UNITED NATIONS CONFERENCE ON TRADE AND DEVELOPMENT

Background document to the Commodities and Development Report 2021

Commodity dependence, productivity and structural change

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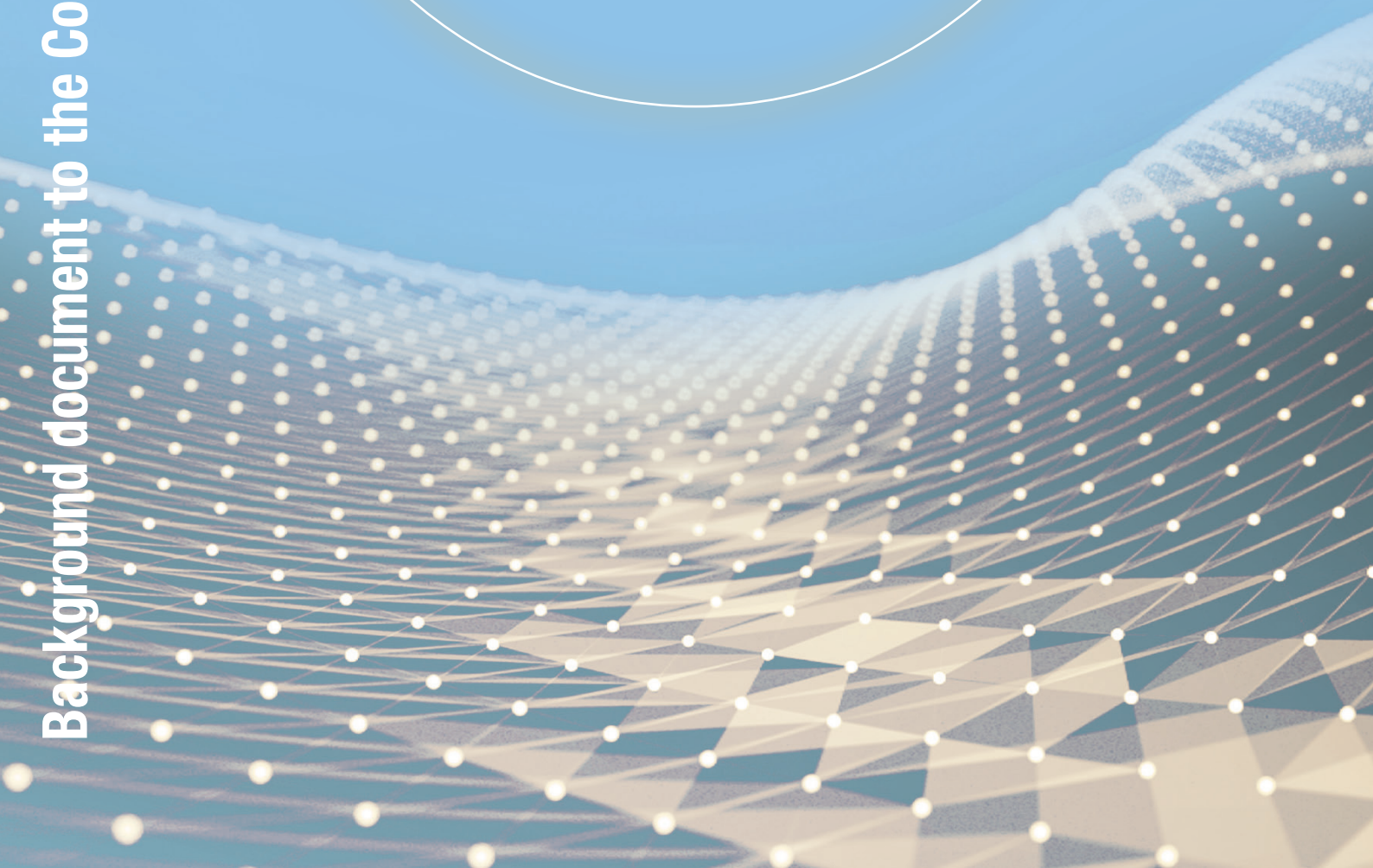

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Abstract

This paper explores the links between commodity dependence, labour productivity trends and structural change. It shows that commodity dependence is associated with low levels of labour productivity, slow productivity growth and a high frequency of negative productivity shocks. Structural change in commodity dependent developing countries (CDDCs) has been characterized by a shift of employment shares from agriculture towards non-tradable sectors at the lower end of the productivity spectrum, which raises questions about the long-term viability of the current structural change path in these countries. Empirical analyses of disaggregated productivity data suggest that commodity dependence is primarily linked to lower productivity growth in the manufacturing sector. Hence, commodity dependence can be an impediment in developing countries aiming to industrialize on the way to achieving the Sustainable Development Goals. The paper shows that in there is ample scope for aggregate labour productivity growth in CDDCs through both intrasectoral productivity gains and structural change. Technological development and innovation can play important roles in this context.

1. Introduction

This background paper analyzes the connections between commodity dependence, labour productivity trends and structural change in commodity-dependent developing countries (CDDCs). Improvements in labour productivity are a key source of economic growth and thus closely linked to the overall development process in low and middle-income countries. In particular, labour productivity growth can be a long-run driver of rising real wages and improving living standards in developing countries. The importance of labour productivity growth for the development process is reflected by its inclusion in the Sustainable Development Goals (SDGs) framework: target 8.2 aims to "achieve higher levels of productivity of economies through diversification, technological upgrading and innovation, including through a focus on high value added and labour-intensive sectors" and indicator 8.2.1 is the annual growth rate of real GDP per employed person, as noted in resolution 71/313 of the General Assembly.[1] As the target stipulates, diversification and technological development play crucial roles for labour productivity growth.

The growth of economy-wide labour productivity can be driven by productivity growth within individual sectors and/or by productivity-enhancing structural change, *i.e.,* a reallocation of production factors from sectors with lower productivity to sectors with higher productivity.[2] In this context, technological upgrading and innovation can be important drivers of within-sector labour productivity growth. Structural change is particularly relevant for labour productivity growth when there are large differences in productivity levels across sectors. Such intersectoral productivity differences tend to be highest in low-income countries, where agriculture is typically the least productive sector, but employs large shares of the labour force.

Starting from the observation that CDDCs exhibit lower average levels of labour productivity growth than other country groups, a key question addressed in this study is whether commodity dependence acts as an inhibitor to the within-sector component, the structural change component or both components of labour productivity growth. This is a question of significant practical relevance for policymakers in CDDCs. For example, if commodity dependence is a drag on growth-enhancing structural change, policy interventions should focus on facilitating the flow of production factors from low-productivity to higher-productivity sectors. However, if commodity dependence weighs down within-sector productivity growth, policies that induce such growth at the sectoral level need to be strengthened. Finally, if commodity dependence is a drag on both components, a policy mix will be needed.

As shown in this study, commodity dependence is associated with low levels of labour productivity, slow productivity growth, high volatility in productivity growth and a high frequency of negative productivity shocks. The empirical evidence suggests the link between commodity dependence and stunted productivity growth is particularly strong in the manufacturing sector. Furthermore, there is an association between technology development and labour productivity growth across sectors. Overcoming commodity dependence can strengthen the role of the manufacturing sector as a driver of economic growth and productive employment, which can, directly and indirectly, contribute to the achievement of the SDGs. Technological upgrading and innovation can play important roles in the diversification process.

The study has five sections, as follows: in section 2, labour productivity trends are analysed through the lens of commodity dependence; in section 3, the patterns of structural change in CDDCs since 1995 are highlighted; in section 4, sectoral productivity trends and drivers and their relationship with commodity dependence and technological development are examined; and in section 5, a summary and conclusions are provided.

2. Labour productivity trends in commodity dependent developing countries

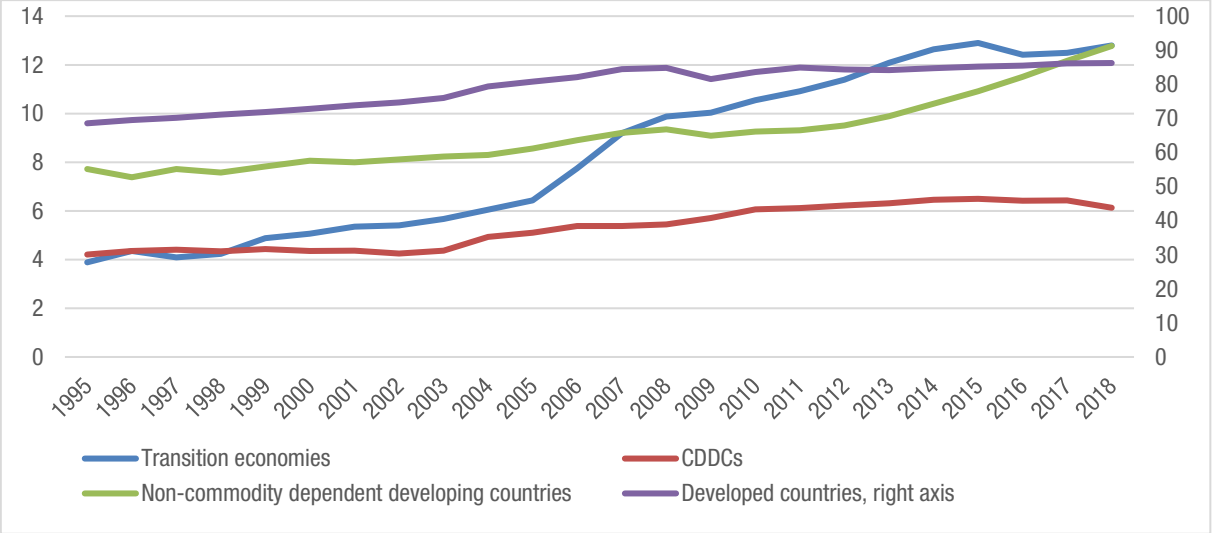
Labour productivity is defined as output per unit of labour. It is therefore calculated by dividing total output by the number of workers or the number of work hours in a given period. National GDP, value added generated by an economic sector

[1] The growth rate of labour productivity was also an indicator of MDG 1 ("Eradicate extreme poverty and hunger").
[2] Either of these components can, of course, also impact negatively on aggregate labour productivity.

or value added generated by an individual firm can each act as a proxy for output. Aggregate labour productivity is defined as the labour productivity of the economy as a whole, that is, GDP per worker.[3]

In the period 1995-2018, the median labour productivity in CDDCs was substantially below the median observed in non-CDDCs and developed countries (figure 1).[4] Labour productivity in transition economies exceeded that of CDDCs from 1999 onwards, with a rapidly widening gap. The difference between median labour productivity in CDDCs and all other country groups was significantly larger in 2018 than in 1995 implying that while labour productivity increased remarkably in other country groups, CDDC progress was muted. Indeed, labour productivity in CDDCs was virtually stagnant from 1995 until the onset of the commodity price boom in 2003 and the compound annual growth rate of the median labour productivity of CDDCs from 1995 to 2002 was only 0.1 per cent. This rate increased to 4.3 per cent in the boom period in 2003–2011, after which growth levelled off, and the rate was negative in 2012–2018. During the boom period, labour productivity growth in CDDCs was primarily fuelled by an accelerated flow of workers out of the agricultural sector towards non-farm employment in higher-productivity sectors and, to a lesser extent, by labour productivity growth within services sectors. The majority of workers exiting the agricultural sector moved to the construction sector and relatively low-productivity services sectors. In particular, the construction sector in CDDCs benefited from increased spending on infrastructure and significant investments in mining undertaken during the boom period (World Bank, 2015).

Figure 1. Median labour productivity
(Thousands of constant 2010 dollars)

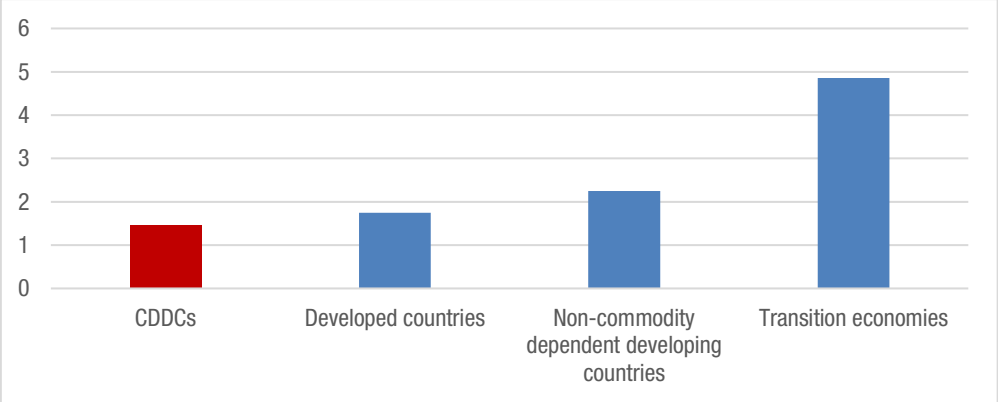


Source: UNCTAD calculations, based on data from Dieppe and Matsuoka, 2020, and the UNCTADstat database.
Notes: Transition economies, developing countries and developed countries are defined as in the UNCTADstat database. CDDCs are defined as developing countries with an average share of primary commodities in total merchandise exports greater than 60 per cent in 1995–2018. The data set covers 166 economies in 1995–2018 (see annex, table A1).

In 1995–2018, the average annual growth rate of labour productivity in CDDCs was 1.5 per cent, lower than in developed countries, at 1.7 per cent; non-commodity dependent developing countries, at 2.3 per cent; and transition economies, at 4.9 per cent (figure 2). Therefore, combined with a low initial level of labour productivity, slow productivity growth has been widening the productivity gap between CDDCs and other country groups.

[3] In this paper, the term "labour productivity" refers to aggregate labour productivity unless specified otherwise.
[4] Throughout the paper, medians are used for country groups when the indicator reflects a level (e.g., labour productivity in dollars) and averages when the indicator is a percentage figure (e.g., growth rate of labour productivity).

Figure 2. Average annual growth rate of labour productivity, 1995–2018
(Percentage)

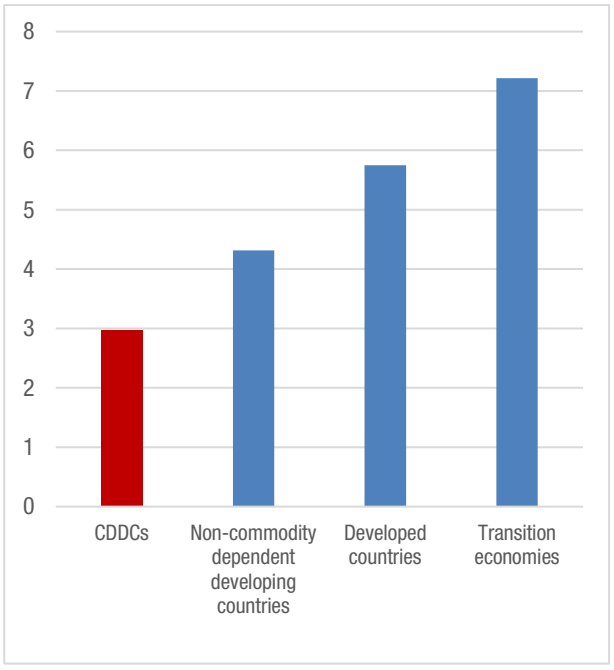


Source: UNCTAD calculations, based on data from Dieppe and Matsuoka, 2020, and the UNCTADstat database.

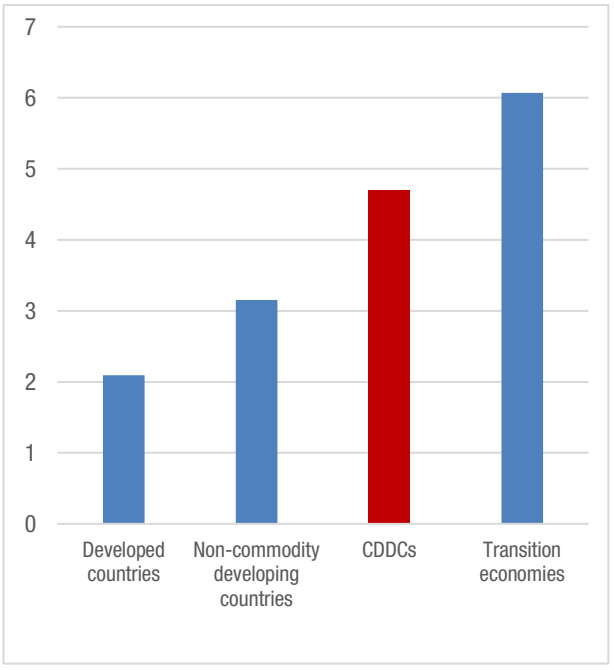
In addition to experiencing slower labour productivity growth, CDDCs have also experienced negative productivity shocks at a greater frequency than other country groups. In 1995–2018, these countries experienced negative aggregate labour productivity growth on average once every three years, significantly more frequently than non-commodity dependent developing countries, at 4.3 years; developed countries, at 5.8 years; and transition economies, at 7.2 years (figure 3, panel (a)). Labour productivity growth in CDDCs was also more volatile than in non-commodity dependent developing countries and in developed countries, but less volatile than in transition economies (figure 3, panel (b)).

Figure 3. Labour productivity, 1995–2018
(Years)

a) Average interval between occurrences of productivity growth



(b) Average standard deviation of negative labour annual growth rate of labour productivity



Source: UNCTAD calculations, based on data from Dieppe and Matsuoka, 2020, and the UNCTADstat database.

As shown in this section, in 1995–2018, in terms of aggregate labour productivity, CDDCs lagged behind other country groups, including non-commodity dependent developing countries. Furthermore, commodity dependence was associated with comparatively low levels of labour productivity growth, a greater frequency of negative productivity shocks and an elevated volatility in productivity growth.

3. Structural change in commodity dependent developing countries

Aggregate productivity trends are determined by productivity trends within individual sectors and by changes in the structural composition of an economy. To explain the aggregate productivity trends in CDDCs highlighted in section 2, it is therefore necessary to examine the structures of their economies. The structure of an economy can be described by the relative weights of its individual sectors, typically expressed as the share of value added or employment but which may also be expressed as the share of final consumption; the evolution of these shares over time is referred to as structural change. Developed countries underwent profound structural change along their development paths, which featured similar patterns of industrialization followed by an expansion of the weight of services in value added and employment (Herrendorf et al., 2013). Developing countries have also experienced structural change, but its depth and contribution to economic growth has varied substantially across countries since 1990 (McMillan et al., 2017). Structural change characteristics in CDDCs in 1995–2017 are highlighted in this section using a data set that disaggregates an economy into the nine sectors shown in table 1.[5]

Table 1. Sectoral disaggregation of labour productivity

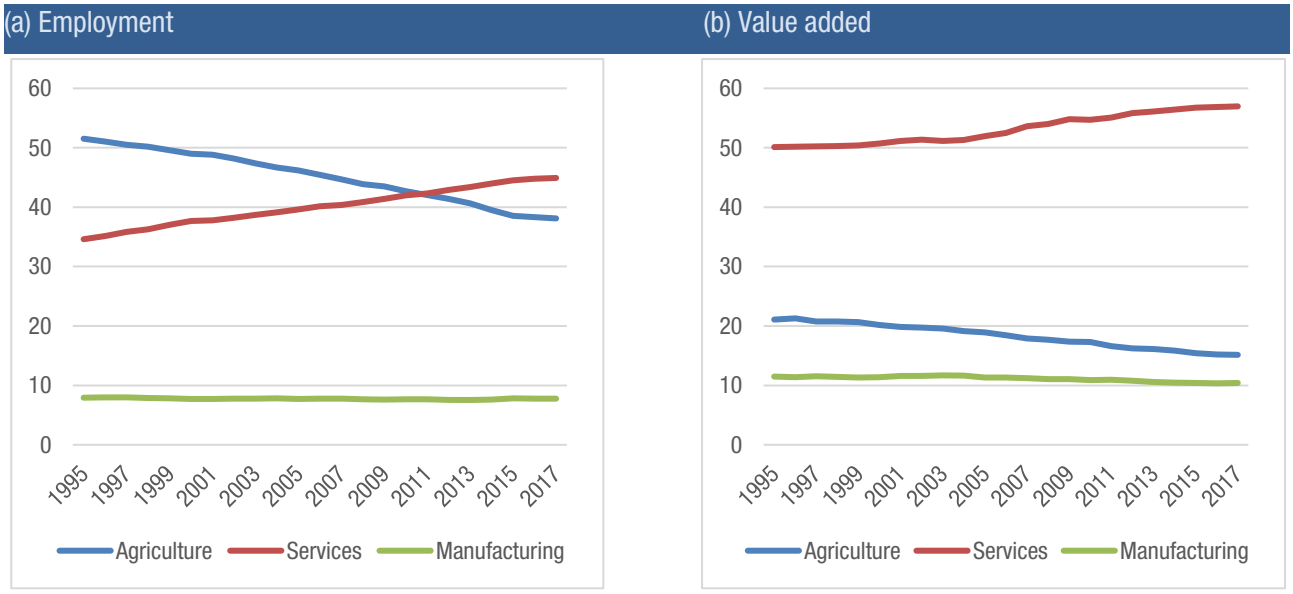
Sector	Description
Agriculture	Agriculture, forestry, and fishing
Mining	Mining and quarrying
Manufacturing	Manufacturing
Utilities	Electricity, gas, steam and air conditioning supply
Construction	Construction
Trade services	Wholesale and retail trade; repair of motor vehicles and motorcycles; Accommodation and food service activities
Transport services	Transportation and storage; Information and communication
Financial and business services	Financial and insurance activities; Real estate activities; Professional, scientific and technical activities; Administrative and support service activities
Other services	Public administration and defense; compulsory social security; Education; Human health and social work activities; Arts, entertainment and recreation; Other service activities; Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use; Activities of extraterritorial organizations and bodies

Source: UNCTAD, based on Dieppe and Matsuoka, 2020.

In 1995–2017, structural change in CDDCs was characterized by a steady flow of labour out of the agricultural sector and into services (figure 4, panel (a)). The average share of the agricultural sector in total employment decreased from 51.5 per cent in 1995 to 38.1 per cent in 2017. In the same period, the average share of services increased from 34.6 to 44.9 per cent. The average share of manufacturing remained almost constant, from 7.9 per cent in 1995 to 7.8 per cent in 2017. In CDDCs, shares of value added showed similar trends as shares of employment (figure 4, panel (b)). In 1995–2017, the average share of agriculture in total value added decreased from 21.1 to 15.1 per cent. In the same period, the average share of services increased from 50.1 to 57.0 per cent and the average share of manufacturing decreased by 1.1 percentage points, from 11.5 to 10.4 per cent.

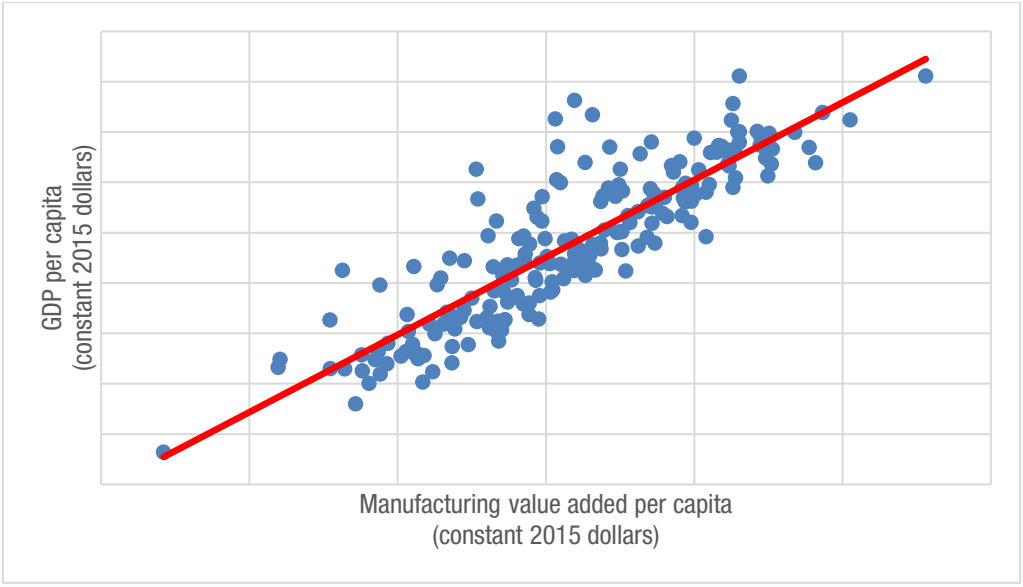
[5] The empirical analyses in this section and section 4 are based on a dataset that incorporates sectoral productivity data from the World Bank (Dieppe and Matsuoka, 2020), trade data from the UNCTADStat database as well as a range of indicators from the Penn World Tables (Feenstra et al., 2015), the World Development Indicators database and the International Telecommunications Union. This dataset covers the period 1995-2017 for 94 countries that represent more than 90 per cent of global GDP and more than 85 per cent of the global population, according to data on GDP in 2019 (purchasing power parity) from International Monetary Fund's World Economic Outlook (October 2020) and data on the global population in 2019 from the United Nation's World Population Prospects database.

Figure 4. Commodity dependent developing countries: Average sectoral shares
(Percentage)



Source: UNCTAD calculations, based on data from Dieppe and Matsuoka, 2020, and the UNCTADstat database.

Figure 5. Manufacturing and output linkages, 2019
(Constant 2015 dollars)



Source: UNCTAD calculations, based on data from the United Nations Industrial Development Organization manufacturing value added 2020 database.
Notes: The data set includes all 208 economies in the database. The figure shows the natural logarithms of GDP per capita and value added per capita and a linear trendline.

These trends show that structural change in CDDCs did not follow a path of industrialization in 1995-2017. This suggests that CDDCs as a group are not moving towards the second target of SDG 9, which calls to "promote inclusive and sustainable industrialization and, by 2030, significantly raise industry's share of employment and gross domestic product, in line with national circumstances, and double its share in least developed countries."[6] It is important to note that the level of manufacturing value added per capita is closely linked to average income and therefore to a range of

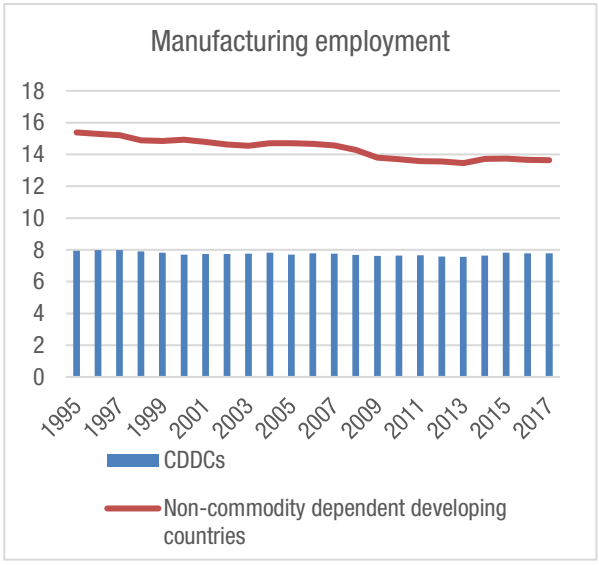
[6] The two indicators of SDG target 9.2, as noted in resolution 71/313 of the General Assembly, are manufacturing value added as a proportion of GDP and per capita; and manufacturing employment as a proportion of total employment.

other Goals, including Goal 1 on ending poverty and Goal 8 on promoting sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all (figure 5).

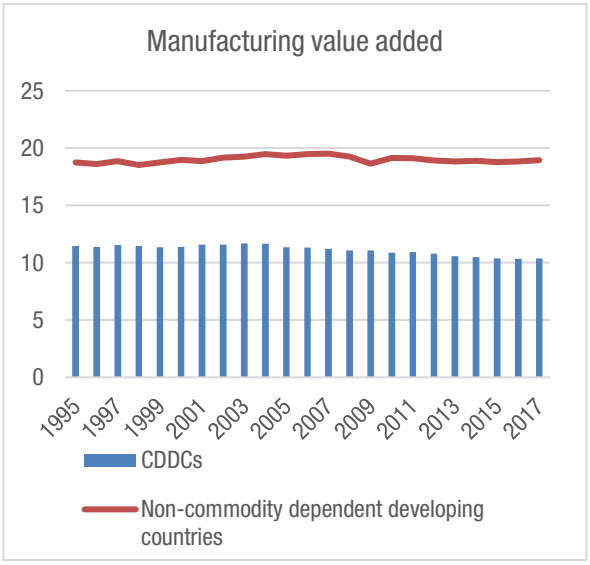
The weight of manufacturing in employment and value added in CDDCs has stagnated at levels far below those in non-commodity dependent developing countries (figure 6) and even further below the peak levels in developed countries (table 2).

Figure 6. Average share of manufacturing
(Percentage)

(a) Employment



(b) Value added



Source: UNCTAD calculations, based on data from Dieppe and Matsuoka, 2020, and the UNCTADstat database.

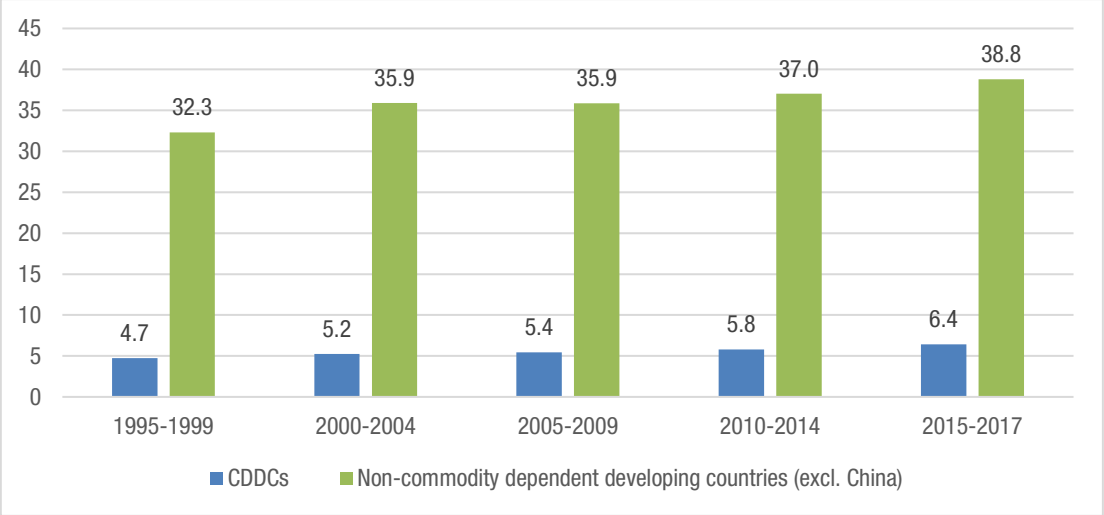
Table 2. Selected developed countries: Greatest share of manufacturing in total employment

	Share of manufacturing in total employment (per cent)	Year of highest share
Australia	24.7	1971
Canada	22.9	1970
Germany	35.8	1970
France	26.0	1973
Japan	26.2	1973
Republic of Korea	28.7	1989
United Kingdom	30.1	1971
United States	22.6	1970

Source: UNCTAD calculations, based on data from the structural analysis database of the Organisation for Economic Co-operation and Development.
Notes: Germany refers to the former Federal Republic of Germany. Manufacturing employment data is not available for the United Kingdom for 1970.

CDDCs also lag substantially behind non-commodity dependent developing countries in terms of the share of global manufacturing employment, with a gap that widened from 27.6 percentage points in 1995 to 32.4 percentage points in 2017 (figure 7). Given the crucial role of the manufacturing sector in the development process (see Haraguchi et al., 2017, Rodrik, 2013, Rodrik, 2016, and Szirmai, 2012), this indicates an important policy challenge for CDDCs.

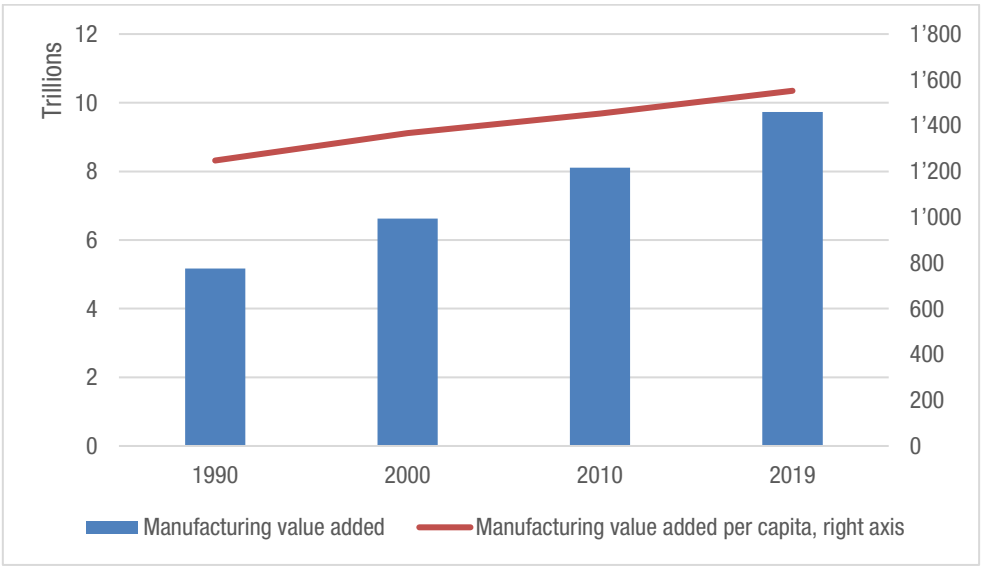
Figure 7. Share of global manufacturing employment
(Percentage)



Source: UNCTAD calculations, based on data from Dieppe and Matsuoka, 2020, and the UNCTADstat database.
Note: Data for non-commodity dependent developing countries excludes China, the country with the greatest number of manufacturing jobs, since the inclusion of this data would show an even wider gap and a greater increase in the gap in 1995–2017.

It is important to note that the manufacturing sector continues to expand at the global level and can thus still be an engine of growth for developing countries, including CDDCs. Global manufacturing value added increased in terms of both level and per capita in 1990–2019, even when data for China is excluded (figure 8).

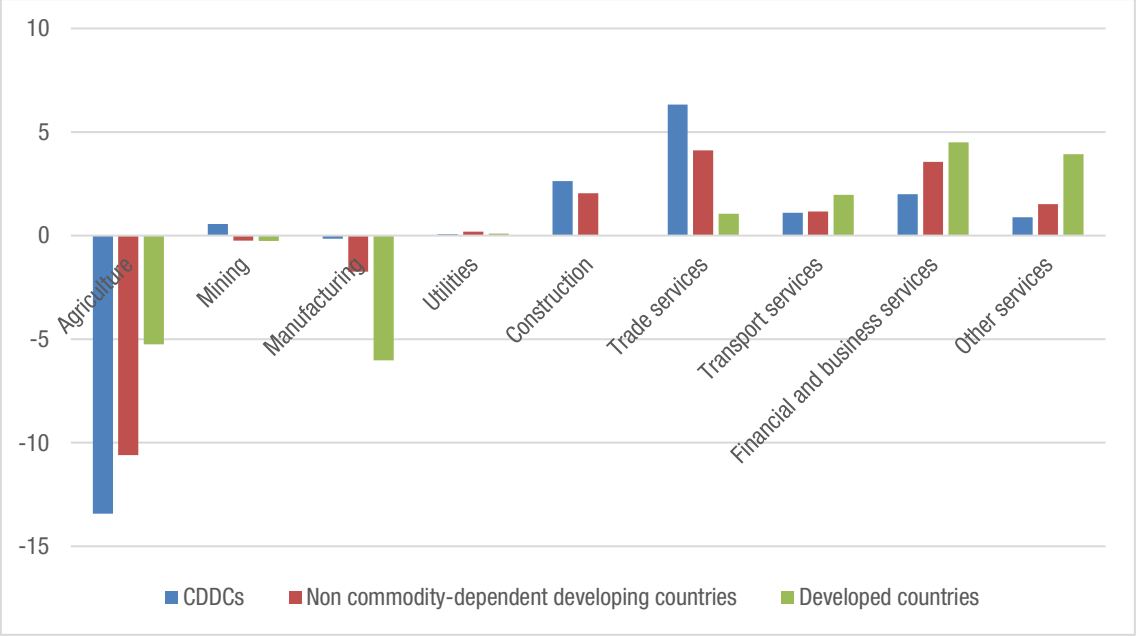
Figure 8. Global manufacturing value added
(Constant 2015 dollars)



Source: UNCTAD calculations, based on data from the United Nations Industrial Development Organization manufacturing value added 2020 database.
Note: Data for manufacturing value added excludes China, the country with the greatest manufacturing output.

In CDDCs, the majority of labour that has left the agricultural sector has moved to trade services (wholesale and retail trade; repair of motor vehicles and motorcycles; accommodation and food service activities) and to construction (figure 9). In 1995–2017, among all sectors, the trade services sector had the greatest increase in employment share. In 2017 in CDDCs, among all services sectors, the trade services sector had the greatest average share of total employment, at 19.3 per cent, and of employment in services, at 43.0 per cent.

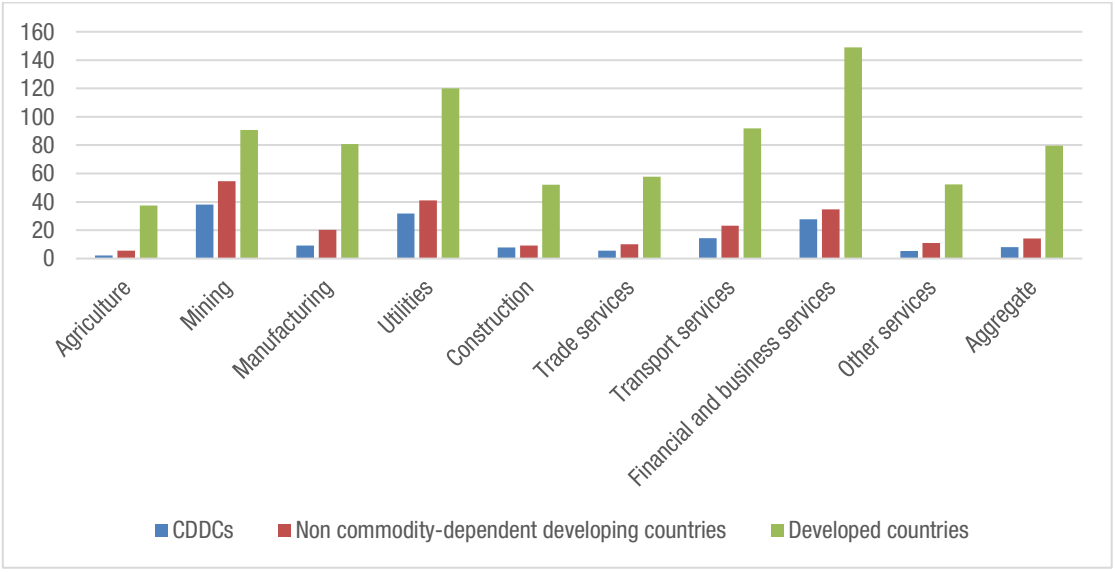
Figure 9. Change in average sectoral employment share, 1995–2017
(Percentage points)



Source: UNCTAD calculations, based on data from Dieppe and Matsuoka, 2020, and the UNCTADstat database.

A common feature of the construction and trade services sectors is their position at the lower end of the productivity spectrum not only in CDDCs but also in developed countries (figure 10). Hence, structural change in the former has disproportionately favoured sectors that appear to have less potential for future productivity growth compared with the manufacturing and other market services sectors. Furthermore, the difference in productivity levels between CDDCs and developed countries is lower in trade services than in all other services sectors except other services (non-market services). This limits the potential for productivity gains through convergence effects, which help lower-productivity economies to catch up with higher-productivity economies and appear to be present in many sectors, including in services (International Monetary Fund, 2018). Furthermore, in CDDCs, employment shares have shifted largely towards non-tradable sectors in which the potential for future expansion is limited to domestic demand.

Figure 10. Median labour productivity levels, 2017
(Thousands of constant 2010 dollars)



Source: UNCTAD calculations, based on data from Dieppe and Matsuoka, 2020, and the UNCTADstat database.

There are two additional observations with regard to sectoral labour productivity levels in CDDCs.

First, the sector with the highest median labour productivity level in CDDCs is mining. However, the potential of this sector to contribute to aggregate labour productivity growth is limited since it generally does not employ many workers and often operates as an enclave with few linkages to other sectors. For example, in Zambia in 2017, the mining sector accounted for 80 per cent of exports but only 2.2 per cent of total employment. The employment share of mining in OECD member States with large mining sectors, such as Australia and Chile, were in a similar range in 2017, at 1.8 and 2.4 per cent of total employment, respectively. In addition, sectoral differences between median labour productivity levels in CDDCs and developed countries is lowest in the mining sector. This could perhaps be explained by the global presence of large international mining companies that apply similar, capital-intensive technologies at mining sites in different countries.

Second, the sector with the second highest median labour productivity level in CDDCs is utilities. This sector also does not have the capacity to absorb large numbers of workers. For example, in 2017, the average employment share of the utilities sector in developing countries and developed countries was 0.7 per cent and 1.4 per cent, respectively. These examples show that, while CDDCs stand to gain from across-the-board productivity increases, not all sectors have the same potential to absorb large numbers of workers in higher productivity and better paid jobs and thereby generate broad-based development benefits.

As shown in this section, CDDCs as a group have not followed a path of industrialization since 1995. Instead, the shares of manufacturing in employment and value added have peaked at significantly lower levels than in non-commodity dependent developing countries and developed countries. Structural change in CDDCs has been characterized by a shift of employment shares away from the agricultural sector. Since labour productivity in agriculture remains low in these countries, any flow out of this sector results in productivity-enhancing structural change. However, employment shares have moved primarily towards non-tradable sectors at the lower end of the productivity spectrum, which raises questions about the long-term viability of the structural change path.

4. Sectoral productivity trends and drivers in commodity dependent developing countries

The results of an empirical analysis of the links between labour productivity, commodity dependence and technological development are presented in this section. Based on the observation that aggregate productivity growth in CDDCs is lower than that in non-commodity dependent developing countries, the focus is on the identification of the sources of productivity growth that are stunted in the former and the sectors that are most affected. This requires separating aggregate productivity growth into its two components of intrasectoral productivity growth and structural change, then examining intrasectoral productivity growth in each sector separately.

The growth rate of economy-wide labour productivity can be disaggregated into its intrasectoral and structural change components as follows: [7]

$$\frac{\Delta Y_t}{Y_{t-1}} = \sum_i \frac{\theta_{i,t-1}}{Y_{t-1}}(y_{i,t} - y_{i,t-1}) + \sum_i \frac{y_{i,t}}{Y_{t-1}}(\theta_{i,t} - \theta_{i,t-1}) \quad (1)$$

With Y and y_i being economy-wide labour productivity and labour productivity in sector i, respectively, and subscript t denoting the period. θ_i refers to the share of sector i in total employment. The first term on the right-hand side of equation 1 is the weighted sum of intrasectoral labour productivity changes where the weights correspond to the sectors' employment shares. The second term represents the aggregate productivity change that is due to sectoral reallocation of labour; thus, it is the weighted sum of changes of employment shares, where the weights are the sectors' labour productivities. The results of the disaggregation described in equation (1) are shown in table 3.

[7] There are different ways of disaggregating economy-wide productivity changes and computing average growth rates over time. Here the method used in Diao et al. (2017) is followed.

Table 3. Disaggregated labour productivity growth

	Average labour productivity growth rate 1995-2017	Intrasectoral component	Structural change component
CDDCs	1.8%	0.8%	1.0%
Non-commodity dependent developing countries	2.3%	1.7%	0.6%
Developed countries	1.6%	1.3%	0.3%
Full sample	1.9%	1.3%	0.6%

Source: UNCTAD calculations, based on data from Dieppe and Matsuoka, 2020, and the UNCTADstat database.
Notes: Labour productivity growth rates are based on real value added in constant 2010 prices. The figures in column 1 differ from the figures in section 2 since the latter are based on a data set covering more countries and an additional year.

The results show that aggregate labour productivity growth in CDDCs was slower than in non-commodity dependent developing countries, which concurs with the findings analysed in section 2. Structural change contributed more to overall productivity growth in CDDCs s than in non-commodity dependent developing countries and developed countries. This is primarily because in the former, a greater share of labour shifted away from the agricultural sector, which is typically the least productive sector. It is important to note that agriculture in these countries accounted for substantially greater average employment shares than in other country groups at the start of and throughout the period 1995–2017. For example, in 1995, the average share of employment in the agricultural sector was 51.5 per cent in CDDCs and 31.8 per cent in non-commodity depending developing countries. Average intrasectoral productivity growth rates in non-commodity dependent developing countries were more than twice as great as those in CDDCs and intrasectoral productivity growth in the latter was outpaced by that in developed countries. Furthermore, labour productivity in non-commodity dependent developing countries grew faster than the global average, while the opposite was observed in CDDCs.

The decomposition results above are the starting point for further analysis. In order to examine the link between commodity dependence and intrasectoral labour productivity growth at a more disaggregated level, a series of regressions is carried out where the growth of labour productivity within individual sectors in the period 1995-2017 are the dependent variables. This allows to investigate whether commodity dependence has a uniform or heterogenous impact on intrasectoral labour productivity growth:

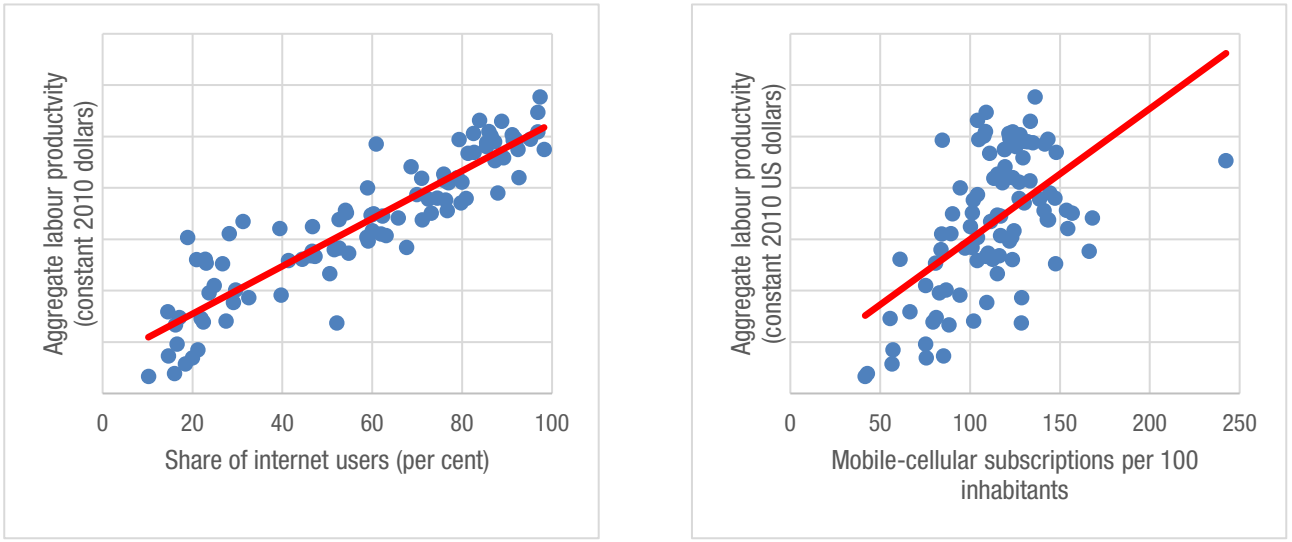
$$GR_{ij} = \beta_0 + \beta_1 CS_i + \beta_2 X_i + v_i \qquad (2)$$

where GR_{ij} is the average annual growth rate of labour productivity of sector j in country i in1995-2017.[8] CS_i is the average annual share of primary commodities in total merchandise exports; and X_i is a set of control variables. The control variables include the average human capital index, the average annual share of gross capital formation in GDP, the average annual population growth rate and the natural logarithm of the initial level (i.e. the level in 1995) of labor productivity in sector j measured in constant 2010 dollars. Since there is a strong positive correlation between indicators of technological development and aggregate labour productivity (figure 11), the average share of the population that uses the internet and, alternatively, the number of mobile-cellular subscriptions per 100 inhabitants are included in the regressions as proxies for the former. Table 4 shows descriptive statistics for the main variables included in the regression as well as their sources.

[8] Using the compound annual growth rate as dependent variable does not change the results.

Figure 11. Average aggregate labour productivity and indicators of technological development, 2015–2017

(a) Internet use (b) Mobile cellular use



Source: UNCTAD calculations, based on data from Dieppe and Matsuoka, 2020, the International Telecommunication Union and the UNCTADstat database.
Note: The y axes show the natural logarithm of aggregate labour productivity.

Table 4. Descriptive statistics and sources of main variables

Indicator	Description	Mean	Standard deviation	Number of observations	Data source
Commodity dependence	Share of primary commodities, precious stones and non-monetary gold in total merchandise exports (percentage)	46.40	29.7	2 162	UNCTADstat database
Technological development 1	Share of population using the Internet (percentage)	30.63	30.15	2 110	World Development Indicators database
Technological development 2	Number of mobile cellular subscriptions per 100 inhabitants	64.08	50.29	2 130	World Development Indicators database
Human capital	Human capital index based on years of schooling and returns to education	2.62	0.66	2 116	Penn World Table, version 9.1
Investment	Average annual share of gross capital formation in GDP (percentage)	24.16	6.37	2 047	World Development Indicators database
Population growth	Average annual growth rate	1.22	1.39	2 139	World Development Indicators database

Source: UNCTAD.
Note: Primary commodities, precious stones and non-monetary gold are those referred to by United Nations standard international trade classification 0 + 1 + 2 + 3 + 4 + 68 + 667 + 971.

Technological development is expected to be positively associated with productivity growth. Likewise, a higher level of human capital and higher shares of gross capital formation in GDP, which is a measure of physical investment, are expected to be associated with higher labour productivity growth. Population growth could be negatively related to labour productivity growth since the latter is a per capita measure. Finally, if there is conditional convergence at the sectoral level, countries with a lower initial labour productivity level are expected to have higher labour productivity growth rates. Table 5 summarize the regression results.

Table 5. Results of linear regressions

	1	2	3	4	5	6	7	8	9
	Agriculture	Mining	Manufacturing	Utilities	Construction	Trade services	Transportation services	Financial and business services	Other services
Commodity share	0.007 (0.465)	0.023 (0.681)	-0.023*** (0.001)	-0.001 (0.963)	0.008 (0.425)	-0.008 (0.303)	-0.000 (0.959)	-0.009 (0.258)	-0.014** (0.039)
Technological development	0.048* (0.068)	0.126** (0.042)	0.039** (0.029)	0.127** (0.022)	0.032 (0.271)	0.066*** (0.004)	0.031* (0.066)	0.067*** (0.001)	0.039** (0.027)
Human capital	-0.130 (0.848)	-2.557 (0.329)	1.424** (0.020)	-1.808 (0.220)	1.922** (0.043)	1.110* (0.057)	0.544 (0.310)	0.915 (0.279)	0.153 (0.765)
Investment	0.011 (0.804)	-0.240 (0.266)	0.135*** (0.000)	0.136 (0.163)	0.144** (0.045)	0.136*** (0.001)	0.128*** (0.001)	0.063 (0.255)	0.110** (0.035)
Initial labour productivity level	-0.609* (0.071)	-3.152*** (0.000)	-1.088*** (0.000)	-2.479*** (0.006)	-1.295*** (0.003)	-1.642*** (0.000)	-1.331*** (0.000)	-1.947*** (0.000)	-1.469*** (0.000)
Population growth	-0.725*** (0.006)	-1.162 (0.229)	-0.337* (0.057)	0.160 (0.578)	0.057 (0.878)	-0.354 (0.187)	-0.066 (0.697)	0.416 (0.321)	0.085 (0.646)
Countries	90	90	90	90	90	90	90	90	90
R^2	0.18	0.22	0.62	0.34	0.25	0.50	0.43	0.43	0.50

Notes: *, **, *** denote coefficients that are statistically significant at the 90 per cent, 95 per cent and 99 per cent levels, respectively. "Technological development" corresponds to the share of internet users per 100 inhabitants.

The results in Table 5 show that commodity dependence is primarily linked to lower labour productivity growth in the manufacturing sector. There is also a weaker but statistically significant negative association with productivity growth in non-market services (other services).[9] The measures of technological development, human capital and investment show a statistically significant positive association with labour productivity growth in the manufacturing sector, while the estimated coefficient of the initial level of labour productivity is negative and statistically significant. For the other sectors, there is a robust, statistically highly significant negative association between the initial level of labour productivity and labour productivity growth in all sectors except agriculture, where the statistical significance of the association is low. This suggests that there was broad-based conditional convergence, albeit at different rates, in the period 1995-2017. This finding complements results of a study by the International Monetary Fund (2018) that found evidence of an unconditional convergence of productivity levels in most sectors but not in agriculture. The link between technological development, human capital, and investment, on the one hand, and labour productivity growth, on the other hand, is not homogeneous across sectors. This suggests that, while broad-based investments in education, technology and infrastructure are likely to yield aggregate productivity gains, their impact may be maximized if sector-specific challenges and opportunities are taken into account. Such targeted measures could, for example, consist of developing the specific skills required for employment in emerging manufacturing and services sectors.

Based on the finding that commodity dependence is primarily linked to lower labour productivity growth in the manufacturing sector, the next step of analysis consists in zooming in more this relationship. To this end a dynamic panel data model is estimated as follows:

$$GR\_man_{i,t} = \beta_0 + \beta_1 LP_{i,t-1} + \beta_2 CS_{i,t} + \beta_3 X_{i,t} + v_{i,t} \quad (3)$$

with the error term $v_{i,t} = \mu_i + u_t + \varepsilon_{i,t}$ where μ_i is a country-specific effect, u_t a time effect, and $\varepsilon_{i,t}$ an idiosyncratic error term. To smooth out short-term fluctuations, we take non-overlapping 3-year averages of all variables.[10] $GR\_man_{i,t}$ is the average annual growth rate of labor productivity in the manufacturing sector of country i over period t; $LP_{i,t-1}$ is the average level of manufacturing labour productivity of country i in period t-1 (measured in constant 2010 dollars). The latter term is introduced to capture convergence effects. $CS_{i,t}$ is the average share of primary commodities in total merchandise exports of country i in period t; and $X_{i,t}$ is a set of control variables. The control variables include the period-to-period changes of the average percentage of population using the internet and the average of the human capital index, the average share of gross capital formation in GDP and average population growth. Equation (3) is estimated with the one-step system-GMM estimator (Blundell & Bond, 1998), and the results are summarized in table 6 below.[11]

The results of the dynamic panel data model confirm those obtained from the cross-sectional analysis. Higher shares of commodities in exports are associated with lower growth of labour productivity in the manufacturing sector. Furthermore, there is a statistically significant positive link between growth of labour productivity in manufacturing and technological development and investments in human and physical capital. The estimated coefficient of the lagged labour productivity level is negative but not statistically significant; this could mean that the pace of the convergence effects that were identified in the cross-sectional regression is not fast enough to be detectable between the 3-year periods of the panel regression.

As shown in this section, commodity dependence can be an impediment in developing countries aiming to industrialize on the way to achieving the SDGs. A positive message for CDDCs is that there is ample scope for labour productivity growth in both of its components. The significant distance of the productivity levels in virtually all sectors in these countries to the global productivity frontier represents significant potential for aggregate productivity growth through intrasectoral productivity gains. Similarly, the significant productivity differences across sectors in these countries highlight the potential of structural change to contribute to aggregate productivity growth.

[9] As a robustness check, equations (2) have also been jointly estimated using the Seemingly Unrelated Regression Equations (SURE) framework (Zellner, 1962), which yields similar results.
[10] Since our dataset spans 23 annual observations (1995-2017), our final time period is averaged over 2 annual observations.
[11] As a robustness check, equation (3) has also been estimated with the two-step system-GMM estimator, which yields similar results.

Table 1. Results of system-GMM estimation

	Dependent variable: growth rate of manufacturing labour productivity
Commodity share	-0.049*** (0.002)
Technology development	0.077** (0.046)
Human capital	13.030*** (0.010)
Investment	0.168*** (0.000)
Population growth	-0.520*** (0.003)
Lagged labour productivity level	-0.025 (0.887)
Countries	90
AR(1)	0.000
AR(2)	0.972
Hansen test	0.466

Notes: *, **, *** denote coefficients that are statistically significant at the 90 per cent, 95 per cent and 99 per cent levels, respectively. P values are based on robust standard errors. AR(1) and AR(2) refer to the p values of the Arellano-Bond test of first and second order autocorrelation of the residuals, respectively.

5. Conclusions

The link between commodity dependence, labour productivity trends and structural change was examined in this study, showing that commodity dependence is associated with low levels of labour productivity, slow productivity growth and a high frequency of negative productivity shocks.

CDDCs have not followed a path of industrialization since 1995 and their levels of industrialization appear to have peaked at much lower shares of manufacturing in employment and value added than in non-commodity dependent developing countries and developed countries. Structural change in the former has been characterized by a shift of employment shares from agriculture towards construction and non-tradable services sectors. The greatest increase in absolute and relative employment was concentrated in low-productivity services such as retail and wholesale trade. Growth in these sectors is largely limited to the confines of the domestic economy and does not benefit from trade expansion. In addition, productivity growth through potential convergence in these sectors is limited since they are on the lower-productivity end and distant from the global productivity frontier. This raises questions about the sustainability of the current development path in these countries.

A positive view of the large gap between productivity levels in CDDCs and the global frontier is that it represents substantial potential for intrasectoral productivity growth. In addition, while the highest-productivity sectors in these countries, namely, mining and utilities, have limited potential to absorb labour, there are also substantial productivity differences between agriculture and manufacturing and between different services sectors, which represent substantial potential for aggregate productivity growth through structural change. Technological upgrading can play an important role in this process.

The empirical analysis suggests that commodity dependence is associated with lower levels of intrasectoral productivity growth in the manufacturing sector. This constitutes a policy challenge in CDDCs since the manufacturing sector plays an important role in the development process. For example, the manufacturing sector traditionally employs a significantly greater share of low-skilled workers than services (Hallward-Driemeier and Nayyar, 2018). Furthermore,

manufacturing creates tradable goods, so that the growth of manufacturing is not limited to the domestic market, which is relatively small in many CDDCs.

The manufacturing sector also tends to generate stronger backward and forward linkages, so that manufacturing growth can generate multiplier and spillover effects that benefit other sectors of the economy and aggregate growth. Sustainable industrialization, as aimed for under Goal 9, should therefore remain high on the agenda in many CDDCs. However, given the ongoing expansion of services sectors in these countries, it is also important to devise strategies that enhance services-led growth through, for example, its contribution to employment generation, technological development and economy-wide productivity gains.

The importance of diversifying production and export patterns in CDDCs and reducing commodity dependence is highlighted in this study. Strengthening broad-based drivers of labour productivity, including education, technology and infrastructure, are necessary in order to raise productivity levels across the board. However, horizontal policies need to be complemented by targeted measures that address sector-specific obstacles to productivity growth. For example, skills development programmes need to ensure that the flow of labour into higher-productivity sectors is not limited by a lack of workers with the appropriate skill set. Technological upgrading and innovation that spurs productivity growth within individual sectors should be enabled and promoted through the development of adequate infrastructure, including digital infrastructure.

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Annex

Table A1: Economies included in dataset for section 2

CDDCs	Non-commodity dependent developing economies	Developed countries	Transition economies
Afghanistan	Bahamas, The	Australia	Albania
Algeria	Bangladesh	Austria	Armenia
Angola	Bhutan	Belgium	Azerbaijan
Argentina	Brazil	Bulgaria	Belarus
Bahrain	Cabo Verde	Canada	Bosnia and Herzegovina
Belize	Cambodia	Croatia	Georgia
Benin	China	Cyprus	Kazakhstan
Bolivia (Plurinational State of)	Costa Rica	Czechia	Kyrgyzstan
Botswana	Dominican Republic	Denmark	Moldova
Burkina Faso	Egypt, Arab Republic	Estonia	Montenegro
Burundi	El Salvador	Finland	Russian Federation
Cameroon	Eswatini	France	Serbia
Central African Republic	Guatemala	Germany	Tajikistan
Chad	Haiti	Greece	Turkmenistan
Chile	Honduras	Hungary	Ukraine
Colombia	Hong Kong, China	Iceland	Uzbekistan
Comoros	India	Ireland	
Democratic Republic of the Congo	Indonesia	Italy	
Congo	Israel	Japan	
Côte d'Ivoire	Jordan	Latvia	
Ecuador	Republic of Korea	Lithuania	
Equatorial Guinea	Lebanon	Luxembourg	
Ethiopia	Lesotho	Malta	
Fiji	Liberia	Netherlands	
Gabon	Madagascar	New Zealand	
Gambia, The	Malaysia	Norway	
Ghana	Mauritius	Poland	
Guinea	Mexico	Portugal	
Guinea-Bissau	Morocco	Romania	
Guyana	Nepal	Slovakia	
Iran (Islamic Republic of)	Pakistan	Slovenia	
Iraq	Panama	Spain	
Jamaica	Philippines	Sweden	
Kenya	Samoa	Switzerland	
Kuwait	Singapore	United Kingdom	
Lao People's Democratic Republic	South Africa	United States of America	
Malawi	Sri Lanka		
Maldives	Saint Vincent and the Grenadines		

CDDCs	Non-commodity dependent developing economies	Developed countries	Transition economies
Mali	Thailand		
Mauritania	Tunisia		
Mongolia	Turkey		
Mozambique	Viet Nam		
Myanmar			
Namibia			
Nicaragua			
Niger			
Nigeria			
Oman			
Papua New Guinea			
Paraguay			
Peru			
Qatar			
Rwanda			
Saudi Arabia			
Senegal			
Seychelles			
Sierra Leone			
Solomon Islands			
Saint Lucia			
Sudan			
Suriname			
São Tomé and Principe			
United Republic of Tanzania			
Timor-Leste			
Togo			
Tonga			
Uganda			
United Arab Emirates			
Uruguay			
Vanuatu			
Zambia			
Zimbabwe			

Table A2: Economies included in dataset for sections 3-4

CDDCs	Non-commodity dependent developing economies	Developed countries	Transition economies
Argentina	Bangladesh	Australia	Russian Federation
Belize	Brazil	Austria	Serbia
Bolivia (Plurinational State of)	China	Belgium	
Botswana	Hong Kong, China	Bulgaria	
Burkina Faso	Costa Rica	Canada	
Cameroon	Dominican Republic	Croatia	
Chile	Egypt	Cyprus	
Colombia	Eswatini	Czechia	
Ecuador	Honduras	Denmark	
Ethiopia	India	Estonia	
Fiji	Indonesia	Finland	
Ghana	Jordan	France	
Iran (Islamic Republic of)	Lesotho	Germany	
Jamaica	Malaysia	Greece	
Kenya	Mauritius	Hungary	
Lao People's Democratic Republic	Mexico	Iceland	
Malawi	Morocco	Ireland	
Mongolia	Pakistan	Italy	
Mozambique	Philippines	Japan	
Namibia	Republic of Korea	Latvia	
Nigeria	Singapore	Lithuania	
Paraguay	South Africa	Luxembourg	
Qatar	Sri Lanka	Netherlands	
Rwanda	Saint Vincent and the Grenadines	New Zealand	
Saint Lucia	Taiwan Province of China	Norway	
Senegal	Thailand	Poland	
Uganda	Turkey	Portugal	
United Republic of Tanzania	Viet Nam	Romania	
Zambia		Slovakia	
		Slovenia	
		Spain	
		Sweden	
		Switzerland	
		United Kingdom	
		United States of America	


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