OECD Economics Department Working Papers No. 1607

North Korea: The last transition economy?

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https://dx.doi.org/10.1787/82dee315-en

OECD

Organisation for Economic Co-operation and Development

ECO/WKP(2020)15

Unclassified

English - Or. English

25 November 2020

ECONOMICS DEPARTMENT

Cancels & replaces the same document of 12 May 2020

NORTH KOREA: THE LAST TRANSITION ECONOMY?

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By Vincent KOEN and Jinwoan BEOM

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Abstract/Résumé

North Korea: the last transition economy?

The North Korean economy has been a statistical black hole for decades but is undergoing substantial transformations. Rapid post-war industrialisation was not sustained beyond the mid-1960s and South Korea's economy far outpaced North Korea's during the next three decades, during which trend growth declined and turned negative as Soviet support ended and the terms of trade with China became less friendly. Today, GDP in North Korea is reportedly lower than in 1990, notwithstanding a larger population, and gross national income per capita is probably down to only a tiny fraction of South Korea's. A large share of the workforce remains in agriculture but domestic food production is insufficient to avoid widespread chronic undernourishment. At the same time, the scale and breadth of market activities has visibly expanded since the turn of the millennium, as part of a transition to a hybrid system mixing State, Party and army control with decentralised initiative, against the backdrop of a military build-up met by tightening international sanctions.

JEL classification: N15, N35, N45, N55, N65, N75, O21, O53, P21, P22, P23, P24, P26, P27, P28, P31, P52, Z32.

Keywords: North Korea, South Korea, China, Russia, Soviet, development, transition, central planning, marketisation, trade, smuggling, exchange rates, monetary reform, corruption, transport, rail, energy, food, health, tourism, construction, pollution, digitalisation, special economic zones, defence, international sanctions, natural disasters.

Corée du Nord : la dernière économie en transition ?

Depuis des décennies, l'économie nord-coréenne est un trou noir statistique, mais elle est en voie de transformation. L'industrialisation rapide après guerre n'a pas duré au-delà du milieu des années 1960 et l'économie a été distancée par la Corée du Sud au cours des trois décennies suivantes, pendant lesquelles la croissance tendancielle a faibli, devenant négative avec la fin du soutien soviétique et des termes de l'échange moins amicaux avec la Chine. Aujourd'hui, l'économie nord-coréenne est réputée plus petite qu'en 1990, malgré une population plus nombreuse, et le revenu par tête n'est probablement plus qu'une toute petite fraction de celui en Corée du Sud. Une part importante de la main d'œuvre travaille dans le secteur agricole mais la production alimentaire ne suffit pas à éviter une malnutrition chronique. Cependant, les activités de marché se sont visiblement développées depuis le tournant du millénaire, dans le cadre d'une transition vers un système hybride combinant contrôle par l'État, le Parti et l'armée avec des initiatives décentralisées, sur fond de renforcement des capacités militaires accompagné d'un durcissement des sanctions internationales.

Classification JEL : N15, N35, N45, N55, N65, N75, O21, O53, P21, P22, P23, P24, P26, P27, P28, P31, P52, Z32.

Mots clés : Corée du Nord, Corée du Sud, Chine, Russie, soviétique, développement, transition, planification centralisée, marchéisation, commerce, contrebande, taux de change, réforme monétaire, corruption, transports, rail, énergie, nourriture, santé, tourisme, construction, pollution, digitalisation, zones économiques spéciales, défense, sanctions internationales, catastrophes naturelles.

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North Korea: the last transition economy?[1]

> "Eleven years ago in Pyongyang there was not one stone standing upon another (...) Now a modern city of a million inhabitants stands on two sides of the wide river (…) A city without slums (...) Even more remarkable are the neat villages, scattered over the countryside (…) A nation without poverty (…) everyone is adequately provided with food, clothing, shelter, medical care, and educational opportunities"
>
> "All the economic miracles of the postwar world are put in the shade by these achievements (…) Every industry and every service is building up capacity so as to be able to rush aid to the South as soon as communications are opened up."
>
> Joan Robinson (1965), "Korean Miracle", based on her short visit to Pyongyang and Hamheung, and on a Report of the Statistical Bureau of the Planning Committee

Insofar as available statistics allow for any such comparisons, some estimates suggest that North Korea's rapid post-war industrialisation put it ahead of South Korea by the mid-1960s (Eichengreen et al., 2015). During the next three decades, however, South Korea grew very rapidly, far outpacing North Korea, where trend growth declined and turned negative as Soviet support ended and the terms of trade with China shifted to a commercial basis. What gullible visitors lauded as a miracle in the mid-1960s morphed into sclerosis. Today, real GDP in North Korea is reportedly lower than in 1990, notwithstanding a larger population, and gross national income per capita is only a tiny fraction of South Korea's. A large share of the workforce remains in agriculture but domestic food production is insufficient to avoid widespread chronic undernourishment. At the same time, the scale and breadth of market activities has visibly expanded since the turn of the millennium, as part of a transition to a hybrid system mixing State, Party and army control with decentralised initiative, against the backdrop of a military build-up met by tightening international sanctions.

Economic trends and conditions

Assessing economic developments in North Korea is extremely difficult. The country has not published any regular national account statistics since the 1960s (Kim et al., 2007) nor any budget information in level terms since the early 1980s. In many ways, it remains "a riddle wrapped in a mystery inside an enigma", to borrow a phrase once used to describe Russia (Churchill, 1939). The Ministry of Unification has estimated North Korea's GDP growth during the 1980s and the Bank of Korea (BOK) has been estimating North Korea's GDP and national income since 1990. While these estimates may be the most authoritative ones, they are very crude, as the BOK lacks reliable data sources from North Korea and uses

[1] This paper was written by Vincent Koen and Jinwoan Beom, both of the OECD Economics Department. It benefited from many helpful suggestions provided in the context of the first OECD seminar on the North Korean economy held on 28 November 2019 by Jun Gyu Min, Taehyoung Cho, Antoine Bondaz, Hak Kil Pyo, Eric Martin and Françoise Nicolas. The authors are also most grateful for comments on early versions of the paper received from Randall Jones, Peter Ward, Haruki Seitani, Ramon Pacheco Pardo, Kyoochul Kim, Suk-jin Kim, Sung Hwan Kang, Kee Park, Hazel Smith and Olga Petrik. Thanks are also due to Lutécia Daniel for some of the figures and to Sisse Nielsen and Michelle Ortiz for technical preparation. The cut-off date for the information reflected in the paper is early March 2020.

South Korean relative prices to estimate real GDP, and they have not gone unchallenged (Kim Byung-Yeon, 2017; Lee et al., 2019; Kim and Hong, 2019). Although UN-related international organisations, a large number of South Korean authorities and several NGOs sometimes report statistics on North Korea, their reliability and mutual consistency is also questionable, due to restrictions on visits and lack of data sources (Table 1). While information from North Korea defectors is often used to make up for data shortages, using witness accounts and interviews has pitfalls, including sample bias (Mimura, 2019), limited means of verification and inaccuracy of memories (Song and Denney, 2019). It is essential to bear these limitations in mind when interpreting the numbers quoted in this paper, which alongside official publications also draws to an unusual extent on press reports.

Table 1. Information sources for the North Korean economy

Type	Sources	Main information, data and *remarks*
South Korean public institutions	Bank of Korea, Statistics Korea, relevant South Korean ministries, agencies and corporations (Rural Development Administration, Korea Rural Economic Institute, Korea Electric Power Corporation, etc.)	Population, GDP, GNI, industry structure, agricultural production, rail and road network, State-owned companies, energy, etc.
Trade statistics	UN Comtrade, IMF Direction of Trade, CEPII BACI (Base pour l'Analyse du Commerce International), Observatory of Economic Complexity North Korea page, Korea Trade Investment Promotion Agency, North Korea trading partners (China, Russia, etc.)	Exports and imports by country *Foreign countries sometimes confuse South Korea with North Korea (KOTRA, 2019)*
International organisations	UNICEF Multiple Indicator Cluster Survey UNSD, UNDP, WHO, WFP, FAO, UNFPA, World Bank, IMF	Population Census (1993, 2008) Food production and intake Living conditions, health
North Korean defectors	Surveys of defectors by the Institute for Unification Education, Seoul National University, research institutions, etc.	Ongoing economic developments Changes in economic and social perceptions
Others	International news media (NK News, Daily NK, 38 North, Asiapress, Radio Free Asia, Yonhap, Reuters, AP, Bloomberg, Voice of America, etc.) Domestic news media (Korean Central News Agency, Rodong Sinmun, Pyongyang Times, etc.) Satellite information (NASA, …) NGOs, academic institutes (KDI, KIEP, KIET), blogs (e.g. North Korea Economy Watch) North Korea government statistics or agencies	Market prices, exchange rates Living conditions Foreign migrant workers Illegal activities Economic policy

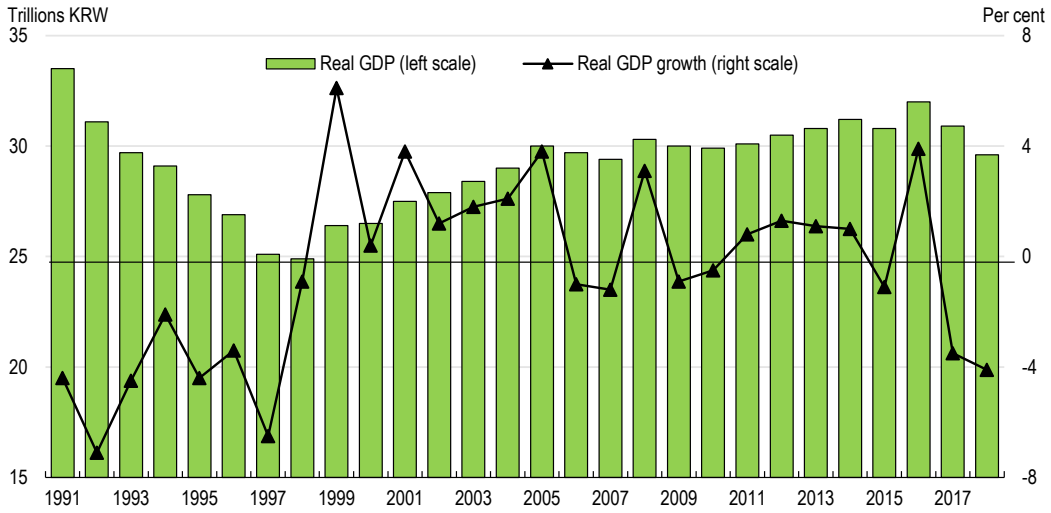
Source: Adapted from Cho (2019) and Min (2019).

The North Korean economy suffered a severe recession in the 1990s, against the background of the implosion of the Soviet Union, of China starting to ask market prices for its exports, of a series of natural disasters and of confusion after the death of the founder of the Democratic People's Republic of Korea, Kim Il-sung, in 1994. Between 1990 and 1998, the economy is estimated by the BOK to have shrunk by around 30%, and other sources point to an even large decline (IMF, 1997). The collapse was thus of the same order of magnitude as in some of the former states of the Soviet Union (de Broeck and Koen, 2000). At least several hundred thousand people are estimated to have died of starvation or hunger-related illness between 1994 and 1998, during what was called the "Arduous March" (Haggard and Noland, 2007; Tudor and Pearson, 2015).

According to the BOK estimates, the North Korean economy slowly recovered starting in 1999, when real GDP growth turned positive. Notwithstanding several downturns (which partly reflected the impact of the sanctions taken in the wake of the 2006 and 2009 nuclear tests), annual GDP growth averaged 1.4% between 1999 and 2016. The economy grew almost 4% in 2016, the fastest rate since 1999, thanks to a strong pick-up in mining and agriculture.

However, following North Korea's fourth nuclear and missile test in January 2016, the international sanctions were extended to major trade items (see below) and the economy began to shrink (Figure 1). Real GDP dropped by 3.5% in 2017 and 4.1% in 2018.

Figure 1. Estimated GDP level and growth rate



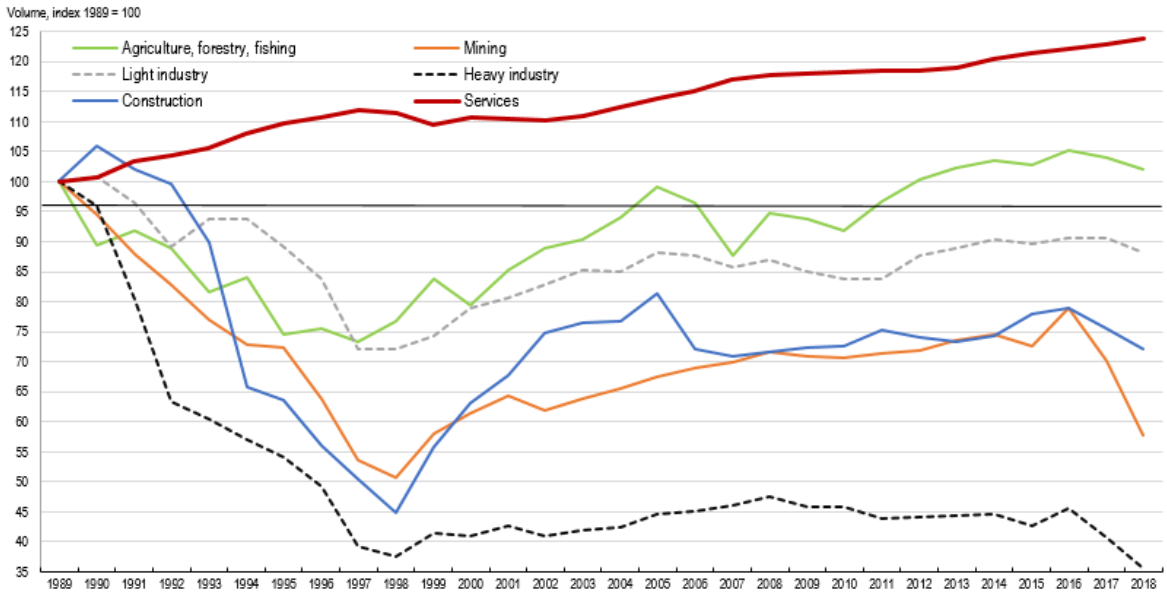
Estimated at 2010 constant prices.
Source: Bank of Korea (2018, 2019).

The service sector has developed more steadily than the agriculture, forestry and fisheries sector, while manufacturing has stagnated during much of the past two decades (Figure 2). Marketisation and "dollarisation", "yuanisation" or "euroisation" (see below) have supported commerce. This trend has intensified after the death of Kim Jong-il and the accession to power of Kim Jong-un in late 2011 (Yang, 2016a).

The authorities have also tried to foster construction and tourism, including by soldiers as manpower (Ha, 2019b; Lee et al., 2019). In recent years, large-scale construction projects such as high-rise apartments on Mirae Scientists Street and Ryomyong Street in Pyongyang and tourist infrastructure have been promoted. Tourism, which is not targeted by UN sanctions, is seen as a prominent foreign currency source (Pacheco Pardo, 2014). The government has developed a number of large-scale tourist zones (see Box 2 further down). This construction drive is reflected in the changing Pyongyang skyline, with the more recent parts thereof dubbed Pyonghattan (Pearson and Sagolj, 2016; Lee, Je-hun 2019b; Bianchi and Drapić, 2019). However, some reports suggest that the sanctions have slowed construction and affected housing prices (Jang, 2019a), consistent with the fall-off in cement production since 2016 (Figure 3).

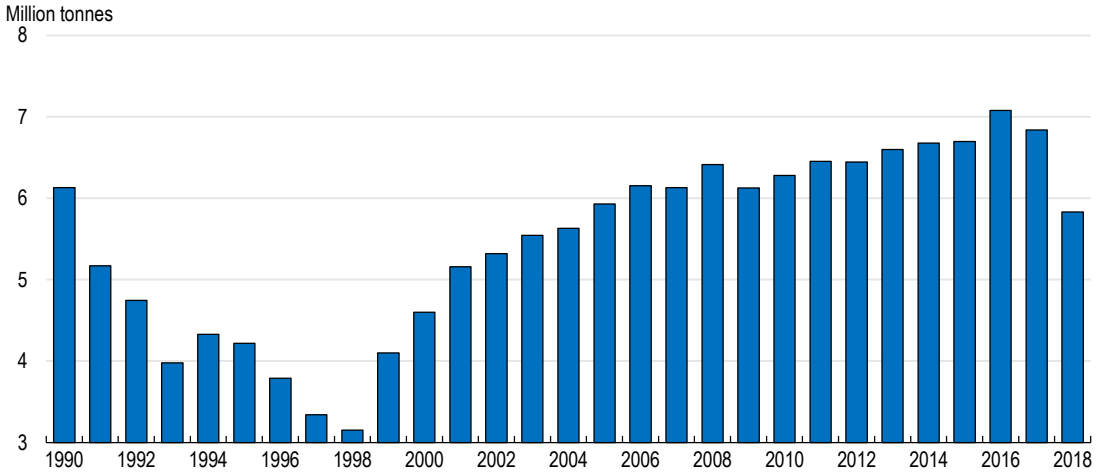
The mining industry, which accounts for over one tenth of GDP, grew rapidly until 2016, as mineral exports to China expanded, but following the tightening of sanctions, it contracted sharply in 2017-18. Coal accounts for a sizeable share of mining and its production dropped by close to 42% in 2017-18 (Figure 4). Coal has traditionally been exported mainly to China, representing a major source of foreign currency earnings. UN sanctions bearing on the exports of coal and other minerals were ratcheted up in the course of 2016 (see below). This affected recorded coal exports but sales have continued via other routes. A number of small mines have been shut down but larger coal mines have remained active, with satellite images suggesting that improvements have been made to the coal supply-chain infrastructure, notably to some port facilities and rail-to-road transfer stations (Makowsky et al., 2019).

Figure 2. Production trends by sector



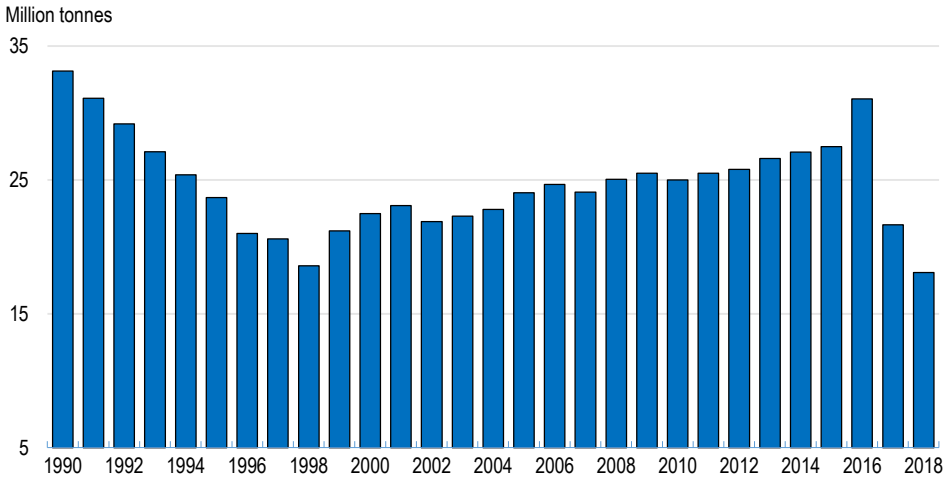
Source: Bank of Korea.

Figure 3. Cement production



Source: Bank of Korea.

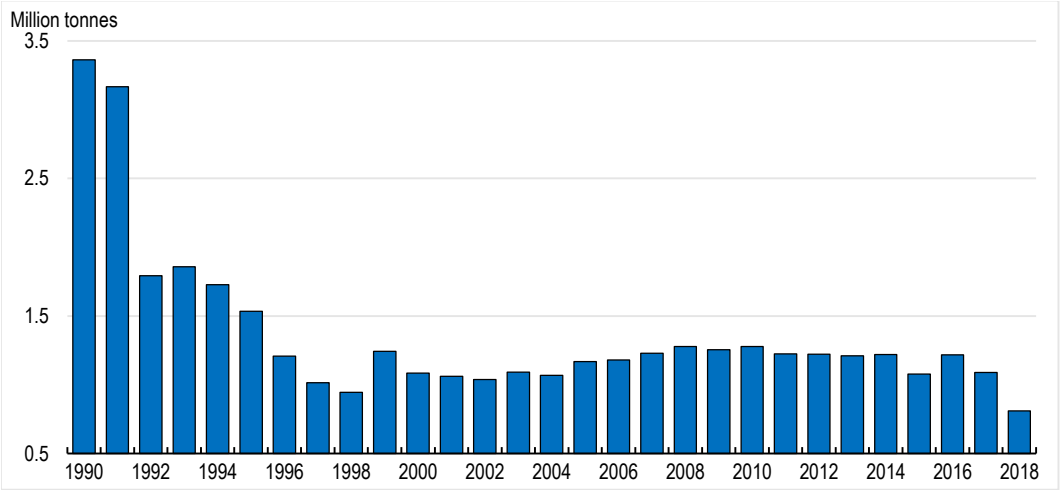
Figure 4. Coal production



Source: Bank of Korea.

The stagnation in manufacturing has long been a major concern in North Korea, and partly reflects a dilapidated capital stock, the result of underinvestment, shortages of spare parts and inadequate maintenance (Eberstadt, 2007). To some extent, this is the flipside of the concentration of investment in the defence sector: on one estimate, spending on the military averaged some 23% of GDP between 2010 and 2016 (Cho, 2018); another source, indicating that close to 16% of the state budget is being spent on defence, implies a lower but still extremely high share of military spending in GDP (Korean Central News Agency, 2019). Steel production is but one striking example of industrial sclerosis (Figure 5). In contrast, light and machinery industry such as industrial machinery, motorcars and trucks grew with marketisation (Park et al., 2018). In 2017-18, however, manufacturing, and notably heavy industry, was also affected by the sanctions, with large declines in output.

Figure 5. Steel production



Source: Bank of Korea.

Food shortages

More than two decades after the famines of the 1990s, food shortages remain serious (Belgrave, 2019), especially outside Pyongyang and a few cities close to the Chinese border. Prior to the 1990s, the population received food and necessities through the so-called Public Distribution System (PDS). However, the PDS largely unravelled in the 1990s, leading households to try and secure food through other means, including local informal markets (*jangmadang*), which are mostly run by women (Tudor and Pearson, 2015). Households grow grains and vegetables in the allocated small plot of land or kitchen garden near their homes, and they sell crop surpluses in the markets to make a profit and to get other necessities (Institute for Unification Education, 2019).

The international community has long been assisting North Korea with food. In this context, the Food and Agriculture Organization (FAO) and the World Food Programme (WFP) conduct limited research and estimate crop production and distribution of food. Recent adverse weather conditions have affected food supply. According to the UN food security assessment report (FAO/WFP, 2019), total grain production in November 2018-October 2019 was down 12% on a year earlier to around 4.2 million tonnes in milled terms and cereal equivalent (Table 2) – the lowest level since 2008. South Korea's Rural Development Administration, which gauges crops in North Korea using weather conditions and various other sources, estimates that the total volume of grain crops declined by 3.4% in 2018 but recovered about 2% in 2019, with an uptick in rice production (Rural Development Administration, 2018, 2019).

More specifically, recurrent heatwaves, droughts and flooding, as well as limited supplies of agricultural inputs such as fertiliser and fuel, all contributed to lowering agricultural production in North Korea in 2018-19 (FAO/WFP, 2019; USDA, 2019). Typhoons also severely damaged crops (Rural Development Administration, 2018). Taking into account the 0.22 million tonnes to be secured through imports and external support, the actual food shortfall was expected to amount to 1.36 million tonnes. To enhance support to North Korea, the WFP has intensified South-South initiatives: in 2019, India for example contributed USD 1 million to the WFP for supporting impoverished North Koreans. In addition, the South Korean government offered to provide 50 000 tonnes of rice via the WFP to address food shortages, but as of early 2020 North Korea had not accepted the offer. Furthermore, in late 2019 the UN Green Climate Fund (2019) approved USD 752 000 in funding for North Korea to help address the impact of climate change, to be implemented through the FAO (North Korea is a party to the UN Framework Convention on Climate Change and to the Paris Agreement).

Table 2. Food supply and uses

November 2018 - October 2019

	Rice (milled)	Maize	Wheat and barley	Other cereals	Potatoes	Soybeans	Total
Total utilisation (food use, seed)	1.94	2.71	0.24	0.20	0.50	0.16	5.76
Domestic availability	1.38	1.88	0.06	0.20	0.50	0.16	**4.17**
– Main season production	1.38	1.88		0.20	0.25	0.16	3.86
– Winter/spring production			0.06		0.25		0.31
Import requirements	0.56	0.83	0.19				**1.59**
– Commercial imports and food assistance							0.22
Uncovered deficit							1.36

Source: FAO/WFP (2019).

During the past two decades, North Korea has failed to overcome food shortages: food production increased only 15% (Kim et al., 2019), even as the population expanded by around 14%. Shortages of arable land – in a country that is more mountainous than South Korea – and lack of equipment and

technology (even simply tractors) contribute to low per capita crop productivity, which stands at only half the level of South Korea's. Shortages of fuel and electricity (see below) hamper the transport and processing of crops as well as the ventilation of stocks (FAO/WFP, 2019). Moreover, poor irrigation and drainage systems amplify the impact of recurrent natural disasters such as flooding (Table 3). Beyond those physical challenges, and notwithstanding some partial liberalisation measures (see below), inadequate incentives greatly limit crop production, as they did in China, Russia and Vietnam before those countries switched from collective to more individualised farming (Kim Younghoon, 2017).

Table 3. Natural disasters in recent years

Year	Disaster and impact
2012	Heavy rains caused flooding in North and South Pyongan, killing 231 people. Over 240 000 people were affected, 212 000 were left homeless.
2013	Heavy rains caused flooding, severely affecting North and South Pyongan, killing 189 people and affecting 800 000 people and displacing 49 000.
2014	An 18-month long dry spell starting in March 2014 affected agricultural production and access to water.
2015	Heavy rain and Typhoon Goni caused flooding in South Hwanghae, North and South Hamgyong, and especially Rason City, affecting 22 000 people and displacing 15 000.
2016	Heavy rain from Typhoon Lionrock caused flooding in North Hamgyong, killing 138 people, affecting 600 000 and displacing 68 000.
2017	The Government declared a national emergency in June, following a dry spell that affected key food producing provinces in the south-west of the country.
2018	In mid-year, a heatwave affected key agricultural areas, with temperatures up to 11 degrees above normal. In late August, flooding affected the North and South Hwanghae and Kangwon provinces. Some 340 000 people were affected, more than 11 000 were displaced and over 17 000 hectares of crops were lost.
2019	A drought, plus Typhoon Lingling and an epidemic of African swine fever affected agriculture.

Source: Adapted from OCHA (2019); press reports.

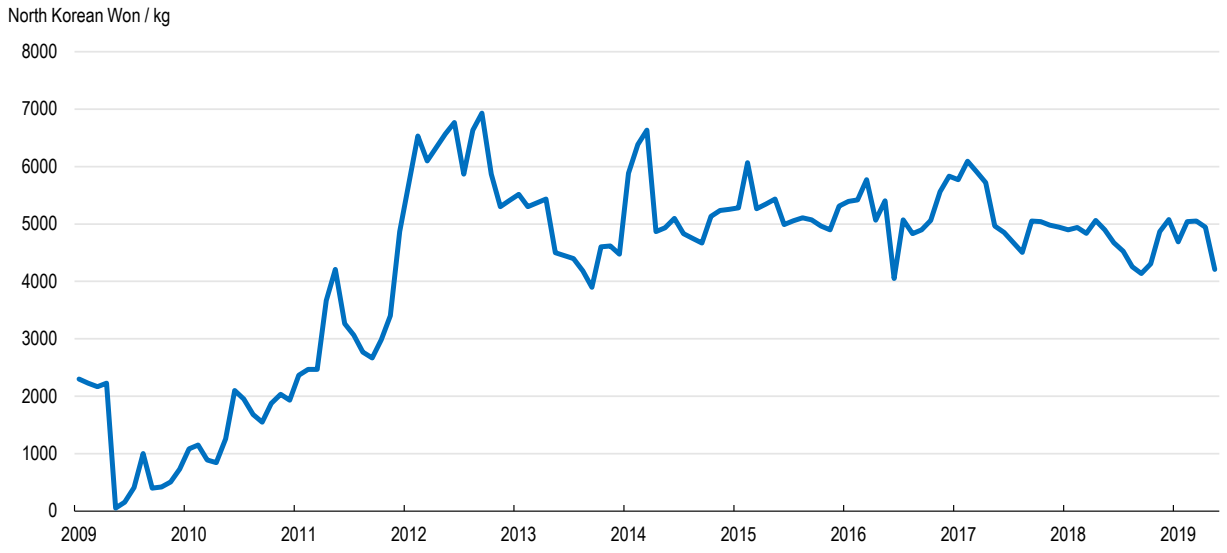
Food consumption is very low and quality is very poor. The average diet is basic and monotonous, consisting mainly of rice, maize and potatoes, complemented by kimchi and vegetables. Insufficient protein intake is a serious nutritional problem. As of January 2019, the daily ration amounted to only half of the UN recommended 600 grammes per person per day (Kim et al., 2019). Although estimates vary across observers (Kim and Hong, 2019), about 11 million people, i.e. 40% of the total population, were suffering from food shortages in 2018-19 according to FAO/WFP (2019). Grebmer et al. (2019) estimate that 48% of the total population may have endured malnutrition in 2016-18, while Thome et al. (2019) argue that 57% of North Korea's population was food insecure in 2019 (in the sense of lacking consistent access to enough food for an active, healthy life). North Korea ranks 92th out of 117 countries in the Global Hunger Index (Grebmer et al., 2019).

However, people's ability to secure food seems to have improved with marketisation. According to interviews with North Korean defectors, over 85% of them could eat food three times per day after 2015 (Seoul National University, 2018), a clear improvement from the early 1990s, when official campaigns promoted the health merits of eating just one meal a day (Kristof, 1992). Worrying about possible unrest, the North Korean authorities have also made efforts to uphold food supply and stabilise prices (Institute for Unification Education, 2019).

Marketisation and the maintenance of the PDS in the public sector have contributed to stabilising food prices in recent years (Figure 6). Farmers' markets have played an increasingly important role. Moreover, as the international sanctions do not cover food, North Korea imports rice and grains through both formal and informal channels, with cereal purchases from China recorded by KOTRA amounting to over USD 100 million per annum in 2011-12 and to around USD 30 million per annum in 2016-18. Food aid has also played a role. Being keen to avoid surges in rice prices, such as the one witnessed after the failed 2009 currency reform (Box 1), the authorities have tended to respond to food shortages by encouraging traders

and state-controlled enterprises to import food but also by instructing distributors to release stocks into the market and via direct price caps, most recently in the wake of the coronavirus outbreak, which pushed up the price of rice imported from China (Kang, 2020). In addition, the food distribution system for the state-owned farms and military has been used to control food prices.

Figure 6. Rice price



Monthly average of Pyongyang, Sinuiju and Hyesan.
Source: *Daily NK*.

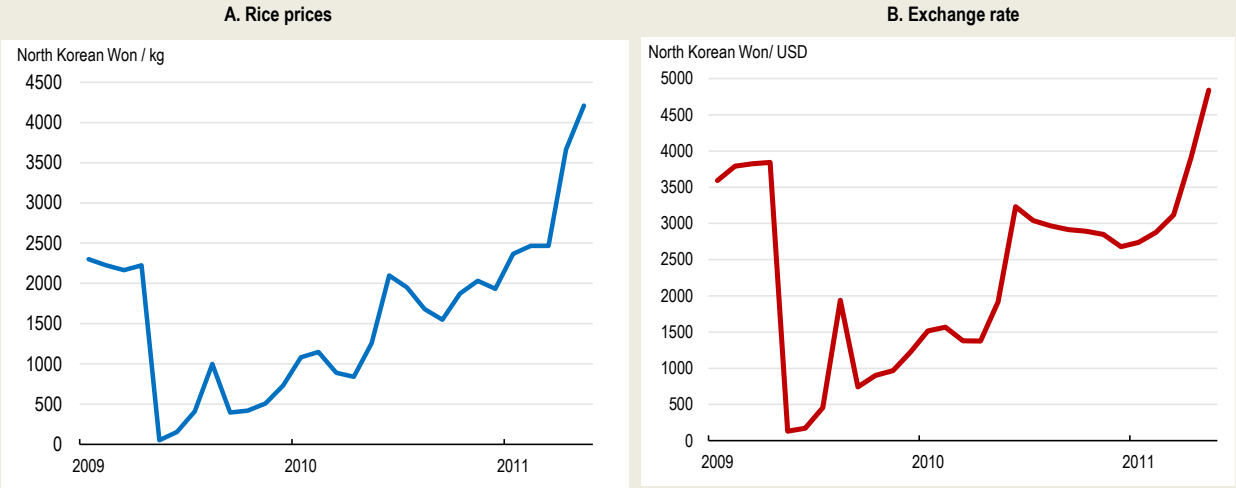
Box 1. The failed 2009 currency reform

As informal markets grew in the early 2000s, the gap between official and market prices of goods widened sharply. Inflation soared, while the value of the North Korean currency plummeted. Rice prices, which were 57 North Korean Won (KPW) per kilogramme in 2002, rose 39 fold to KPW 2 200 in 2009 (Lee, 2016). In addition, North Korean citizens avoided depositing their savings in banks because this could trigger questions about their income sources and withdrawals were difficult (Institute for Unification Education, 2019).

Against this backdrop, a currency reform was undertaken in November 2009 to try and stabilise prices and absorb the money circulating in the shadow economy. The key measure was to exchange a new North Korean won for 100 old ones, both for cash and for bank accounts. The currency exchange period was only seven days and the amount of exchange per household was initially limited to KPW 100 000 (around USD 30 to 40 at the black market exchange rate), though this ceiling was subsequently raised to KPW 150 000 for cash and KPW 300 000 for deposits in the face of the population's anger – the press reported that stacks of old notes were being burnt in protest against the redenomination, which also led to some suicides (AP, 2009).

The 2009 currency reform failed to achieve its objectives. It amounted to the confiscation of the bulk of citizens' cash savings and caused enormous confusion. High inflation re-emerged soon (Figure 7, Panel A) and the market exchange rate soared (Panel B). Dollarisation deepened, and people's trust in the North Korean currency and the government's economic policy worsened (Lee, 2016).

Figure 7. The rice price and the market exchange rate after the 2009 currency reform



Monthly average rice prices of Pyongyang, Sinuiju and Hyesan and monthly average exchange rate.
Source: *Daily NK*.

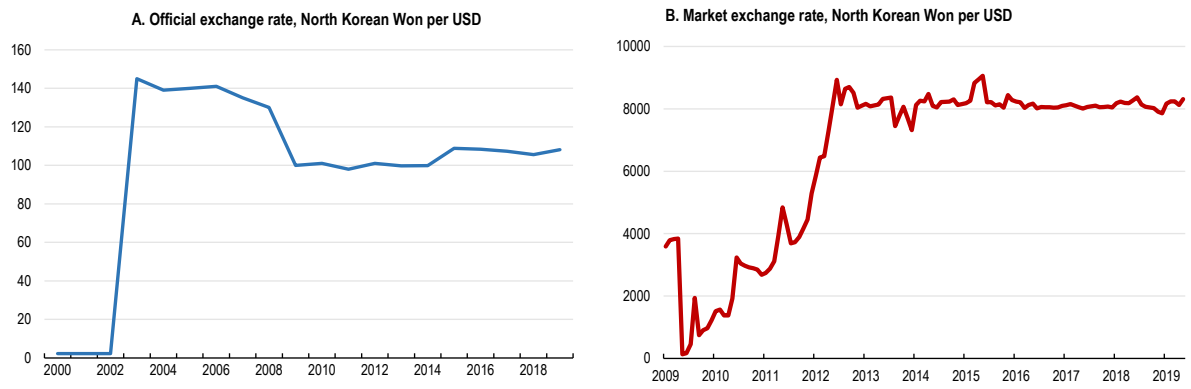
Exchange rate developments

North Korea has long had a multiple exchange rate system, though it was streamlined somewhat around 2013, when in effect the black market exchange rate was no longer deemed illegal and became the basis for a broader range of transactions in the domestic economy (Ward, 2019). The official exchange rate shown below is not determined in international financial markets but set by the country's Chosun Trading Bank.

In July 2002, as part of a price reform that essentially monetised years of fiscal deficits (Seliger, 2005), North Korea adjusted its official exchange rate by a factor of more than 70, to 150 North Korean Won (KPW) per US dollar, to reduce the gap between the official and market exchange rates. However, since then the market exchange rate has depreciated sharply while the official exchange rate fluctuated much less (Figure 8, Panel A). As the official exchange rate has been overvalued compared to the market exchange rate, foreign currency has flown into the informal economy. Following the second attempt at monetary reform, the black market exchange rate depreciated further, to around KPW 8 000 per US dollar by 2012. It has subsequently remained around that level, despite the intensification of sanctions (Panel B).

In recent years, the government has made efforts to extract foreign currency from the private sector in various ways, such as mobile phone sales and separate exchange rates for foreign travellers (though foreigners can now legally exchange hard currency into North Korean wons at the market rate in some of Pyongyang's shopping arcades). Even electricity fees in parts of Pyongyang are reportedly charged in dollars (Jang, 2020). The Financial Authority has adopted measures to channel domestically-owned foreign currency to domestic investment. In particular, it announced that banks would not ask depositors about the provenance of their deposits and has expanded the use of electronic payment cards, which are now quite common, especially in Pyongyang (Park et al., 2018).

Figure 8. Exchange rates

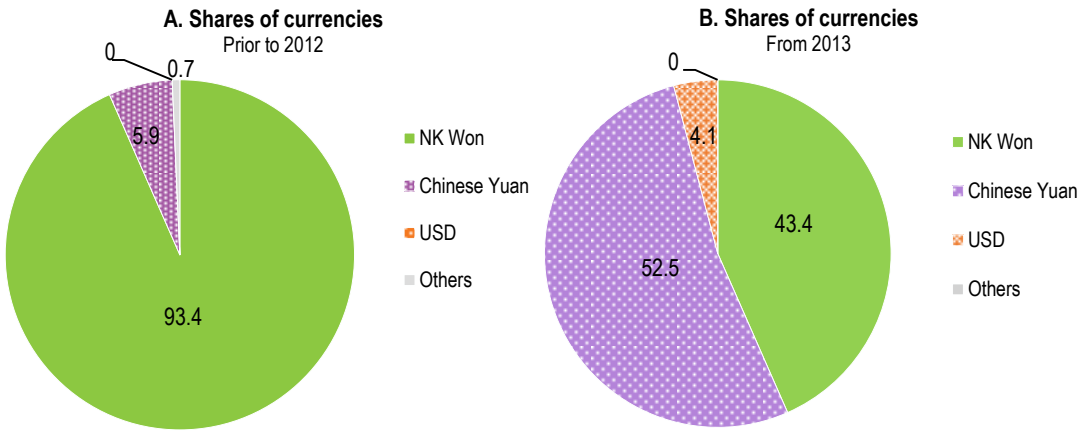


Source: Statistics Korea (official exchange rate); *Daily NK* (market exchange rate, monthly average).

Like in a number of developing countries, foreign currencies are used in North Korea alongside the domestic won, including the Chinese yuan and the US dollar (Figure 9). Yuan are routinely used to purchase even basic food items in general markets (Asiapress, 2019a), notwithstanding the occasional threats of crackdowns (Asiapress, 2019c). Some of the on-demand taxi drivers in Pyongyang for example reportedly accept payment only in yuans or dollars (Chan, 2018). Tourists can readily pay with euros and yens in Pyongyang. While the yuan is the most widely available foreign currency, US dollars, euros, and Japanese yens are more popular among the wealthy in North Korea (Kim, 2018a). The widespread use of foreign currencies can entail challenges for monetary policy, as witnessed in Eastern Europe and the former Soviet Union (Baliño et al., 1999).

The huge gap between the official and the market exchange rate is also a socially corrosive factor. Wages are mostly paid in local currency and equivalent to no more than a few US dollars a month at the market exchange rate, though to the extent recipients have access to goods and services at state prices, plus social benefits, this is an understatement. The huge gap between official wages and incomes in the marketised sphere is a major work disincentive for state employees and a strong incentive to pilfer workplace property to use it for private purposes, to abuse official power to extract bribes and to undertake other jobs on the side, paid in hard currency.

Figure 9. Currencies used in domestic transactions



Source: Lee (2016).

Poor electricity supply

Hydroelectric and thermal power plants are the core of energy production in North Korea, with oil playing a limited role (Table 4). Hydroelectric power accounts for over half of total electricity production (Figure 10, Panel A), implying that rainfall significantly affects supply. Thermal power plants mostly rely on coal, as the availability of oil diminished sharply following the end of subsidised imports from the Soviet Union in the 1990s and more recently the sanctions. Power plants and transmission equipment are old and inefficient, owing to poor technology, spare parts shortages and lack of funding (Talmadge, 2018). By 2018, total electricity generation was around 10% below the level in 1990, and only one 20th of the level in South Korea.

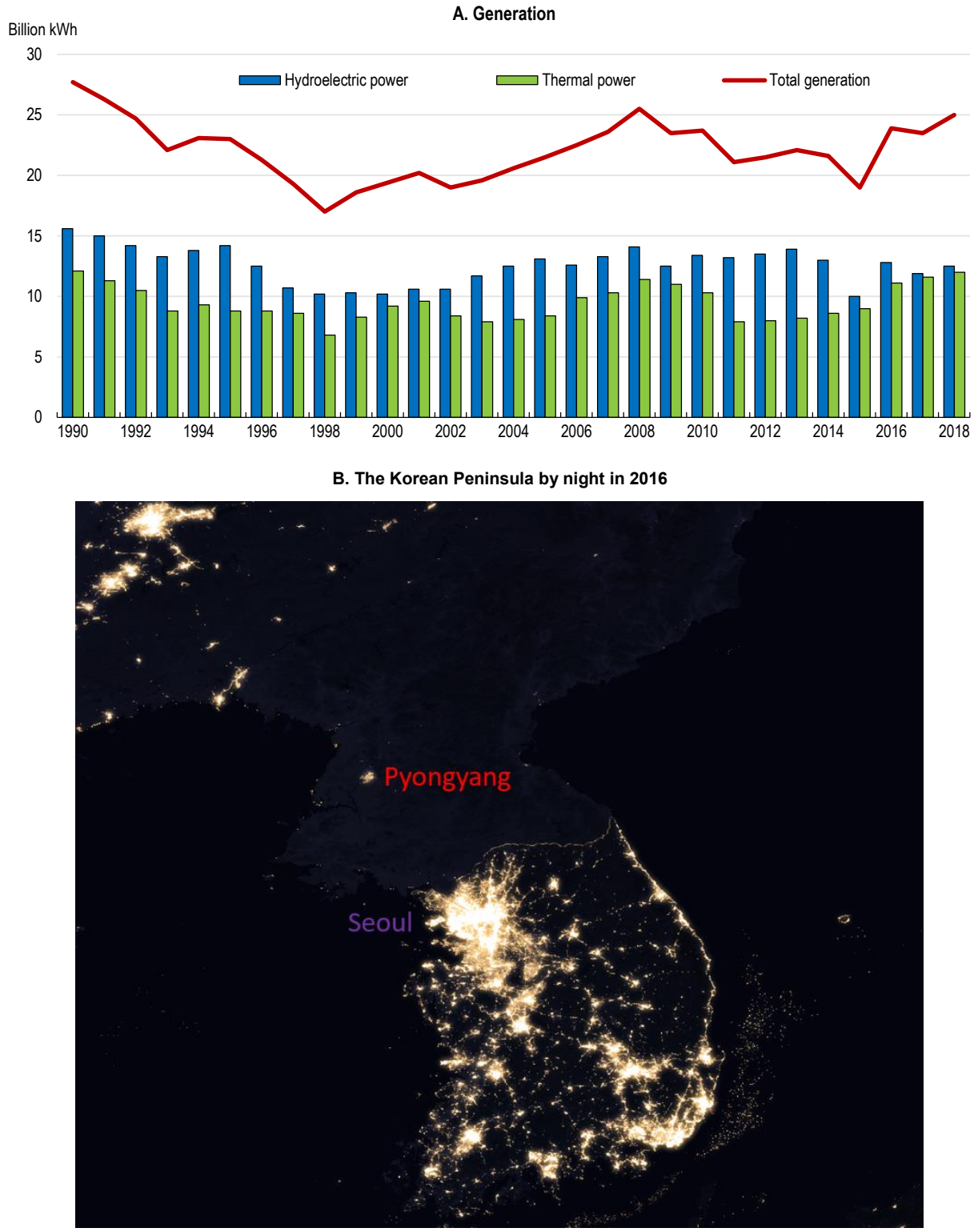
Table 4. Primary energy supply

	Coal	Petroleum	Hydropower	Other	Total	Coal	Petroleum	Hydropower	Other
	Tonnes of oil equivalent					% share			
1985	18750	1960	3110	1120	24940	75.2	7.9	12.5	4.5
1990	16575	2520	3748	1120	23963	69.2	10.5	15.6	4.7
1995	11850	1100	3535	795	17280	68.6	6.4	20.5	4.6
2000	11250	1117	2540	780	15687	71.7	7.1	16.2	5.0
2005	12030	1034	3283	780	17127	70.2	6.0	19.2	4.6
2010	10347	704	3352	1260	15663	66.1	4.5	21.4	8.0
2011	7275	763	3300	1260	12598	57.7	6.1	26.2	10.0
2012	6970	684	3370	1260	12284	56.7	5.6	27.4	10.3
2013	5190	710	3470	1260	10630	48.8	6.7	32.6	11.9
2014	5810	730	3250	1260	11050	52.6	6.6	29.4	11.4
2015	3930	1010	2500	1260	8700	45.2	11.6	28.7	14.5
2016	4280	1170	3200	1260	9910	43.2	11.8	32.3	12.7
2017	6030	970	2980	1260	11240	53.6	8.6	26.5	11.2
2018	8810	950	3200	1260	14220	62.0	6.7	22.5	8.9

Source: Statistics Korea, *Major Statistics Indicators of North Korea*, various years.

According to the World Bank (2019), 56% of the total population lacked access to electricity in 2017. Insufficient power supply also causes difficulties for manufacturing and mining. Electricity provision varies greatly across regions, with power shortages worst outside Pyongyang (Mun, 2019; Figure 10, Panel B). Recently installed Chinese generators reportedly supply around 40% of the capital's power use (Kim, 2018b). Power shortages have also affected the army and some core national defence technology institutions such as the National Defence University (Kim Jeong Hun, 2019).

Figure 10. Electricity



Source: Statistics Korea; NASA Earth Observatory.

While electricity provision by state-owned power plants has stagnated, access to energy has improved gradually for some residents and enterprises (Park et al., 2018). North Korea citizens and public institutions such as nursery centres and farms began to generate their own electricity through small-scale solar panels following encouragement from the authorities. Imports of Chinese solar generation materials have increased and there are now more than 100 000 houses with solar equipment (Bing and Lee, 2017; Park and Noh, 2019). Recently, the North Korean authorities have tried to improve the energy efficiency of industrial facilities and to develop alternative energy sources, including renewables (Kwak, 2018). In principle, this could help address the very severe air pollution problems afflicting the country, where deaths ascribed to this cause were 10 times higher than in South Korea in 2012, and higher than in China and India (World Health Organization, 2017).

Transport infrastructure shortcomings

North Korea's transportation infrastructure has not improved much over the past half century. There is scant facility repair and improvement and logistical functions are not working properly. The situation is even worse in most areas outside Pyongyang, notwithstanding some Chinese-sponsored efforts to build or upgrade bridges and roads in a few of the border areas between the two countries (Hastings, 2016).

The backbone of transportation in North Korea is the railroad system. North Korea ships by rail more than 90% of its domestic freight, whereas in South Korea 92% is transported by road. In 2018, the total length of railways in North Korea was 5 289 km, longer than in South Korea, but the network is antiquated, the trains are very slow and often late because of power cuts (Park Eun-Kyung, 2019). In Pyongyang, the subway system, built very deep under ground in the 1960s, runs only on the western side of the Taedong River, with only two lines and 17 stops. There are also four tram lines, one of which serves to shuttle passengers to and from the mausoleum where the bodies of Kim Il-sung and Kim Jong-il lie in state. Both mass transit systems use old rolling stock – the trams were purchased second hand from what was still Czechoslovakia – but have begun to be upgraded (Talmadge, 2019). The length of the roads, at 26 180 km, is 24% of South Korea's, and the paving rate in the North is only 10%. The total capacity of North Korean ships, amounting to 1 million tonnes in 2018, is 1/12th of South Korea's.

Cooperation projects with South Korea could have improved North Korea's transport infrastructure substantially (Table 5). However, little progress has been made on the ground, against the backdrop of the international sanctions that prohibit bringing in machinery and construction materials. With the approval of the United Nations, the two Koreas jointly conducted a field study on two main railroads in 2018 (the Gaeseong to Sinuiju line and the Geumgang to Tuman River line). The overall condition of tracks, bridges and tunnels was poor, and trains' average speed is reportedly only 30 to 50 km per hour.

Table 5. Agreements between the two Koreas on transport links

Main events	Main decisions
Ministerial meeting, July 2000	Agreement on a connection, Gyeongui railway and road
Ministerial level meeting, April 2002	Agreement on a connection, East Sea railway and road
Joint declaration at Summit, October 2007	Agreement on renovation for joint use of railways and expressways Establishment of a direct flight route between Mount Baekdu and Seoul Development of rail cargo transportation between North Korea's Gaeseong City and South Korea's Munsan
Panmunjom declaration, April 2018	Agreement on the connection and modernisation of railways and roads on the East Sea Lines and Gyeongui Lines
Joint field study, November 2018	Decision on the Joint South-North Korea Investigation of the Gyeongui Line and the East Sea Line

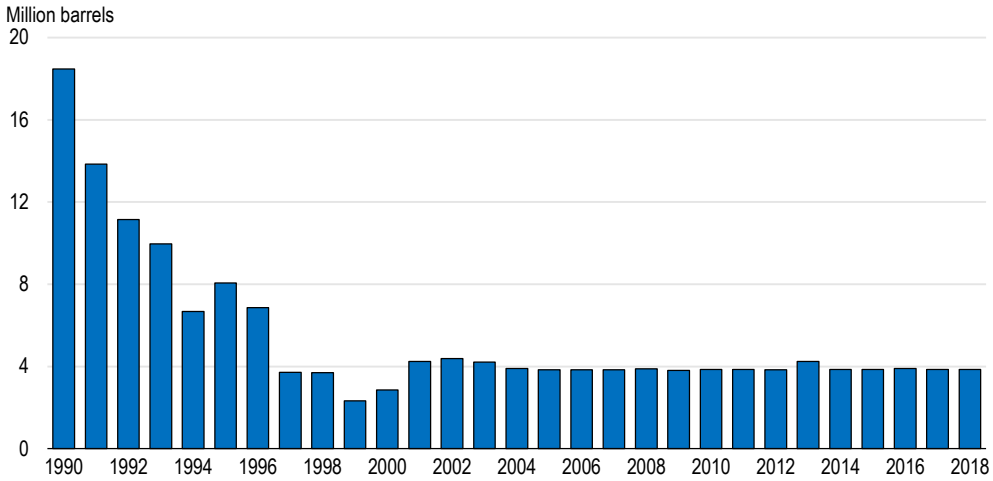
Source: Jin et al. (2018).

Sanctions and the economic impact of their intensification

International sanctions on North Korea

North Korea unilaterally withdrew from the nuclear Non-Proliferation Treaty (NPT) in 2003 and has conducted a number of nuclear and long-range missile tests since 2006. In response, the United Nations Security Council has extended sanctions against North Korea (Table 6). Prior to 2016, these mainly covered conventional armament and weapons of mass destruction (WMD). Thereafter, the UN expanded their scope to include general trade transactions and economic cooperation. The intensified sanctions restrict the inflow of foreign currency and directly affect the North Korean economy. The UN banned key exports such as coal, textiles and seafood. It also cut off imports of machinery and electronics, which could be used for weapon development. Crude oil imports are only allowed up to 4 million barrels annually (Figure 11), and refined oil imports up to 0.5 million barrels. Financial transactions and economic cooperation with North Korea were also restricted and North Korean workers were prohibited from working abroad, reducing an important source of foreign currency. In principle, UN member countries were to return North Korean workers to North Korea by the end of 2019, but in practice, a number of them seem to have remained abroad, notably in China and Russia (see below).

Figure 11. Estimated official crude oil imports



Source: Bank of Korea.

On top of the UN sanctions, the United States, the European Union, Japan, Australia and South Korea have their own. In 2016, the US Congress adopted the North Korea Sanctions and Policy Enhancement Act. It prohibits the provision of goods, technologies, services and financial transactions in connection with goods subject to sanctions. It also includes a potential secondary boycott that could affect third-party firms with business in the United States, in the case of illegal transactions with North Korean individuals and firms. The United States designated North Korea as a primary money laundering concern in 2016 and as a state sponsor of terrorism in 2017. Since the US Act deals with human rights and money laundering issues as well as WMD, North Korea would need to address those concerns together for the United States to lift sanctions (Do, 2018). In September 2016, the United States first imposed secondary sanctions on Chinese companies and executives on charges of illegal transactions with North Korea. In 2018, the US administration indicted Singaporean companies on similar charges. Meanwhile Japan, North Korea's first trading partner before 2000, suspended all trade with the country after the 2006 nuclear test.

South Korea has also stepped up its own sanctions on tourism, general trade and the Gaeseong Industrial Complex (Table 7). When a tourist was killed in the Mount Geumgang area in 2008 (Box 2), South Korea stopped the tours there. In 2010, North Korea sank the South Korean Cheonan warship and bombarded Yeonpyeong Island. In response, the South Korean government suspended all trade with North Korea, except for the Gaeseong Industrial Complex (Box 3) (Ministry of Unification, 2010), drastically reducing inter-Korean trade. When North Korea carried out its fourth nuclear and long-range missile tests in 2016, South Korea decided to shut down the Gaeseong Industrial Complex (Ministry of Unification, 2016).

While the sanctions affect North Korea's trade and investment, it is impossible to trace all trade deals and North Korea has actively tried to circumvent the sanctions (UN Panel of Experts, 2019), including through increased abusive recourse to the diplomatic "pouches" embassy personnel are entitled to use (Park and Walsh, 2016). In practice, the identification of sanctions violations is difficult, with North Korean exports diverted via Russia or bearing "made in China" labels (Shin et al., 2016). However, some sources suggest that in the course of 2018, North Korea received 263 deliveries of oil via ship-to-ship transfers (Bondaz, 2019), which likely helped keep gasoline prices relatively stable.

Table 6. Main UN Security Council resolutions on North Korea

Events	UNSCR	Sanctions
North Korea announces it will leave the NPT, March 1993	UNSCR 825 March 1993	Adoption of a resolution condemning North Korea's withdrawal from the Nuclear Non-Proliferation Treaty
North Korea leaves the NPT, January 2003		
First nuclear test, October 2006	UNSCR 1718 October 2006	Prohibition of the sale and transfer of weapons of mass destruction (WMD) and luxury goods
2nd nuclear test, May 2009	UNSCR 1874 June 2009	Expansion of the prohibition of WMD transfers and authorisation for countries to inspect North Korean cargo on sea, land and air
3d nuclear test, February 2013	UNSCR 2094 March 2013	Air cargo sanctions (no landing of aircraft with suspect cargo)
4th nuclear test, January 2016 Long-range missile test, February 2016	UNSCR 2270 March 2016	Ban on arms trade with North Korea, tightening of obligations to monitor North Korean ships, export sanctions on minerals (anthracite coal, iron ore, gold, rare earths, etc.), and prohibition of technical cooperation on satellites and space
5th nuclear test, September 2016	UNSCR 2321 November 2016	Quota for North Korean coal exports (within USD 0.4 billion or 7.5 million tonnes per year) and addition of silver, copper, zinc, nickel to the list of prohibited minerals
Ballistic missile launch, July 2017	UNSCR 2371 August 2017	Prohibition of exports of North Korean coal and iron ore, export sanctions on seafood, ban on new investments in North Korea, and freeze of the overseas dispatch of North Korean workers
6th nuclear test, September 2017	UNSCR 2375 September 2017	Ban of textiles exports and limitation of annual imports of oil to 4 million barrels of crude oil and 2 million barrels of refined oil
Ballistic missile launch, November 2017	UNSCR 2397 December 2017	Prohibition on the purchase of fishing rights in North Korea, tightening of the restriction on imports of refined oil to 0.5 million barrels, repatriation of overseas North Korean workers by end-2019

Source: United Nations; Ministry of Unification; Korea Institute for National Unification.

Table 7. South Korea's sanctions on North Korea

Events	Sanctions
A North Korean soldier shoots and kills a South Korean tourist in the Mount Geumgang area, July 2008	Suspension of the Mount Geumgang tourism business between the two Koreas from 2008 (in response, North Korea stops the Gaeseong tourist business, which had started in 2007) Suspension of food and fertiliser aid to North Korea
North Korean attack on South Korean Cheonan corvette and Yeonpyeong Island, March 2010	Suspension of all trade between the two Koreas, except for the Gaeseong Industrial Complex, from May 2010 Prohibition of new investment in North Korea Prohibition of North Korean ships from sailing in South Korean waters Restrictions on meetings with North Koreans
4th nuclear test, January 2016 Long-range missile test, February 2016	Suspension of Gaeseong Industrial Complex from February 2016 Strengthening of financial and shipping sanctions against North Korea Suspension of the international Najin-Hasan rail freight project (involving Russia, South Korea and North Korea) Sanctions on North Korean individuals and organisations involved in nuclear and WMD development Urging South Koreans to avoid overseas North Korean restaurants
5th nuclear test, September 2016	Strengthening of the sanctions on North Korean individuals and organisations involved in nuclear and WMD development

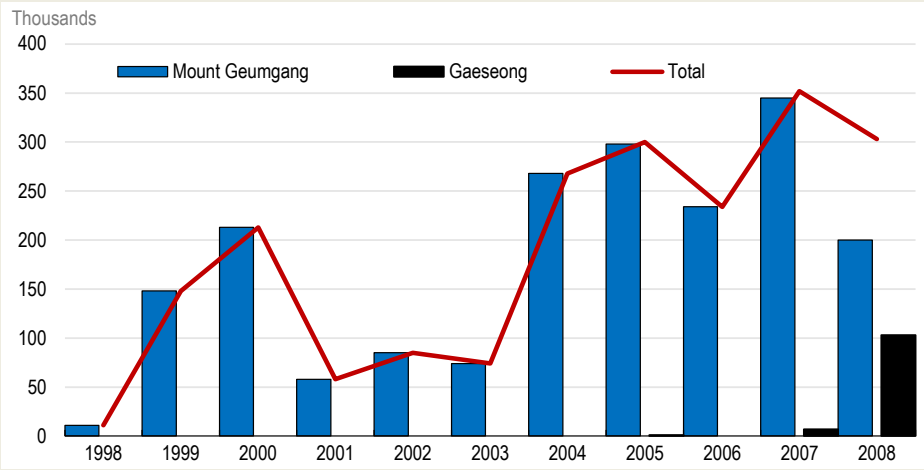
Source: United Nations; Ministry of Unification; Korea Institute for National Unification.

Box 2. Ups and downs in tourism

Foreign tourists are a source of hard currency which North Korea has long sought to exploit, albeit on a limited scale and with ups and downs. As the UN sanctions do not target tourism, this source of revenue has become increasingly attractive in recent years.

South Korean tourism in North Korea began at Mount Geumgang* in 1998, and expanded to the Gaeseong* region in 2007. The number of tourists from South Korea started to take off in 2004, and exceeded 300 000 in 2007 (Figure 12). By 2008, around 2 million South Korean tourists had visited North Korea. However, the shooting of a South Korean tourist led to the interruption of the South Korean tours in July 2008. Mount Geumgang was run by a South Korean enterprise, which holds a 50-year license for the Mount Geumgang tour programme, and North Korea received a tourism fee per tourist, which was estimated to bring in $10-20 million annually (Kim, 2015). In November 2019, North Korea requested the withdrawal of the South Korean company's building and facilities from the Mount Geumgang tourist region, a legal breach which could deter foreign investment in the future.

Figure 12. Tourist entries in the Mount Geumgang and Gaeseong areas



Source: Ministry of Unification (2019a); Statistics Korea, KOSIS.

Recently, North Korea opened the Masik Pass ski resort in 2014 and constructed Samjiyon mountain resort near Mount Baekdu*, with a ski resort and accommodation for 4 000 families in 2019 (Choe, 2019). In addition, the North plans to introduce medical tourism in 2020, including health clinics for neuralgia, arthritis and skin ailments near hot springs (Shin, 2019). The North is soon to open the Wonsan-Kalma tourist zone located between the beach once used for missile tests, and the Wonsan-Kalma airport, once a military airport (O'Hare, 2019). For the development of tourism, North Korea has established flights, to supplement existing rail and bus lines and attract Chinese tourists after the suspension of tourism with South Korea. Around 90 % of all tourists are reported to be Chinese (Jiang and Cheng, 2019). China stopped publishing official statistics on the number of Chinese tourists visiting North Korea after 2013, when it stood at 207 000 (Kim Hankyu, 2019), but some reports suggest that it had increased since, driven inter alia by a nostalgia of sorts, to the point of straining absorption capacity (O'Carroll, 2019). The coronavirus outbreak in China, however, has halted these tourist inflows.

* Also often transliterated as Kumgang, Kaesung or Paektu, respectively (North Korean romanisation).

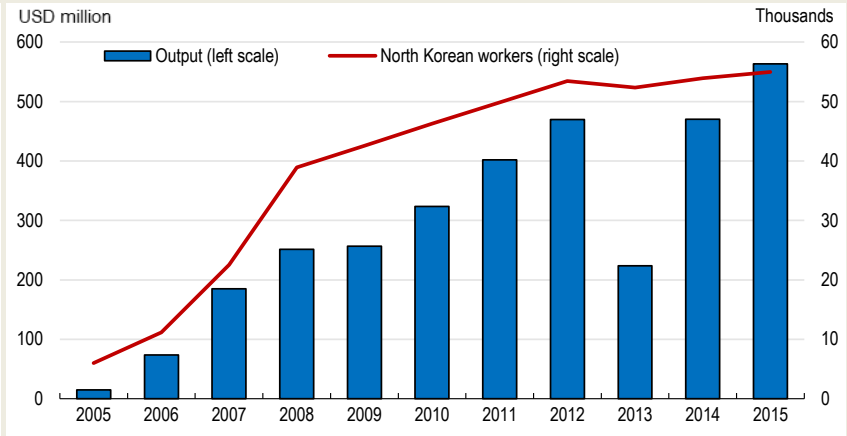
Box 3. The Gaeseong Industrial Complex

In 2000 the two Koreas agreed to develop the Gaeseong* Industrial Complex (GIC), located 8 km west of Gaeseong, the former capital, 60 km north of Seoul, 50 km east of Incheon, 160 km south of Pyongyang, and just 5 km from the Demilitarised Zone. It opened in late 2004 and became a flagship economic cooperation project, combining the economic comparative advantages of the two Koreas: South Korea developed the land and power infrastructure of the GIC and its firms invested in facilities, while North Korea provided low-wage workers. Originally, the GIC was to be completed in 2012, spreading across an area of 56 km^2, with 2 000 companies (including from countries other than South Korea) employing 350 000 people and with production worth USD 16 billion (Yang, 2013). Residential facilities, hospitals, shopping centres and a theme park were also envisaged. The hope was that in the future, the Trans-China and the Trans-Siberian railroad would connect the GIC with China, Russia and Europe by land, turning it into a Northeast Asia hub.

In practice, the GIC covered only 3.3 km^2 by 2016. Shipping out the goods produced in the GIC was not straightforward. Indeed, in the context of heightened military tensions the North Korean authorities restricted operations for several days in 2009, and even froze them for four months in 2013. The GIC's output, consisting of products such as clothing, watches or car parts, increased from USD 14 million in 2005 to USD 563 million in 2015, and the number of South Korean enterprises from 18 in 2005 to 125 in 2015 (Figure 13). The number of North Korean workers in the GIC peaked at around 55 000 in 2015. Wages were payable in US dollars or other hard currencies except for South Korean won, and not paid directly to the workers but via the North Korean authorities. According to the Ministry of Unification (2016), North Korea received USD 560 million through the GIC project. However, apart from Hyundai Asan, which developed the area, larger South Korean enterprises did not participate given the political risks.

Following North Korea's fourth nuclear and long-range missile tests in 2016, the South Korean government decided to shut down the GIC. Against the background of the recent efforts to step up cooperation between the two Koreas, some of the firms involved sought to make the case for reopening the GIC to U.S. lawmakers (Hwang, 2019).

Figure 13. Activity in the Gaeseong industrial complex



Source: Ministry of Unification (2019a, 2019b), Statistics Korea; investgic.org.
* Also often transliterated as Kaesong (North Korean romanisation).

The impact of sanctions on the North Korean economy

The economic sanctions have affected North Korea's foreign trade, reduced foreign currency earnings and altered domestic industrial structures, notably in manufacturing and mining, and especially so since their intensification in 2016, even though the counterfactual is difficult to pin down and there is room for disagreement on their exact impact (Park and Walsh, 2016). They have not prevented continued imports of luxury goods from China for wealthier customers, at least until 2017 (Jeong, 2019). Furthermore, while they are not meant to harm the civilian population, they have imposed costs on some of the more vulnerable groups in North Korean society, in particular because they hinder the delivery of humanitarian aid (Martin, 2019) and the imports of fuel, machinery and spare parts needed in agriculture (UN Panel of Experts, 2019; FAO/WFP, 2019).

While North Korea publishes scant trade data, the information on bilateral trade flows released by the countries that do business with North Korea is often used as "mirror statistics" to get insights into North Korea's trade. However, these data fail to capture smuggling, which has reportedly been widespread, both across land and sea borders, and to a large extent with the involvement of North Korean State trading companies operating in China (Park and Walsh, 2016; Mandhana, 2018; Kyodo, 2019). Over the years, smuggled items exported by North Korea have ranged all the way from very cheap high-end Myong Shin cigarettes, which are popular in China (Kim Johoon, 2019) to drugs and counterfeit goods and banknotes (Hastings, 2016) and to coal and iron (AP, 2017). Illicit imports have ranged from oil, which follows various trafficking routes (Table 8) to weapons concealed under bags of sugar in ships' holds (Griffiths and Siirtola, 2013; Hunt, 2016). They also include dual-use industrial equipment manufactured by Western companies in China, or luxury items made in Europe, which are sold to Chinese middlemen who then hide them in regular commercial dispatches to North Korea, selecting routes that are congested or subject to few inspections (Park and Walsh, 2016), or transit via the Russian Far East, as has been documented for high-end cars (C4ADS, 2019).

Table 8. Petroleum trafficking

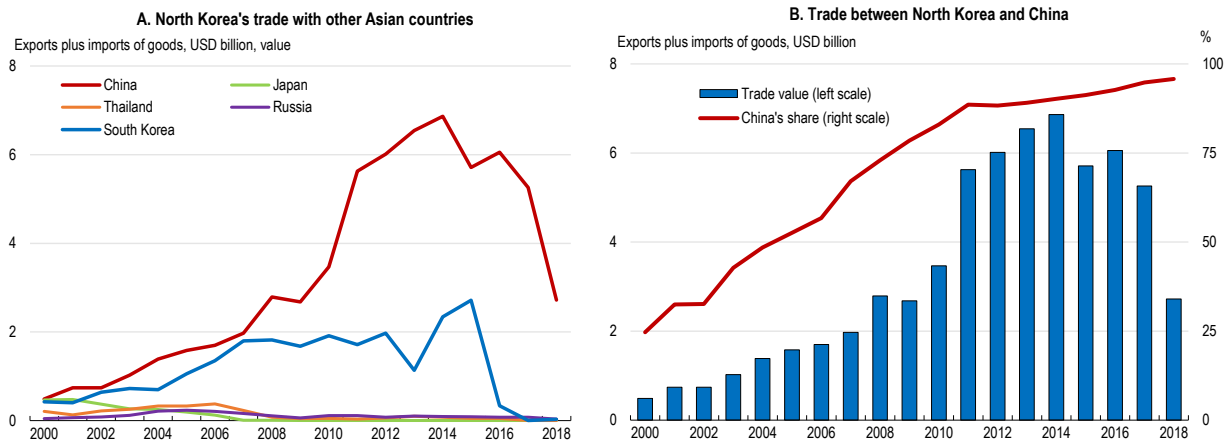
Source		Routes
Agencies, enterprises and factories at county, city, province and central government level		Petroleum products distributed by the authorities are pilfered by officials in charge of managing petroleum products or heads of institutions
Military units		Petroleum products distributed by Kangseong Trading Company to military units are pilfered by manipulating training hours
Fuel storage bases and depositories		Pilfered by officials in charge of managing petroleum products or heads of institutions
Smuggling	Fuel oil from Nakhodka	*Donju* dispatch personnel to Nakhodka, Russia to illegally import petroleum
	Enterprises and factories	North Korean products are bartered with other countries for petroleum
	Private importers	Using small vessels (mostly in international waters) or empty spaces in import vessels

Source: Kim Kyung Sool (2019).

Based on the partial mirror statistics, China became North Korea's largest trading partner in 2000. Japan suspended all trading with North Korea in 2006, and so did South Korea in 2016 (Figure 14, Panel A). North Korea's trade dependence on China increased from 50% in 2005 to 95.8% in 2018 (Panel B). Along with yuanisation, this has reinforced China's influence on the North Korean economy. The recent coronavirus outbreak in China has illustrated some of the risks associated with this high dependence on a single partner. While imports from China have increased sharply over time, they continue to consist mainly of consumer goods, textiles and electrical products. Trade with China has allowed some cities on the Chinese borders to prosper, such as Sinuiju, Hoeryong and Rason, whose per capita income is reportedly similar to Pyongyang's (Lankov, 2017).

Russia and India are North Korea's second and third largest trading partners, but trade was only USD 34 million and USD 21 million respectively in 2018. Thailand was the second largest trading partner from 2004 to 2007, but trade has declined sharply to just USD 11 million in 2018 (Panel A).

Figure 14. Trade with other Asian countries

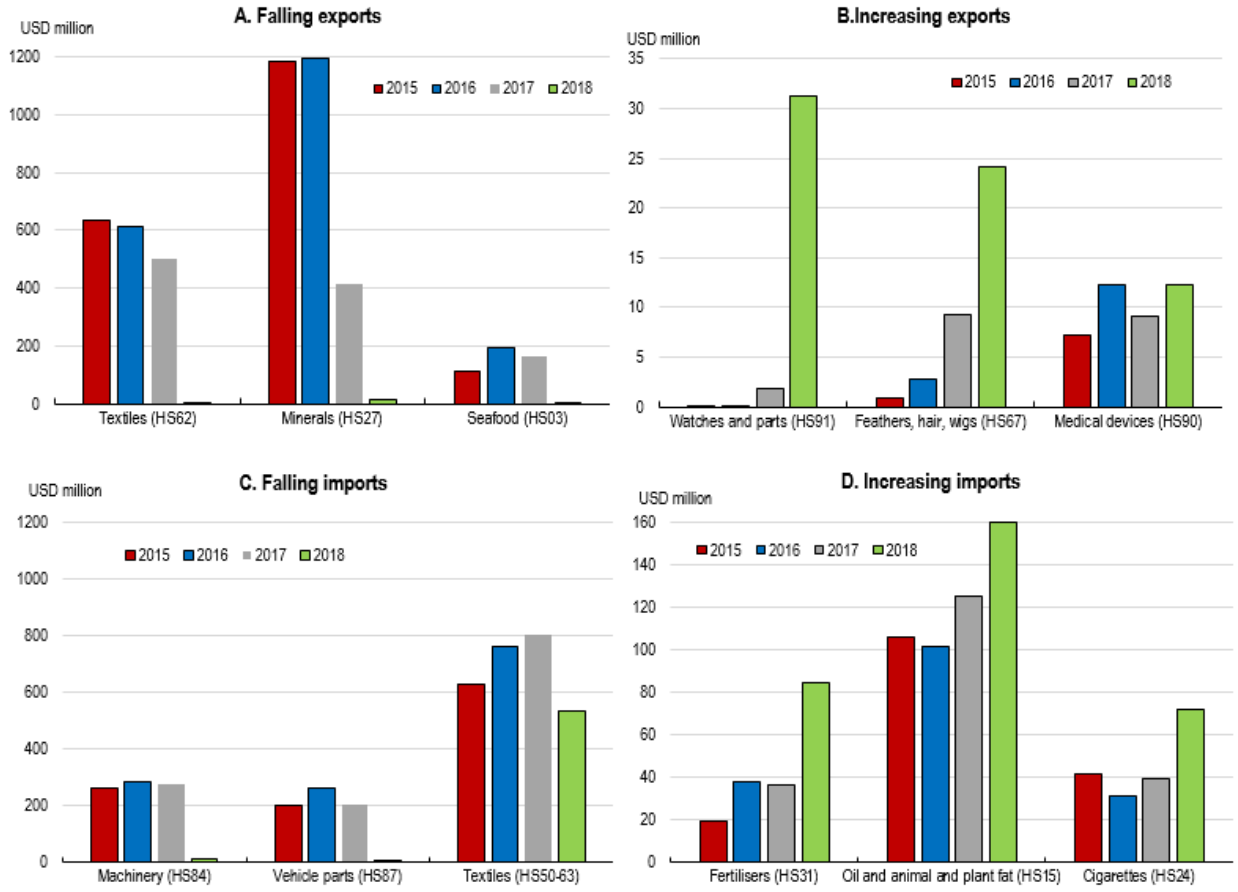


Source: Korea Trade-Investment Promotion Agency (KOTRA).

Sanctions have also altered the composition of North Korea's foreign trade. Due to the UN ban, North Korea's exports of mineral products, textiles and seafood dropped by more than 90% (Figure 15, Panel A). In contrast, exports of watch parts, feathers, hair and wigs, and medical devices, which are not covered by the sanctions, increased sharply, but from such a low base that this could not offset the decrease in other exports (Panel B).

The composition of imports changed as well. Purchases of textiles, which used to be the largest import category, fell by more than 30% (Panel C). Purchases of raw and subsidiary materials for textile products likely decreased due to the ban on textile exports (Hong, 2019). Recorded imports of machinery and vehicle parts collapsed, even though Pyongyang visitors report seeing foreign-made cars – including higher-end models – which have entered the country in recent years, notably second-hand Japanese vehicles (Shen, 2018). Meanwhile, fertiliser imports and the imports of oil and fat from animal and plant increased slightly (Panel D).

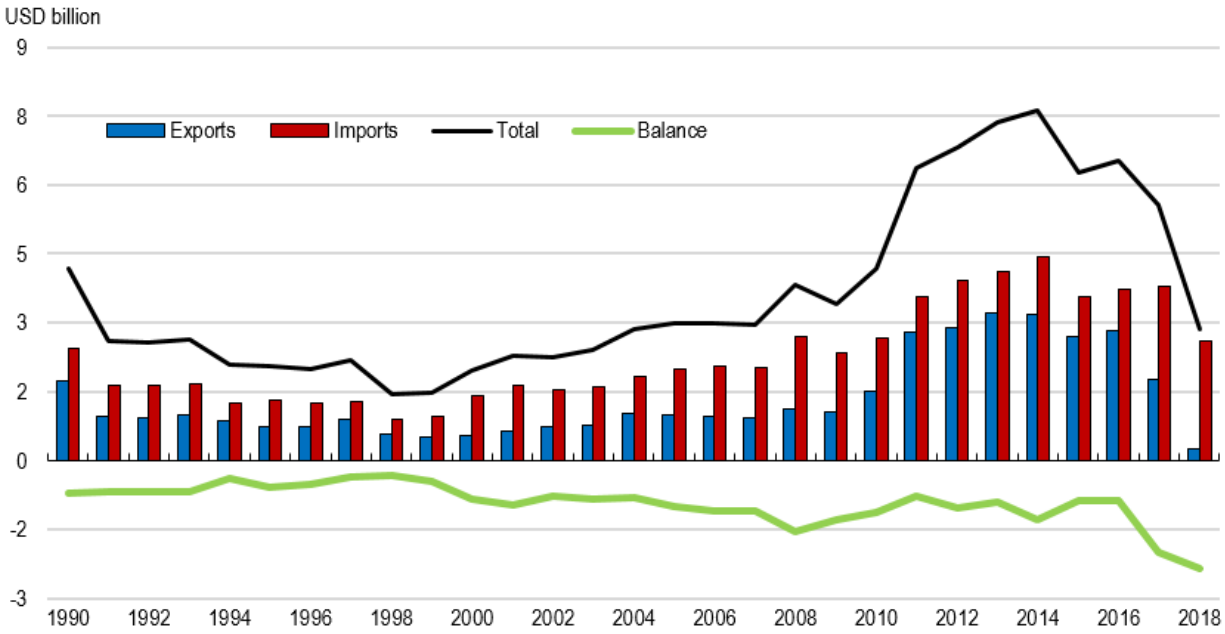
Figure 15. Changes in exports and imports after the tightening of sanctions



Source: Korea Trade-Investment Promotion Agency (KOTRA).

In the process, the trade deficit has widened (Figure 16). Total exports fell by more than 90% between 2015 and 2018 to USD 0.2 billion in 2018 and imports by 26% to USD 2.6 billion. The trade deficit thus increased to over USD 2 billion by 2018, double the 2004-15 annual average deficit. The magnitude of the trade deficit may be overstated, however, insofar as commissions paid to North Korean exporters by their clients abroad are not reflected in the trade statistics (Kim Byung Yeon, 2017). Besides, this estimate fails to capture smuggling.

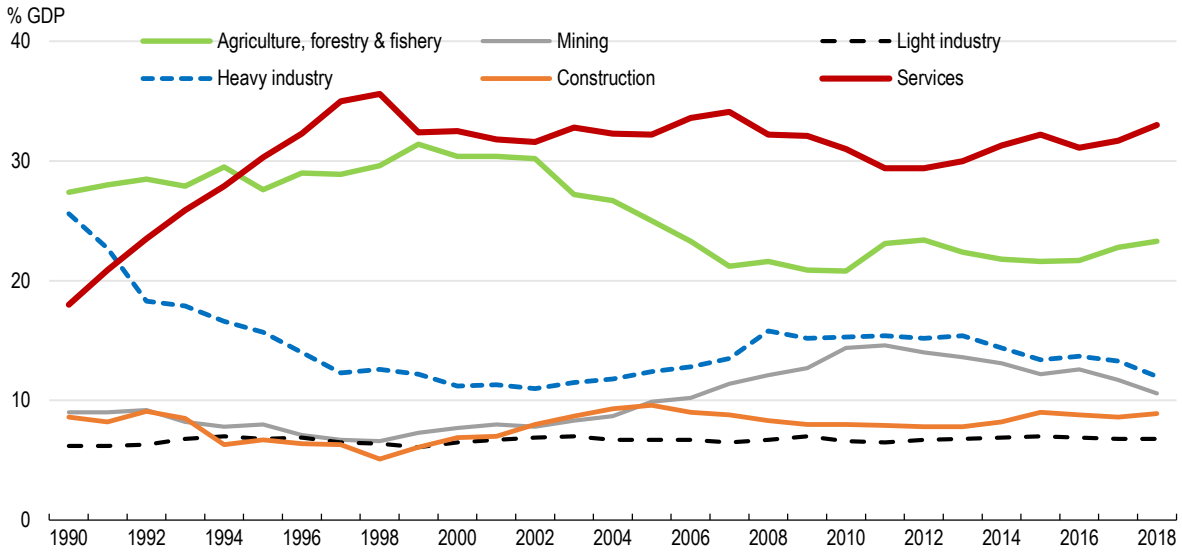
Figure 16. Trade balance



Source: Korea Trade-Investment Promotion Agency (KOTRA).

Economic sanctions have likely affected the economy's sectoral structure as well. Manufacturing firms have struggled to secure inputs from markets and to pursue domestic production in some facilities (Park et al., 2018). One recent example is the closure of the country's largest fertiliser plant, the Hungnam Fertiliser Complex, which suffered from the ban on oil imports (Jang, 2019b). Accordingly, the share of mining and manufacturing has declined while that of services and agriculture, forestry and fisheries has increased (Figure 17). In recent years, however, marketisation has also been a driving force, boosting services, especially transportation, and consumer goods (Yang, 2016b).

Figure 17. Evolution of the sectoral structure



Source: Bank of Korea, ECOS.

North Korean migrant workers

North Korea has sent workers to China, Russia, the Middle East, South East Asia (Viet Nam, Cambodia), Europe (Poland), and Africa (Nigeria) to earn foreign currency. There are no reliable statistics on North Korean migrant workers but Lee et al. (2016) estimated that the number of overseas North Korean workers totalled between 113 700 and 147 600 in 2015-16. More recently, the US State Department (2019) has put the number at around 90 000, most of whom seem to work in China. Those North Korean workers receive only a fraction of their wages, with the remainder going to the government (Zang, 2013). Even so, many of them consider such expatriate jobs as attractive opportunities (Park et al., 2018). In China, they tend to work as manual labourers in construction, textiles and manufacturing in the Northeast of the country. In Russia, they also often work in construction, in seafood processing factories, as seasonal agricultural workers or on pig farms in the Far East. Zang and Kim (2019) estimated that North Korean migrant workers earned around USD 200 million annually in 2015-17, up from around USD 130 million annually in 2012-14.

Since 2017, the United Nations have put restrictions on this source of foreign currency earnings (UNSCR 2397, Table 5). As noted, UN member countries were to return North Korean workers by 22 December 2019. According to the United Nations, by end-August 2019, about 22 000 workers in Russia and Middle Eastern countries had returned to North Korea (Nichols, 2019). However, the number of tourist and student visas granted by the Russian Interior Ministry to North Korean citizens soared in the course of 2019, suggesting that at least several thousand workers stayed, or arrived, with a different status (Fromer, 2020; Ha, 2019a). China, which has the largest number of North Korean workers, did not provide the relevant statistics but North Korean workers who stay there for less than 90 days do not need any work permit, which reportedly enables some short-term worker rotations across the border (White et al., 2019).

Meanwhile, North Korea also earns foreign currency through restaurants and companies abroad (Hastings, 2016). Zang (2013) estimated that North Korea operated around 300 such restaurants and firms in 2012. In addition, the North earns foreign currency through fishing fees from foreign ships, which may have brought in around USD 170 million between 2014 and 2016 (Zang and Kim, 2019).

Structural changes and marketisation

North Korea's special economic zones

Seeking to emulate China's experience, North Korea introduced its first joint venture law in 1984 and started to establish special economic zones (SEZs) in 1991, with the Rajin-Sonbong (or Rason) special economic and trade zone (Table 9). In 2002, Sinuiju, Gaeseong and Mount Geumgang were granted special status. So was Hwanggumpyong-Wiwha in 2011. However, only the Gaeseong Industrial Complex and the Mount Geumgang tourism area drew in investment by South Korean companies (Clément, 2019). While North Korea hoped to attract Chinese production facilities, Chinese firms made little investment in the North's SEZs, notwithstanding some engagement, alongside with Russia, in Rason (Abrahamian, 2011), preferring to step up their involvement in the trade sector with less exposure to investment risks.

Since 2012, North Korea has intensified its efforts to attract foreign investment via SEZs. Over 20 additional zones have been listed as economic development zones, mostly close to the border so as to attract investment by Chinese entrepreneurs (Clément, 2019). These SEZs are typically smaller, however, and often established by local governments.

Even so, results have been disappointing so far (Lee, 2015). Political uncertainty and risks are too high for foreign investors, who face a fluid and ambiguous environment: the boundaries between state and non-state activities, formal and informal businesses, licit and illicit dealings, are all blurred and the rule of law cannot be relied upon (Hastings, 2016). While wages and rents are low, foreign firms need to bear the cost of infrastructure development. They also need to deal with ubiquitous corruption (Kim Sang-hoon, 2017), with North Korea ranking 176th out of the 180 countries monitored by Transparency International (TPI,

2019) and numerous examples of bribery and extortion pervading everyday life (OHCHR, 2019; Asiapress, 2019b). Moreover, the international sanctions and their unpredictable evolution are a major disincentive for potential investors. Reputational risk may also deter them.

Table 9. Special economic zones

Started	Management	Name and location
Before 2012	Central government	Rajin-Sonbong (1991,North Hamgyong – also referred to as Rason) Gaeseong Industrial Complex (2002) Sinuiju Special Administrative Region (2002, North Pyongan) Mount Geumgang tourist region (2002, Kangwon) Hwanggumpyong-Wiwha (2011)
After 2013	Central government	Unjong high technology development zone (2014, Pyongyang) Kangryong international green model zone (2014, South Hwanghae) Jindo export processing zone (2014, Nampho) Sinuiju international economic zone (2014, North Pyongan) Mubong international tourist zone (2015, Ryanggang)
	Local government	Hyesan (2013, Ryanggang), Manpo (2013, Jagang), Wiwon (2013, Jagang), Amnok river (2013, North Pyongan), Wau-do (2013, Nampho), Songrim (2013, North Hwanghae), Chongjin (2013, North Hamgyong), Onsong (2013, North Hamgyong), Orang (2013, North Hamgyong), Pukchong (2013, South Hamgyong), Hungnam (2013, South Hamgyong), Hyondong (2013, Kangwon), Sinpyong (2013, North Hwanghae), Chongnam (2014, South Pyongan), Wonsan Mount Geumgang tourism zone (2014, Kangwon), Sukchon (2014, South Pyongan), Chonsu (2014, North Pyongan), Kyoungwon (2015), Kangnam (2017)

Source: Ministry of Unification; Jin et al. (2018); Clément (2019).

Marketisation

Small-scale markets for small items have long existed in North Korea. As noted above, in the 1990s, as the country's distribution system collapsed, these unofficial markets started to play a greater role in supplying necessities and other goods for ordinary North Koreans and evolved into general markets, which were first tolerated by the authorities, but later became more organised, bringing in substantial revenue through stall license fees and quasi-taxes (Yang, 2016b; Lee Suk, 2019). These fees can be quite substantial (Table 10).

Table 10. Daily market fees per stall in general markets

Stall selling	Grains	Vegetables	Clothing	Seafood	Electric appliances	Domestic shoes	Imported shoes	Meat
2004 Ministry of Finance regulation								
Fee (KPW)	100	80	120	200	250	200	400	250
Observed onsite in late 2019 in Pyongsong								
Fee (KPW)	3000	2400	3600	6000	7500	6000	12000	7500

Source: Jo (2019).

As a result, the general markets have grown in number and size (Table 11). Some 200 general markets operated officially in North Korea in 2010, but by 2016 that number had more than doubled and around 1.1 million people were estimated to work in the general markets (Hong et al., 2016). As of early 2019, some 500 general markets were likely in operation across the country, with some tendency towards specialisation across the country and within the large cities (Lee Je-hun, 2019a). The number of sales stalls and merchants in many of those markets has soared, with up to 17 000 stalls in the largest one, in Chongjin, a port city with connections to China and Russia (Cha and Collins, 2018). Just in Pyongyang, there are 30 general markets (Figure 18), and the largest one, called Unification Street Market, in the

Rangrang District, is even vaster than Seoul's huge Dongdaemun Market (Lee Je-hun, 2019a). These formalised markets are housed in permanent buildings that are readily identifiable via satellite imagery. They come on top of the many "black", "grey" or "informal markets" (also dubbed "grasshopper markets"), located on the fringe of general markets, in back alleys and on the side of the road, which tend to use makeshift structures and are harder to spot from the sky. Vendors in the unofficial markets are not expected to pay any quasi-taxes but are frequently subject to shake-downs by security or police, or even pressed to nonetheless pay quasi-taxes (Jo, 2019).

Table 11. Selected general markets in North Korea around the mid-2010s

Province or city	**Representative general market**	**Population of province or city** (thousands)	**Number of markets**	**Total market size** (m^2)	**Total number of stands** (thousands)
North Pyongan province	Cheha Market (National distribution hub for Chinese imports)	2 729	51	213 212	118
South Pyongan province	Pheongseong Market (largest retail and wholesale market trading commodities)	3 715	65	240 917	135
North Hamgyong province	Sunam Market	3 066	46	217 458	134
South Hamgyong province	Sapo Market (foodstuffs, clothing, shoes)	2 130	48	253 218	150
North Hwanghae province	Sariwon Market (wholesale grains, foodstuffs, clothing)	2 114	34	174 431	94
South Hwanghae province	Yangsa Market	2 310	34	206 455	118
Kangwon province	Kalma Market	1 478	29	101 817	61
Jagang province	Kanggye Market (food, seafood, shoes)	1 299	24	63 572	35
Ryanggang province	Hyesan Market (grains, food, imported items, clothing)	336	18	31 499	17
Pyongyang City (capital)	Songsin Market (the first official market) Unification Street Market (best known general market, with three buildings and a parking lot)	2 999	30	207 202	142
Nampho special city	Jungdaedudong Market	719	21	103 061	70
Rason special city	Sinheong Market	197	4	26 840	19
Total		**23 348**	**404**	**1 839 682**	**1 093**

Source: Institute for Unification Education (2017); Hong et al. (2016).

Figure 18. General markets in Pyongyang

Around 2016

Source: Lee Je-hun (2019a), drawing on Hong et al. (2016).

In the process, accumulated assets and purchasing power in the private sector led to the development of consumer goods and services, notably for food, clothing, cosmetics and electronics. The real estate market grew as well. The North Korean government began leveraging the inflow of private capital to finance public projects such as high-rise apartments and construction projects, giving incentives to the new wealthy. Accordingly, the one family - one house principle has weakened, and some wealthy people are known to own several houses.

New domestic markets, such as delivery and transport services, which were previously absent or insignificant, have taken off. Privately-owned companies have emerged in areas such as briquetting, liquefied petroleum gas delivery, day-care centres, kindergartens, plastic surgery and so on. With the growth in taxis and buses, demand for oil seems to have increased. Satellite photographs suggest that the number of gas stations in North Korea is inching up despite tougher sanctions on oil imports (Bogle, 2019).

Marketisation has also involved some changes in corporate governance. The autonomy and incentives of corporations and co-operatives have been increased gradually, with the "28 June measures" in 2012, followed by the "30 May measures" in 2014. In 2012, the "socialist enterprise responsibility management system" was launched, which grants more autonomy to enterprises for their production and pricing decisions and allows them to seek investment funding from the private sector (Lee, 2016; Yonhap, 2017) – an evolution that was reflected in the 2019 amendments to the Constitution. Some state-owned enterprises have also begun to be subjected to harder budget constraints (Lee Sang Yong, 2019). In agriculture, the way was opened to smaller, family-sized farming units, with the right to retain a larger portion of surplus output and to cultivate a larger kitchen garden.

At the same time, North Korea still prohibits individuals from owning private property and means of production. In practice, however, individuals do have private property and carry out business, taking advantage of so-called grey zones. Individuals operate restaurants, shops and small factories in the name of state enterprises (Lankov et al., 2017). The state-owned enterprises receive de facto quasi-tax contributions from individuals in exchange for giving them operating rights. Through this channel, marketisation has helped the North Korean government secure revenue from the private sector. Moreover, some state-owned enterprises have evolved into huge, diversified chaebols of sorts, with a measure of family control: to wit, Air Koryo, which besides the airline runs taxis and gas stations, and produces cigarettes and soft drinks (Wong and Pearson, 2017), or Korea Kumgang Group, which inter alia runs a bank and taxis (Frank, 2018).

However, capital accumulation is limited by the fact that the authorities, the Party and corporation managers extract a considerable share of the gains from marketisation. Insufficient capital accumulation in turn is an obstacle to further development of the domestic market.

The spread of marketisation has widened the income gap between regions and social classes. Economic activity in Pyongyang and border cities is higher than in other regions and a new mercantile class has emerged with marketisation (Box 4).

Box 4. The emergence and role of the *donju*, North Korea's new mercantile class

So-called "masters of money" (*donju*) have emerged as marketisation progressed in North Korea. *Donju* originally worked for trading companies under the Workers' Party, the military and government agencies involved in exporting raw materials and importing finished products. With financial resources, the new wealthy have expanded their economic activities in markets, including for consumer goods, transport, distribution, and money lending. They also run businesses within State-owned enterprises.

In the course of the 2010s, the *donju* have begun to play a bigger role in real estate development. They raise funds and supply inputs for civil engineering and construction industries that require large-scale funds and materials. They have invested in large projects such as Ryomyong Street, Changjeon Street and several Scientists streets (Lee Je-hun, 2019b). They are then remunerated in the form of buildings' usage rights after construction.

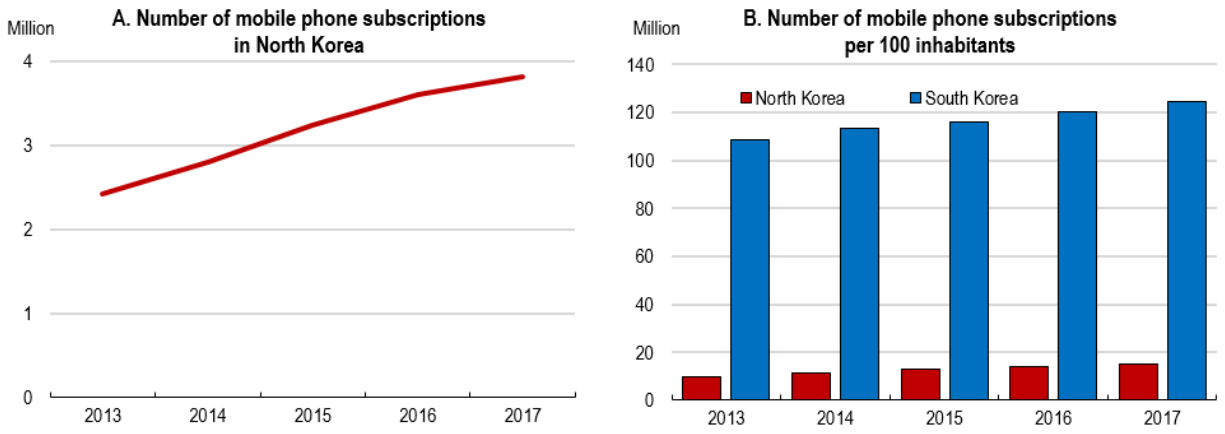
The "*nouveaux riches*" *donju* have used their clout to raise their social status and advance their economic interests. They receive medals and awards for their donations, which can serve as a mitigating factor when they are punished for illegal activities.

Digitalisation

Digitalisation is making headway in North Korea. The country's main wireless network, Koryolink, was built by an Egyptian firm, Orascom. Smartphones have spread, even though they remain far less common than in South Korea (Figure 19), and so have USB sticks (Tudor and Pearson, 2015). According to Park Ju-Min (2019), as many as 6 million people – one quarter of the population – may have a smartphone. Notwithstanding the sanctions, North Korean-branded smartphones have been found to include Taiwanese semiconductors, Chinese batteries and a modified version of the open-source Android operating system (that tracks users' downloads). They typically cost USD 100 to 400 for a basic model, and monthly calling plans USD13 per 100 minutes. Foreign-branded smartphones are not officially on sale, but traders and wealthy North Koreans can obtain them for use with a local SIM card. Customs data indicate that North Korea imports of mobile phones from China amounted to USD 82 million in 2017, or around 2.5% of total recorded imports from China, but fell to zero in 2018. Chinese mobile phones reportedly continue to be smuggled in, however.

The proliferation of smartphones has promoted information distribution and affected people's daily habits (Kang, 2019). They enable retail traders to communicate with wholesalers and to run their business. While internet access is strictly controlled (Williams, 2019a), the national intranet is used in some workplaces and schools, but also for shopping, with at least three e-commerce websites (Lee et al., 2019), distance learning and even recruitment (Zwirko, 2019). Foreigners such as travellers, embassy staff, and workers in NGOs can have some access to the worldwide Internet. The North Korean government is promoting the automation and digitalisation of some of the factories through the development of computerised numerical control (Lee, 2018). As seen in recent cyberattacks on cryptocurrency exchanges (UN Panel of Experts, 2019), software expertise is quite advanced in some respects.

Figure 19. Mobile phone subscriptions



Source: International Telecommunication Union.

Evolution of economic planning and the focus on science education

Economic policy is hard to read and to assess, given the opacity of decision-making and the dearth of reliable statistics. Even so, some trends can be identified. As documented above, marketisation has long changed from a bottom-up survival process to one partly managed from the top, and its reach is no longer limited to selected goods markets but extends into services, labour, housing and financial markets. Economic planning has also changed, shifting from a Soviet- and China-inspired central planning approach to a somewhat more qualitative and aspirational one. In recent years, it has also been putting a renewed emphasis on science education.

Evolution of economic planning

Centrally-set plans were drawn up and executed starting in 1947 (Table 12). Their horizon was initially only one year but over time it was extended. Some plans were deemed fulfilled early, but the implementation of others officially fell short of the targets, notably in the case of the second Seven-Year Plan, to the point that the third one started only after a two-year gap and that its targets remained undisclosed for several years. Following a prolonged hiatus without any such central plans, a Ten-Year State Strategy Plan for Economic Development was announced in 2011, but it was not carried out (Korea Institute for National Unification, 2016).

A somewhat different Five-Year National Economic Development Strategy was unveiled in 2016 for 2016-20, under the aegis of the "*Byungjin*" policy of jointly pushing forward economic development and nuclear armament. This policy was declared successful in April 2018, implying a greater emphasis being put on economic development, but official pronouncements in late 2019 suggested a reversion to *Byungjin*. The

Strategy aimed at tackling industrial imbalances while promoting selected sectors. It also called for reducing the dependence on China, solving the problem of power generation, developing transportation, and promoting manufacturing (Institute for Unification Education, 2019). In the event, many of the objectives of the Five-Year Development Strategy are likely to be missed.

Table 12. Evolution of central planning

Phase	Plans	Context, selected features	Quantitative targets		
			National income	Industrial output	Food production
1946		*Nationalisation of industry and land reform*			
Development of a socialist economic system	1947	One-year and two-year plans "Peaceful reconstruction period"			
	1948				
	1949-50				
		Korean War			
	1954-56	Three-Year Post-war Reconstruction Plan; focus on heavy industry and collectivisation of agriculture and mobilisation of labour force	↑ 1.8 times	↑ 2.6 times	1.2 times the 1949 level
	1957-60	Completion of socialisation process; the intended Five Year Plan was completed in four years	↑ 1.5 times	↑ 2.6 times	3.8 million tonnes
Development of the self-reliance (*Juche*) economy	1961-67-70	First Seven-Year Plan, extended by three years; focus on industrialisation and in the later years on defence	↑ 2.7 times	↑ 3.2 times	6-7 million tonnes
	1971-76	Six-Year Plan; more emphasis on technological advance, self-sufficiency in raw materials, product quality, correcting imbalances across sectors, developing power and extractive industries	↑ 1.8 times	↑ 2.2 times	7.0-7.5 million tonnes
Adoption of the North Korean style partial open door policy	1978-84	Second Seven-Year Plan; focus on self-reliance, mechanisation and automation, and adoption of up-to-date production and management techniques and introducing the partial opening of the economy (e.g. the Joint Venture Law in 1984)	↑ 1.9 times	↑ 2.2 times	10 million tonnes
	1987-93	Third Seven-Year Plan; same focus as the second Seven-Year Plan, but with more emphasis on foreign trade and joint ventures (e.g. development of SEZs starting in 1991)	↑ 1.7 times	↑ 1.9 times	15 million tonnes
		Planning hiatus			
	2011-20	Ten-Year State Strategy Plan for Economic Development	Seemingly little follow-through		
	2016-20	Five-Year National Economic Development Strategy	No specific targets		

Source: Cha et al. (1997); KINU (2016) and various other sources.

A growing focus on science education

The Five-Year National Economic Development Strategy for 2016-2020 also emphasized the development of science and technology through modernisation, "scientification" (i.e. the adoption of up-to-date production and management techniques) and "informatisation" (Korea Institute for National Unification, 2016). This was further reflected in the 2019 amendments to the Constitution (Lee et al., 2019).

In 2017 compulsory education was lengthened from 11 to 12 years (Park et al., 2018). The education system, especially in the capital, puts increasing emphasis on science and the knowledge economy. Indeed, 11 new secondary schools of information technology, one per province, are reportedly being erected, and 37 universities are setting up 85 new departments and corresponding courses on subjects including information security, robotics and engineering (Williams, 2019b). State spending on science and technology was reportedly to be increased by 8.7% in the 2019 budget (Korean Central News Agency, 2019).

North Korea's goal of improving science and technology, however, is difficult to achieve without greater openness and exchanges with advanced countries (Korea Institute for National Unification, 2016). Moreover, inequalities in education are reportedly stark. Wealthy families have recently been known to offer their children private tutoring, to complement the poor standards in the underfunded public schooling system. According to a survey of North Korean defectors, a growing share of children have the experience

of private education (Seoul National University, 2018). In provincial cities and in the countryside, however, the quality of education is much lower than in large cities and access to private education is made difficult by the implied financial burden (Park et al., 2018). Another problem is that educational effectiveness in North Korea is low due to low competition and academic motivation, related to the low tertiary enrolment ratio (Kim Jin Suk, 2017).

Annex A. Selected comparisons between the two Koreas

Subject to the aforementioned caveats surrounding the data for North Korea, comparisons between the two Koreas can be made for living standards and economic conditions (Table A1).

Table A.1. Comparing North and South Korea: selected indicators

	(A) North Korea	(B) South Korea	Ratio (B/A)
Population, expenditure approach (2018)			
Population (millions)	25.1	51.6	2.1
Urbanisation	61.9	81.5	1.3
GNI (trillion won)	35.8	1 898.5	52.9
GNI per capita (million won)	1.4	36.8	25.7
Total trade (billion USD)	2.8	1 140.0	401.4
Exports	0.2	604.8	2020.3
Imports	2.6	535.2	205.8
Of which: inter-Korean exports[1]	0.2	0.1	0.5
Industrial statistics (2018 unless noted otherwise)			
Share of mining in GDP (%)	10.6	0.1	0.0
Oil imports (million barrel)	3.9	1116.3	289.9
Steel production (million tonnes)	0.8	72.5	89.5
Cement production (million tonnes)	5.8	52.1	8.9
Power generation (billion kWh)	24.9	570.0	22.9
Mobile subscribers (2017, million)	3.8	63.6	22.6
Agricultural production (2018)			
Share of agriculture, forestry and fishing in GDP (%)	23.3	1.8	0.0
Rice (million tonnes)	2.2	3.9	1.8
Fertilisers (million tonnes)	0.6	2.3	3.8
Infrastructure (2018)			
Railways (km)	5289	4261	0.8
High-speed railways (KTX)	0	1740	-
Share of double tracked railways	2.9	58.0	20.0
Roads (km)	26 180	110 714	4.2
Express ways (2016, km)	774	4 438	5.7
Car registrations (2017, thousands)	285	22 528	79.3
Port cargo handling capacity (million tonnes)	43.6	1188.2	27.2
Ships (million tonnes)	1.0	11.7	11.6
Civil airplanes (2017, unit)	24	719	30.5

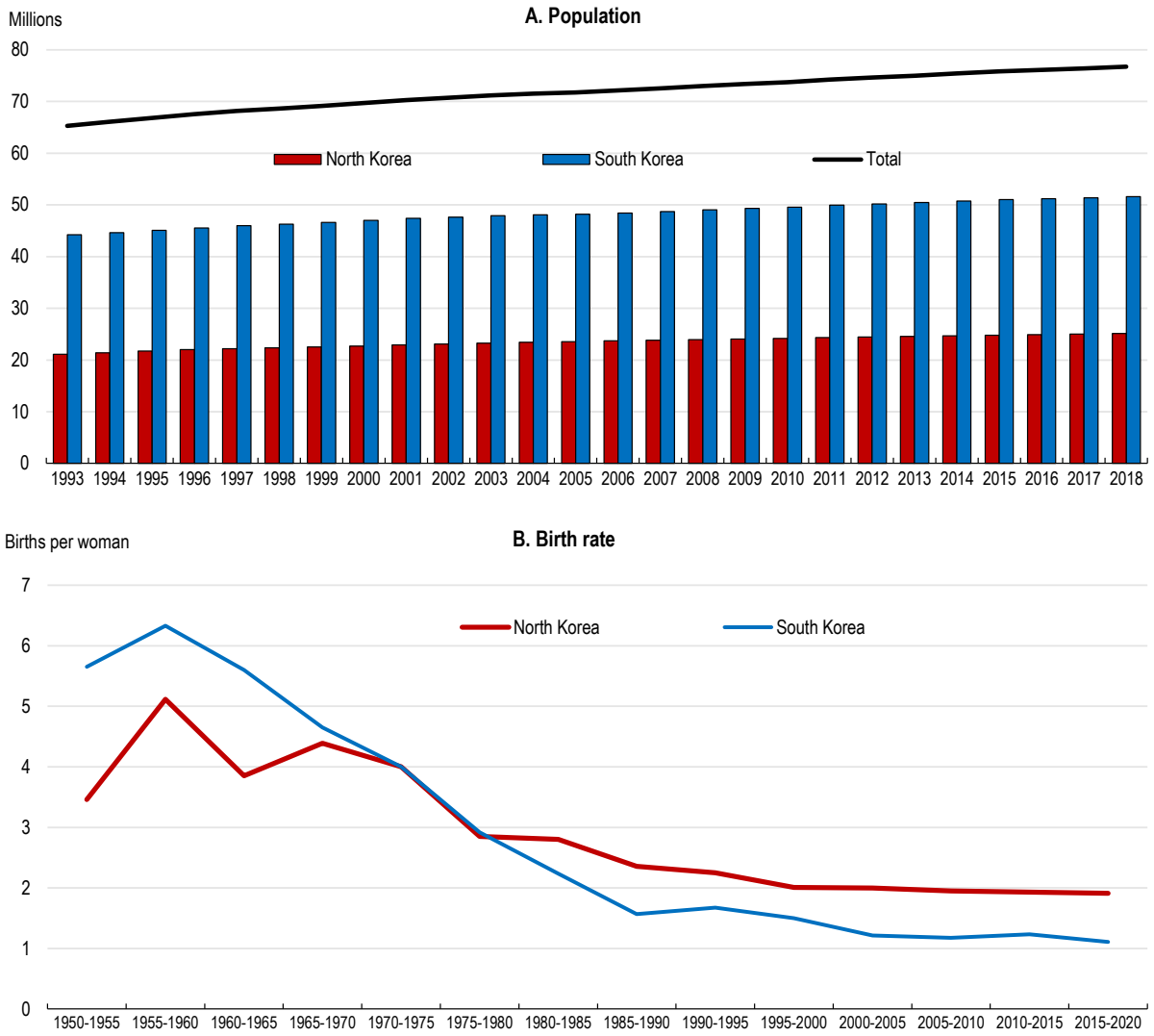
1. North Korean exports to the South in column Panel A, and South Korean exports to the North in column B.
Source: Statistics Korea; Bank of Korea; United Nations (2018).

Demographics

North Korea's population was 25.1 million in 2018, about half of South Korea's (Figure A1, Panel A). Its annual growth rate declined from around 2.5% in the 1960s to under 1% since 1997. According to the United Nations (2019), North Korea's fertility rate averaged 1.9% between 2015 and 2020, well above South Korea's 1.1% (Panel B). Birth control policy to secure female labour in the 1970s and economic hardship in the 1990s pulled down the birth rate. Another factor driving down fertility rates, on both sides

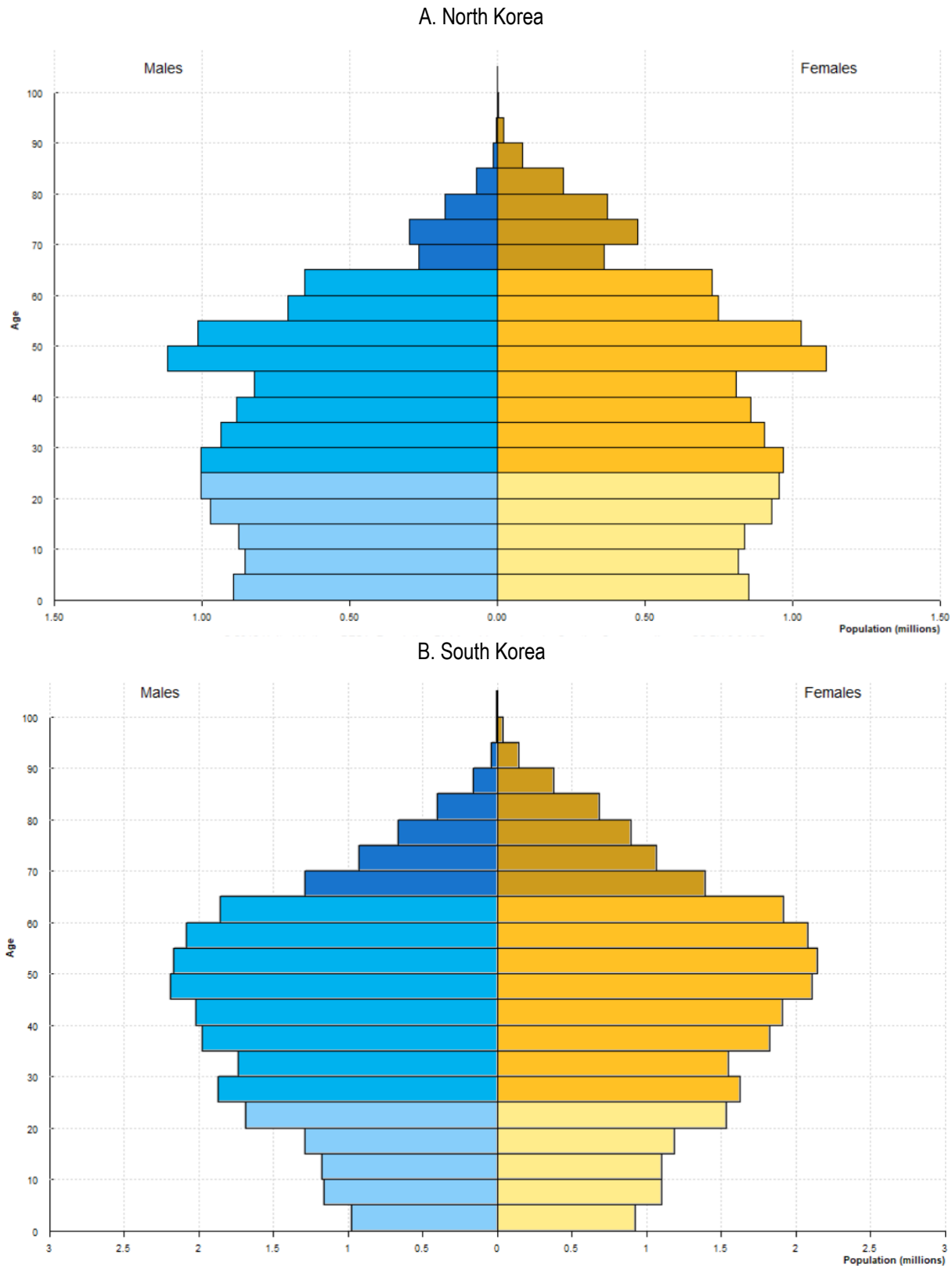
of the border, is the cost of raising children and the aspirations to higher living standards. The number of men per 100 women was 95.5 in 2018 in North Korea, as against 100.5 in South Korea (Figure A2). North Korea's population is rapidly ageing due to the low fertility rate and rising life expectancy (Choi, 2016), but less so than in South Korea (Figure A3). In 2015, the North Korean authorities issued a directive banning medical professionals from performing birth control procedures and abortions in an attempt to reverse the fall in the birth rate.

Figure A.1. Population and birth rate



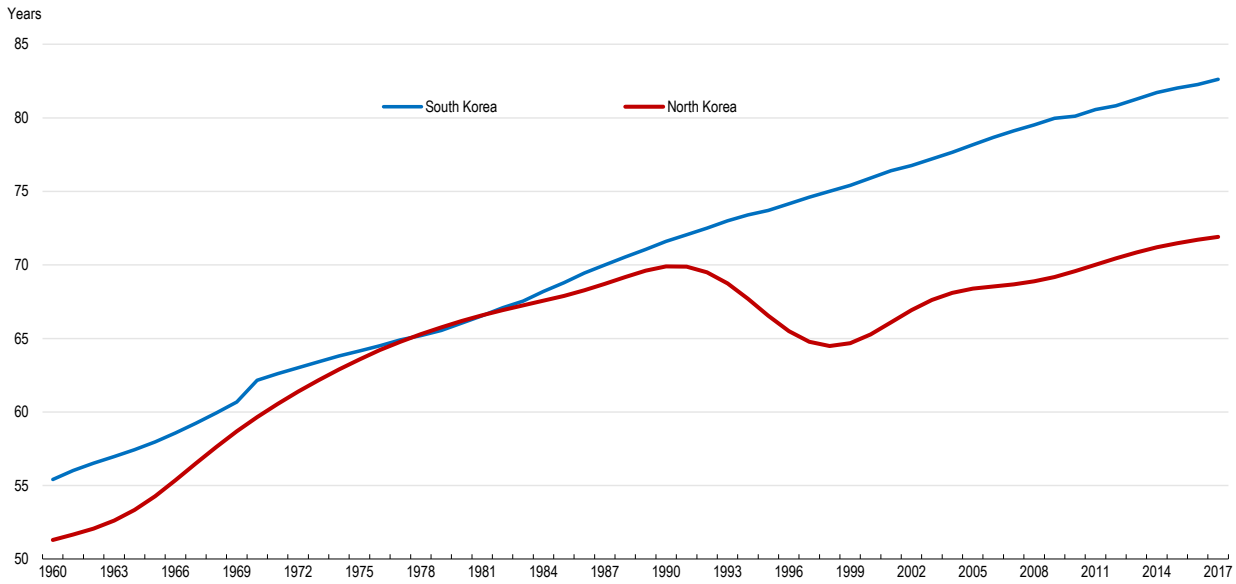
Source: Statistics of North Korea, Statistics of South Korea; United Nations, *UN World Population Prospects: The 2019 Revision*.

Figure A.2. Population pyramid



Estimates for 2019.
Source: United Nations, *UN World Population Prospects: The 2019 Revision*.

Figure A.3. Life expectancy at birth



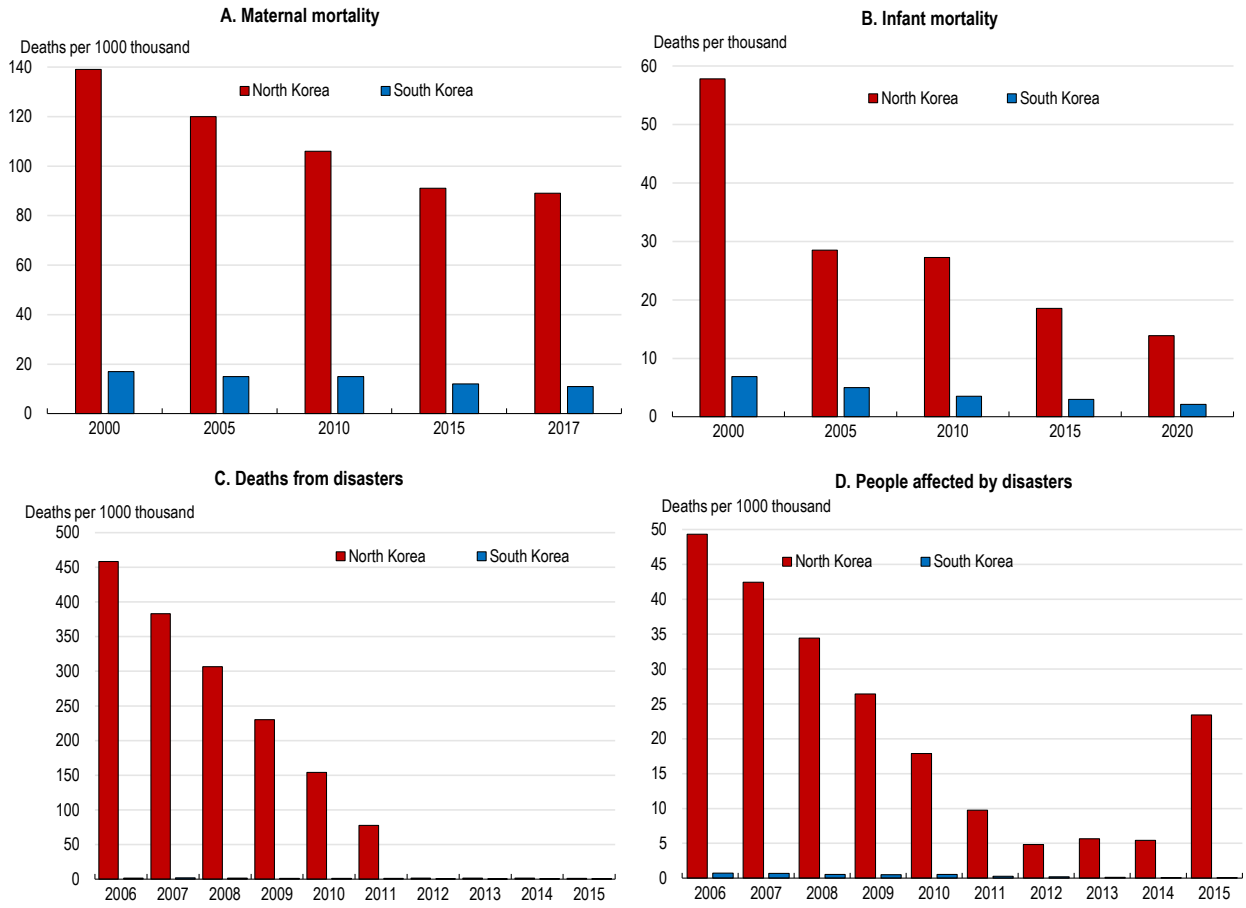
Source: World Bank, *World Development Indicators*.

Health

Health conditions in North Korea seem to have improved over the past decade or so, even though hidden hunger, micro-nutrient deficiencies and stunting remain widespread (Belgrave, 2019) and the country's rudimentary health care system is a vulnerability in the face of the recent coronavirus outbreak. According to the UNICEF (2019), North Korea's maternal mortality ratio decreased to 89 per 100 000 births in 2017 from 106 in 2010, but it is still eight times higher than South Korea's (Figure A4, Panel A). The infant mortality rate in North Korea also improved to 18.5 deaths per 1000 births, still six times higher than in South Korea (Panel B). Around one fifth of the population still faced chronic or recurrent malnutrition in 2017, and stunting still affected 19% of the children, with large regional variations, from 10% in Pyongyang Province to 32% in Ryanggang Province (Martin, 2019; OCHA, 2019).

The damages from disasters such as flooding, road crashes and collapsing buildings are still widespread (Pacheco Pardo et al., 2019). Even though the number of deaths from disasters has decreased since 2010, the number of people affected by disasters remains very high compared to South Korea (Panels C, D).

Figure A.4. Health indicators



Source: World Health Organization; UNICEF; United Nations, *World Population Prospects: The 2019 Revision*; IFRC (2019).

Economic and industrial indicators

The economic gap between the two Koreas is considerable (Table A1), notwithstanding the North's richer endowment in mineral and natural resources. North Korea's estimated GNI per capita stood at KRW 1.4 million in 2018, just 3.9% of South Korea's. The gap in trade was even larger: in 2018, North Korea's foreign trade, at only USD 2.84 billion, was about 400 times smaller than South Korea's. North Korea's power generation amounted to 24.9 billion kWh in 2018, 1/23rd of South Korea's. North Korea produced 0.8 million tonnes of steel in 2018, as against 72.5 million in South Korea. North Korea produced 5.8 million tonnes of cement, versus 52.1 million in South Korea. North Korea's estimated labour productivity was only 3.8% to 5% of South Korea's in 2017 (Pyo, 2019).

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