



Growth and Geography of Markets in North Korea

New Evidence from Satellite Imagery

Benjamin Katzeff Silberstein
October 2015

US·KOREA
INSTITUTE AT SAIS

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ACKNOWLEDGMENTS

The research for this report was made possible through fellowship support from the US-Korea Institute at the Johns Hopkins School of Advanced International Studies (SAIS) to which the author is very grateful. Keith Krulak offered crucial research guidance and advice throughout the process. Curtis Melvin generously offered satellite imagery placemarks for the markets studied for this report. The author conducted the main part of the research from the office of the Network for North Korean Democracy and Human Rights (NKNet), a nongovernmental organization in Seoul, and wishes to thank Han Ki Hong, Choe Young Sang and the other staff members at NKNet for their valuable support.

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EXECUTIVE SUMMARY

This report uses a new approach to quantitative research on the North Korean economy. Such research is often thought to be impossible due to the constraints on collecting data inside the country. This report, however, builds upon a dataset crafted from satellite imagery. It analyzes how North Korea's formal markets have changed in size over time, and also studies patterns in their geographical distribution. The report focuses exclusively on officially sanctioned markets that are housed in building structures visible from above.

The research has been conducted using Google Earth, which enables users to view free satellite imagery to observe changes in North Korea over time, although the time period will vary from location to location depending on available imagery. Using this platform, North Korean markets have been measured over the time frames available using Google Earth's "yardstick" function.

Overall, the results show that markets in North Korea have grown over time. In most cities, markets have grown only very marginally, but the general pattern is clear. In Sinuiju, for example, total market space in the city grew by 114 percent between 2003 and 2014. Other cities saw much more moderate increases, like Kaesong, where aggregate market size grew by approximately 16 percent between 2004 and 2013.

In some cities, like Sariwon, market space changed only marginally, while in Hamhung, no changes were seen during the measurement period. Many of the observed changes appear on satellite imagery to have emanated from the restructuring of markets rather than from major expansions or contractions.

As these examples show, the narrative of North Korea's markets is complicated, but the overall trend is that markets have survived or even thrived during periods of repression. For instance, in 2009-2010, when the government created policies aimed at suppressing market activities, according to the dataset no corresponding decreases in aggregate market size are visible on satellite imagery.¹ The exception is Pyongsong, where the closure of the wholesale market in 2010 made the city's aggregate market size decrease by 70 percent.

However, this does not mean that repressive measures were not instituted. Whether or not a market is actually operating is difficult to tell from satellite imagery, since only the building structures are visible from above. Markets may have been temporarily closed during policy retrenchment periods and such moves would not be possible to discern from imagery alone. At the very least, the dataset shows that policies of market repression have not translated into permanent closures and removals of markets.

While the findings of this study do not give conclusive answers about the efficiency and dynamics of market governance, they indicate that strong differences exist between localities.

¹ In 2009, the North Korean government conducted a currency reform aimed at destroying the wealth of the market trading middle class. Moreover, between 2009 and 2010, the government also closed down several markets in order to suppress private trading activity in the country. See, for example, Choe, Sang-hun, "North Korea Appears to Ease Markets Crackdown," *New York Times*, February 4, 2010, retrieved on September 28, 2015, http://www.nytimes.com/2010/02/05/world/asia/05korea.html?_r=0.

Some cities have seen much greater changes than others, and in some cases, these differences are not explicable by any clear factors. This indicates that attitudes among local government officials may be one cause.

The dataset also reveals interesting findings regarding the geographical distribution of markets, and suggests several patterns that have not previously been part of the narrative of markets in North Korea. The western port city of Nampo, for instance, has the largest aggregate market space in terms of square feet per capita followed by Haeju. Pyongsong, a former wholesale market hub, has the smallest market space per capita due to the closure of a very large wholesale market in 2010.

While North Korea's northern areas are often predominantly associated with market trade, the data shows that aggregate market space per capita is, in fact, significantly larger in the country's southern areas. While one can only speculate, this may be caused by market trade in the northern regions being conducted in less official spaces, due to its interconnection with illegal and semi-legal trade and smuggling from China.

Another finding that indicates a previously overlooked pattern is that all cities that stand out in terms of large aggregate market space per capita can be found in the western regions of the country, and particularly in cities with major ports. This suggests that market trade in North Korea may be driven by factors that are not often discussed, such as trade via sea routes. For example, Nampo, the city with the largest market space per capita, is home to a major port. Haeju, which has the second largest market space per capita, is also home to an important port. Chongjin, the city with the fourth largest market space per capita in the sample, is also home to an important port. Sariwon, the city with the third largest aggregate square feet of market space per capita, lacks an international trading port, but it does have a small river port connecting it to Nampo and Pyongyang.

The study leaves several interesting questions unanswered, and suggests a number of areas for further research. The role of transport infrastructure for the development of markets is one area where more research could be done. Important insights could also be gained from analyzing the geographical position of markets inside cities, and their proximity to sites like train stations and government facilities, to name a few.

INTRODUCTION

Markets have grown to become an integral part of the North Korean economy ever since the famine of the 1990s and the breakdown of the planned economy.² Across the country, most cities have several of these markets, and North Koreans are dependent on them for a significant part of their food consumption. Markets first sprang up illegally as a response to the breakdown of the public distribution system. Since then, many markets have been formalized and integrated into the public finance system through taxes and administrative permits.³

This paper focuses on these formalized markets in North Korea. It relies on a dataset specifically created for this research to understand the growth of the markets over time and patterns in their geographical distribution. The purpose of this study is to build an understanding of how the markets have developed and why they are seemingly more prominent in some cities than in others.

Economic research on North Korea is often thought to be impossible because reliable statistics are unavailable and researchers cannot freely enter the country. Stephan Haggard, Marcus Noland and other scholars have used structured refugee interviews to overcome these problems. Another available route is to study North Korea from above using satellite imagery. The dataset for this study has been created by measurements from these images.

Total market space for each provincial capital and “special city” in North Korea has been measured via Google Earth. In addition to providing free satellite imagery of virtually all of North Korea, Google Earth lets the user view historical imagery, although availability varies by location. This has allowed for the creation of a time series showing how the markets have changed in size over time. Moreover, comparing the data for market size with information about variables such as population, infrastructure and geography makes it possible to study what factors correlate with the total size of markets in each city.

Why Market Size Matters

The change in size of markets over time is an important part of the overall story about markets in North Korea. While much scholarship is available on the markets, particularly about the microeconomic aspect,⁴ this report focuses on their overall structural development.

This report also studies what has happened to the markets during periods of government policy change, such as 2005 and 2009, years during which Pyongyang cracked down on the markets in various ways.⁵ Looking at the size of markets over time shows us how their role has developed.

² Hazel Smith, *Hungry for Peace: International Security, Humanitarian Assistance and Social Change in North Korea* (Washington, D.C.: United States Institute of Peace Press, 2005), 141–42.

³ See, for example, Stephan Haggard and Marcus Noland, *Witness to Transformation: Refugee Insights Into North Korea* (Washington, D.C.: Peterson Institute for International Economics, 2011), 83.

⁴ See, for example, Haggard and Noland, *Witness to Transformation*. For a historical perspective on the markets, see Philip H. Park, ed., *The Dynamics of Social Change in North Korea: An Institutional Perspective* (Seoul, South Korea: Kyungnam University Press, 2009).

⁵ Stephan Haggard, Marcus Noland, and Erik Weeks, “Markets and Famine in North Korea,” *Global Asia* 3, no. 2

Furthermore, because this study focuses on markets that are administered by the government, their geographic distribution as well as changes in size can reasonably be assumed to be results of local or central government policies. Put simply, if a market expands or shrinks, it is because some level of government has made some corresponding decision. Comparing market sizes with other variables allows us to study the rationale and factors leading up to such decisions.

What Markets Are Measured?

This report deliberately focuses on formalized markets that are administered by the government and that operate within specific building structures, because these can be spotted and measured with satellite imagery. However, street markets are also common in the country and can frequently be spotted from above. Given that many of these markets take up vast areas that often stretch across entire streets, some may operate with varying levels of consent from local government authorities.

However, it is not possible to fully include such markets in this study. Unlike markets with dedicated building structures, street markets are possible to spot on satellite imagery only when they are actually operating.

Thus, in cases when satellite imagery is captured at a time of day when street markets are not operating, they are not visible. Figures for street markets are therefore only briefly analyzed and discussed throughout this report when relevant, separately from formalized markets.

How Are Markets Measured?

The markets measured have been identified by Curtis Melvin, a researcher at the US-Korea Institute at the Johns Hopkins School of Advanced International Studies. Since markets have several clearly distinguishable and unifying features throughout the country, he has been able to locate and mark them on Google Earth.

Aside from analyzing the look of objects, Melvin uses information from pictures taken inside North Korea, North Korean media, and interviews with North Korean defectors to analyze and map out objects, such as markets, in the country.⁶ Figure 1 is an illustrative example of a market with typical traits, most notably its wall structures and clearly visible market stalls, which make it easy to recognize. This image shows the patterns that make it possible to distinguish formalized markets on satellite imagery.

(2008): 32–38.

⁶ Interview with Curtis Melvin, September 2, 2014, at the US-Korea Institute at SAIS, Washington, DC.

Figure 1. Tonghunsan market, Hamhung.

Image: Google Earth, August 14, 2005.

To build the dataset of market size, this report used the market location data generously shared by Melvin and measured the size of markets by dividing them into easily measurable shapes on the images. These markets have been measured for square footage using the “yardstick” tool in Google Earth. Figure 2 shows the measurement of the Kaephung market in Kaesong, from imagery captured on October 5, 2007.

Figure 2. Measurement illustration, Kaephung market, Kaesong.

Image: Google Earth, October 5, 2007.

In some cases, unclear wall structures and other features complicate efforts to determine precisely where the market area ends. For example, in cities in the agricultural southern region, markets often appear to be adjacent to farms. In such cases, the judgment has been based on visible features such as gates, where crowds cease to appear; shapes appearing to be dividing structures even though they are not walls; and other traits. While there is obviously room for error given the degree of uncertainty, the measurement method has been consistent across the country, to minimize the room for error.

A Note on Satellite Imagery

The most significant limitation with regards to data gathering, aside from the difficulty of identifying all markets and their exact area, is the availability of imagery. Images on Google Earth are often scattered and seldom consistently available for all years over an extended period of time. For many cities, some satellite imagery covers only one part of the city for a certain point of time, while other parts of the city have been photographed at different times.

While constructing the dataset, the date of the imagery for each respective market has been carefully noted. The measurement over time has been done only for periods in which observations have been made for all measured markets.

For example, some markets in Hamhung can be viewed earlier than 2008, but since all markets in the sample can be viewed only between 2008 and 2014, this is the period analyzed. In some cases, where imagery for a market is available at two separate points in time with a gap, but no change is observed between the time periods, it is assumed that the market size has remained the same during the time period in question.

There is no simple method for measuring markets in North Korea. Formalized markets may not tell the whole story about market development, and one cannot identify every market with full certainty without physically entering the country. Nevertheless, this study offers a baseline measurement of market size in North Korea, and given the consistent measurement method, the probability for error is the same for all cities measured.

What Does the Data Cover?

The dataset for this report contains measurements for all provincial capitals and special cities in North Korea:

- Pyongyang
- Hamhung, South Hamgyong Province
- Chongjin, North Hamgyong Province
- Nampo, Nampo special city⁷
- Wonsan, Kangwon Province
- Sinuiju, North Pyong'an Province
- Kaesong, North Hwanghae Province⁸
- Sariwon, North Hwanghae Province
- Pyongsong, South Pyong'an Province

⁷ Special cities are directly governed by the central authorities in Pyongyang, unlike regular provincial capitals, which are governed by the local administration of the province.

⁸ Though not a provincial capital, Kaesong is included because of its economically and politically special status in North Korea, as well as for its large population.

- Haeju, South Hwanghae Province
- Kanggye, Chagang Province
- Hyesan, Ryanggang Province

Figure 3. Map of North Korea with measured cities circled.



Map: iStockPhoto. Annotation by Benjamin Katzeff Silberstein.

About 60 percent of North Koreans are estimated to live in urbanized areas.⁹ Provincial capitals are natural places to include in this study, since they are likely to be the main commercial hubs in their respective regions. The special cities have been included as well, since they are some of the largest cities in the country.

⁹ Central Intelligence Agency, *CIA World Fact Book*, accessed November 12, 2014, at <https://www.cia.gov/library/publications/the-world-factbook/fields/2212.html>.

ANALYSIS: MARKETS OVER TIME

First, this report looks at the general results of how markets in North Korea have grown or diminished in size over time, in order of largest to smallest in terms of population size. Because imagery is often scattered over time, the dataset does not allow for a full study of changes in size across time for the whole country. The analysis therefore looks separately at how market size has developed in each city. The dates showed on the horizontal axis in all graphs below are data points, that is, dates for which consistent imagery has been available for all markets measured in each city. Markets have grown in eight of the twelve cities measured, as summarized below.

General Findings

- On the whole, markets have grown in almost all cities analyzed. However, in most cases, the growth has been quite marginal and primarily resulted from restructurings or minor enlargements of existing markets.
- Contrary to what might be expected, periods of market repression by the government, such as 2009–2010, did not lead to decreases in market size as observable on satellite imagery.
- Degrees of change vary greatly between cities. Sinuiju, Haeju and Pyongsong are examples of cities where size changes have been particularly dynamic, while aggregate market size in Hamhung, Pyongyang and some other cities has hardly changed at all.

Changes in Market Space Over Time for Each City Measured

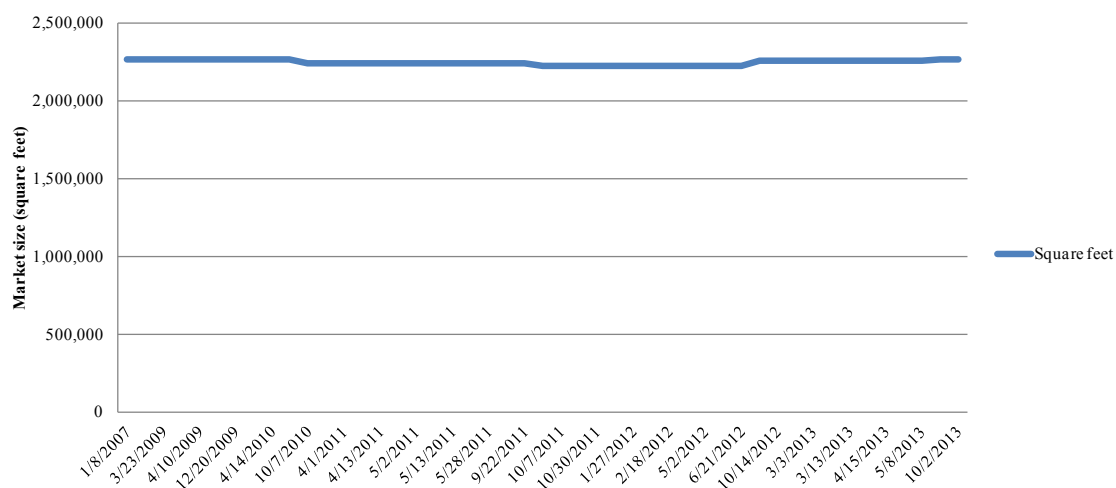
- Pyongyang: market size decrease of 0.2 percent between 2007 and 2013
- Hamhung: no change between 2008 and 2013
- Chongjin: market size increase of 2.5 percent between 2006 and 2013
- Nampo: market size increase of 11.2 percent between 2008 and 2013
- Wonsan: market size increase of 2.5 percent between 2009 and 2013
- Sinuiju: market size increase of 114 percent between 2003 and 2014
- Kaesong: market size increase by 15.8 percent between 2004 and 2013
- Sariwon: market size increase by 0.17 percent between 2006 and 2014
- Pyongsong: market size decrease of 70 percent between 2005 and 2013 due to the closure of the city's wholesale market in 2010
- Haeju: market size increase of 227 percent between 2004 and 2014
- Kanggye: no change between 2006 and 2013
- Hyesan: market size increase of 109 percent between 2003 and 2013

Pyongyang

Imagery for Pyongyang allows for a unified measurement of its aggregate market size between 2007 and 2013. A break occurs in data points for 2008, when no consistent imagery was available.

During the measured time period, the data reveal a stark absence of change. All in all, aggregate market size in the city was slightly negative, decreasing by 0.2 percent, primarily due to changes to individual markets that appear too small to be the results of government decisions. This pattern can be seen throughout the measured periods, with aggregate market size shifting slightly as individual markets are restructured or changed in scale.

Figure 4. Aggregate market space over time: Pyongyang



The development of markets in Pyongyang, however, is difficult to assess, both in terms of economic importance and changes over time. The capital's socioeconomic standard is much higher than that of other cities in the country, and its citizens have access to a wide range of opportunities and conditions unavailable to the majority of the population.

The significance of markets in the city's economic environment, therefore, is difficult to determine. Several expat residents of Pyongyang have stated that shops and other outlets for goods that are commonly sold in formalized markets are much more prolific in Pyongyang than in other cities.¹⁰ Even given these conditions, formalized market structures in Pyongyang appear from satellite imagery to be much more advanced and modern and on a larger scale than their counterparts in other cities. Pyongyang's special conditions are important to bear in mind when analyzing the growth of its markets since the early 2000s.

Here, as in many other cities, there seems to have been little impact from the supposed market crackdown periods. The observable changes have mainly occurred when previously existing market structures have been changed. For example, the aggregate size drop between 2009 and

¹⁰ This information has been garnered from private conversations with several expat residents of Pyongyang, such as ambassadors, diplomats and aid workers and their spouses.

2010 is primarily a result of the Pyongchon market in Pyongyang becoming smaller because its market structure, which was previously spread out into a number of separate stall areas in the market space, was consolidated under one building, seemingly of higher quality than before. This drop merely constitutes a negative change of 0.8 percent. All in all, the total change between 2007 and 2013 is negative, by 2.3 percent.

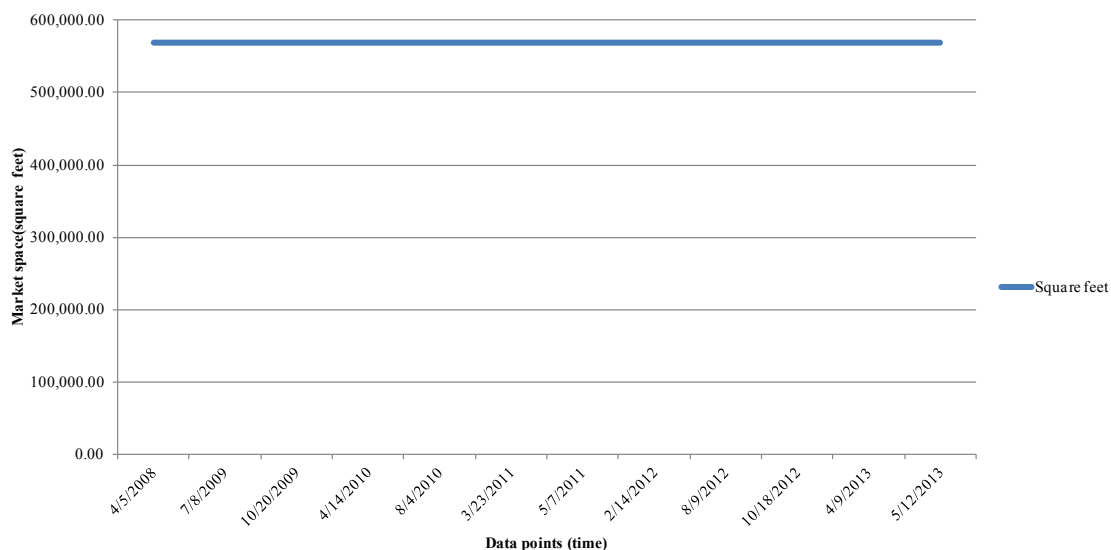
However, these numbers do not capture the development of markets earlier than the satellite imagery allows for them to be measured in a unified and aggregate fashion. A large number of altogether new markets were built in Pyongyang in the early 2000s. Though more were probably added than the measurement method captures, the dataset reveals that 16 of the 36 formalized markets in the city were built between 2000 and 2005. This is not surprising, as the regime began formalizing more and more markets in the wake of economic reforms in July 2002.

This may not tell the full story of market size development in Pyongyang, as it is unclear precisely when many of these markets first appeared. It does, however, confirm that a significant number of markets were added precisely during a period commonly associated with market expansion due to regime policy changes.

Hamhung

Due to the scattered availability of imagery, a consistent measurement of all identified markets is only available between 2008 and 2013. No changes in size can be identified during this period. However, this is an interesting finding in itself, because it shows that government policy on market management in Hamhung is much less dynamic than in Sinuiju and elsewhere, where market size changed significantly over the same period. Possible factors for this will be discussed further below, but it may be that Hamhung's geographic location, far from the Chinese border, insulates market size from the dynamics of cross-border trade.

Figure 5. Aggregate market space over time: Hamhung



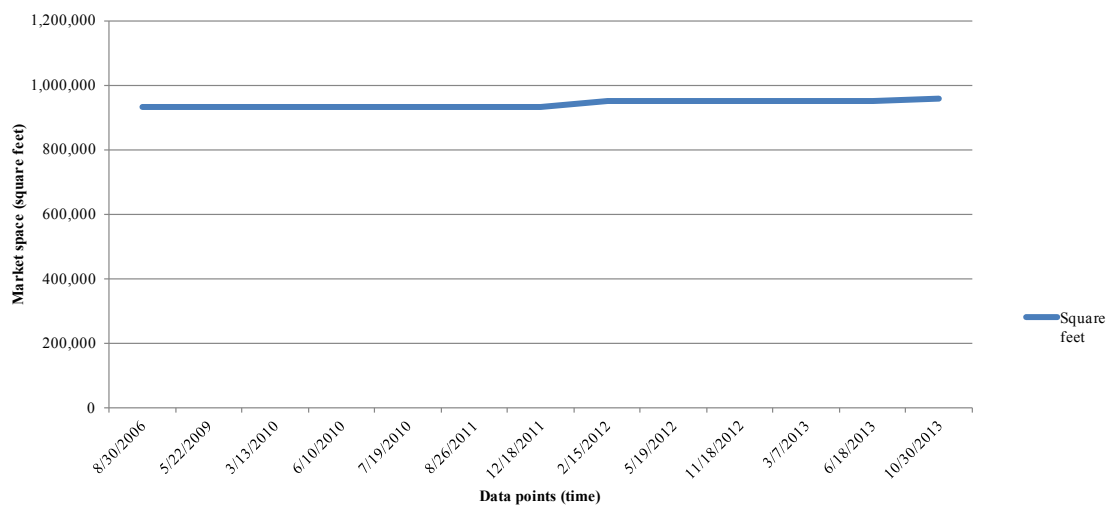
During periods of market repression, such as 2009–2010, no markets seem to have been closed and demolished in a way that is visible on satellite imagery. Still, it is possible that market activity was restricted or banned during this period and that only building structures remained while market activity ceased. For example, it was rumored in 2009 that the Chupyong market in the city was going to be closed down due to its large size.¹¹ While it may have been temporarily shut down, its structures had not been torn down as of 2013, suggesting that market activity continued despite the rumors.

Chongjin¹²

The dataset allows for a study of developments of markets in the city between 2006 and 2013. There is a gap in data points for 2007 and 2008, caused by a lack of consistent imagery. Changes are relatively small, and markets have grown by a total of 2.5 percent within the period measured.

It is necessary to note that market space in the city was already relatively large from the outset of the measuring process. For example, total market space is 63 percent larger than that of Hamhung. The growth in 2012 is incremental, resulting from the expansion of the Rabuk market. Growth also comes from the addition of the Kwanhae market in 2013. However, this market may have been built earlier. Satellite imagery is available for this particular market only for 2004, 2006, 2011 and 2013, so while it first appears on imagery in 2013, it is possible that it was built in 2012.

Figure 6. Aggregate market space over time: Chongjin



¹¹ IFES, “North Korea begins closing wholesale markets,” *NK Brief No. 10-01-08-1*, Institute for Far Eastern Studies, January 8, 2010. Quoted in its entirety at <http://www.nkeconwatch.com/2010/01/12/north-korea-begins-closing-wholesale-markets/>, accessed November 13, 2014.

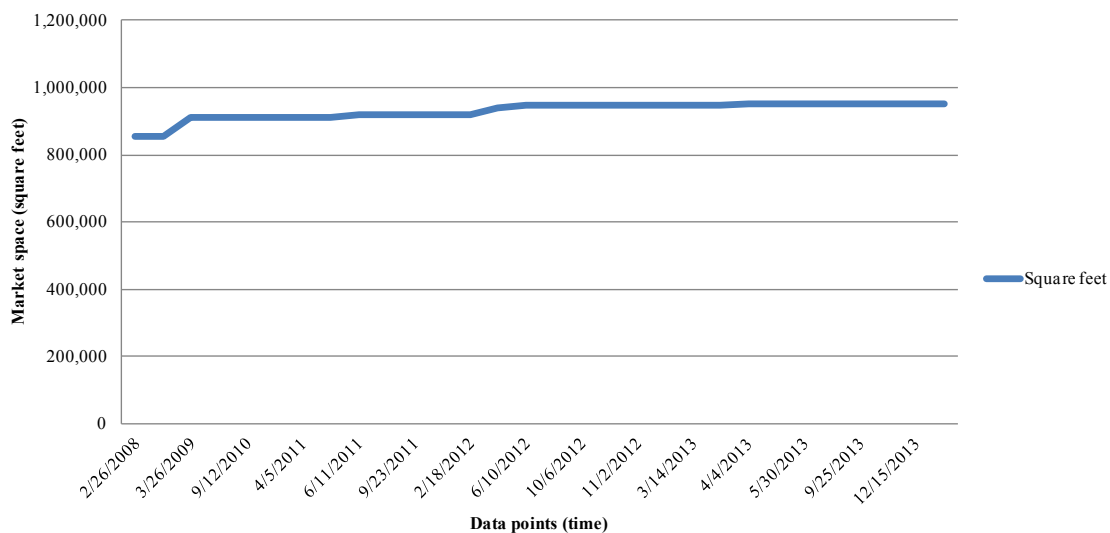
¹² Latest available imagery for Ryonjin market, one of 17 markets measured in Chongjin, was captured in 2011 according to Google Earth. Rather than capping the cross-time measurement at 2011, for measurement purposes, it has been assumed that no change occurred in this market, even though satellite imagery has not been available for the entire period and ends at 2011 for this particular market. While this may well not be the case, the overall data for Chongjin would have changed only marginally even if the market had been removed completely.

It should also be noted that no imagery is available between 2006 and 2009, making any changes during this period impossible to detect. While growth patterns are relatively small, the direction of enlargement is clear. This is particularly notable because the city was said to have been part of the same governmental attempts to close down large-scale wholesale markets such as those in Hamhung in 2009, which are also refuted by the data.

Nampo

Markets in Nampo have grown by a total of 11.2 percent throughout the measurement period, which stretches from 2008 to 2013. Most of this increase is due to the addition of a new market between 2008 and 2009. Other increases, such as that in 2012, have occurred because of increases in the space of existing markets.

Figure 7. Aggregate market space over time: Nampo



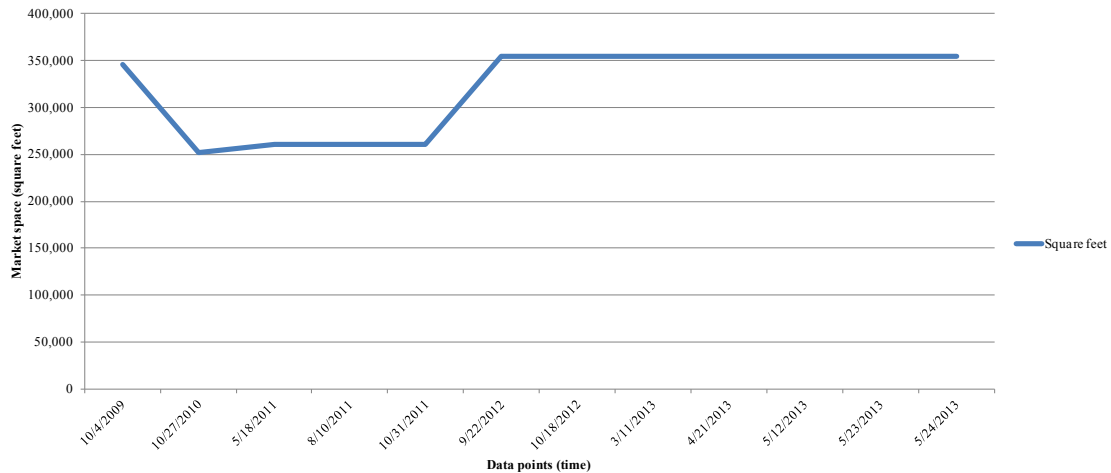
Nampo also shows little impact from market crackdown periods, and its market size changes do not appear to correlate with any known periods of policy change from the central government. Nampo is a “special city” in administrative terms, which means that it is directly governed by the central authorities. It also lies very close to Pyongyang, and a highway connects the two cities. It could be argued that this proximity should make Nampo more sensitive to government policy changes regarding the markets. At the same time, its importance for Pyongyang consumers may have also insulated it from market crackdowns and given markets in the city more room to grow than in other locations.

Wonsan

Consistent satellite imagery for all markets in Wonsan is available between 2009 and 2013. During this period, aggregate market space grew by 2.5 percent. Overall market space first declines by 27 percent in 2010, then increases by 36 percent in 2012. This change is primarily caused by space changes in the Ryul market, where one section of the market is closed and later reopened. Another section of this large market appears to be taken down on the same date

that the section mentioned above is reopened, but market stalls continue to appear there as well throughout the measured period.

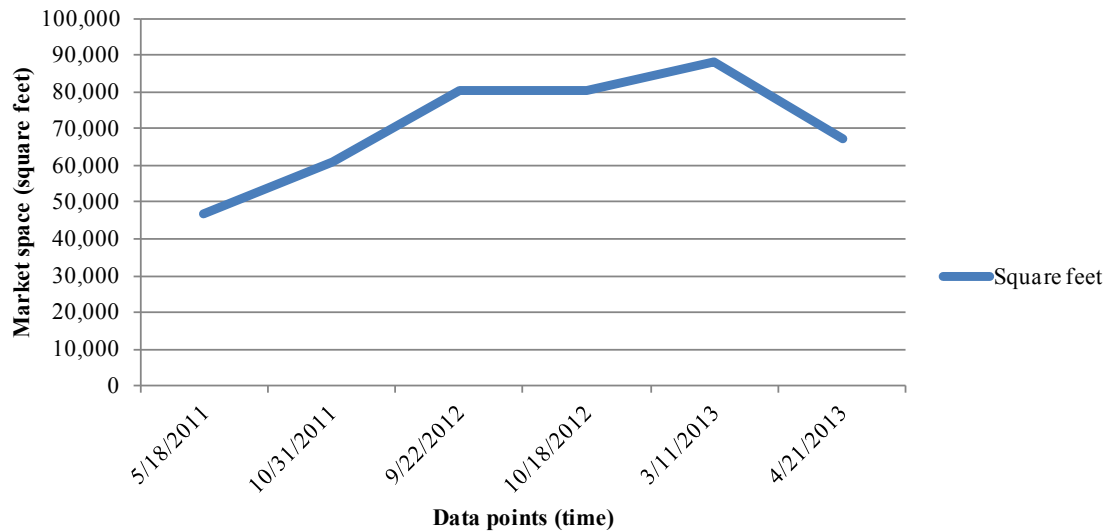
Figure 8. Aggregate market space over time: Wonsan



It should also be noted that for two of the markets measured, space continuously increases between 2002 and 2009. It is difficult to tell exactly when this increase occurs since there is a break in the imagery between 2002 and 2007.

According to these figures, Wonsan appears to suggest that markets grew during a period commonly associated with government formalization of markets from 2002 (though the period is not included in the aggregate measurement since no consistent satellite imagery is available), decreased after 2009–2010 when the government allegedly cracked down on markets, and grew again in 2012. However, since these changes are, again, mainly caused by one individual market, it is hard to discern how much they mean. It is possible that they were done mainly for practical rather than political reasons.

For Wonsan, consistent measurement of street markets is available between 2011 and 2013. These figures roughly correspond in reverse to formal market changes: when formal market space decreases, street market space increases and vice versa, albeit with a lag of several months.

Figure 9. Aggregate street market space over time: Wonsan

Given the short period measured, it is difficult to determine the broader implications of this development. The figures do, however, provide a modest indication that street markets grow and shrink as formalized markets do. That is, when the space for formalized markets decreases, trading appears to simply move to street markets that may or may not have been designated as such by the authorities.

Sinuiju

Market space in Sinuiju has consistently grown between 2003 and 2014. There is a gap in data points, due to a lack of consistent imagery between 2005 and 2009. Thus, any changes that would have showed up immediately after the policy changes in 2005 would not appear in the data. Nevertheless, imagery for 2009, 2010, 2011 and 2012 is available, and throughout this time, markets have grown incrementally and consistently in Sinuiju. In total, market space in Sinuiju has grown by around 114 percent between 2003 and 2014.

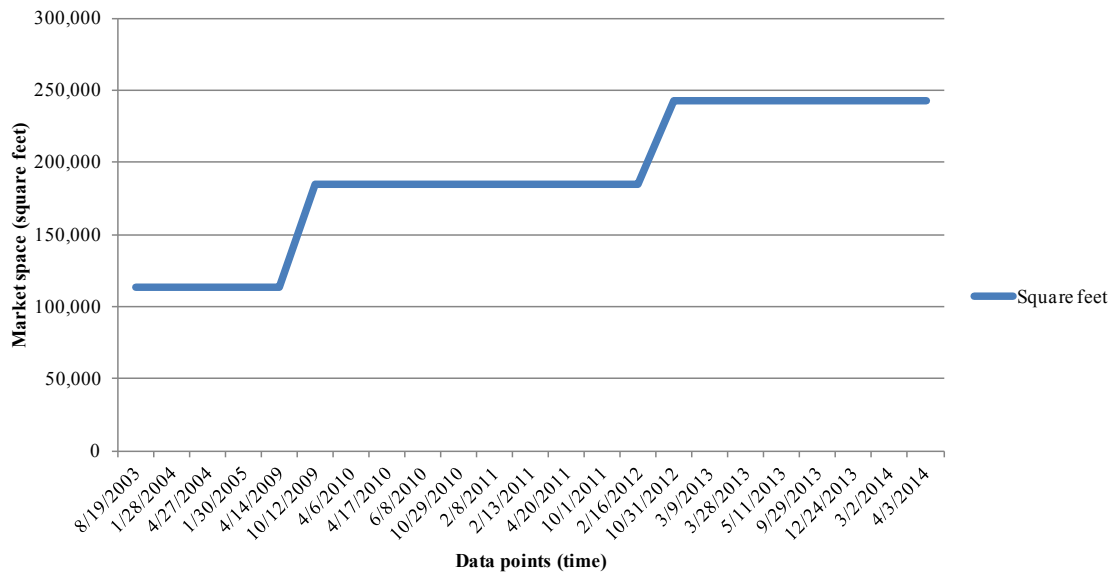
This is particularly interesting given the perception of increased repression and curtailment of the markets in 2009–2010. Though much evidence indicates that government policy toward the markets became much more restrictive at this time, the data for Sinuiju show a development in the opposite direction.

One possibility is that market trade has been restricted while the structures themselves have not been taken down. It would not be immediately possible to detect such developments via satellite imagery alone. However, markets later continue to grow, and a major increase occurs between 2012 and 2013.

Sinuiju might well be a special case where markets are more dynamic. Its local government may have greater autonomy and flexibility in policymaking around the markets because of the city's importance as a hub for trade with China. Its proximity to China may also make the need for

market expansion more easily sensed than in cities that are less connected to cross-border trade flows.

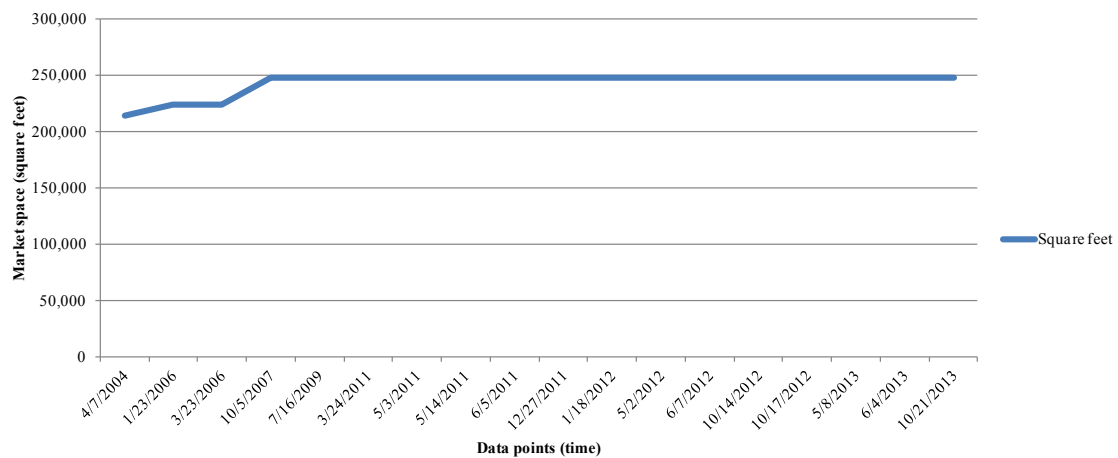
Figure 10. Aggregate market space over time: Sinuiju



Kaesong

Market space in Kaesong increased by a total of 15.8 percent during the measurement period. Markets are measured between 2004 and 2013, with a gap in imagery between 2006 and 2011. The increase largely comes from reconstructions and slight expansions of existing markets. It should be noted that Kaesong, like other cities in the agricultural southern region, has a significant number of markets that appear to be attached to collective farms. It is difficult to determine precisely where markets begin and end in many of these cases, but the same criteria have been used consistently to identify market borders.

Figure 11. Aggregate market space over time: Kaesong

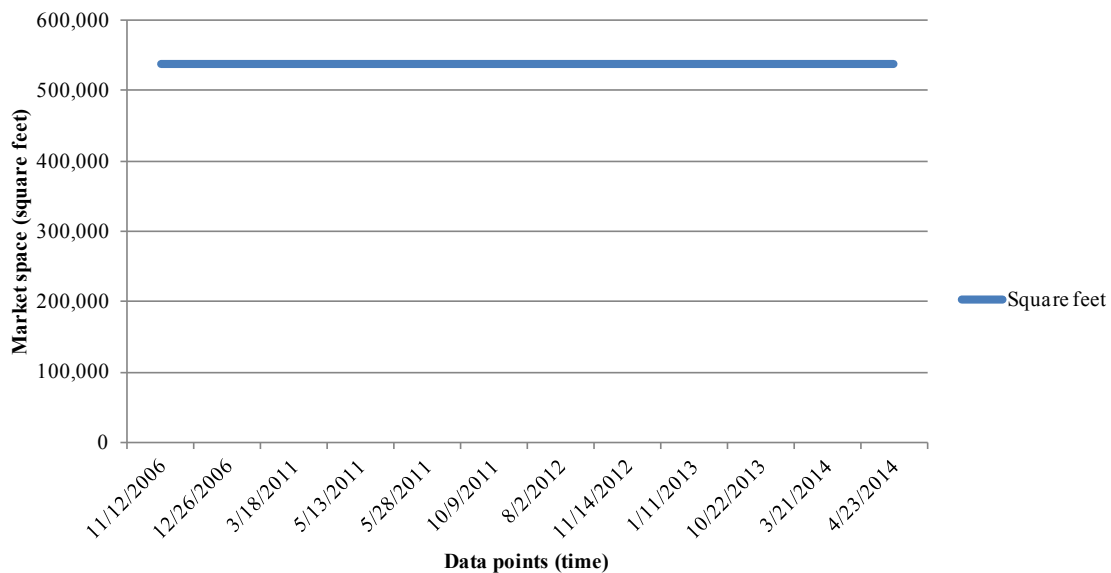


In Kaesong, as in many other cities, there is little sign of change during the crackdown period of 2009–2010. Moreover, the main increase in market space occurs between 2006 and 2007, while increases in some other cities happened in 2012. The pattern in Kaesong is consistent with that of both Haeju and Sariwon, two other predominantly agricultural cities, where market space also mainly increased sometime between 2006 and 2011 and stayed largely the same for the remainder of the measurement period. It may be that agricultural cities like these are subject to a similar set of policy dynamics, ones that are not guided by crackdowns on private trading networks and wholesale markets that feature imported or smuggled goods from China.

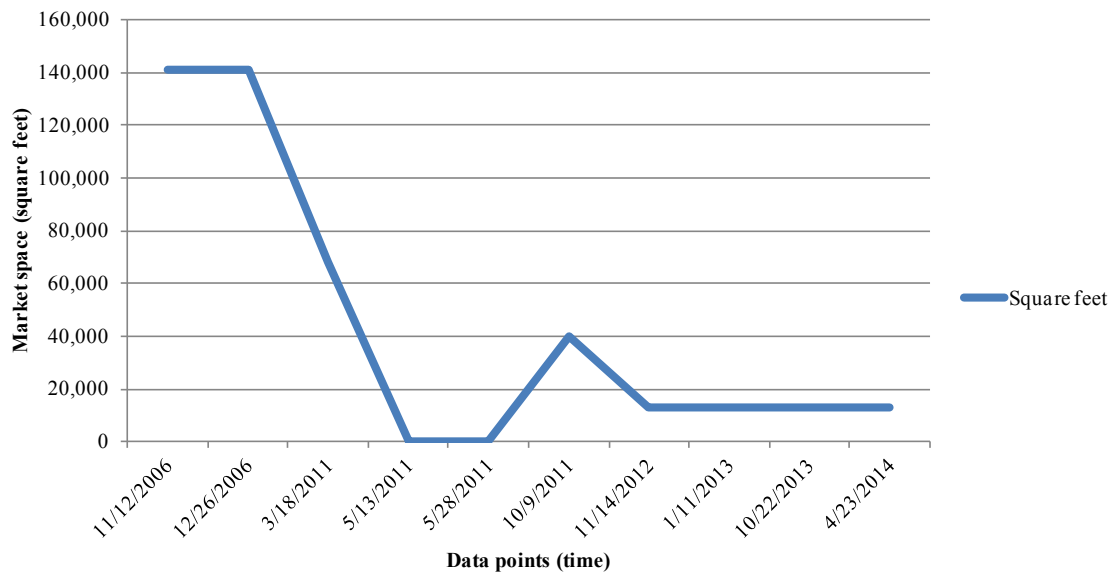
Sariwon

Market space in Sariwon is observable between 2006 and 2014, with a gap in satellite imagery between 2006 and 2011. Between 2006 and 2014, market space stayed largely constant, with a marginal increase of 0.17 percent. A slight structural enlargement of one of the city's two markets, both of which are relatively large and prominent structures, was solely responsible for this increase.

Figure 12. Aggregate market space over time: Sariwon



Sariwon provides a case where some street markets are also measurable for a number of points in time. According to data extracted from the satellite imagery, street market space decreased significantly in the measured period. There is a lack of imagery between 2006 and 2011, when data points are subsequently unavailable.

Figure 13. Aggregate street market space over time: Sariwon

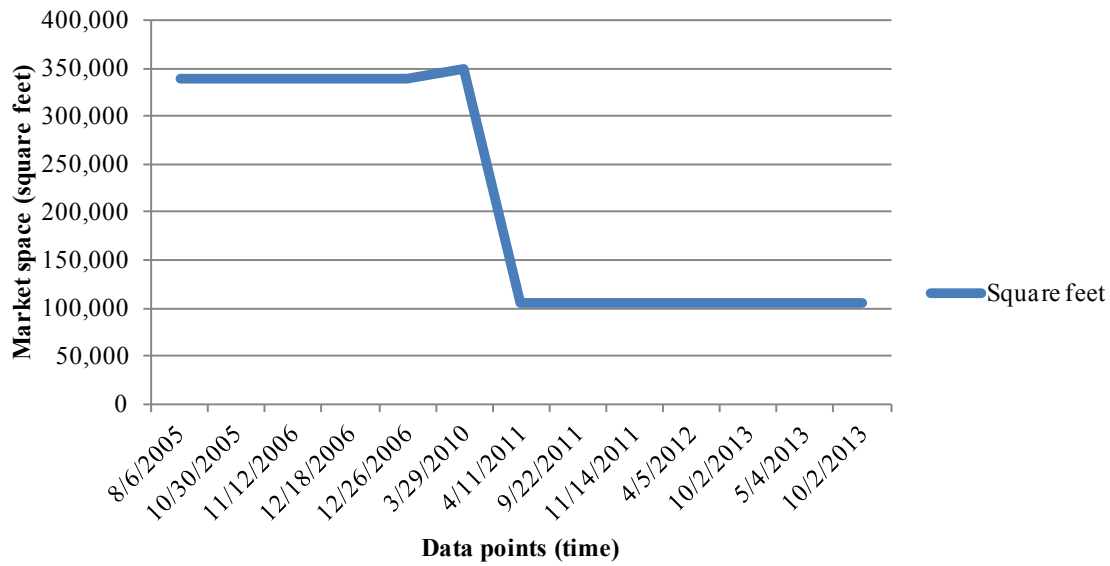
Again, street markets are measurable only when satellite imagery has been captured at a time of day when these markets are populated. This may be a main reason for the stark drop, particularly for times when market space is recorded as zero. However, street market space does remain constant over four measurement points, from 2012 to 2014. Taken together, the reconstruction and apparent update of one of Sariwon's markets and the drop in street market space suggest that street market trade has been further included in the formalized economy throughout the years.

Pyongsong

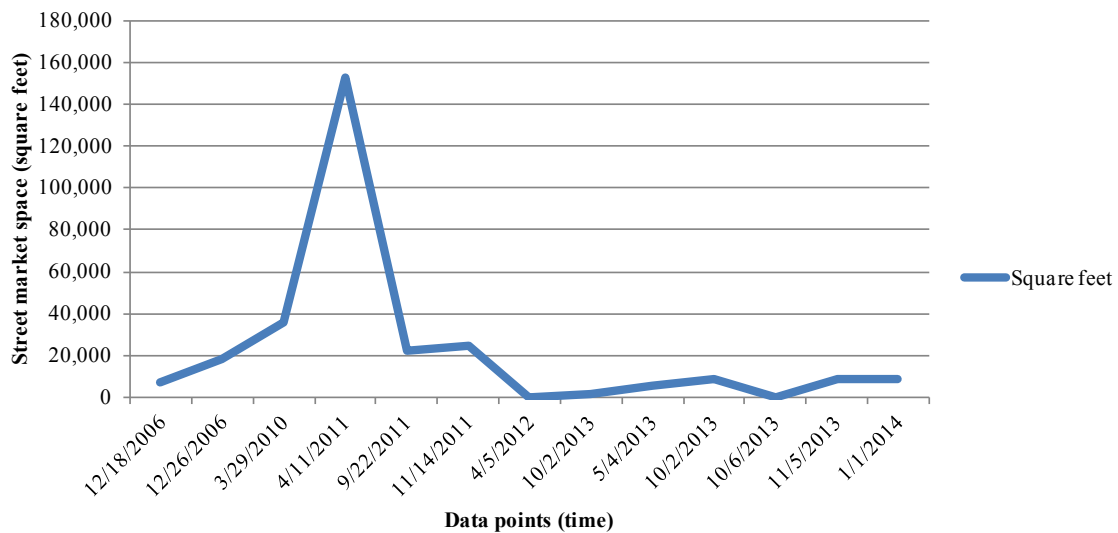
Aggregate market space in Pyongsong dropped by 70 percent between 2005 and 2013. The data for Pyongsong allow for an interesting study of a direct and very notable impact of government policy. Until 2010, the city was home to one of the largest wholesale markets in the country. This market, which served as a hub for market trade in the region, probably grew particularly large due to market demand from the wealthier capital city Pyongyang, located less than 20 miles away.

In 2009, sources inside North Korea began to report a government initiative to place harsher regulations on large wholesale markets like the one in Pyongsong, allegedly because local authorities believed they had grown too big.¹³ The wholesale market was reportedly closed temporarily in 2009, but later continued to operate. However, in 2010, the market was, in fact, closed and later demolished. This caused the dramatic drop in aggregate market size in the city. There is a lack of consistent imagery and data between 2006 and 2010, but it should be noted that this has not affected the ability to measure the sizable drop.

¹³ Curtis Melvin, "The Closing of the Pyongsong Wholesale Market," *NKEconWatch*, May 3, 2011, accessed at <http://www.nkeconwatch.com/2011/05/03/the-closing-of-the-pyongsong-wholesale-market/> on November 13, 2014.

Figure 14. Aggregate market space over time: Pyongsong

It is interesting to note what happened to street markets in the city at the time of the closure of the wholesale market. Again, street markets cannot be measured over time due to the lack of consistent imagery. Luckily, however, imagery from the wholesale market closure makes data gathering possible. Street market size shoots up by over 2,000 percent from March 2010 to April 2011, as Figure 15 shows. There is a lack of imagery and data between 2006 and 2010, a time for which data points are subsequently unavailable.

Figure 15. Aggregate street market space over time: Pyongsong

Again, street markets are very difficult to measure because the imagery on Google Earth might not have been captured at a time of day when they were operating. The only certain way to identify them is by the gathering of crowds within a specific area. Nevertheless, in this case, we can spot the huge increase in street market space occurring at the closure of the wholesale

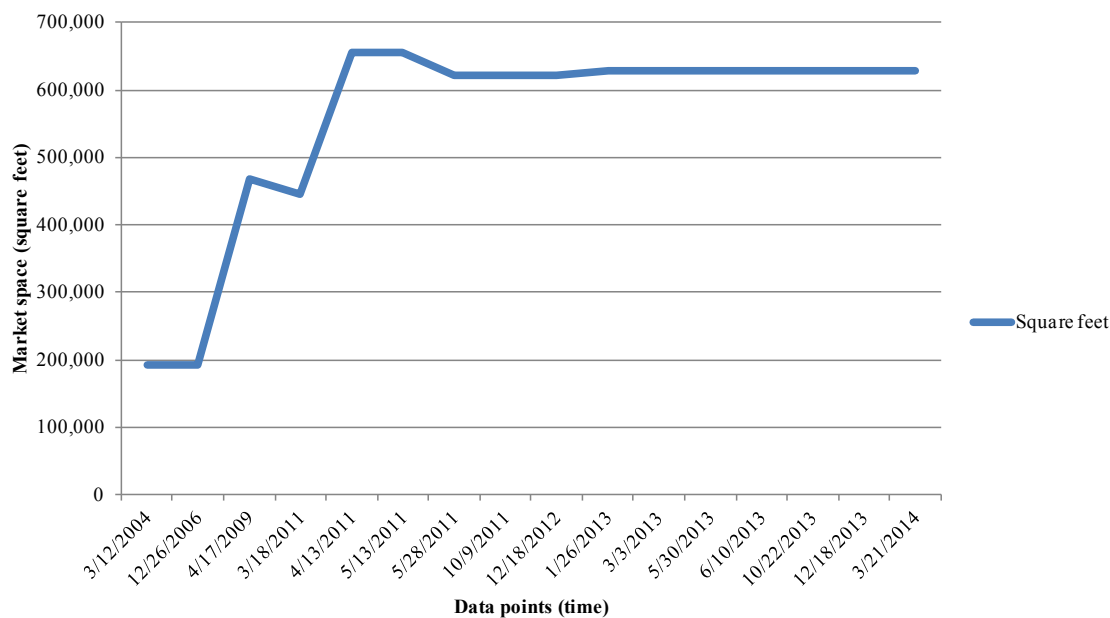
market. This shows that market trade did not stop with the closure—it simply moved. In subsequent observations, where street market space has decreased to levels closer to those previous to the closure, trading might just have moved to other markets in nearby cities such as Pyongyang.

There are two noteworthy observations relating to Pyongsong. First, market trading is difficult for the regime to stamp out. It can continue even when formal markets are closed. Second, the fact that the wholesale market in Pyongsong was indeed closed, while other wholesale markets rumored to be up for elimination remained, indicates that policy relating to the markets is perhaps more easily enforced in areas closer to Pyongyang than in those farther away.

Haeju

For Haeju, the fully observable period spans between 2004 and 2014, with a break in satellite imagery availability between 2006 and 2009 and between 2009 and 2011. The years observed a period of consistent growth. All in all, aggregate market space grew by 228 percent. At least three of the seven measurable markets in Haeju were set up between 2002 and 2004, while two were set up sometime between 2009 and 2011, and another market was established in 2011. Thus, while most other cities show no significant decrease in market space during periods when it is commonly asserted that Pyongyang cracked down on market activity, such as 2009–2010, many markets in Haeju were added during this period.

Figure 16. Aggregate market space over time: Haeju



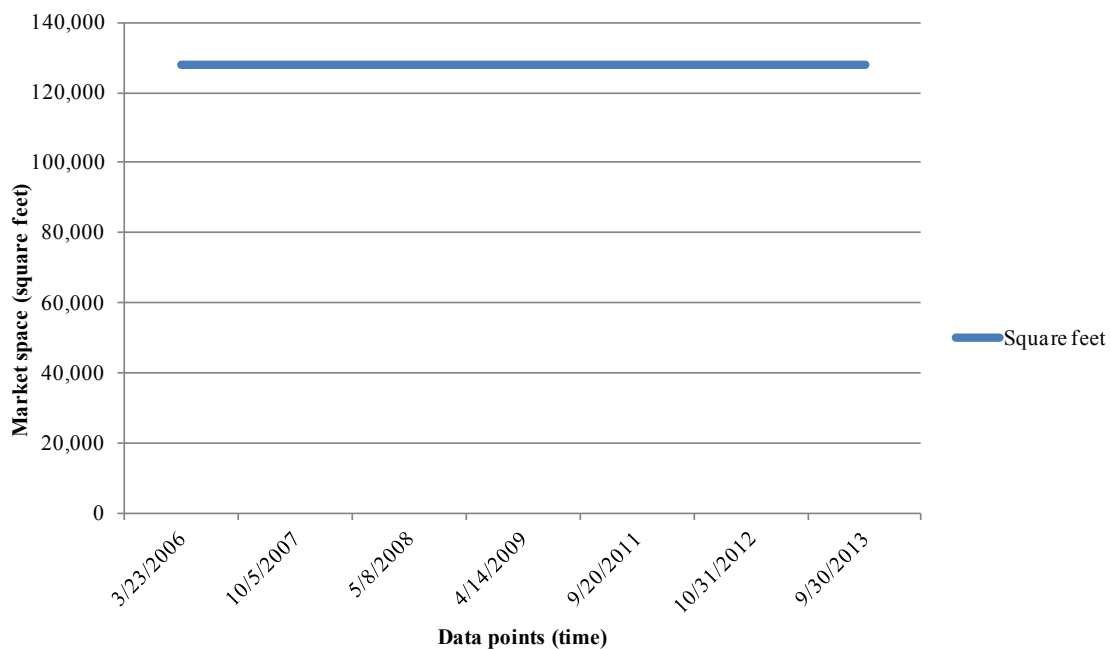
There are several plausible explanations for this development. Perhaps Haeju, situated far from the Chinese border, has a market system less fueled by imports from China and is a less politically sensitive city when it comes to market activity. Because of the distance from China, it may also be that those market networks affected by the 2010 government crackdown on markets in Chongjin, Pyongsong and elsewhere are not as important for Haeju as they are for other cities.

It should also be noted that the southern region has traditionally been more politically favored than the north. It is a place where only those deemed trustworthy by the regime have been allowed to live, because of the proximity to South Korea. This may also be a reason for the rapid market expansion seen in the period measured.

Kanggye

Kanggye, the provincial capital of one of North Korea's northernmost provinces, Chagang, and home to a wide range of sensitive military facilities,¹⁴ has only two formalized markets. The measurement period stretches between 2006 and 2013, with a break in 2010. During the observable period, aggregate market size has remained constant in the city.

Figure 17. Aggregate market space over time: Kanggye



No periods of policy change are possible to study directly, but according to the dataset, markets were not closed or reduced in size between 2009 and 2011, suggesting that formalized market space was not adversely affected during the market crackdown period in 2010. At the same time, while market space increased in a number of other cities in 2012, no such development is observable in Kanggye.

The lack of change in Kanggye is itself interesting. One possible reason is that the city's distance from Pyongyang makes it less sensitive to policy changes. On the contrary, it may be that the presence of a large number of key defense facilities makes border security tighter in Kanggye

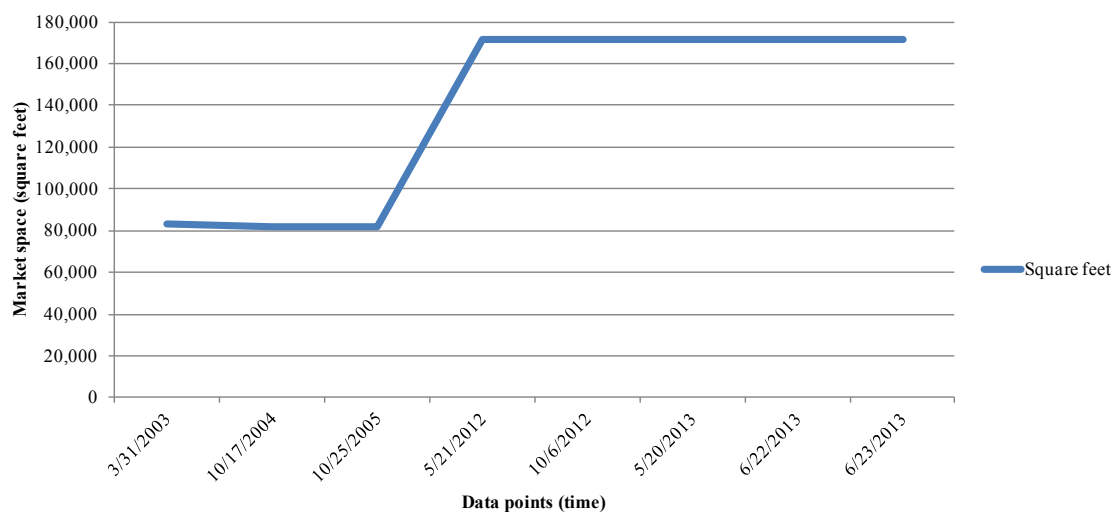
¹⁴ Rainer Dormels, "Profiles of the cities of DPR Korea—Kanggye," in *North Korea's Cities*, ed. Rainer Dormels (Seoul, ROK: Jimoondang, 2014), retrieved at http://www.univie.ac.at/koreanologie/fileadmin/user_upload/DigitalNK/Forschungsarbeit/Kanggye.pdf and accessed January 11, 2014.

than in other cities and that market activity in the city is therefore less sensitive to external factors, such as trade with China, that affect the economy in other cities.

Hyesan

Observations for Hyesan are relatively few. The measurement period spans ten years, from 2003 to 2013, but there is a significant break in available satellite imagery between 2005 and 2012. During these years, total market space more than doubled in the city, by a total of 109 percent. Since imagery is unavailable for two significant periods of policy change, both 2002 and 2009–2010, it is difficult to determine what impact market policy changes have had on Hyesan. Nevertheless, it is clear that there has been a major increase in market space over time in Hyesan.

Figure 18. Aggregate market space over time: Hyesan



This development could perhaps be explained merely by pressure from the public and from traders. News reports from Hyesan frequently indicate that market activity there is highly prolific and that both legal imports and smuggled goods from China provide an important source for goods.¹⁵ However, stifling such activity and limiting the room for particularly successful market traders has been an important rationale for government crackdowns on the markets. These factors are further discussed in the next section.

¹⁵ For an example, see Seol Song Ah, “Price War as Stores Take On Nimble Vendors,” *Daily NK*, July 22, 2014, retrieved at <http://www.dailynk.com/english/read.php?num=12108&catald=nk01500> and accessed January 10, 2015.

ANALYSIS: GEOGRAPHY OF MARKETS

This section studies patterns in the aggregate size of markets per city. We first analyze the correlation between population and aggregate market size. We then compare the square feet per capita of all cities in the sample with the following variables:

- Northern vs. southern cities
- Eastern vs. western cities
- Distance from Pyongyang
- Cities with and without ports

In short, the following patterns can be identified:

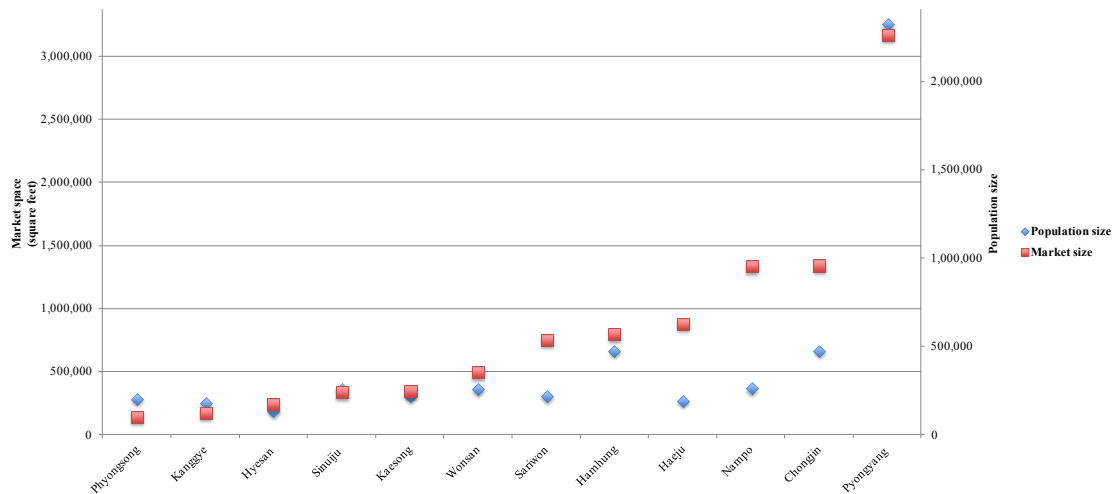
- There is a correlation between population size and aggregate market size, but it is quite weak and many outlier cities that do not fit this pattern are present in the sample.
- The correlation between distance from Pyongyang and aggregate market size is weak.
- With the exception of Kaesong, all cities in the south of the country have larger market square feet per capita than those in the north.
- All cities with the largest aggregate market size per capita can be found in the western part of the country, while cities in the east are closer to the average size for the country.
- Many outlier cities that diverge from the average in terms of market size per capita are cities with major ports, such as Nampo.

Population Size and Aggregate Market Size

For analyzing the correlation between population size and market square feet per capita, population figures from the 2008 census are used.¹⁶ For market size measurements, the latest available measurement from each city is used. Therefore, the analysis is only a snapshot of the situation in 2013–2014. Plotting these series on a diagram, we get the following image:

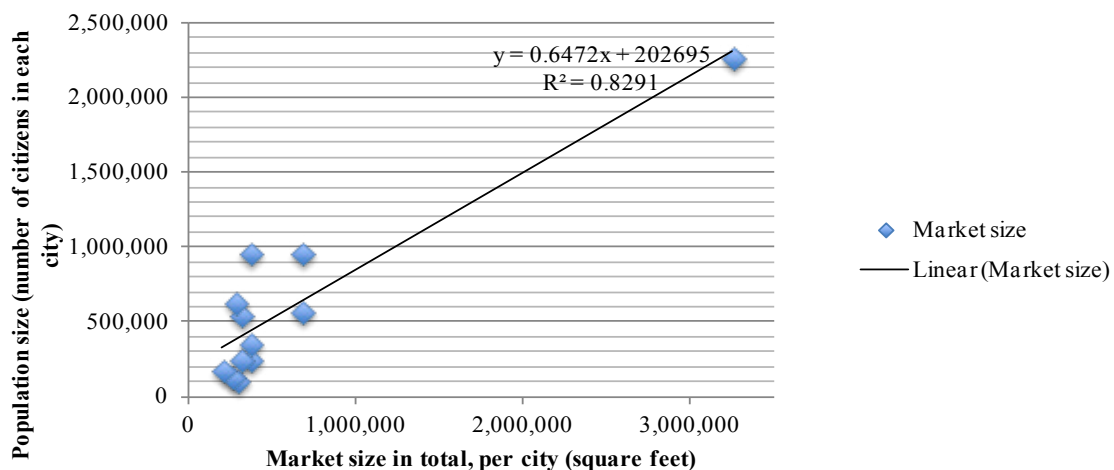
¹⁶ These can be found at Central Bureau of Statistics of DPR Korea, *DPR Korea 2008 Population Census. National Report* (Pyongyang, North Korea: Central Bureau of Statistics, 2008). Retrieved via the UNStats website December 3, 2013, at http://unstats.un.org/unsd/demographic/sources/census/2010_PHC/North_Korea/Final%20national%20census%20report.pdf.

Figure 19. Market square feet and population



As Figure 20 shows, population size and market size move in the same direction in most cases. This makes intuitive sense, as cities with larger populations can reasonably be expected to have more and larger markets. Some cities are clear outliers and will be further discussed. The r-square, a statistic that describes how closely plotted points are clustered around a fitted regression line, where “1” represents full correlation and “0” represents no correlation at all, is 0.83 for the entire sample.

Figure 20. Market size and population size correlation

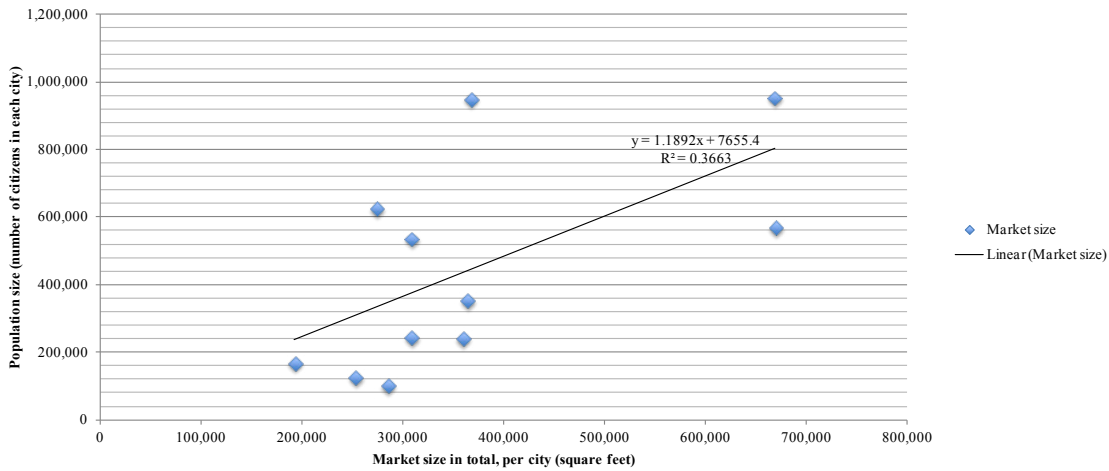


However, this number does not give a full picture. Pyongyang, the capital city, needs to be treated as a special case. Its numbers, both for population and for aggregate market size, are much larger than those of other cities that measurements become disproportionate. Figure 21 shows the sample plotted together without Pyongyang and gives an r-square number of approximately 0.37 a relatively weak number.

The same relation holds when the numbers are analyzed using a different method, studying the correlation coefficient: the correlation with Pyongyang in this method is 0.9, a fairly strong

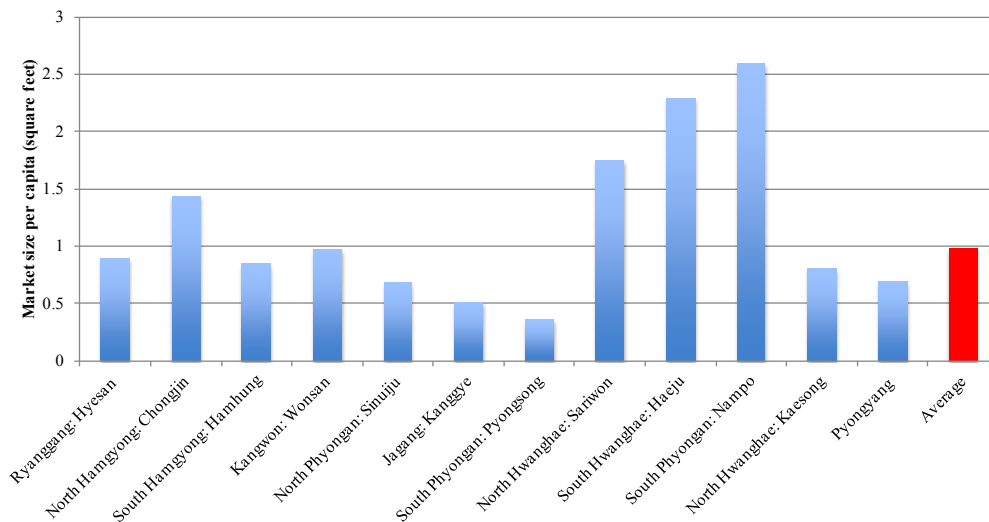
number, while correlation without it is 0.6, a much weaker number. Given the small sample sizes, however, these statistical tests as well as all others in this paper should be taken only as indicative.

Figure 21. Market size and population size correlation, excluding Pyongyang



In sum, there exists a relatively weak correlation between aggregate market size in a city and its population. The following graph, depicting the aggregate market size per capita for all sample cities, shows this divergence clearly.

Figure 22. Market size per capita (in square feet), each city



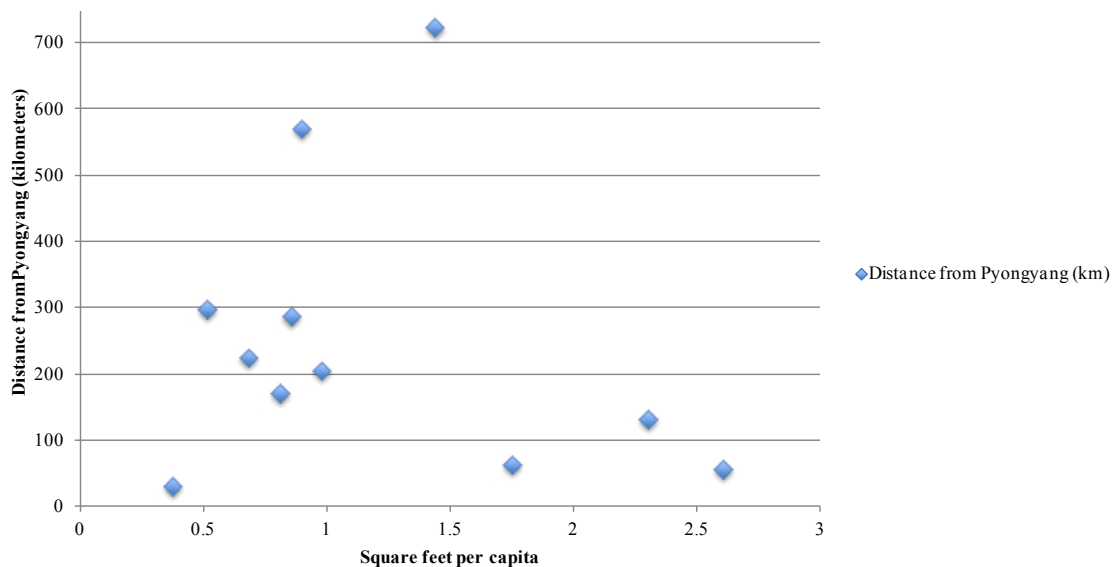
While most cities have market sizes per capita relatively close to the average of around 1 square foot per capita, some cities diverge greatly. Chongjin, Sariwon, Haeju and Nampo are particularly noteworthy examples of cities with an aggregate market size per capita much larger than others. These cities are further examined, together with others, in the following sections that look at patterns in the sample.

Distance from Pyongyang

The distance between the sample cities and Pyongyang, North Korea's wealthiest city by far, is an interesting variable to test since it would appear reasonable to assume that demand from Pyongyang residents drives some of the market economy in neighboring cities. This was reported to have been the case for Pyongsong before the closing of its wholesale market in 2010.

However, there appears to be a very weak statistical correlation between distance from Pyongyang and market size per capita. The correlation is negative but very weak at -0.187 , and the r -squared is only 0.03 . Distance from Pyongyang, thus, appears to be quite a weak explanatory variable for aggregate market size, as the following scatterplot diagram demonstrates. It should, however, be noted that both the figures and the graph would have looked slightly different had pre-2010 figures been used for Pyongsong, since these would have included its large-scale wholesale market, where demand was largely driven by Pyongyang citizens.

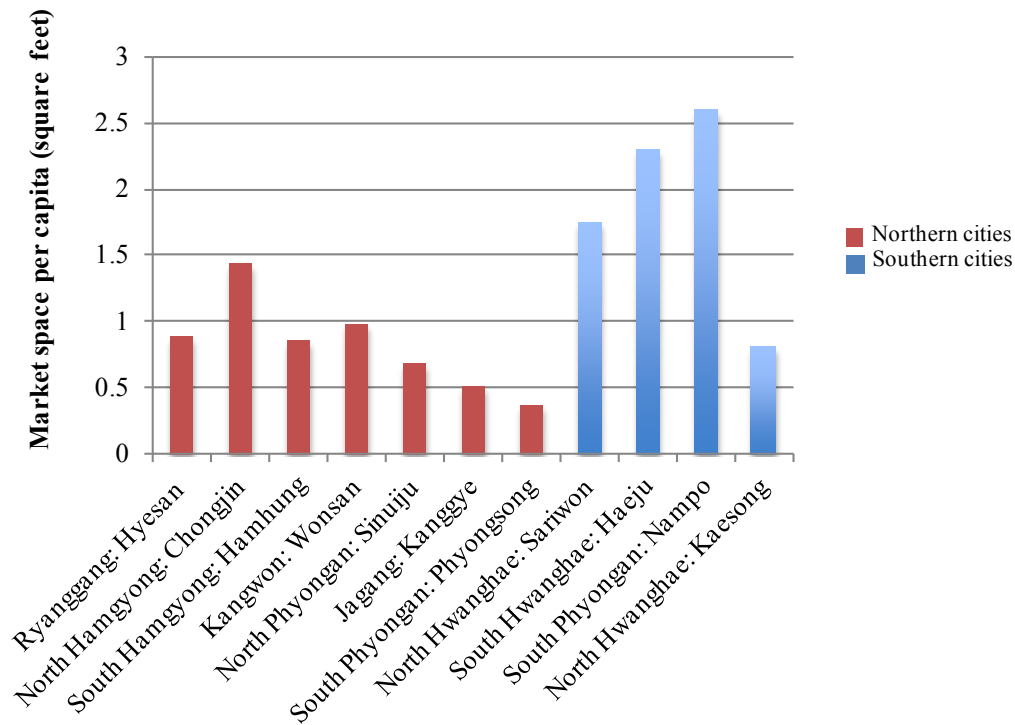
Figure 23. Distance from Pyongyang and market square feet per capita



Market Size: Northern versus Southern Cities

According to the dataset, aggregate market space in the southern part of North Korea is significantly larger on average than that of the north. Figure 24 shows market size sorted between northern and southern cities.

The regional division could be questioned and debated. Throughout Korea's history, there have been many debates about what constitutes north and south, often based on notions of distinct geographic identities. Nevertheless, in contemporary North Korea, it seems most reasonable to use Pyongyang as the divider between north and south since it is the political and economic capital of the country, with a wealth surpassing all other cities. Both Wonsan and Pyongsong could be seen as ambiguous cases because neither city is far from Pyongyang, but they have been included in the southern and northern counts, respectively, to ensure methodological consistency.

Figure 24. Northern and southern regional cities and market square feet per capita

The figures show that market space in the south is more than double that of the north, and over 136 percent larger on average. These results might surprise some, since the north of North Korea is most tightly associated with market activity due to its proximity to the Chinese border. While these figures would appear to contest this notion, this may not be the case.

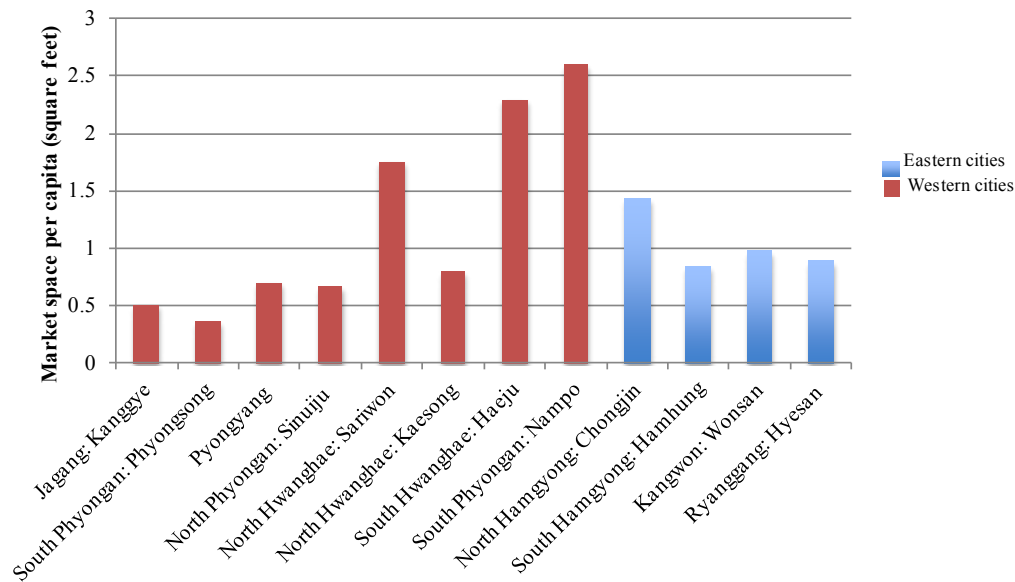
The figures encompass only formalized markets, and it may well be that market activity in the northern part of the country has a more unofficial character than in the south, and that the activity takes place in people's homes and the like to a higher degree than in the south. Moreover, population figures for many cities in the north, such as Hamhung (668,558), Sinuiju (359,341) and Chongjin (667,893), are higher than those of cities in the south, like Sariwon (307,764), Haeju (273,300) and Kaesong (308,440). It may be that there exists a threshold over which larger population size simply does not translate into larger aggregate market space, for reasons of capacity or city size.

Nevertheless, it is striking that all three of the cities that have the largest amount of square feet per capita of market space lie in the south. The divergence may be caused by the fact that the southern region is predominantly agricultural and that trade in this sector is recognized and permitted to a higher degree by the government than trade in other goods, because it is easier to regulate. It may also be that southern cities have been granted more market space as a favor from the government. Their populations are supposedly more politically trusted by the regime, which is the very reason they are permitted to live so close to the border to South Korea. However, these are mere speculations, and closer studies are needed.

Market Size: Western versus Eastern Cities

A second geographic analysis of the figures shows a fairly strong divergence between the eastern and western parts of the country. These cities are divided between east and west depending on what coast they are closest to. It should be noted that Kanggye is far from both coasts, but still closer to the west coast. Thus, it has been classified in the west coast category. On average, aggregate market space per capita in cities in the west of the country is around 68 percent higher than in the east. The red pillars in Figure 25 represent cities in the west, and blue pillars show cities in the east.

Figure 25. Western versus eastern cities and market square feet per capita



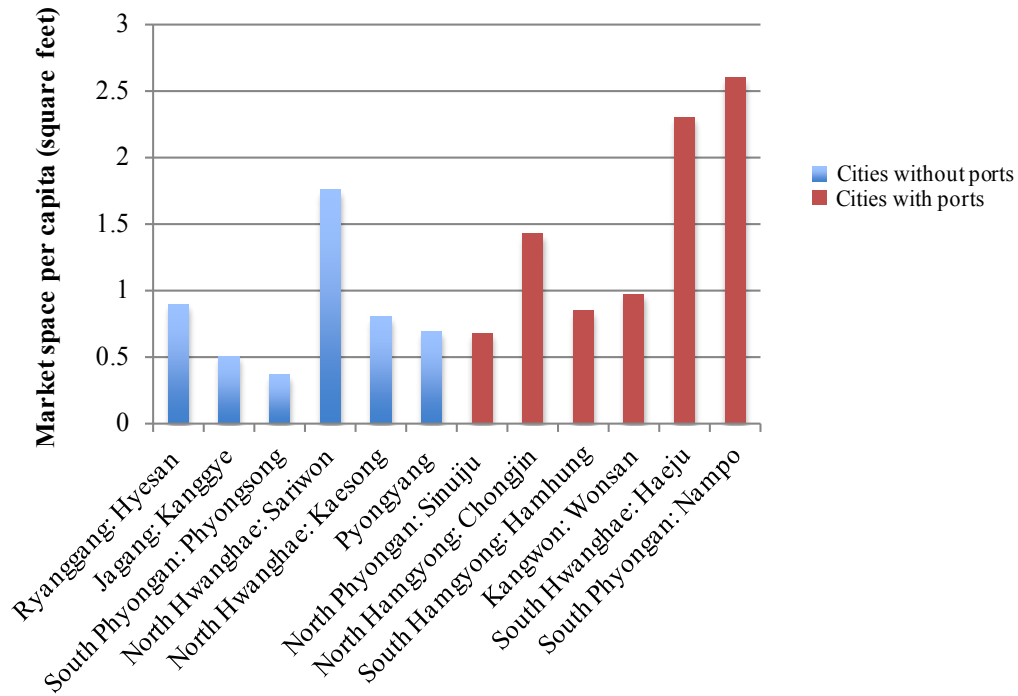
It is difficult to draw precise conclusions from this analysis, as it spans across agricultural and industrial regions alike. Demand in Pyongyang may be a strong factor. Indeed, the cities that stand out—Sariwon, Haeju and Nampo—are all relatively close to Pyongyang. Just as in previous analyses, figures for Phyongsong captured before the closure of the wholesale market in 2010 would have generated a different analysis and reinforced the divergence between east and west, as well as the notion that immediate proximity to Pyongyang may be a driver for larger market space.

It is not surprising that a divergence exists between the western and eastern parts of the country. Only one major highway connects the west and east coasts, going between Pyongyang and Wonsan. Moreover, several mountain chains separate west from east, making communication difficult. It is possible that the Japanese sanctions against North Korea in 2006 either led to this divergence or enhanced it, since much of the previous trade between the countries occurred via North Korea's eastern ports. This speculation is given further relevance by the fact that many of the cities with the largest market space per capita, as observed through the satellite imagery, are those with major ports.

Port Cities

Figure 26 shows aggregate square feet per capita in cities without ports compared to cities with ports. This analysis seems to reveal an interesting pattern: virtually all markets that stand out in terms of aggregate market space per capita have major ports.

Figure 26. Market size per capita in cities without and with ports: comparison



Nampo, Wonsan, Chongjin, Hamhung, Haeju and Sinuiju all have important ports.¹⁷ While Sariwon does not have a major port for foreign trade, it does have a small river port that connects it to Nampo and Pyongyang, which may be a factor driving its markets. Not all these cities have a market size per capita that stands out, but many of them, such as Haeju, Nampo and Chongjin, do.

If aggregate market space is driven by the size and scope of market activity, and market activity is driven by the presence of ports, it implies a pattern of trade that has been little analyzed or understood. Trade across the Chinese border is widely understood to be a major factor for market trade in North Korea, but these figures imply that trade via ships, presumably with imports originating from Dalian and other Chinese cities, is also an important driver. This implication is reinforced by the fact that Wonsan and Hamhung on the east coast both have significantly lower aggregate market space per capita than the port cities on the west coast. The very character of port cities, which globally tend to be more open and cosmopolitan than other cities due to their history of international exposure, may also have come to play a role in North Korea. This variable deserves further study.

¹⁷ Yonhap News Agency, *North Korea Handbook* (Armonk, N.Y. M. E. Sharpe, 2003), 398. For Sinuiju reference, see Haggard, Noland and Weeks, "Markets and Famine in North Korea."

CONCLUSION

Bearing in mind the limitations of this study, a few careful lessons can be observed. First, with the exception of Pyongsong, most markets in North Korea have either grown or remained at a virtually unchanged level in recent years despite central government crackdowns. Even in cities where market space has not changed much, many markets have been updated, rebuilt and renovated.

This is yet another indication among many that the markets are a crucial part of the North Korean economy, and the fact that they have grown in many cities would seem to imply that their importance is growing, too. (The dataset for this paper focused on market size and did not capture the renovations and updates of market structures that have taken place across the country, as visible on satellite imagery.)

Second, crackdowns and repressive measures against the market system by the central government have not translated into long-term practical action regarding the formal markets, as these have, in most cities, remained in place during periods of supposed market repression. This does not mean market repression did not take place, but it does imply that market repression measures, thus far, have not had permanent impacts that can be observed on satellite imagery or in the data. Many changes in aggregate market size appear to occur for practical reasons, such as market structures being rebuilt and updated.

Third, market trade may be driven by factors other than those previously assumed. While proximity to the Chinese border has long been thought to be a driver for market trade, this is not reflected in the data on formal market size. The fact that port cities on the west coast have a consistently larger aggregate market size per capita than other cities indicates that sea route trading may be a structural factor for market trade.

Moreover, the large market space per capita in the south as a whole suggests that domestic agriculture may also be a major driver for the market economy. None of this is to suggest that cross-border trade with China does not matter. The findings of this report do, however, indicate that the picture is more diverse than previously assumed. Overall, one of the core insights of this study is that many of the factors that determine the size of markets remain far from understood.

This study leaves a number of interesting questions unanswered. Infrastructure for transport may be an important determinant of aggregate market space, and a quantitative study of whether market space correlates with access to high-quality highways and railways would be highly relevant.

Another interesting issue to explore would be the geographic placement of markets within cities, and whether a clear pattern exists in where markets are situated. Moreover, the strong divergence between developments in cities, sometimes without clearly inferable reasons, suggests that local government authorities may play a strong role in the management of the markets. Studying this development further could generate interesting findings about governance and local government autonomy in North Korea.

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