



International isolation and regional inequality: Evidence from sanctions on North Korea

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ABSTRACT

This paper examines how the spatial distribution of economic activity evolved within North Korea during a period of economic sanctions. Countries have used economic sanctions to isolate North Korea from the benefits of international trade and finance. China, however, has not imposed the sanctions, and consequentially has offset the trade restrictions imposed by other countries. I hypothesize three channels by which North Korea could have responded in this context: regional favoritism by the ruling elites, reallocation of commerce that reflects the trade diversion to China, and import substitution. Using nighttime lights from North Korea, I find that the capital city, trade hubs near China, and manufacturing cities become relatively brighter when sanctions increase. However, production shifts away from capital-intensive goods, potentially deterring industrial development. The results imply that despite the intention to target the ruling elites, sanctions may increase regional inequality at a cost to the already marginalized hinterlands.

1. Introduction

This paper examines how the spatial distribution of economic activity evolved within North Korea during a period of economic sanctions. Countries have used economic sanctions to punish North Korea's nuclear weapons development and isolate North Korea from the benefits of international trade and finance. China, however, has not imposed the sanctions. Moreover, China's trade with North Korea increased during this period, which has effectively offset the restrictions on trade imposed by other countries. This paper's main objective is to shed light on how regional economic activity and inequality within North Korea changed when North Korea was becoming isolated from most countries, but at the same time was increasingly relying on China for trade. The case of North Korean sanctions is unique, since we normally do not see sanctions being offset so effectively by a country the size of China. Nonetheless, examining how economic activity evolved in North Korea, where data is so scarce, adds to our very limited understanding of the country, and potentially adds to our understanding on the efficacy of economic sanctions.

There are several channels by which sanctions could affect North Korea's regional economic activity. One is through regional favoritism whereby the ruling elites allocate limited resources and public goods to

regions based on private political and economic gain, rather than aggregate welfare. Regional favoritism by the ruling elites is more prevalent in autocracies (Hodler and Rashky 2014), which are often the targets of economic sanctions. Another channel by which sanctions could affect regional inequality is through the economic geography responses to trade. Sanctions alter the relative trade costs between countries, which can change trade patterns. In the case of North Korea, trade with China increased during the period of sanctions. Accordingly, production could move to regions within the country that benefit most from the new trade patterns. For example, Mexico's production activities near the US border increased after the Mexico-US Free Trade Agreement (Hanson and Krugman 1993). Lastly, sanctions could also impact regional economic activity via import substitution and industrial development. When the West imposed sanctions against Russia for invading Crimea in 2014, a senior Russian official argued that sanctions could serve as a powerful incentive for Russia to develop her industries and seek out new trade partners.¹ If sanctions indeed promote industrial development, manufacturing regions could see a relative increase in economic activity compared to other regions of the country. The North Korea case is particularly appealing because internal migration is strictly limited. Hence, the observed changes in the geographic distribution of economic activity predominantly reflect

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¹ In an interview with a Russian newspaper, Sergei Ivanov, the head of the Kremlin administration, stated that "...the imposed sanctions could serve as a powerful incentive for our industries to take more active part in our own development..." (<http://sputniknews.com/russia/20140921/193153341/Western-Sanctions-to-Boost-Russian-Industry-Development.html>).

centralized planning rather than voluntary migration towards better economic conditions. This distinction is important since migration towards urban areas for better economic opportunities would not necessarily imply that rising regional inequality reflects increasing economic inequality. However, the main challenge is that administrative or survey data on North Korea, especially at subnational levels, are almost non-existent.

To examine the impact of sanctions in North Korea I use several data sets including the Defense Meteorological Satellite Program's nighttime lights data and the UN Comtrade's product level international trade data. The nighttime lights data have been used in the literature to proxy for economic activity in countries where economic data are sparse, particularly at sub-national levels (Chen and Nordhaus 2011; Henderson et al., 2012; Michalopoulos and Papaioannou 2014; Hodler and Raschky 2014). I create an average luminosity measure for each one by one arc minute grid, which translates to approximately a one by one mile grid, between 1992 and 2013. I document North Korea's nuclear provocations and agreements that led countries and the UN to tighten or relax sanctions and create a sanctions index. I find that the difference in nighttime lights between the capital Pyongyang and the rest of the country increases by 1.9% with an additional sanctions event. This translates to about 0.6% in terms of GDP, using Henderson et al., (2012) elasticity estimate of 0.3. For manufacturing cities, the difference in nighttime lights increases by 1% with an additional sanction. I map North Korea's mineral deposits and mining areas by latitude and longitude and identify regions within 3 km of the coordinates. The difference in nighttime lights between mining areas and the rest of the country increases by 2.7% with an additional sanction. However, this effect disappears once I control for world coal prices. The luminosity gap between Sinuiju, a trading hub abutting China, and the rest of the country increases by 10% with an additional sanction. As China did not impose the sanctions on North Korea, the relative trade costs with China became substantially lower, and economic activity increases in areas near the Chinese border. On the other hand, traditional port areas become darker when sanctions increase. In short, economic activity as measured through nighttime lights increases relatively more in the capital city, manufacturing cities, and regions bordering China when sanctions increase. Various robustness checks find that the results are not driven by China's economic growth, world mineral prices, the sensitivity of satellite sensors, or internal migration.

The relative increase in nighttime lights in Pyongyang is consistent with the regime disproportionately favoring its hometown. Pyongyang as the hometown of the dictator, as well as communist party members, bureaucrats, military and cooperative leaders, represents the North Korean elites.² Though sanctions often aim to punish the target country's elites, the results indicate that the populace in the marginalized regions may be the ones who suffer more. Also, the relative increase in nighttime lights in Sinuiju and regions near the Chinese border shows that sanctions could affect the regional distribution of economic activity based on changing trade partners. North Korea's trade with China increased substantially with sanctions. Lastly, despite the relative increase in nighttime lights in manufacturing cities, the evidence from the trade data does not support the view that North Korea was able to import substitute and develop its industry. Industrial upgrading would generally be associated with more capital-intensive production, but I find that the export of capital-intensive goods decreased while the import of those goods increased with sanctions.

² The North Korean regime decides who can live in Pyongyang and it is generally the most privileged, trusted, and connected members of North Korean society. Many of the traditional elites - communist party members, military leaders, bureaucrats, cooperative leaders, etc. - live in Pyongyang. Some people bribe officials to live in Pyongyang, but only those who have the resources and connections can bribe. Many anecdotal and journalistic reports reveal how life in Pyongyang is unexpectedly good compared to other parts of North Korea (The Telegraph, July 27, 2013; The New York Times, April 30, 2017).

Though the literature has examined the efficacy of sanctions (Eaton and Engers 1992; 1999; Davis and Engerman 2003; Hufbauer et al., 2009; Besedes et al., 2017), economics research on how sanctions affect the target country population is relatively scarce. Public health studies have found that sanctions negatively affect childhood mortality (Ali and Shah 2000, Daponte and Garfield, 2000) and political scientists have argued that sanctions can increase the suffering of more vulnerable groups and negatively impact human rights conditions in the target state (Weiss 1999; Wood 2008). Levy (1999) argues that sanctions on South Africa induced the apartheid government to increase its oppression on blacks and that blacks were often the main victims of mass layoffs. To the best of my knowledge the current paper is the first to empirically examine how externally enforced isolation via economic sanctions alters regional economic inequality *within* the target country.³ Though the general findings from this paper may not necessarily translate to other countries given North Korea's strong control over resources including electricity, the paper does provide insight into a regime we know little about.

The regional inequality result, especially the diversion of resources to the capital city, is closely related to the literature that examines national institutions and regional inequality. Ades and Glaeser (1995) find that urban concentration in the capital city is greater in dictatorships and politically unstable regimes. Hodler and Raschky (2014) find that the nighttime light intensity near the leaders' birthplaces becomes brighter when leaders come into power, especially in autocratic countries. Burgess et al., (2015) find that more roads are built in districts that have the same ethnicity as the incumbent president in Kenya, and such ethnic favoritism weakens during democratic periods. My paper contributes to this literature by examining a novel determinant of regional inequality, i.e., international isolation due to economic sanctions.

2. The North Korean economy and sanctions against North Korea

Despite the collapse of the Soviet bloc in the 1990s and China's gradual integration into the world economy, North Korea has maintained core features of a centrally planned economy. The communist party dictates production activities and allocates labor directly, restricting migration within the country. The Bank of Korea estimates that North Korea's GDP was about 24 billion in 2010 and that agriculture and fisheries comprised 20.8%, mining 14.4%, manufacturing 22%, and service 31% of the economy. Despite the popular reference as a hermit kingdom, North Korea has diplomatic and trade relationships with many third world and past communist countries. When communism was declining in the late 20th century, North Korea strengthened its dictatorship and adhered to a home-grown ideology called Juche, which emphasizes self-reliance, and ultimately started developing nuclear weapons.

Sanctions are not new to North Korea. The US Department of Treasury restricted financial transactions related to North Korea since the 1950s. Several notorious international bombings against South Korea by North Korean agents during the 1980s (Rangoon bombing, KAL flight 858 bombing) further tightened sanctions against North Korea, and in 1988 the US added North Korea to the Department of State's list of state sponsors of international terrorism. Animosity between North and South Korea did not dissipate and there was minimal economic interaction between the Koreans during most of the 20th century.

Sanctions against North Korea started to ease during the 1990s when South Korea's then liberal government pushed for engagement policies with the North, and the Clinton administration signed the

³ In this regard, this paper is also related to the literature that examine the impact of trade embargoes or blockades on the domestic economy (Irwin 2005; Etkes and Zimring 2015; Juhász, 2014), and how trade openness affects the domestic labor market (Autor et al. 2013; Kovak, 2013).

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