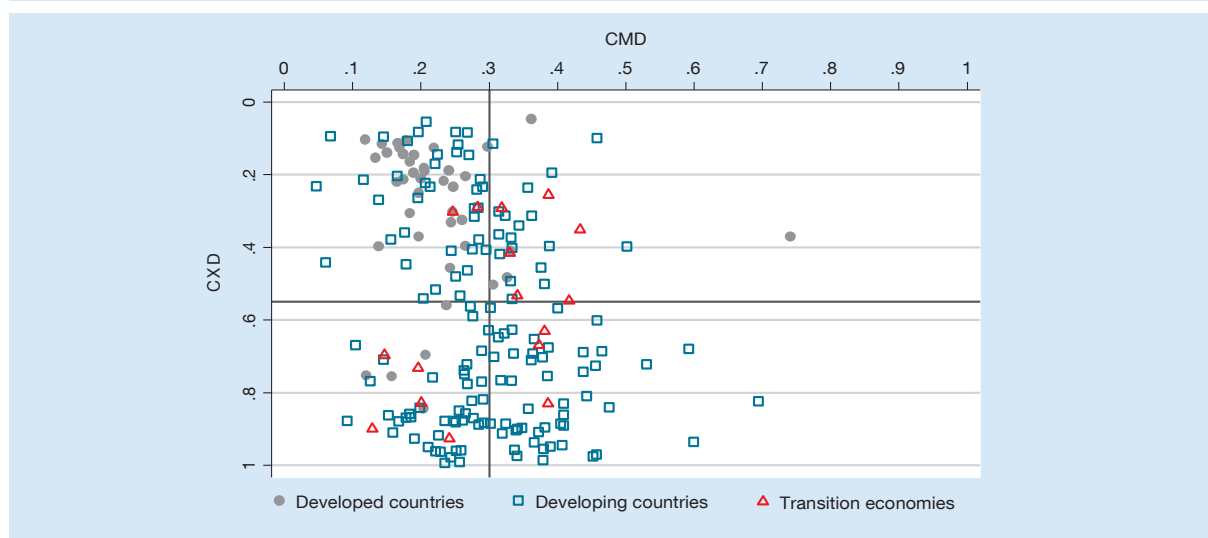
are relatively low given that they produce these resources domestically. Furthermore, these natural resource-rich countries, particularly oil-exporting countries, benefit from commodity rents that allow them to afford more non-commodity imports, reducing the ratio of commodity imports to total merchandise imports.

Finally, the category that encompasses countries with low export dependence and high import dependence (Low$_X$; High$_M$) counts 18 developing countries, including Haiti, Jordan, Lebanon, Morocco and Pakistan. Developed countries and transition economies found in this category include Cyprus, Georgia, Greece, Ukraine and Japan.

3.2. Commodity dependence and HDI: naive regression

This sub-section quantitatively assesses the relationship between HDI and commodity export and import dependence, between 1995 and 2013.[9] Countries with less than 500 000 inhabitants were dropped from the sample. As a result, estimations are based on 163 countries.[10] In order to assess potential differentiated effects of commodity dependence in developing countries compared to developed countries, a dummy variable is introduced in a simple linear equation between HDI and commodity dependence with respect to exports (equation (3)) and imports (equation (4)). Equation (5) introduces both export and import dependence ratios simultaneously.

$$HDI_{it} = \alpha + \beta^X CXD_{it} + \delta^X (CXD_{it} \otimes D_{DE}) + \varepsilon_{it} \tag{3}$$

$$HDI_{it} = \alpha + \beta^M CMD_{it} + \delta^M (CMD_{it} \otimes D_{DE}) + \varepsilon_{it} \tag{4}$$

$$HDI_{it} = \alpha + \beta^X + \delta^X (CXD_{it} \otimes D_{DE}) + \beta^M CMD_{it} + \delta^M (CMD_{it} \otimes D_{DE}) + \varepsilon_{it} \tag{5}$$

D_{DE} is a dummy variable that takes a value of 1 if a country is developed and zero otherwise.[11] As such, the effects of commodity dependence (export or import) are captured by the coefficient β^κ (k = X and M) for developing countries and $(\beta^\kappa + \delta^\kappa)$ for developed countries.

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[9] HDI data for 2014 were not available at the time of writing this study.

[10] Although the number of countries is reduced to 163, descriptive statistics such as average ratios for commodity (export and import) dependence did not change substantially.

[11] Developed countries in the sample (after dropping countries with less than 500 000 inhabitants) are Australia, Austria, Belgium, Bulgaria, Canada, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Israel, Italy, Japan, Latvia, Lithuania, Luxembourg, Netherlands, Norway, New Zealand, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, United Kingdom, and United States.

In estimating equations (3), (4) and (5) above independently, data are clustered on the basis of the categories specified in Table 2. The general argument for clustering is that HDI observations for countries within the same category may not be independent.

Figure 5 is a scatter plot with a fitted regression line between HDI and the ratios of commodity export and import dependence, with the red dots representing developed countries. The fitted line reveals, a priori, a negative relationship between HDI and commodity dependence. This relationship is stronger for commodity import dependence. However, developed countries and developing countries are distributed differently, supporting the inclusion of a dummy variable in the naive equations to capture the potential differentiated association between HDI and commodity dependence in developing and developed economies.

The results summarized in Table 3 seem to confirm the negative and statistically significant relationship between HDI and commodity dependence in developing countries. However, for developed countries, the coefficient is positive and significant, suggesting that commodity dependence is associated with higher HDI.[12]

Figure 5.   Scatter plot of HDI and commodity export and import dependence
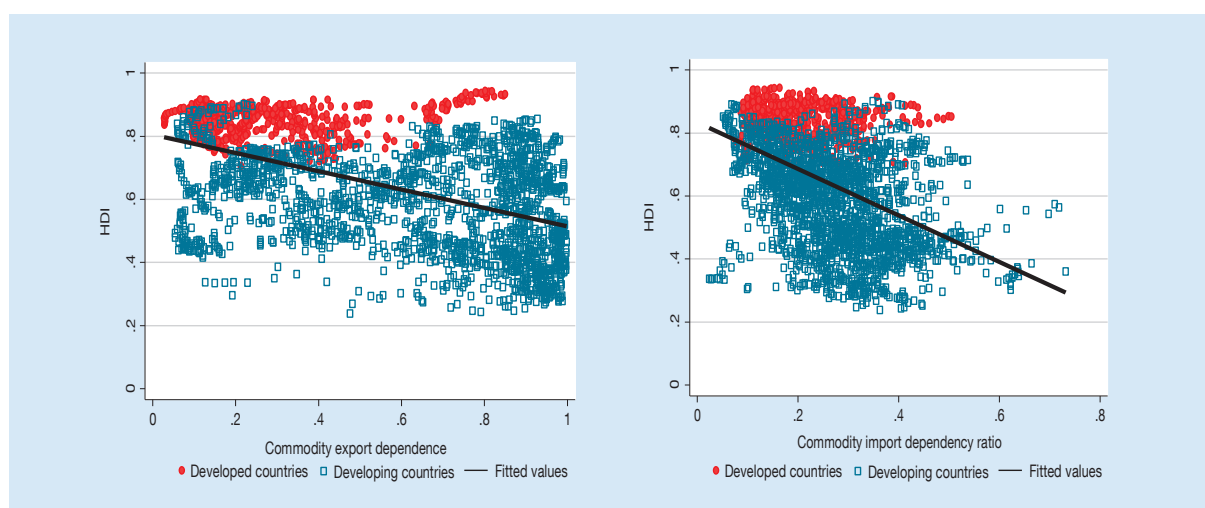
More specifically, starting with column I of Table 3 (equation 3), the estimated coefficient of commodity export dependence is negative for developing countries: the higher the export dependence ratio, the lower the HDI. By contrast, the relationship is strongly positive for developed countries. The implication of these results is that the dependence on primary commodity exports may be a curse for developing countries but this is not the case for developed countries.[13] In column II, the results for commodity import dependence are similar to those in the case of export dependence. While countries that highly depend on food and fuel imports are associated with low human development across the developing world, the relationship is rather positive for developed countries. When including both import and export dependence ratios in a single equation (see column III), results for developing countries are similar to those in Columns I and II. Although the association is positive for developed countries, it is not statistically significant.

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[12] These results do not say much however on causality direction. They can only be interpreted here as stylised facts.

[13] The results for developing countries do not mean that the relation between HDI and CXD or CMD is systematically negative for all countries. It may be positive for some countries, but in general, the relation is negative for developing countries as a group.

Table 3. Commodity dependence and HDI: naïve pooled regression				
Variable	**Parameters**	**I (equation 3)**	**II (equation 4)**	**III (equation 5)**
primc_xdep (CXD)	β^X	-0.236*		-0.127*
xdep_DE	δ^X	0.518**		0.202**
f_f_mdep (CMD)	β^M		-0.619***	-0.516**
mdep_DE	δ^M		1.011***	0.620**
	$\beta^X + \delta^X$	0.282***		0.074
	$\beta^M + \delta^M$		0.392**	0.103
_cons	Constant	0.739***	0.751***	0.802***
Adjusted R2		0.448	0.501	0.55
Observations		2436	2556	2436

Significant at: 1% ***; 5% **; 10%*.

To refine the analysis, the differentiated effects of food and fuel imports on HDI are investigated (Table 4). Food and fuel import dependence is negatively associated with HDI in developing countries, whereas the relation is positive for developed countries. However, the association of food import dependence with HDI is stronger than the corresponding association between fuel import dependence and HDI.

Table 4. Food and fuel import dependence and HDI		3.I	3.II
		Food	**Fuel**
food_mdep	β^X	-0.997**	
foodep_DE	δ^X	2.156**	
fuel_mdep	β^M		-0.383*
fueldep_DE	δ^M		1.727**
Food	$\beta^X + \delta^X$	1.159**	
Fuel	$\beta^M + \delta^M$		1.344**
_cons		0.728***	0.640***
R-squared		0.53	0.343
Number of observations		2556	2556

Significant at: 1% ***; 5% **; 10%*.

Disaggregating further the data, equation (3), (4) and (5) are estimated taking into account the categories identified in Table 2. The results are displayed in Table 5.

Table 5.　Commodity dependence and HDI for various country categories

Variable	Categories	1 (LowX; LowM)			2 (LowX; HighM)			3 (LowM; HighX)			4 (HighX; HighM)		
		(equation 3)	(equation 4)	(equation 5)	(equation 3)	(equation 4)	(equation 5)	(equation 3)	(equation 4)	(equation 5)	(equation 3)	(equation 4)	(equation 5)
primc_xdep (CXD)	β^X	-0.302***		-0.113***	-0.395***		-0.157**	-0.129***		-0.149***	-0.206***		-0.209***
xdep_DE	δ^X	0.654***		0.092*	0.566***		0.048	0.385***		0.193**	(omitted)		(omitted)
f_f_mdep (CMD)	β^M		-0.482***	-0.368***		-0.345***	-0.454***		-0.681***	-0.647***		0.014	0.085
mdep_DE	δ^M		0.909***	0.818***		0.675***	0.621***		1.476***	0.600*		(omitted)	(omitted)
	$\beta^X + \delta^X$	0.352***		-0.022	0.171***		-0.109*	0.256***		0.044			
	$\beta^M + \delta^M$		0.427***	0.450***		0.330***	0.166		0.795***	-0.047			
_cons		0.751***	0.750***	0.758***	0.736***	0.717***	0.813***	0.718***	0.764***	0.881***	0.635***	0.469***	0.606***
R2		0.481	0.535	0.567	0.364	0.469	0.494	0.249	0.312	0.339	0.051	0	0.054
N		939	968	939	232	246	232	730	766	730	535	576	535
BIC		-1731.48	-1913.3	-1887.29	-300.614	-347.659	-342.6	-783.075	-885.397	-863.233	-651.378	-654.393	-646.84

Significant at: 1% ***; 5% **; 10% *.

Globally, the strongest negative relationship between export dependence and HDI in developing countries is found for countries with low export and high import dependence (Low$_X$; High$_M$). This suggests that higher import dependence may exacerbate the detrimental effect of export dependence on developing countries. This seems to be the case as the relationship is weaker for countries with low import and high export dependence compared to those with high import and high export dependence. Reasons could include the high heterogeneity within this group of countries in terms of development processes or a misspecification of the model, as the results are from a naive regression. For developed countries, when accounting only for export dependence, the relationship is strongly positive for the various categories. This is consistent with previous findings.

The association between commodity import dependence and HDI is negative and strongly significant for developing countries, except for countries categorized as highly dependent on both commodity exports and imports. A potential explanation is that developing countries with high export revenues are able to finance their food and fuel imports no matter how high their prices might be. Therefore, they are able to better absorb direct impacts of food and fuel import bills on their population, relative to other developing countries.

For developed countries, the association between import dependence and HDI remains positive. However, the relationship is stronger for developed countries with high export and low import ratios (Low$_M$; High$x$). The rest of the paper investigates further the negative relation for developing countries controlling for other potential determinants of human development.

4. COMMODITY DEPENDENCE AND HUMAN DEVELOPMENT: A MULTIVARIATE ANALYSIS

In the previous section, the effect of commodity dependence on human development is explored in a bivariate model that does not control for other potential determinants of human development. This section explores the same relationship with a multivariate model focusing on developing countries (113 countries in total with a population above 500 000 and for which data are available). Firstly, the variables other than commodity export and import dependence that might explain human development are discussed. Secondly, multivariate models of HDI are estimated.

A number of studies have investigated the deleterious effect of commodity dependence or resource intensity on per capita income and aggregate long-run economic growth (van der Ploeg, 2011; Hausmann *et al.*, 2007; Rodriguez and Sachs, 1999). However, the study by Carmignani and Avom (2010) appears to be among the first to investigate the interaction between commodity dependence and non-monetary aspects of development. The study finds that "non-monetary" indicators of development (e.g. health and education) are negatively correlated with commodity dependence through macroeconomic volatility and distributional inequalities. This section builds on Carmignani and Avom (2010) and uses the most recent disaggregated data to determine the effect of commodity dependence on human development, measured by the HDI.

The effect of commodity dependence on HDI may depend on a country's level of development. For example, the effect of commodity dependence on least developed countries (LDCs) could be more detrimental compared with the effect on other countries, as suggested by the results based on naïve regressions. Indeed, LDCs have limited resources, including financial and human resources, as well as weak institutional capacity, which increase their vulnerability to shocks from commodity markets. By contrast, CDDCs with high HDI tend to be associated with diversified economies and hence are less vulnerable to shocks. In order to allow for the effect of commodity dependence to vary over the distribution of HDI, a quantile regression is estimated.

The choice of control variables is based on the literature (Carmignani and Avom, 2010; Gupta *et al.* 2002; Carmignani, 2008). The following variables are included as controls:

(i)   Trade openness *(trade)*: captures the expected positive effect of globalization on social outcomes, particularly human capital formation (Carmignani and Avom, 2010). This suggests a positive relationship between trade openness and human development. The variable is measured as the sum of exports and imports of goods and services over GDP (source: WDI);

(ii)   Government expenditure *(gov_exp)*: measured as the sum of Government spending on goods and services (including compensation of employees) over GDP. It is expected to capture spending on social sectors, with high expenses expected to increase human development (source: WDI);

(iii)   Institutional quality *(inst_quality)*: tends to impact positively on countries' economic development. It is an index based on six individual indicators, namely voice and accountability, political stability and absence of violence/terrorism, government effectiveness, regulatory quality, rule of law, and control of corruption (source: Worldwide Governance Indicators, WGI[14]).

(iv)   Latitude *(lat_abst)*: measures the distance separating a country and the Equator. This variable has been used in the literature to capture the effect of being in the tropical zone, which is associated with challenges such as malaria prevalence (source: La Porta *et al.*, 1999). Hence, the longer the distance the higher the human development.

(v)   Dummy variables *(LDC)*: A dummy variable capturing the LDC status is included.

4.1. Quantile regression

The ordinary least squares (OLS) regression assumes that the conditional mean function of the dependent variable y can be modelled as a linear combination of the covariates, i.e. $E[y|x_1,...,x_k] = \alpha + \sum_{i=1}^{k} \beta_i x_i$ .In other words, the conditional mean summarizes all the relevant information on the relationship between y and x_i, $i=\{1,...,k\}$. However, the estimated βs may not be accurate, as the magnitude of the effect of covariates might vary at different levels of the dependent variable. In this case, it is important to investigate the impact of the covariates on the whole distribution of the dependent variable: they may increase its dispersion (increase heteroskedasticity), induce multimodality, or compress or stretch a tail of its distribution. Conditional quantile regression models are used in this case: the p-th quantile of a random variable y is assumed to be a linear function of the independent variables, i.e. $Q_y[p|x_1,...,x_k] = \alpha^{(p)} + \sum_{i=1}^{k} \beta_i^{(p)} x_i$. The factor loadings $\beta_i^{(p)}$ represent the effect of the x_i on the pth quantile they reveal more information than the OLS loadings, especially if the distribution of the dependent variable y is not symmetric. Figure 6 shows the results of the quantile regression.

Commodity export dependence has a negative effect on human development and the effect is strongest (in absolute value) at relatively low levels of HDI. The coefficient of commodity dependence relative to human development is below -0.037 (the coefficient obtained with the OLS regression, which may be interpreted as the average coefficient for the various quantiles) up to the 60th percentile, implying that the negative effect of commodity export dependence on human development is strongest for countries that are in the first six deciles of HDI. Moving to higher percentiles of HDI, the coefficient decreases, in absolute terms. Indeed, beyond the 60th percentile, the coefficient is lower, in absolute terms, than that of the OLS regression. Hence, the negative effect of commodity export-dependence on human development seems to be stronger in countries with low human development.

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[14] www.govindicators.org

Figure 6. Empirical results of the quantile regression
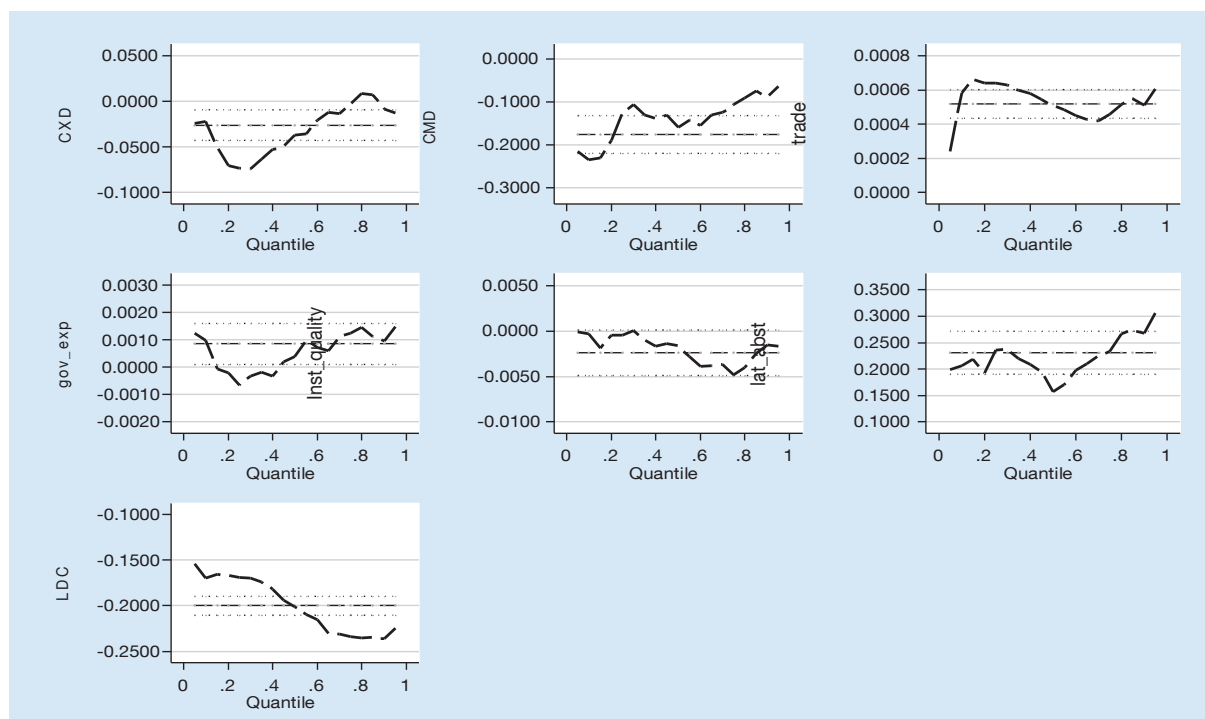
The effect of food and fuel import-dependence on human development is also negative. The coefficient changes substantially along the distribution of HDI, with the negative effect of food and fuel import-dependence being also stronger in countries with low human development. The difference in shapes of the commodity export and import-dependence coefficients illustrates the need to differentiate these two effects. This finding suggests that analyses of the impact of commodity dependence on human development that do not take into account the effect of commodity import-dependence may omit an important aspect of dependence, probably resulting in an omitted variable bias.

Government spending seems to have a positive effect on human development but the effect is weak irrespective of the level of human development. The failure to uncover a statistically strong relationship between Government spending and human development does in no way imply that Government spending is not important for human development. Refining the analysis by using direct estimates of spending on sectors such as education and health, instead of total spending, may return stronger results. Due to data constraints, it is not possible to perform this refined analysis in this study.[15]

The latitude variable has a positive and strong coefficient, as expected, implying that countries that are far from the tropics enjoy a higher level of human development. The effects of trade openness and institutional quality seem to be weak. The dummy variable controlling for the LDC status is negatively associated with HDI, as expected.

These results might, however, suffer from a number of limitations. Some regressors are potentially endogenous. For example, there could be a two-way causality between human development and HDI, as countries with lower human development might lack technology and resources that would help them to diversify their economies and move away from high dependence on primary commodities. As such, the level of HDI may be seen as a determinant of commodity export and import-dependence. An attempt is made to control for endogeneity by using a dynamic panel data model.

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[15] The results did not change much when accounting for a variable that captures the interaction between Government spending and institutional quality.

4.2. Dynamic panel model

The section uses dynamic panel modelling and the Arellano-Bond Generalized Method of Moments (GMM) estimator to investigate the relationship between human development and commodity dependence.

4.2.1. Model specification

The model specification is as follows:

$$y_{it} = \alpha_0 + \alpha_1 y_{it-1} + \alpha_2 CXD_{it} + \alpha_3 CMD_{it} + a\,V_{it} + \varepsilon_{it} \qquad (6)$$

where the dependent variable y is the HDI;[16] CXD and CMD are respectively primary commodity export and import-dependence ratios, which are assumed not to be strictly exogenous as discussed in the previous sub-section; V is a set of controls, including the variables discussed in the previous sub-section; is an error term with two components, time-invariant country characteristics or fixed effects () and idiosyncratic shocks ().[17] The model as specified allows for mean reversion in the dependent variables through the inclusion of a lagged value. Note that the coefficient. This also means that indicators of development trends and economic growth are a function of their initial values and a set of other variables. Equation (6) is estimated using system GMM, which is designed for cases where independent variables are not strictly exogenous and fixed effects, heteroskedasticity and autocorrelation within individuals are assumed to be present.[18]

The period under consideration goes from 1995 to 2013. The sample consists of 113 developing countries including LDCs and emerging economies. To capture a break due to the commodity price boom of the 2000s, a dummy variable (D_time) taking value 1 after 2002 as the boom started in 2003 and zero otherwise, is included in equation (6).

4.2.2. Main results and discussion

Results are shown in Table 6 where the dependent variable is HDI.[19] Results of the tests for first and second-order autocorrelation in the error term conform to theoretical expectations.[20] Hansen's J test for over-identifying restrictions also supports the validity of the set of instruments used to account for endogeneity in the right-hand side variables of equation (6). In all cases, the coefficient of the dummy variable capturing the effect of the commodity boom of the 2000s is positive and significantly different from zero, meaning that the commodity boom generally positively affected HDI in developing countries.

The positive and strong coefficient of the lagged value of HDI suggests that the process of human development improves slowly. No matter which variable is included in the model, primary commodity export dependence and food and fuel import dependence negatively affect human development. The negative effect of commodity export dependence on development confirms the findings of Carmignani and Avon (2010) despite the fact that the recent decade-long commodity boom is controlled for. The channels through which commodity dependence impedes development might include the factors discussed under Section 2. Trade openness and Government expenditure seem to have no impact on HDI.[21] By contrast, albeit weak, the effect of institutional quality is positive, suggesting that countries with more efficient institutions have higher human development indicators.

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[16] Panel unit root tests based on *Fisher Chi-square* statistics (*Augmented Dickey-Fuller* and Phillips-Perron) revealed that the dependent variables HDI and GDP per capita growth rate are stationary. These results were expected theoretically as, by construction, HDI is bounded between zero and one; and, GDP per capita growth is obtained by differentiating GDP.

[17] This means

[18] For further literature on this, see Roodman (2006) and *Greene (2008)*.

[19] The results did not change much when introducing a dummy variable controlling for LDCs. In any case, the impact of this variable is assumed to be captured by country specific effects, which are treated when using the GMM approach.

[20] The Arellano-Bond test for autocorrelation should detect first order autocorrelation and reject evidence of second order autocorrelation in the residuals.

[21] However, when not accounting for lagged values of HDI trade openness seems to have a positive impact of human development (results not reported in Table 6). This suggests that the effect of trade openness in the equation (6) is embedded in the effect of lagged HDI. Government expenditure, even when removing the lagged HDI as explanatory variable, remains non- significant.

Table 6.   System GMM estimates with HDI as dependent variable

Dependent variable: HDI		(I)	(II)	(III)
lag1_hdi	Lagged HDI	0.9874***	0.9846***	0.9785***
CXD	Commodity export dependence	-0.0055**	-0.0059*	-0.0091***
CMD	Commodity import dependence	-0.0161***	-0.0183***	-0.0121***
D_time	Dummy for commodity boom	0.0019***	0.0019***	0.0023***
lat_abst	Latitude		0.0250*	0.0032
trade	Trade openness			0.00
gov_exp	Government expenditure			0.00
inst_quality	Institutional quality			0.0004***
_cons	Constant	0.0192***	0.0167***	0.0244***
Observations		1725	1629	1273
Arellano-Bond test for AR(1), p-value		0.017	0.023	0.000
Arellano-Bond test for AR(2), p-value		0.593	0.546	0.572
Hansen's J test, over-identifying restrictions, p-value		1	0.998	1

Significant at: 1% ***; 5% **; 10%*.

Table 7 reports results for a model specification in which commodity export and import dependence are disaggregated into their components. The dependent variable is HDI. The results are generally in line with previous findings. Irrespective of the commodity group, the association between commodity export dependence and HDI is negative (though it seems non-significant for minerals, ores and metals). A similar conclusion holds for fuels and food import dependence.

Table 7.   System GMM estimates with disaggregated components of commodity export and import dependence

		HDI
lag1_hdi	Lagged HDI	0.9904***
food_xdep	Food export dependence	-0.0024**
mom_xdep	Min., ores and metals export dependence	-0.0012
fuel_xdep	Fuel export dependence	-0.0021**
food_mdep	Food import dependence	-0.0105***
fuel_mdep	Fuel import dependence	-0.0070***
D_time	Dummy for commodity boom	0.0014***
gov_exp	Government expenditure	0.0000
trade	Trade openness	0.0000
inst_quality	Institutional quality	0.0004***
lat_abst	Latitude	0.0026
lag1_gdp	Lagged GDP per capita growth rate	
_cons	Constant	0.0135***
Observations		1276
Arellano-Bond test for AR(1), p-value		0.0004
Arellano-Bond test for AR(2), p-value		0.7833
Hansen's J test, over-identifying restrictions, p-value		1

Significant at: 1% ***; 5% **; 10%*.

5. CONCLUSION

The analysis carried out in this study focuses on the relationship between growth, human development and commodity export and import dependence. The findings confirm the negative relationship between commodity export dependence and indicators of human development. This negative association holds irrespective of the commodities exported (food, minerals, ores and metals, or fuel). Human development is also negatively associated with food and fuel import dependence.

The results of the study suggest that commodity import-dependence is an important dimension to consider when investigating the relationship between commodity dependence, growth and human development. As such, econometric studies that do not take this dimension into consideration omit an important aspect of dependence, which may result in an omitted variable bias.

Many CDDCs are doubly hurt by commodity dependence as they are both commodity-export and import-dependent. The negative association between commodity dependence and human development suggests that CDDCs should reduce their vulnerability to primary commodity markets in order to improve their human development. This may imply long-term strategies, including diversification away from primary commodities. It is surprising that despite the rhetoric about the need for economic diversification and structural transformation over the past decades (e.g. AfDB, 2013), CDDCs have not, generally, reduced their commodity dependence. This may have limited the benefits accruing to resource-abundant economies. For example, even though most African countries experienced high levels of economic growth during the commodity price boom of the 2000s, many failed to embark on an inclusive and broad-based sustainable development path. For these economies, there is a need to revisit development policies, for example by promoting value addition policies based on linkage development strategies (Morris and Fessehaie, 2014).

Reducing countries' dependence on commodities also implies devising strategies to reduce the adverse impacts of volatile commodity prices on CDDCs, such as the adoption of risk mitigation instruments. However, to be effective, these strategies should be country or sector-specific. Recent research shows that agricultural commodity exports are more prone to idiosyncratic risk whereas minerals and metals are generally more sensitive to global risk (Nkurunziza and Tsowou, 2015). This implies that, for example, to reduce commodity export dependence and its negative effects on human development, exporters of agricultural commodities should diversify towards other unrelated commodities. In contrast, minerals exporters would benefit by diversifying vertically given that adding new mineral products to their export basket would expose them to the same market risk.

The persisting negative link between commodity dependence and development across developing countries remains evident, even after a decade-long commodity price boom that permitted most of them to record high economic growth. This suggests that more analysis combining economic and institutional factors is needed to help understand the persistence of the problem.

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