United Nations TD/B/C.I/MEM.2/46

United Nations Conference on Trade and Development

Distr.: General
4 February 2019

Original: English

Trade and Development Board
Trade and Development Commission
Multi-year Expert Meeting on Commodities and Development
Eleventh session
Geneva, 15 and 16 April 2019
Item 4 of the provisional agenda

Managing commodity price risk in commodity-dependent developing countries

Note by the UNCTAD secretariat

Executive summary

This background note reviews risks faced by commodity-dependent developing countries and highlights various instruments that are available to manage those risks. The analysis focuses on commodity price risk and weather-related risks as key sources of socioeconomic volatility, shock and stress. There are a range of instruments and strategies that can be used to mitigate risks emanating from the commodity sector. These include financial instruments to hedge commodity price risk, fiscal buffers to absorb shortfalls in commodity revenue and commodity-linked bonds to reduce the risk of debt distress in the wake of commodity price shocks. Local commodity exchanges can also provide risk management services to commodity producers and traders. Furthermore, index-based weather insurance schemes can help protect smallholder farmers from weather-related risks. It is important to note that there is no panacea to risk management in commodity markets. In practice, Governments, producers and traders of commodities need to evaluate costs and benefits of available risk management tools and calibrate their individual risk management approach accordingly. In addition to an effective risk management strategy, diversification remains crucial for commodity-dependent developing countries in order to increase resilience and reduce macroeconomic risks related to the commodity sector.

GE.19-01660(E)
1901660

Introduction

1. Paragraph 208 of the Accra Accord[1] gives a mandate to the Trade and Development Board of the United Nations Conference on Trade and Development (UNCTAD) to establish a multi-year expert meeting on commodities and development. The mandate was reaffirmed in paragraph 17 of the Doha Mandate,[2] extending it from 2013 to 2016, and in subparagraph 100 (s) of the Nairobi Maafikiano,[3] adopted at the fourteenth session of the Conference, which further extends the mandate through 2020. This meeting is the eleventh session of the Multi-year Expert Meeting on Commodities and Development.

2. The present background note analyses risks faced by commodity-dependent developing countries and highlights tools and strategies to manage these risks. In this sense, it responds to subparagraph 76 (p) of the Nairobi Maafikiano in which UNCTAD is called upon to "strengthen the capacity of commodity-dependent and net food-importing developing countries to reduce the short-term negative effects of price volatility, through instruments for market risk management".

3. The background note focuses on two key risk sources for commodity-dependent developing countries: price risk and weather and climate-related risks. Price risk affects all participants in the commodity market in commodity-producing countries. Incomes of smallholder farmers and traders of commodities are directly linked to commodity revenue, as are the budgets of commodity-dependent developing countries. Therefore, the background note looks at tools and strategies to manage commodity price risk and successful experiences of commodity-dependent developing countries in this regard. Furthermore, weather-related shocks can have significant impacts on the livelihoods of farmers and their families, as well as rural communities as a whole. In this context, section F of chapter I of the background note highlights lessons learned from index-based weather insurance schemes. Chapter II provides a summary and policy recommendations.

I. Risk management in commodity-dependent developing countries

A. Risks in commodity markets

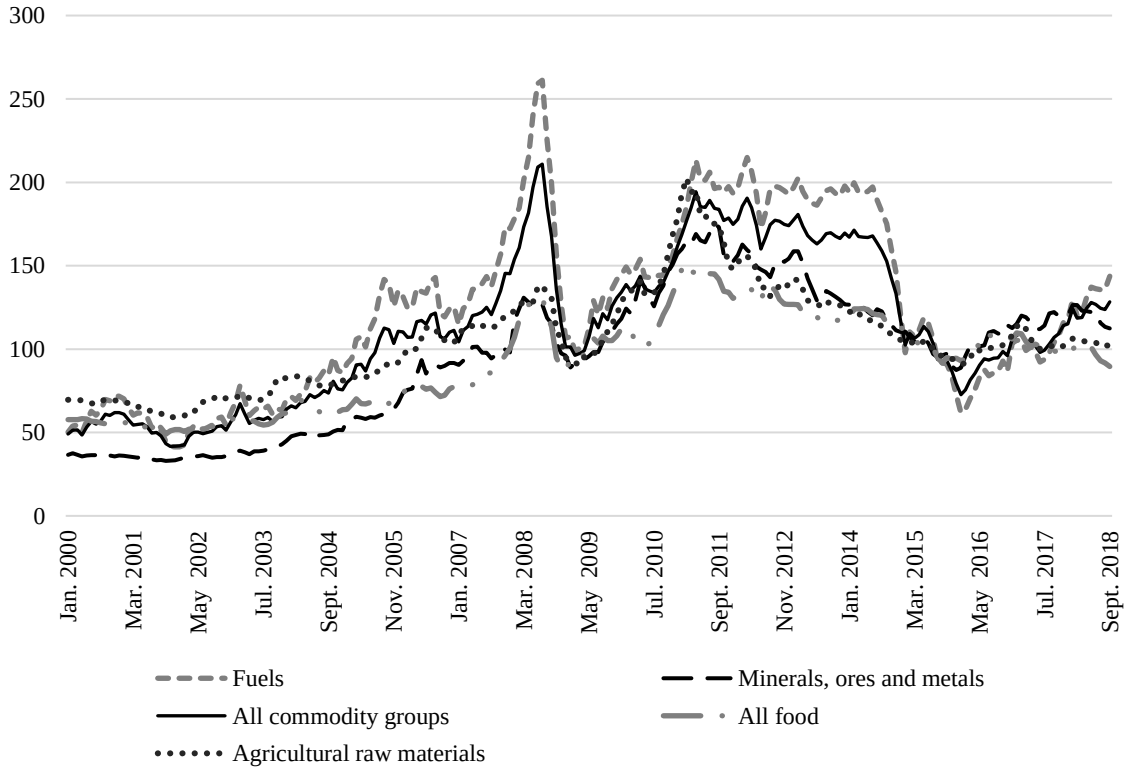
4. Commodity markets feature a range of risks. Consumers and producers of commodities are subject to price risk, which refers to the uncertainty regarding future commodity prices. Uncertainty regarding agricultural yields or mining output gives rise to production risk. The delivery of commodities from producers or traders to consumers is subject to transportation risk. As in all areas of trade, counterparty risk also affects commodity transactions. Currency risk exists when commodity trade takes place across countries with different currencies and when transactions must be settled through currency conversions. Finally, weather and climate-related risks are increasingly impacting commodity markets. The degree to which Governments and private sector actors are exposed to these risk areas depends on several factors. Commodity-dependent developing countries are particularly affected due to the importance the commodity sector has for their economies. Therefore, for commodity-dependent developing countries to achieve sustainable development, the management of commodity price risk and weather-related risks seems particularly relevant. The former is particularly important for commodity producers and Governments of commodity-dependent developing countries, while the latter poses a constant threat to the livelihoods of smallholder farmers.

5. Commodity prices are characterized by a high degree of volatility (figure 1). For instance, between September 2008 and September 2018, the average spot price of Brent

[1] TD/442 and Corr.1 and Corr.2, chapter II.
[2] TD/500/Add.1.
[3] TD/519/Add.2.

crude oil fluctuated between $124.9 and $30.8 per barrel. Similarly, the average monthly price of copper at the London Metal Exchange fluctuated between $9,868 and $3,072 per ton during the same period. Agricultural prices have also been volatile. For example, between September 2008 to September 2018, the average monthly indicator price of the International Coffee Organization reached a high of 231 United States cents per pound, and a low of 98 United States cents per pound.

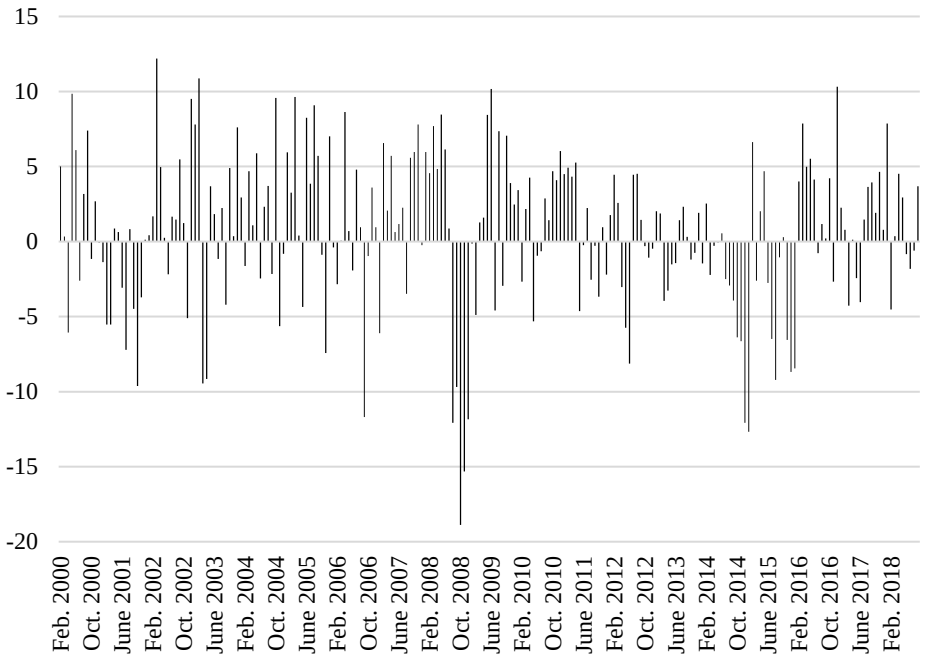
Figure 1
UNCTAD commodity price indices
(2015 = 100)



Source: UNCTADstat database.

6. Figure 2 shows the monthly percentage changes of the UNCTAD commodity price index. These monthly changes reached a high of 12 per cent and a low of minus 19 per cent in the period from February 2000 to September 2018, with an average monthly change of 4 per cent. These figures illustrate the volatility of commodity markets and highlight the risks associated with commodity dependence.

Figure 2
Monthly percentage changes in the UNCTAD commodity price index

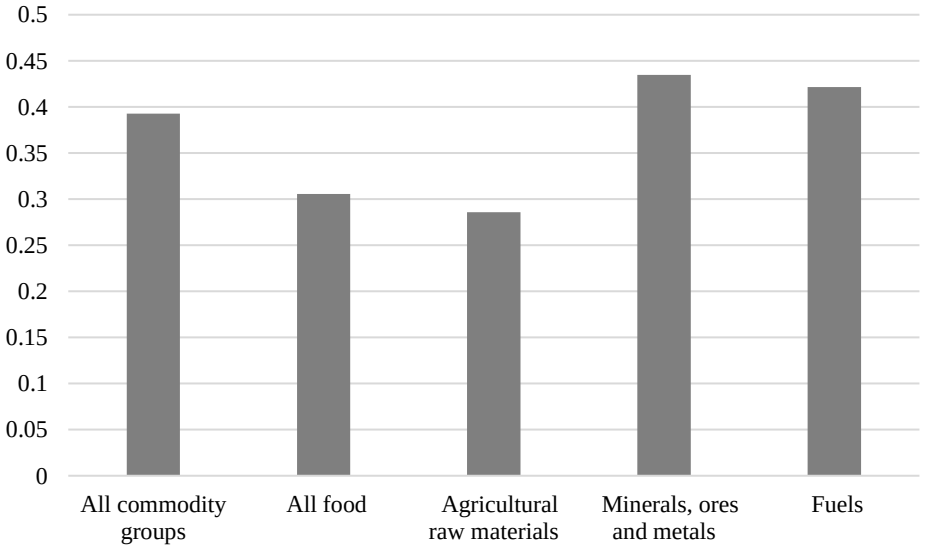


Source: UNCTADstat database.

* Monthly changes for all commodity groups, from February 2000 to September 2018.

7. In terms of commodity groups, minerals, ores and metals have been the most volatile group, as measured by the coefficient of variation of monthly indices since 2000, followed by fuels, then food and agricultural raw materials (figure 3). It must be noted that there is also significant heterogeneity of volatility within these commodity groups.[4]

Figure 3
Coefficient of variation of UNCTAD commodity price indices, January 2000–September 2018



Source: UNCTADstat database.

[4] See TD/B/C.I/MEM.2/42, on diversification and value addition, chapter II, section B.

8. Past initiatives to control commodity price volatility included the establishment of international commodity agreements for commodities, such as sugar, coffee, cocoa and natural rubber in the 1960s and 1970s. A key objective of international commodity agreements was to stabilize commodity prices through export quotas and buffer stock interventions. In 1976, the Integrated Programme for Commodities was adopted at the fourth session of the United Nations Conference on Trade and Development, to support commodity price stabilization through international commodity agreements and provide funding to that end via a common fund for commodities. In the 1980s and 1990s, international commodity agreements were dismantled or ceased to intervene in the market, in line with a global trend favouring price liberalization and the free play of market forces. During the same period, many agricultural marketing boards and other agencies that aimed at stabilizing commodity prices at the national level were abolished or scaled back their activities. Moreover, after its creation, the Common Fund for Commodities was poorly funded and unable to substantially help commodity-dependent developing countries to stabilize their commodities prices as originally intended.

9. Price volatility creates uncertainty about future revenue from commodity sales and exports. For Governments of commodity-dependent developing countries, where public revenues depend to a large extent on commodity exports, this constitutes an enormous challenge. An accurate forecast of future revenue is essential for the financial planning of expenditures and investments. Consequently, in the presence of uncertainty due to price risk, there is a threat to the sustainability and continuity of public development programmes. This in turn creates a risk for the achievement of the Sustainable Development Goals in commodity-dependent developing countries. Similarly, commodity producers, traders and exporters in commodity-dependent developing countries face price risk that translates into uncertainty about their future incomes.

10. Another key source of risk that affects particularly farmers in developing countries relates to environmental conditions, such as rainfall patterns. Smallholder farmers are especially vulnerable to unfavourable weather conditions and weather-related natural disasters that can threaten their revenue as well as food security. In the absence of insurance, weather-related shocks can have significant impacts on the livelihoods of farmers, their families and rural communities that are often highly dependent on agriculture.

B. Financial instruments to hedge commodity price risk

11. There are various financial instruments, also known as derivatives, which can be used to hedge commodity price risk. Broadly, these instruments consist of futures, forward contracts, options and swaps. The following paragraphs provide a brief overview of the key characteristics of these instruments as well as the experience of developing countries in using them.

12. Commodity futures are contracts to buy or sell a commodity at a specified future date:

(a) Commodity futures contracts are regulated and traded on exchanges and therefore standardized in terms of the quantity and characteristics of the underlying commodity. The first centralized market for commodity futures can be traced back to the early eighteenth century, when rice futures were traded at the Dojima Rice Exchange in Osaka.[5] Today, commodity futures are traded on numerous exchanges around the world, including the Chicago Mercantile Exchange, the Dalian Commodity Exchange, the London Metal Exchange, the Mumbai-based Multi Commodity Exchange of India, the São Paulo-based Brasil Bolsa Balcão, the South African Futures Exchange and many more.

(b) Although futures contracts are based on a future sale of a commodity, they are typically cash settled and rarely end in physical delivery. Therefore, market participants in the commodity futures trade are not necessarily commodity producers or buyers looking

[5] Schaede U, 1989, Forwards and futures in Tokugawa-period Japan: A new perspective on the Dojima rice market, *Journal of Banking and Finance*, 13(4–5):487–513.

to hedge price risk, but often investors from outside the commodity space who aim at making a profit from transactions, taking advantage of commodity price movements. Futures cover a wide range of commodities in agriculture, raw materials, metals and energy. Due to the emergence of financial futures, which are based on financial assets and indices such as stocks, treasury bills, interest rates or exchange rates rather than commodities, trade in commodity futures today constitutes a relatively small share of the entire futures market.

13. Forward contracts are similar to futures in that they are based on the agreement of a future sale of a commodity:

(a) The main difference between the two instruments is that forward contracts are not standardized and generally traded over the counter rather than on exchanges. This means that the transaction costs for hedging price risk using forward contracts can be higher than for futures. The terms of forward contracts are negotiated between parties on over-the-counter markets in a decentralized manner. Therefore, forward contracts can be customized to fit the specific needs of contract parties. For instance, the parties involved can agree on a fixed price for the sale of a commodity or a future reference price and stipulate other individual contract characteristics.

(b) As there is no clearing house involved, forward contracts carry the risk of default by one of the contract parties. Furthermore, forward contracts typically result in physical delivery, rather than being closed out before expiration. Thus, forward contracts are often used by physical commodity traders to hedge price risk. The market for commodity forward contracts is very heterogeneous and ranges from large power purchase agreements between power generators and buyers, to agreements between farmers and traders of agricultural commodities, such as cocoa or sugar.

14. Options are instruments that allow buyers and sellers of a commodity to lock in a minimum price and maximum price, respectively:

(a) The buyer of an option pays the counterparty a premium for the right to buy or sell the underlying commodity at a pre-specified price (“strike price”) on or before an expiration date. Call options give the holder the right to buy the underlying commodity, while put options represent the right to sell the underlying commodity.

(b) Options entail no obligation to buy or sell a commodity and, if they are not used, the premium is the only cost to the holders. Options are traded both on exchanges and on the over-the-counter market. Exchange-traded commodity options often have a commodity futures contract, rather than a physical commodity, as the underlying asset. Options are comparatively new financial instruments; the first exchange-traded options on commodity futures were introduced at exchanges based in the United States of America in the early 1980s.

15. Commodity swaps are financial instruments where contract parties exchange cash flows that are based on the price of an underlying commodity:

(a) Swaps are often used by commodity consumers to lock in commodity prices over the medium to long term. For instance, airline companies use swap agreements to hedge the risk of rising jet fuel prices. Under such an agreement, if the oil price increases beyond the pre-specified price the airline company receives a payment equivalent to the price difference for a notional fuel quantity stipulated in the contract. In case of a decrease in the price of jet fuel, the airline company pays an amount equal to the difference in price. In both cases, the airline company is guaranteed a fixed jet fuel price and has used the swap agreement to hedge price risk.

(b) Commodity producers use swaps to hedge price risk. For example, grain producers enter into swap contracts to secure a price for their production and hedge the risk of falling prices. Commodity swaps are generally sold on the over-the-counter market and not traded on exchanges. As with futures and options, commodity swaps account for a relatively small share of the market, while the majority of swap contracts are based on other assets or indices, such as interest rates or exchange rates.

16. While about two thirds of developing countries are commodity dependent,[6] the use of financial instruments to hedge commodity price risk is not widespread among Governments. However, there are some cases where Governments of commodity exporters or State-controlled companies have used financial instruments to manage commodity price risk. For instance, the Government of Mexico has hedged its oil export-related revenue since 2000 and spent $1.25 billion on put options in 2017 to lock in prices of oil exports for 2018. Furthermore, the Mexican State-run oil company Petróleos Mexicanos hedged part of it 2018 production through put options. Another example is the Brazilian State-controlled oil company Petróleo Brasileiro that spent $445 million on put options to secure a minimum price of $65 per barrel for part of its oil output in 2018. Ecuador engaged in an oil hedge involving put options and a swap in 1993 that resulted in costs of $20 million, causing political turmoil that led to the end of the country's oil hedge.[7] Outside the oil sector, there are also examples of the use of financial instruments to insure against unfavourable commodity price developments. For instance, Chilean State-owned copper mining company Corporación Nacional del Cobre trades in derivatives to hedge the financial risk associated with fluctuating copper prices.

17. Financial instruments have also been used by commodity-importing countries to hedge against price risk. Panama has been hedging its oil imports through call options since 2009, in line with its National Strategy for Hydrocarbons Risk Hedging.[8] In the context of its fuel subsidies reform programme, Morocco hedged diesel imports through call options in 2013.[9] Also, Jamaica bought call options to hedge oil imports from June 2015 to December 2016; the hedging programme covered a total of 8 million barrels of oil, one third of the country's imports during the period covered.[10] Uruguay bought call options to hedge 6 million barrels of oil, corresponding to about half of its annual oil imports, over a period of 12 months starting in mid-2016.[11] Ghana hedged its oil imports through call options from 2010 to 2012; the programme had an initial volume of 1 million barrels per month, which was subsequently increased to 2 million barrels per month.[12] When Ghana became an oil exporter, the country also hedged its oil exports in 2011 and 2012. In 2018, Ghana considered launching a new oil hedge programme.[13]

[6] UNCTAD, 2017, *State of Commodity Dependence 2016* (United Nations publication, Sales No. E.17.II.D.9, New York and Geneva).

[7] Cameron P and Stanley MC, 2017, *Oil, Gas and Mining: A Sourcebook for Understanding the Extractive Industries*, World Bank, Washington, D.C.

[8] Yépes-García RA and Dana J, 2012, *Mitigating Vulnerability to High and Volatile Oil Prices: Power Sector Experience in Latin America and the Caribbean*, World Bank, Washington, D.C.

[9] *Reuters*, 2013, Morocco turns to Wall Street for oil imports hedge deal – FT, 9 October, available at https://www.reuters.com/article/morocco-hedging/morocco-turns-to-wall-street-for-oil-imports-hedge-deal-ft-idUSL6N0HZ3CS20131009 (accessed 31 January 2019).

[10] *Jamaica Information Service*, 2015, Jamaica hedges 8 million barrels of crude in deal with Citibank, 1 October, available at https://jis.gov.jm/jamaica-hedges-8-million-barrels-of-crude-in-deal-with-citibank/ (accessed 31 January 2019).

[11] World Bank, 2016, Managing exposure to oil price volatility in Uruguay, Case study (Financial Advisory and Banking Department), September.

[12] Institute for Fiscal Studies, 2015, The falling crude oil prices: Mitigating the risk. Policy Brief Paper No. 1.

[13] Dzawu, MM, 2018, Ghana to buy contracts to protect it from high oil prices, *Bloomberg*, 11 June, available at https://www.bloomberg.com/news/articles/2018-06-11/ghana-to-buy-contracts-to-protect-it-from-high-oil-prices (accessed 31 January 2019).

18. There are few cases where Governments have used or considered using financial instruments to hedge price risk of key agricultural imports. Malawi hedged 60,000 metric tons of its maize imports in 2005 through physical call options, i.e. options that result in delivery rather than a cash settlement.[14] In light of volatile grains prices Egypt has considered hedging wheat imports in 2018.[15] These experiences show that such instruments can be useful elements of a price risk management strategy.

19. Like all insurance products, financial instruments carry costs, which need to be carefully weighed against their potential benefits. In this regard, it should be noted that the purpose of financial instruments in the context of risk management is to mitigate exposure to price risk rather than to speculate on potential favourable price movements. Therefore, it seems that countries have had better experiences with financial instruments where the latter have been embedded within a clear risk management framework and used over a long time period.

C. Commodity exchanges in developing countries

20. Commodity exchanges are regulated market places where commodities, and often commodity derivatives, are traded. In this regard, commodity exchanges fulfil several important functions. These include price discovery, risk management and facilitation of commodity trade. The centralized and regulated nature of commodity exchanges leads to lower transaction costs of commodity trade, as they facilitate coordination between buyers and sellers and ensure product availability and quality. This can enhance market access, in particular for smallholder farmers that are stuck in subsistence farming due to the high transaction costs of trading. In addition, commodity exchanges provide market information by disseminating data on prices, market liquidity and warehouse stocks.

21. Furthermore, many commodity exchanges make important physical infrastructure available, such as warehouses and cold storage facilities, that might not be in place without those commodity exchanges. In the context of risk management, commodity exchanges can help commodity producers and traders in commodity-dependent developing countries to manage price risk and other sources of uncertainty, such as counterparty risk and quality risk.

22. There are many factors that can hinder the participation of commodity producers and traders in international commodity exchanges. For instance, smallholder farmers often do not have the information, technical skills or access to foreign currencies needed to participate in trading on foreign commodity exchanges. Also, traders and exporters based in developing countries might face regulatory, financial or other obstacles that limit their abilities to access commodity exchanges outside their countries. Furthermore, market participants based in developing countries cannot directly benefit from physical infrastructure services, such as warehouses from commodity exchanges that are based abroad. Commodity exchanges in developing countries can play an important role in filling this infrastructure gap.

23. The largest and most sophisticated commodity exchanges outside of developed countries are in emerging economies. These include the Brasil Bolsa Balcão in Brazil; the Rosario Board of Trade in Argentina; the Multi Commodity Exchange of India and the National Commodity and Derivatives Exchange in India; the Dalian Commodity Exchange, the Shanghai Futures Exchange and the Zhengzhou Commodity Exchange in China; the Bursa Malaysia; and the South African Futures Exchange. Beyond these high-volume commodity futures exchanges, there are many developing country-based commodity exchanges that do not offer trade in derivatives, but feature spot markets, warehouse receipt systems and other important services. For instance, the Agricultural Commodity Exchange

[14] Geman H, ed., 2009, *Risk Management in Commodity Markets: From Shipping to Agriculturals and Energy*, John Wiley and Sons, Chichester, United Kingdom of Great Britain and Northern Ireland.

[15] Blas J, de Sousa A and Jha M, 2018, Biggest wheat importer may turn to hedging after price spike, *Bloomberg*, 4 September, available at https://www.bloomberg.com/news/articles/2018-09-04/biggest-wheat-importer-may-turn-to-hedging-after-price-spike (accessed 31 January 2019).

for Africa in Malawi, established in 2006, operates several warehouses and features trade in grains, legumes and nuts. Another example is the Ethiopia Commodity Exchange, established in 2008, which has an electronic warehouse receipt system and offers a spot market for coffee, sesame seeds and other commodities. Rwanda set up the East Africa Exchange in 2013. Commodities traded on the East Africa Exchange include beans, maize, rice, soya, sorghum and wheat. The East Africa Exchange has established subsidiaries in Kenya and Uganda and has plans to expand further in other countries of the East African Community.

24. Commodity exchanges can take different forms, spanning a broad spectrum of physical, electronic and institutional infrastructure that facilitates trade, improves market access and enables the transfer of risk between market participants. For smallholder farmers, services such as storage facilities and warehouse receipt systems can reduce the risk of post-harvest losses and enhance access to finance. For traders, commodity exchanges can reduce counterparty risk and quality risk. However, it must be noted that commodity exchanges can only be effective and successful if certain preconditions, including an appropriate regulatory and legal framework, and physical infrastructure needs are met.[16] In this regard, commodity exchanges that are well designed and respond to the needs of potential users can lower the transaction costs of commodity trading and help commodity producers, traders and exporters to manage risks.

D. Stabilization funds and precautionary saving

25. Commodity price-related risks can be reduced by accumulating savings during periods of high commodity prices in order to enhance economic resilience and stabilize public finances during times of low commodity prices. In this regard, many resource-rich countries have established sovereign wealth funds, through which parts of commodity revenues are set aside. Commodity-funded sovereign wealth funds can have a range of policy objectives, including the stabilization of the budget in the wake of commodity price swings (stabilization funds), the accumulation and transfer of wealth to future generations (savings funds)[17] or a combination of multiple objectives. For instance, the Norwegian Oil Fund, which is the largest commodity-linked sovereign wealth fund, with more than $1 trillion worth of assets under management, serves as a savings fund but also helps to finance the non-oil budget deficit.

26. In the context of risk management in commodity-dependent developing countries, both stabilization funds and savings funds can play a role. Stabilization funds help to shield the annual budget from shocks arising from volatility of commodity revenue. The existence of stabilization funds in resource-rich countries has been shown to reduce volatility of government spending.[18] This strengthens the sustainability and continuity of public development programmes. Furthermore, stabilization funds can support the implementation of countercyclical fiscal policy rules. Savings funds can also contribute to risk management through diversification, i.e. by transforming resource wealth into other forms of assets. In addition, the accumulation of assets helps to improve a country's net debt position, which has been shown to be an important determinant of a Government's financing costs.[19]

[16] UNCTAD, 1997, Emerging commodity exchanges: From potential to success. Report by the UNCTAD secretariat, UNCTAD/ITCD/COM/4, Geneva, 17 June.

[17] For a more detailed classification of sovereign wealth funds, see International Working Group of Sovereign Wealth Funds, 2008, *Sovereign Wealth Funds: Generally Accepted Principles and Practices – Santiago Principles*, available at https://www.ifswf.org/sites/default/files/santiagoprinciples_0_0.pdf.

[18] Sugawara N, 2014, From volatility to stability in expenditure: Stabilization funds in resource-rich countries, Working Paper 14/43, International Monetary Fund.

[19] Hadzi-Vaskov M and Ricci LA, 2017, Does gross or net debt matter more for emerging market spreads?, Working Paper 16/246, International Monetary Fund.

27. Commodity-based stabilization and savings funds are only effective and sustainable if they are characterized by transparency, strong governance and inflow/outflow rules that are anchored in a well-designed fiscal policy framework. In this context, resource-rich countries have had mixed experiences with stabilization funds. For instance, the Economic and Social Stabilization Fund of Chile, which is based on copper revenues, is generally seen as a successful example of a commodity-based sovereign wealth fund. The Economic and Social Stabilization Fund works in conjunction with a structural balance rule that shields the budget from copper price volatility, but also limits withdrawals from the fund. The Pula Fund of Botswana, which is based on revenue from the diamond sector, has helped the Government to carry out countercyclical fiscal policies. With its Petroleum Fund, Timor-Leste has shown that stabilization funds can also work in a post-conflict context.[20] Other stabilization funds have been less effective, such as the Mineral Resources Stabilization Fund of Papua New Guinea, which was closed after the remaining balance was drawn down to pay government debt in 1999.

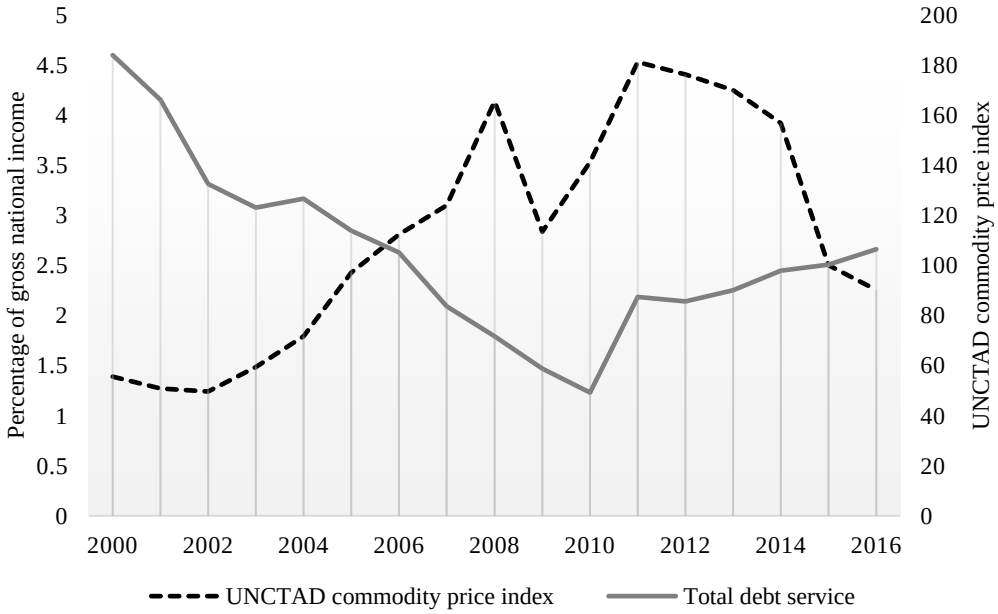
28. The drop in commodity prices after the boom period of the 2000s has underscored the importance of an effective fiscal policy framework for commodity-dependent developing countries. This includes the provision of fiscal buffers, i.e. savings in the form of liquidity or liquid assets, to manage risks and uncertainties from commodity price shocks and volatility. Such fiscal buffers are not only a means of self-insurance against negative commodity price shocks but can also help to carry out countercyclical fiscal policy and limit the growth of external debt during times of falling commodity prices. Commodity price fluctuations and shocks will always be a source of risk for the balance sheets of commodity-dependent developing countries. However, managing this risk through precautionary saving and a robust fiscal policy framework can limit the extent of negative impacts emanating from unfavourable developments on international commodity markets.

E. Commodity-linked bonds

29. Many commodity-dependent developing countries have accumulated significant amounts of external debt during and after the commodity price boom of the 2000s. These debts constitute a major source of risk for governments of commodity-dependent developing countries CDDCs. In particular, when the budget depends to a large extent on commodity revenue there is the risk that falling commodity prices increase the relative burden of debt service payments and thus shrink the government's policy space. For instance, debt service as a share of gross national income fell, on average, for African commodity-dependent developing countries between 2000 and 2010 but has increased every year ever since (figure 4). One way to reduce this risk is to use debt instruments that are linked to commodity prices.

[20] McKechnie A, 2013, *Managing Natural Resource Revenues: The Timor-Leste Petroleum Fund*. Overseas Development Institute, London.

Figure 4
Debt service* for African commodity-dependent developing countries and commodity prices



Source: World Development Indicators database, for debt service data; UNCTADstat database, for commodity price index.

* As a share of gross national income.

Note: Simple average of debt service-to-gross national income ratio of 36 African countries for which the share of primary commodities in total exports exceeded 60 per cent on average during 2000–2016 and for which there are data in the World Development Indicators database.

30. Conceptually, commodity-linked bonds fall into the wider category of State-contingent debt instruments. The basic idea behind State-contingent debt instruments is to create a link between debt obligations and the debtor's repayment ability. Therefore, State-contingent debt instruments are based on a variable that is correlated with a country's capacity to make debt payments such as inflation, gross domestic product or, in the case of commodity-dependent developing countries, commodity prices. Thus, commodity-linked bonds allow a country's debt payments to vary with the price level of its key export commodities. Different design features have been proposed, such as linking coupon rates, principal repayments or payment schedules to commodity prices.[21] In this sense, commodity-linked bonds could work as a mechanism to insure partially against the risk of debt distress or even default due to drops in commodity price. They could also strengthen a Government's ability to execute countercyclical fiscal policies by reducing the need for spending cuts to meet debt obligations during periods of low commodity prices.

31. While there are many examples of private companies in the commodity sector that have issued commodity-linked bonds,[22] Governments of commodity-exporting countries have not made extensive use of these financing instruments. One example is Mexico, which was the first country known to issue oil-indexed bonds in 1977–1980. The so-called "Petrobonds" were a vehicle for the Government to raise funds for the development of the oil industry at relatively low nominal rates.[23] Holders of Petrobonds received a payment at maturity that was based on the export price of oil. A more complex commodity-linked loan agreement was concluded between the oil and gas company Sonatrach, owned by the

[21] International Monetary Fund, 2017, Staff Notes for the G[roup of] 20: State-Contingent Debt Instruments for Sovereigns, February.

[22] For examples, see Privolos T and Duncan R, eds., 1991, *Commodity Risk Management and Finance*, World Bank, Washington, D.C.

[23] Attah-Mensah J, 2004, Commodity-linked bonds: A potential means for less-developed countries to raise foreign capital. Working Paper 2004-20, Bank of Canada.

Government of Algeria, and a group of international banks in 1989. The $100 million loan included the transfer of call options on oil from Sonatrach to the leading creditor bank, which allowed Sonatrach to borrow at a relatively low nominal interest rate.[24]

32. There are several possible reasons why the market for commodity-linked bonds is underdeveloped. For instance, as there is no existing liquid market for commodity-linked bonds, investors might be reluctant to buy these instruments or ask for high risk premiums. Also, Governments of commodity-dependent developing countries might have concerns about potential political backlash due to rising debt payments during times of increasing commodity prices. These real and perceived costs would need to be weighed against the potential benefits of commodity-linked bonds in the context of sovereign risk management and countercyclical fiscal policy in commodity-dependent economies. Given the success of other State-contingent debt instruments, in particular inflation-linked bonds that constitute a $3 trillion global market and have been issued by a number of developing countries and emerging economies, including Brazil, Chile, Colombia, Peru, South Africa and Thailand, a careful evaluation of commodity-linked bonds as risk management instruments for Governments of commodity-dependent developing countries seems worthwhile.

F. Index-based weather insurance for farmers

33. In order to cope with uninsured weather-related shocks, farmers often resort to a range of strategies that are inefficient as well as problematic from a development perspective and can have long-lasting negative effects. For instance, in the event of a crop failure caused by drought, some farmers could be forced to sell productive assets such as livestock or farm land, which diminishes their longer-term income opportunities. Furthermore, a farmer and a farmer's family can be pushed into poverty if the household's pre-shock income was close to the poverty threshold. Other disadvantageous shock-coping strategies consist of reducing spending in critical areas, such as education and health or decreasing food consumption. Such shock responses carry negative impacts for child development, health and educational attainment, which affect productivity and earnings potential over the long-term. Even in the absence of a shock, uninsured risks can lead to income losses by inducing farmers to take suboptimal investment decisions and crop choices. Thus, there are numerous potential benefits that can be obtained through the development of suitable insurance products.

34. Market inefficiencies, such as financial sector under-development, high transaction costs and informational constraints, have impeded the development of adequate insurance products to cover weather-related risks for farmers in developing countries. For instance, traditional indemnity-based insurance schemes require that damages should be verified at the individual level. The costs of this can be prohibitive, particularly in a rural setting and when many farmers are affected. To overcome some of these obstacles, index-based weather insurance schemes for farmers have been introduced since the early 2000s in numerous developing countries, including Bangladesh, Ethiopia, India, Kenya, Malawi, Mexico, Nicaragua, Rwanda, Senegal, Thailand, the United Republic of Tanzania and Viet Nam.

35. Index-based weather insurance schemes are typically developed in partnership between private and public-sector actors and often with donor support. For instance, the World Bank supports design and implementation of such schemes through the Global Index Insurance Facility programme.[25] These insurance solutions are based on weather-related indices, such as rainfall or temperature, and trigger a payout to insured farmers if a threshold level of the index is surpassed.

36. An advantage of index-based insurance vis-à-vis indemnity-based insurance is that no costly verification at the individual farm level is necessary for the former scheme. The key to an efficient index-based insurance is that the index should be measurable and closely related to agricultural losses of the insured farmers. Meeting these criteria in practice is not

[24] International Monetary Fund, 2017, State-Contingent Debt Instruments for Sovereigns – Annexes.

[25] See https://www.indexinsuranceforum.org/.

trivial and, as no meteorological index is perfectly correlated with losses at the individual farm-level, index-based insurance schemes leave some residual risk uninsured. The challenge therefore is to design the insurance in a way that minimizes residual basis risk, while keeping transaction costs as low as possible.

37. The experience with index-based weather insurance so far has shown that these schemes have an impact on the production decisions and risk-taking of previously uninsured farmers.[26] Beyond helping farmers to manage weather risk, these schemes can also generate co-benefits in terms of facilitating access to credit, as insurance reduces the risk of default.[27]

38. There are, however, also many operational issues that have surfaced. Most notably, low uptake has limited the impact of index-based solutions.[28] Several reasons for low uptake of index-based weather insurance among farmers have been identified.[29] These include basis risk, credit constraints, missing regulatory framework and lack of information, organizational capacity and trust. It has also been argued that smallholder farmers have difficulties paying insurance premiums. The design of index-based insurance products needs to address these challenges to be scalable and sustainable, i.e. commercially viable beyond a pilot phase.

39. Going forward, the impacts of climate change could add to weather-related risks, which would reinforce the need for effective and accessible risk management tools to secure rural livelihoods, ensure food security and fight poverty.

II. Summary and policy considerations

40. Commodity markets are volatile and therefore constitute a source of risk and uncertainty for those that depend on them. In this regard, risks emanating from the commodity sector affect all actors in the commodity sector. This includes Governments of commodity-dependent developing countries, exporters, traders and commodity producers, such as smallholder farmers, all of whom can benefit from effective risk management.

41. The nature, scale and potential impacts of risks to which Governments and various private sector actors are exposed vary. Therefore, the optimal choices of instruments and strategies for risk management can be expected to differ between and across different stakeholders.

42. For Governments of commodity-dependent developing countries, price risk can be a key determinant of both income (budget) and expenditure (debt payments). Consequently, Governments may benefit from a careful analysis of their exposure to price risk and an evaluation of available instruments for risk mitigation. This includes, for instance, financial instruments to hedge against unfavourable movements of the prices of key export commodities. In this context, it is important to note that the main purpose of risk management is to reduce risk rather than to speculate on potential favourable price developments. Similarly, fiscal buffers can act as an insurance against fiscal distress in the event of commodity price drops. Moreover, commodity-linked bonds can help Governments to maintain a balance between debt service obligations and repayment capacity.

[26] Cole S, Giné X and Vickery J, 2017, How does risk management influence production decisions? Evidence from a field experiment, *The Review of Financial Studies*, 30(6):1935–1970; Cai J, 2016, The impact of insurance provision on household production and financial decisions, *American Economic Journal: Economic Policy*, 8(2):44–88.

[27] World Bank, 2012, Weather index-based crop insurance in Malawi: Facilitating farmers' access to agricultural credit, Case study (Disaster Risk Financing and Insurance Programme), March.

[28] Burke M, de Janvry A and Quintero J, 2010, Providing index-based agricultural insurance to smallholders: Recent progress and future promise, Center for Effective Global Action Working Paper, University of California at Berkeley.

[29] Carter M, de Janvry A, Sadoulet E and Sarris A, 2015, Index-based weather insurance for developing countries: A review of evidence and a set of propositions for up-scaling, *Revue d'économie du développement*, 23:5–57.

43. Local commodity exchanges can help a range of stakeholders, including smallholder farmers, traders and exporters, to manage commodity-related risks. Commodity-dependent developing countries may want to look at successful examples of commodity exchanges in the developing world and evaluate which elements could be useful in the domestic context. Such an evaluation could include an analysis of the feasibility, costs and benefits of the various forms of commodity exchanges and the necessary regulatory and legal framework, as well as infrastructure requirements.

44. Weather and climate-related shocks are among the key risks to the livelihoods of farmers in developing countries. Farmers that are exposed to uninsured risks often apply risk management methods that limit their earnings potential and, in the event of a shock, resort to coping strategies that have negative impacts on their assets, well-being and future income. Governments may evaluate the potential for index-based insurance solutions and other means to protect smallholder farmers from weather and climate-related shocks. In this regard, existing experiences have shown that it is crucial to tailor insurance solutions to the needs and priorities of the users targeted, so as to ensure effectiveness, acceptance and uptake.

45. Finally, it must be noted that, at the macro-level, in addition to strengthening risk management, reducing commodity dependence through diversification of production, exports and revenue sources remains the most straightforward way to increase macroeconomic resilience and mitigate risks related to international commodity markets. Similarly, fighting poverty and raising the incomes of the most vulnerable groups of society, in line with the Sustainable Development Goals, is crucial to strengthen economic and social resilience at the micro-level.