

# **An input-output analysis of the Korean construction industry's supply side**

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Six years after the commencement of the downturn in construction activity, it is not difficult to observe sequelae in the epicenter of the global financial crisis such as US and UK. The labor market and the public construction market are seen as drags on construction growth. The former remains with deep scar from the crisis and the uncertainty of the latter is generated by the concern over the public deficit. However, it is also true that the housing market has been keeping up construction industry and that the non-residential building market has turned the corner. In sum, the construction industry is cautiously optimistic about future prospects.

To respond effectively to a recovery in demand, the construction industry should not suffer from capacity constraint or price inflation. It means that, in order to encourage further investment by the private and public sector, the industry needs to endure an extended period of depressed price level. In this context, it is of crucial importance for the supply chain to play its role in driving value, reducing cost and eliminating waste.

However, in general, the crisis provides opportunity to move the industry away from unsustainable patterns of production and consumption. Indeed, through

cases of developed European countries, we know that the period of recession was a time of transformation for the construction industry. After the World War II, western European countries experienced an economic growth until the beginning of the 1970s. This economic growth was significant and relatively regular. During the growth phase, the construction industry contributed to the economic growth through the massive development of housing projects, non-residential buildings and civil engineering infrastructures. The stock of residential and non-residential building and infrastructures became highly important.

However, these developed countries went into recession caused by the OPEC(Organization of Petroleum Exporting Countries)'s oil embargo in 1973 and the rise of oil price that followed. Through the recession, the refurbishment and maintenance works have been of the same importance as the new construction. Furthermore, the management of building and infrastructure stocks has become of increasing concern. More and more attention has been drawn to the quality and the cost of the service rendered by the residential and non-residential buildings and the civil engineering infrastructures.

While during the growth phase between 1950s and 1970s the construction industry performed the role of developing massively buildings and infrastructures necessary to meet the needs of the country, the emphasis has been placed through the recession, on the management of the services rendered by such buildings and infrastructures all along the life cycle.

As a result of the transformation, the construction industry can be defined as activities related to "producing and managing the services rendered to end users by the living and working environments throughout their physical life-cycle"<sup>1</sup>,

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<sup>1</sup> Jean Carassus(2004), 'From the construction industry to the construction sector system' p.10, in "The construction sector system approach: an international framework" published by International Council for Research and Innovation in Building and Construction

which comprise production, use, improvement, through to demolition.

The construction industry performs the following three functions: ① continuous management of the existing stock of structures; ② design and complex production assembly on itinerant sites; ③ production and distribution of materials, components, equipment and plant implemented, assembled, installed by construction firms on worksites<sup>2</sup>.

This paper presents a supply-side analysis of the Korean construction industry, by using the input-output tables. They are used in order to find how the global financial crisis has impacted the input structure of the construction industry. This question can be justified by the above described cases of the European countries.

This work deals with the question whether the Korean construction industry is experiencing such a transformation especially as it suffers from the difficulties caused by the global financial crisis in 2008.

To answer the question, we will analyze the construction column in the input-output tables. The construction column indicates intermediate inputs from the other industries besides gross value added, which consists of compensation of employees, consumption of fixed capital and net operating surplus. It may be said to exhibit the supply side of the industry.

Through the analysis, we expect to discover some indices showing signs of the transformation in the Korean construction industry's supply side.

### **Current Difficulties from which the Korean Construction Industry Suffers**

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<sup>2</sup> Ibid. p.12

The current difficulties following the subprime mortgage crisis in 2008 began with the housing market slump that has continued for eight years since 2007. The number of unsold apartments reached a record high of 160,000.

Financial institutions showed the tendency to perform more conservative risk management, especially in relation to the construction industry. The lending rates increased.

The sustained real-estate market downturn subsequently contributed to the rise of non-performing loans in the construction industry. Related to real-estate project finance, non-performing loans have been concentrated among a few large firms. Consequently, as many as 35 construction contractors out of top 100 were brought to the brink of bankruptcy.

In contrast with banks, savings banks did not tide successfully over a crisis caused by the increase of non-performing loans in the construction industry along with those in shipping and shipbuilding industries. Between 2011 and September 2012, 20 of the country's 105 savings banks, comprising 38% of the sector's assets, were closed.

Furthermore, there is the household debt problem. It has in general been evaluated as one of potential risk factors which are supposed to threaten the stability of the macroeconomic stability. In 2012, the size of the household debt was 1.6 times that of the national disposal income, compared with an average 1.3 for the OECD<sup>3</sup>. The household debt is rising much faster than both GDP and the average household income. The problem can be more serious as it is consistently linked to the economic slowdown and ongoing real-estate slump.

Figure 1 shows the trend of the construction industry's outputs and the rates of

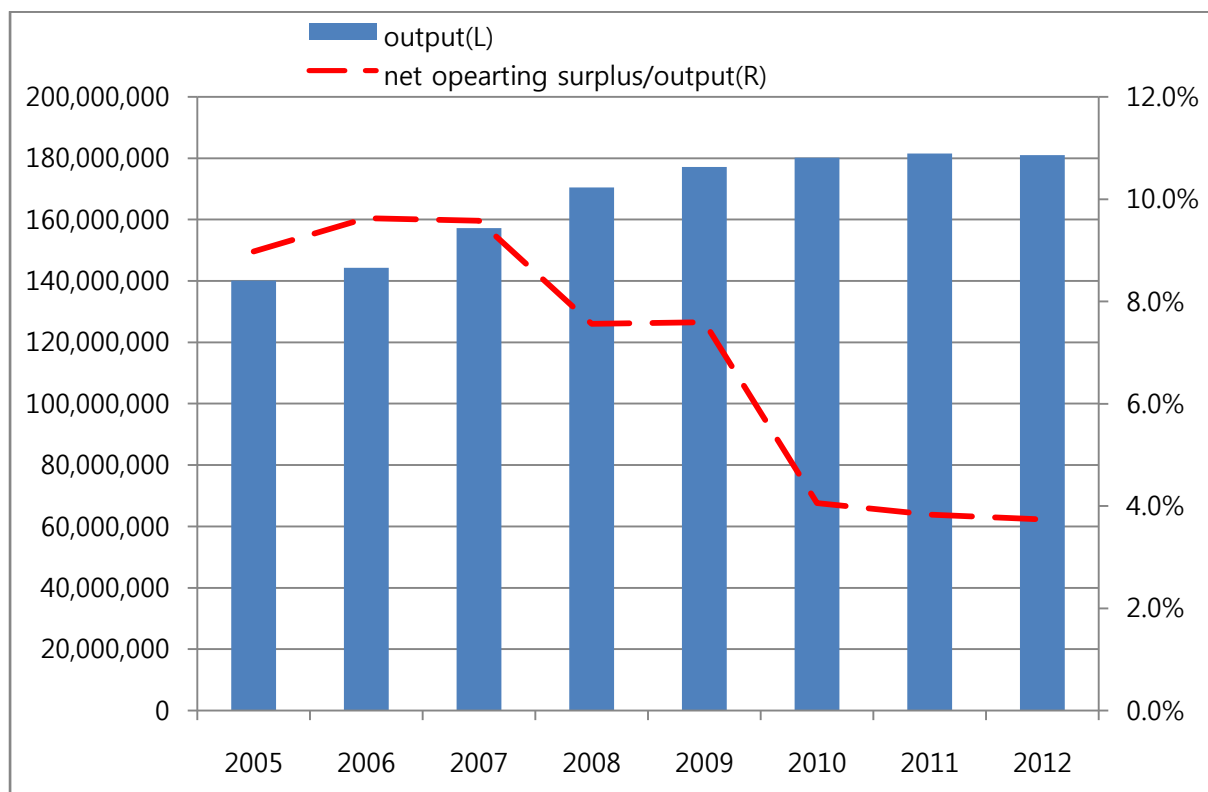
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<sup>3</sup> The Economist (2014), 'South Korea's Household debt, Hole in Won', May 31<sup>st</sup> 2014.

net operating surplus to output from 2005 to 2012.

The difficulties are not expressed in terms of the output which has continuously increased. The average annual growth rate of the output over the period from 2005 to 2012 is 3.8%. In contrast, the difficulties are explicit in terms of the profitability of construction firms. In fact, the profitability was sharply worsened after the subprime mortgage crisis. The rate of net operating surplus to output fell from 9.6% in 2007 to 3.7% in 2012. We can conclude that the Korean construction industry has managed to survive the difficulties by maintaining or even increasing the production in spite of the deterioration in the profitability.

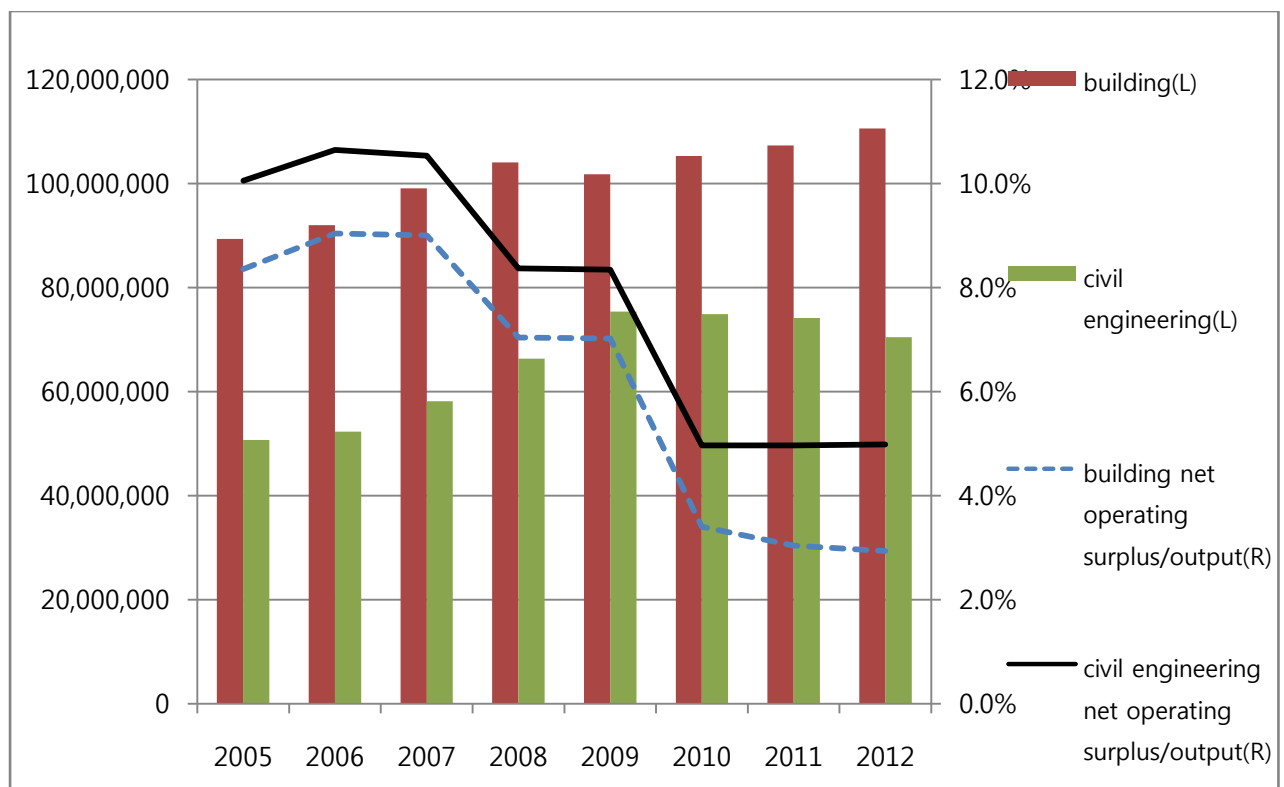
**Figure 1. Evolutions of the construction industry's output<sup>4</sup> and rate of net operating surplus to output**



<sup>4</sup> The unit of the output is million Korean won through the paper.

To deepen the understanding the performance of the construction industry during the period, we divide it into two categories: building construction and civil engineering as shown in Figure 2. According the figure, the output of the building construction decreased 2.2% in 2009 from the previous year. However, the output regained the growing trend in 2010 and went beyond the level of 2008. On the contrary, the rate of net operating surplus to output suffered the reduction from 9.0% in 2007 to 2.9% in 2012.

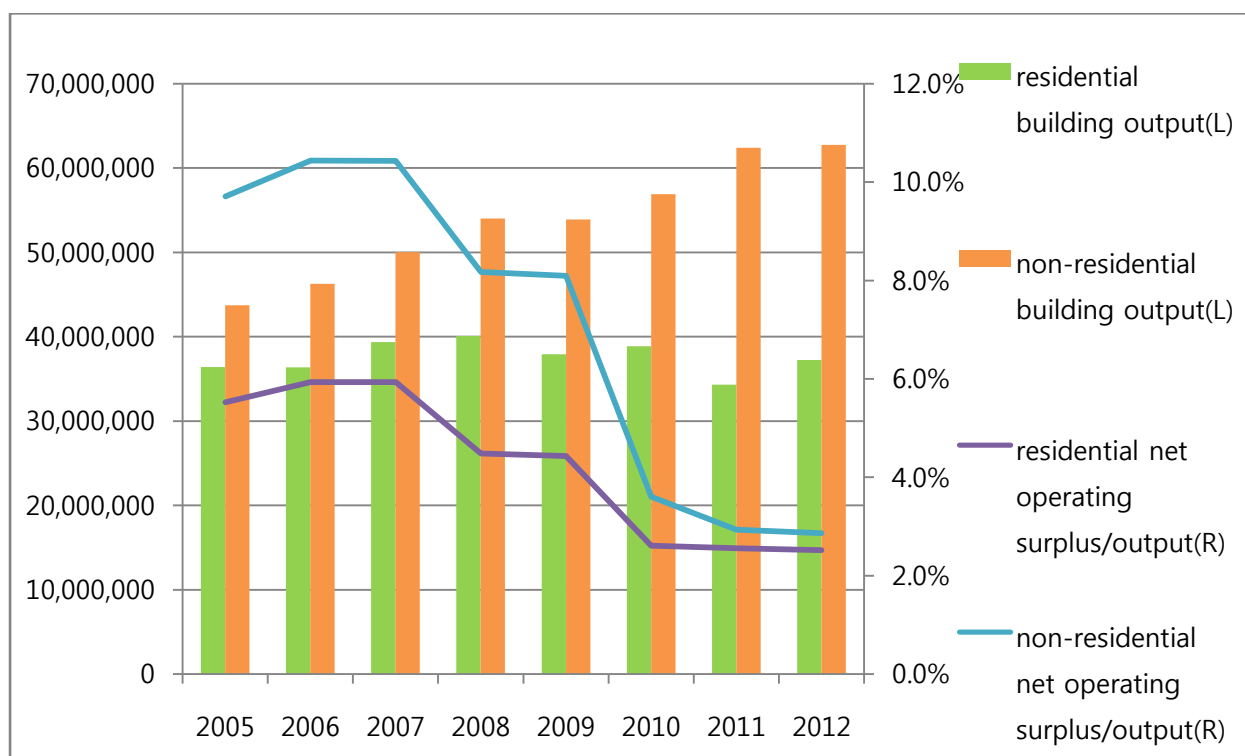
**Figure 2. Evolutions of building construction's and civil engineering's output and rate of net operating surplus to output**



In regard to civil engineering, the output reached the highest level in 2009 owing

to the economic stimulus package enacted in 2008. But the level has decreased since then. However, the output in 2012 is more than that in 2007 before the recession. The rate of net operating surplus to output suffered a decrease from 10.6% in 2006 to 5.0% in 2010. This decrease is less severe than that in building construction.

**Figure 3. Evolutions of residential and non-residential building construction's output and the rate of net operating surplus to output**



We further the analysis in order to regard the evolution of the two subsections of the building construction: residential and non-residential building construction as depicted in Figure 3.

The output of the residential building construction fluctuated continuously during the period from 2005 ~ 2012. In 2009 it decreased 5.4% from the previous year,

but it increased 2.5% in 2010. And, it fell 11.7% in 2011 and rose 8.4% in 2012. On the other hand, the rate of net operating surplus to output suffered a decrease from 5.9% in 2007 to 2.5% in 2012.

The output of the non-residential building construction showed an increasing trend with an exception of a fall of 0.2% in 2009. In contrast, the rate of net operating surplus to output suffered a spectacular fall from 10.4% in 2007 to 2.9% in 2012.

### **Input Structure**

As mentioned above, most of European advanced countries experienced the transformation of their construction industry through the recession from 1970s to 1990s. The industry has laid as much emphasis on continuous management of the existing stock of housings, buildings and infrastructures as on new construction. With the transformation, the professionalization of in-house facilities management or the outsourcing of this management has been advanced. This implies that the shares of services and construction industry in the construction input structure has sensibly risen as much as the share of the inputs from manufacturing has shrunk.

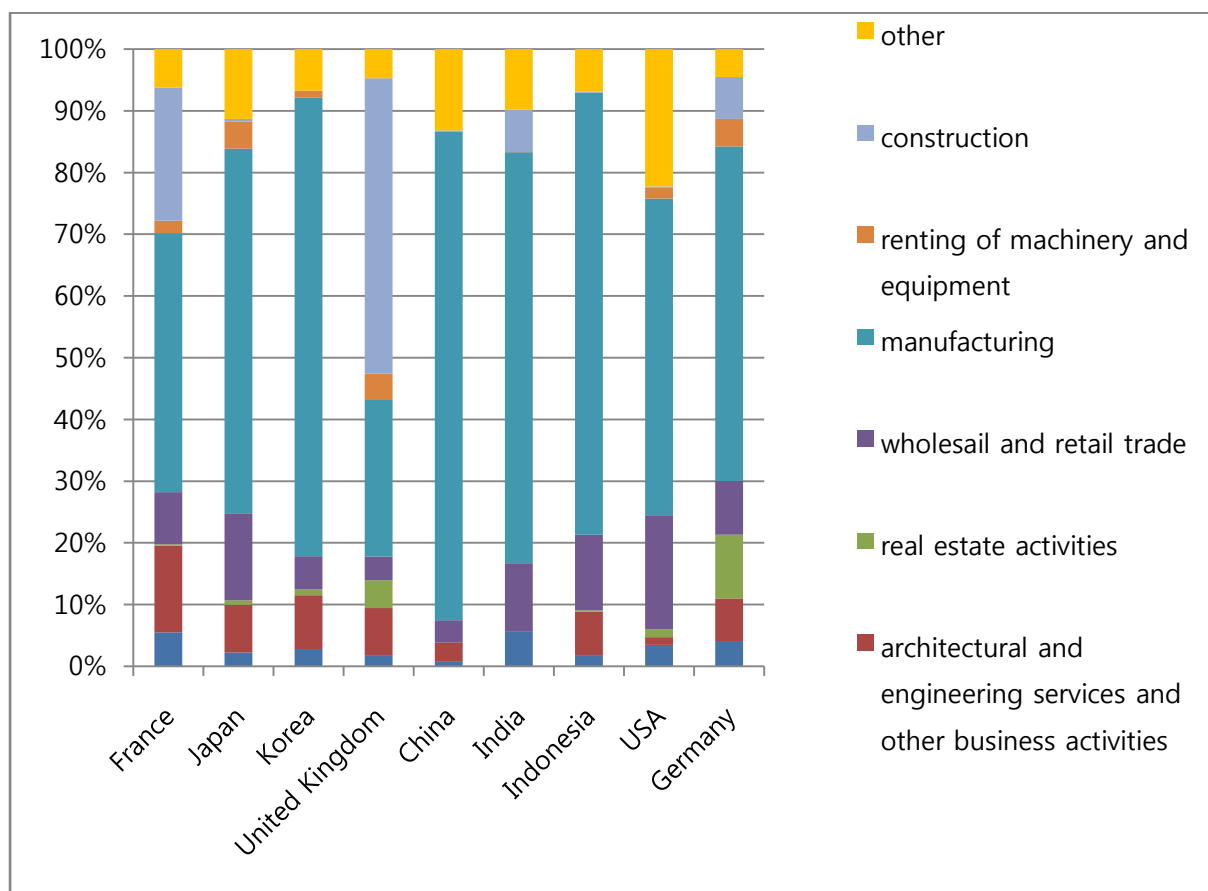
As showed in Figure 4, advanced economies have a relatively significant share of the inputs from services. The shares are 36.2% for France, 40.1% for Japan, 26.6% for the United Kingdoms, 47.9% for the United States and 38.7% for Germany while those are 25.5% for Korea, 20.2% for China, 25.9% for India, and 28.2% for Indonesia.

Especially, the share of the inputs from the construction industry itself is relatively



higher in United Kingdom(47.5%), France(21.4%) and Germany(6.7%) among developed countries. It means that the construction industry of these countries uses considerable amount of intermediate inputs from the construction itself. These intermediate inputs have in turn been produced and enter as a fixed asset in the production process. For Korea, the share is almost equal to zero.

**Figure 4. International comparison<sup>5</sup> of construction industry's input structure**



On the other side of the coin, they have a relatively reduced share of the inputs from manufacturing in which the products of primary industries are included. The

<sup>5</sup> It is based upon data from OECD. The input-output tables are used of 2005.

shares are 41.7% for France, 58.6% for Japan, 25.2% for the United Kingdom, 51.0% for the United States and 53.8% for Germany while those are 74.0% for Korea, 77.6% for China, 65.1% for India, and 71.6% for Indonesia.

The higher share of the inputs from manufacturing means that the majority of materials and components are manufactured off-site and that the inputs from services are used in a limited extent. It implies that the construction industry is concentrated on the production rather than on the management of services derived from built environments.

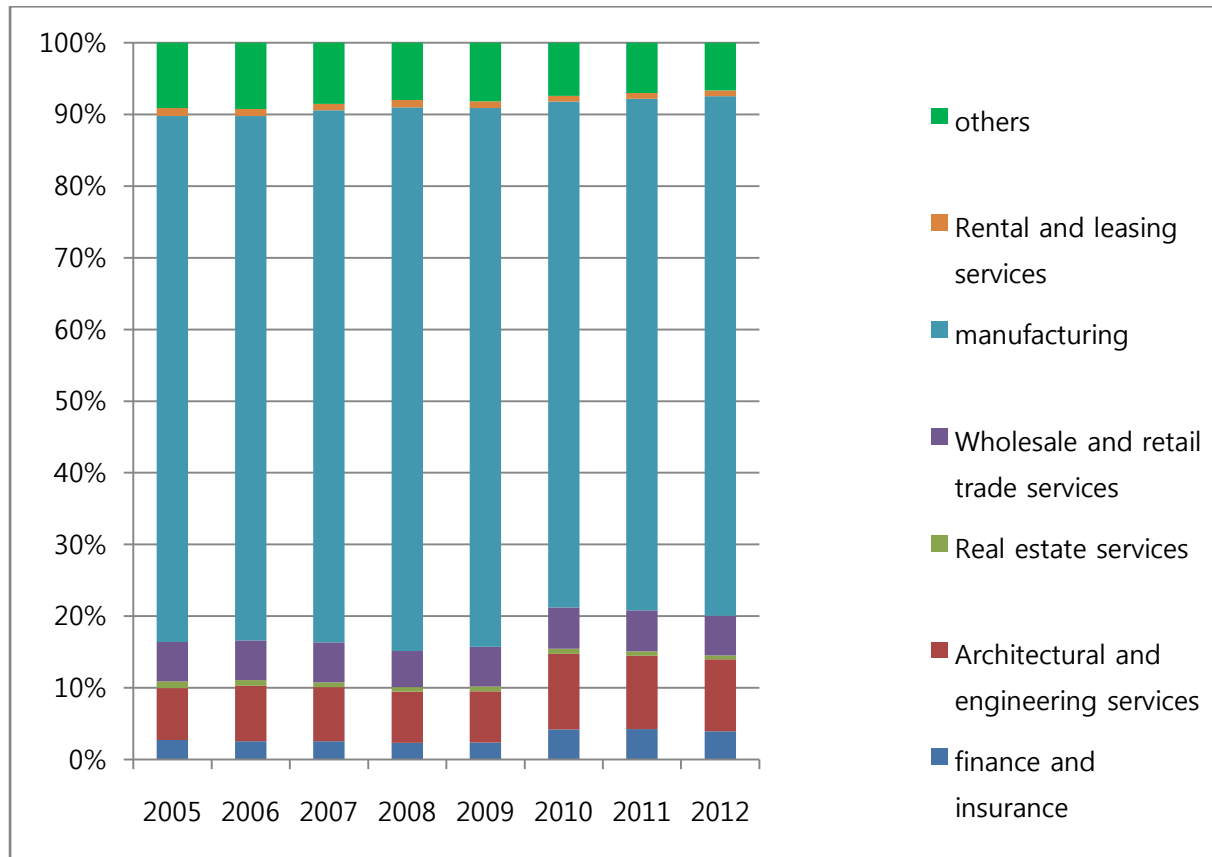
Now let us look at how the input structure of the Korean construction industry has evolved through the period around the global financial crisis. The share of inputs from manufacturing fell sensibly from 75.1% in 2009 to 70.6% in 2010. However, the share returned to 72.6% in 2012.

The share of the inputs from services reached the lowest level of 23.5% in 2008, but it turned back to 26.7% in 2010 and was placed at 25.1% in 2012, which is similar to the level before the recession.

However, two components of the construction industry's input structure are worthy of notice: 'finance and insurance' and 'architectural and engineering services'. The input from finance and insurance increased its share from 2.3% in 2008 to 4.3% in 2011. The share was placed at 3.9% in 2012. The inputs from architectural and engineering services also raised its share from 7.2% in 2009 to 10.6% in 2010. Their share was situated at 10.1% in 2012.

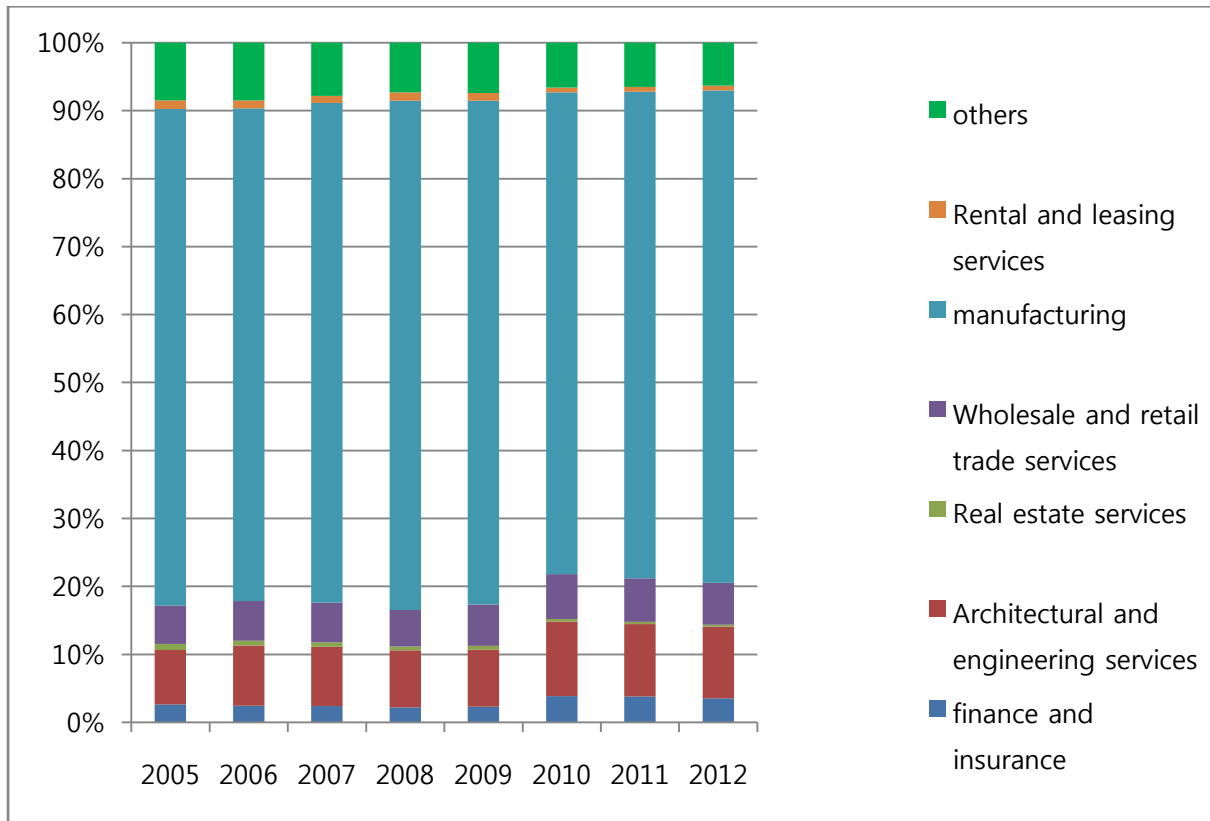
Another characteristic of the Korean construction industry's input structure is that the share of the inputs from construction industry itself has been close to zero.

**Figure 5. Input structure of the Korean construction industry**

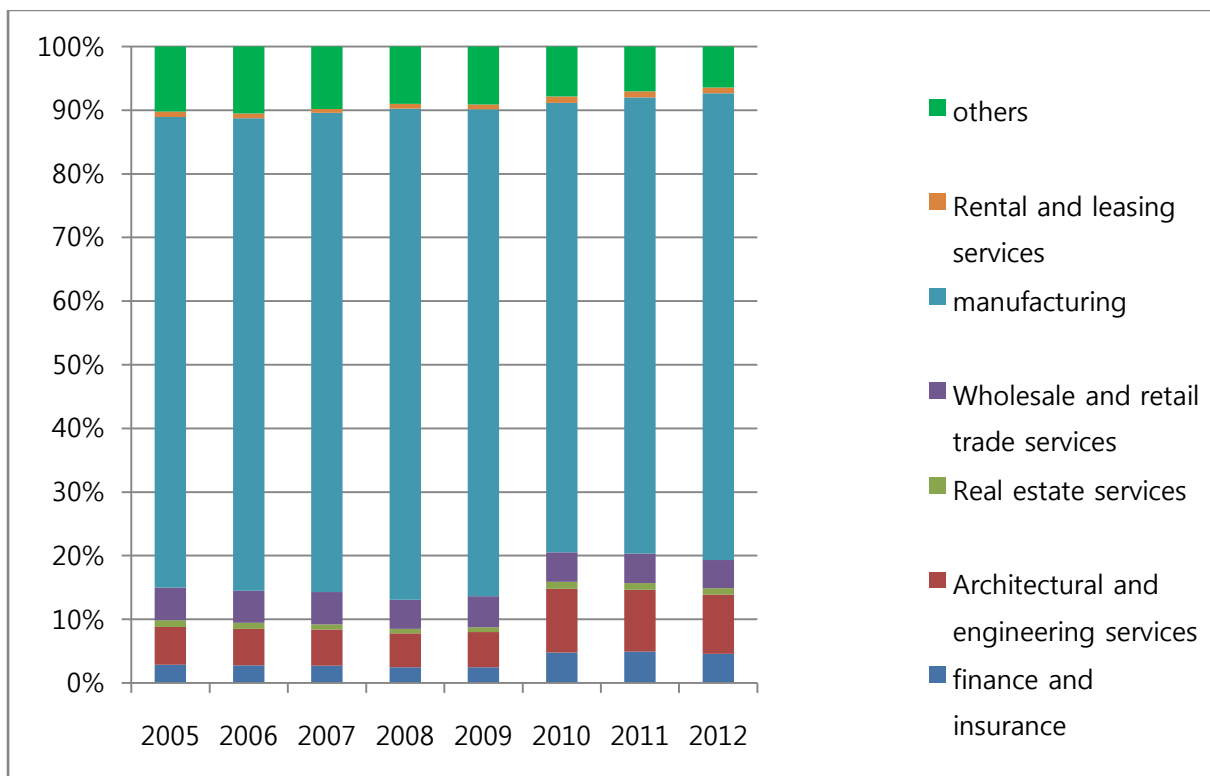


The similar input structure is found both in the sections of building construction and civil engineering and the subsections of residential and non-residential building construction as shown in Figures 6 to 9.

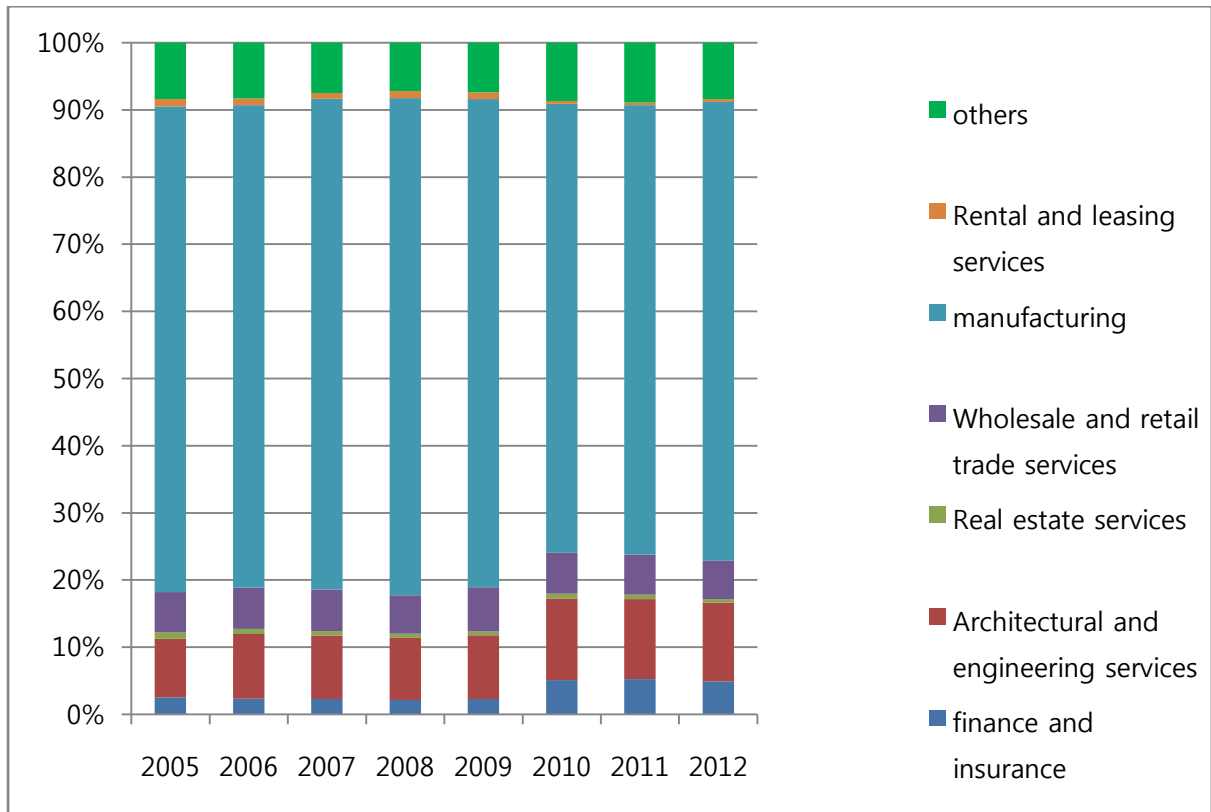
**Figure 6. Input structure of the Korean building construction**



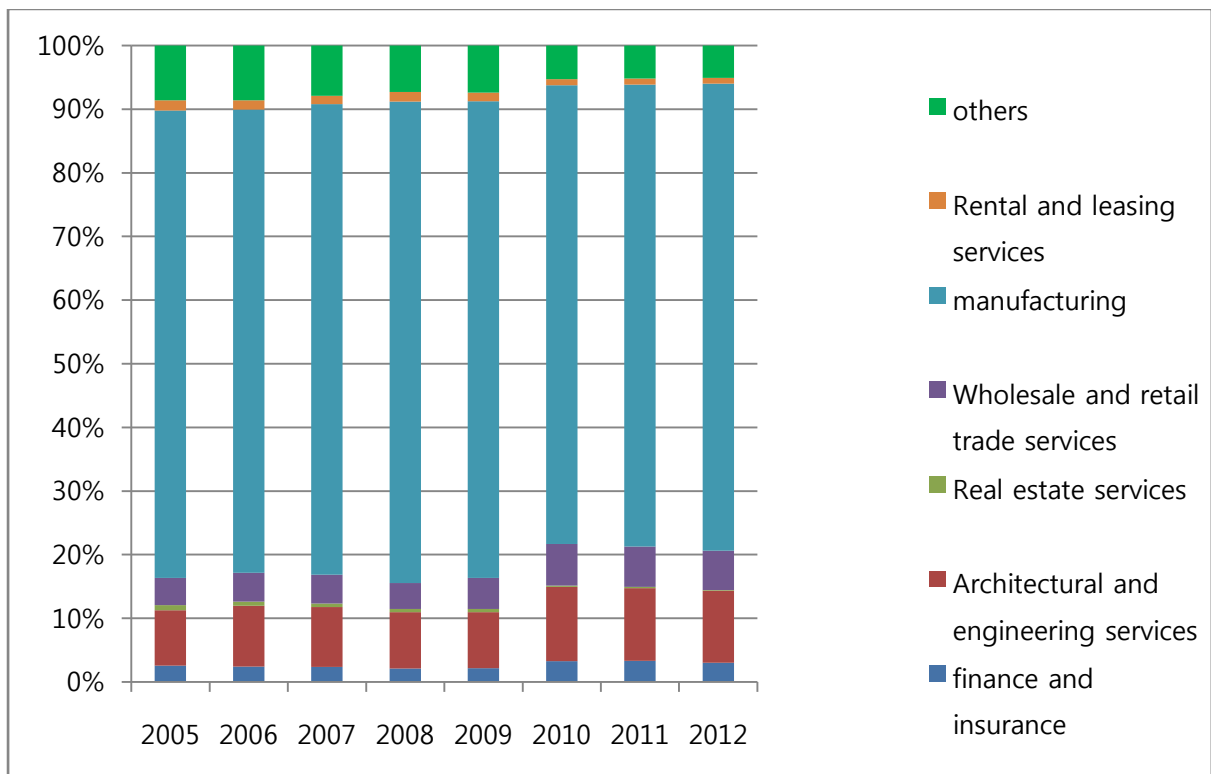
**Figure 7. Input structure of the Korean civil engineering**



**Figure 8. Input structure of the Korean residential building construction**



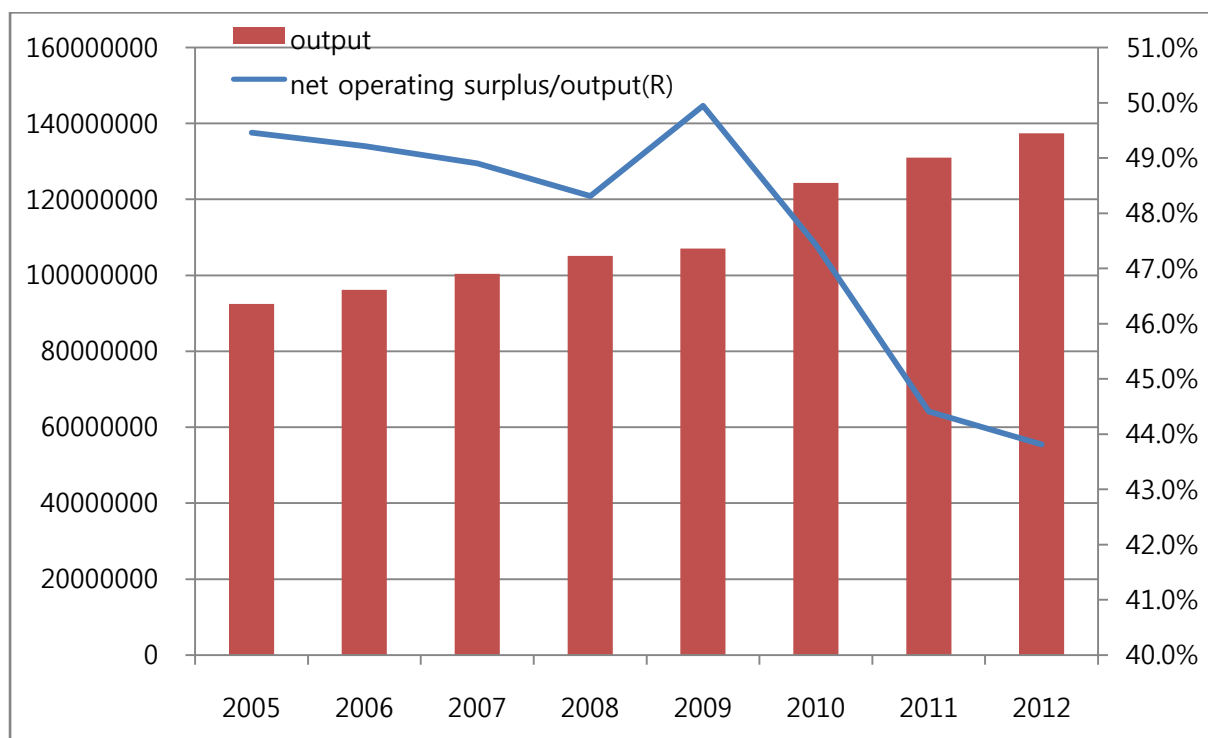
**Figure 9. Input structure of the Korean non-residential building construction**



So far, we analyzed the Korean construction industry's input structure. However, we did not find any indices suggesting that the Korean construction industry experiences the transformation.

Now, to evaluate the importance of the management of the existing stock of structures, we are going to show the evolutions of the output and the rate of net surplus to output of the real estate services and those of one subsection of the construction industry which is building maintenance & repair.

**Figure 10. Evolutions of the real estate services' output and ratio of net operation surplus to output**

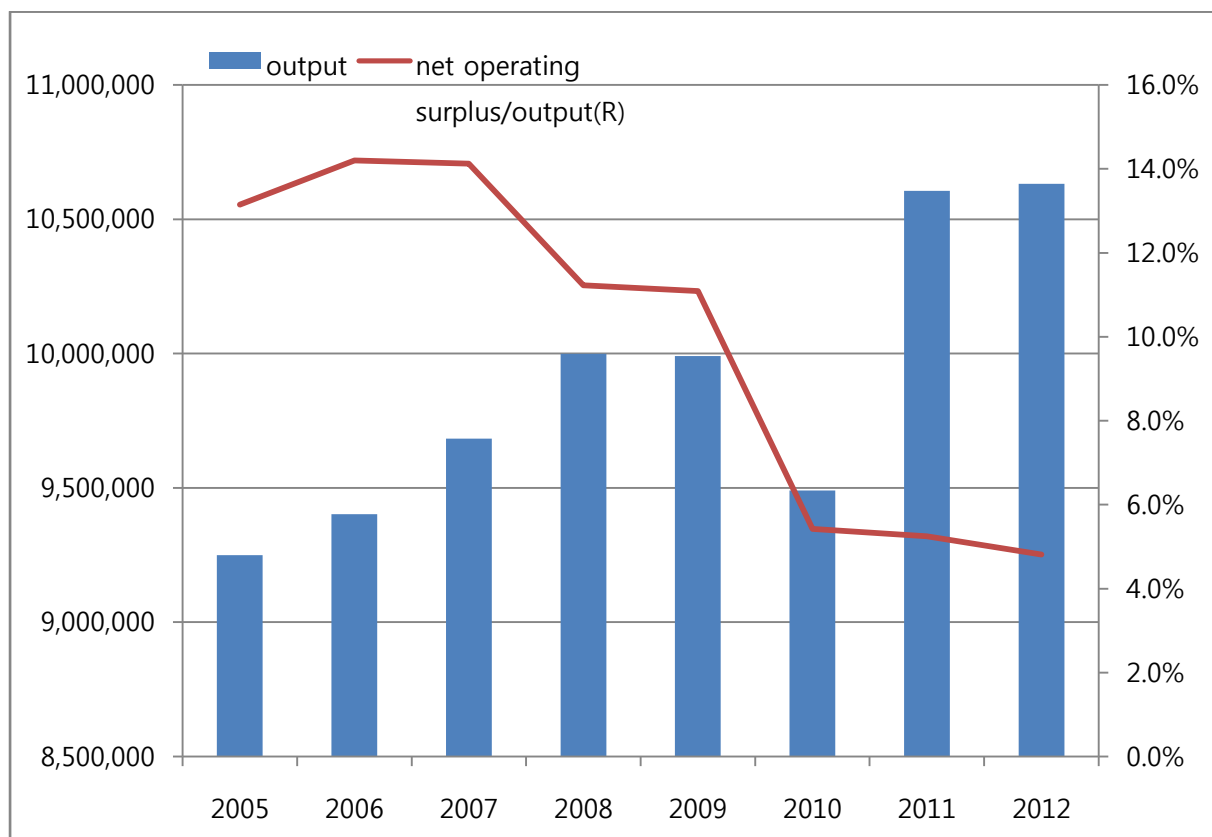


To begin with, real estate services' output kept on increasing and rose 48.6% au total during the period. Especially, in 2010, it increased sensibly 16% from the previous year.

The growing importance of the sector can be described as follows. The size of the out of real estate services was 1.24 times that of building construction in 2012, compared with 1.03 in 2005.

The ratio of net operating surplus to output has maintained a substantially high level, compared with the other subsections of the construction industry, even though it shows a decreasing tendency.

**Figure 11. Evolutions of the building maintenance & repair' output and ratio of net operation surplus to output**



The output of building maintenance & repair rose insistently except 2009 and 2010. It increased 14.9% during the period. It rose by 11.8% in 2011.

However, the portion of building maintenance & repair's output in building construction's output showed fluctuation during the period. It fell from 10.3% in 2005 to 9.0% in 2010 and rose to 9.9% in 2011 and fell again to 9.6% in 2012.

On the other hand, the rate of net operating surplus to output suffered a decrease from 14.2% in 2006 to 4.8% in 2012.

## **Conclusion**

The cases of developed European countries such as France, the United Kingdom and Germany show that, as an economy develops, the construction industry changes its role. From producing massively buildings and infrastructures, the industry puts more emphasis to managing the services rendered to end-users by the existing stock of buildings and infrastructures.

This change implies that of the industry's input structure. As the management of the stock of structures is enhancing its importance in construction industry, the share of the manufacturing sector in the construction industry's input structure decreases whereas the share of the services sector increases.

Around the global financial crisis, the outputs of real estate services and building maintenance & repair grew consistently in Korea.

The share of the inputs from manufacturing lessened somewhat. The most significant reduction occurred in the residential building construction. The least reduction did in the non-residential building.

The share of the inputs from services fluctuated. The shares of both "finance and insurance" and "architectural and engineering services" increased markedly. In particular, the increase was substantial in residential building construction and



civil engineering.

However, although the inputs from services have increased, it is not possible to conclude that services sector substituted for the manufacturing as main suppliers of the construction industry.

In this respect, we think that the unshrinking output of the construction industry has been a barrier to the transformation. However, the current difficulties from which the Korean construction industry is suffering may in the end come to accelerate the transformation of the Korean construction industry. For the fall of the ratio of operating surplus to output may imply that the industry would not do business any longer in the way it used to.

# An input-output analysis of the Korean Construction sector

# Backdrop 1

- In spite of the persistence of sequelae especially in the labor market and the public construction market, the construction market has turned the corner, in the epicenter of the global financial crisis.
- Supply chain analyses have been undertaken in order to enhance the efficiency and the competitiveness, in order for the industry to respond to a lukewarm recovery in demand.
- The crisis provides opportunity to move the industry away from unsustainable patterns of production and consumption as some European countries' cases demonstrate.

# Backdrop 2

- While during the growth phase the construction industry performed the role of developing massively buildings and infrastructures, the emphasis has been placed through the recession, on the management of the services rendered by such buildings and infrastructures along the life cycle.
- It has been defined as activities related to producing and managing the services by the living and working environments throughout their life-cycle.
- It performs: ① continuous management of the existing stock of structures; ② design and complex production assembly on itinerant sites; ③ production and distribution of materials, components, equipment and plant implemented, assembled, installed by construction firms on worksites.

# This paper presents

- On the basis of the above European cases, a supply-side analysis of the Korean construction industry, by using the input-output tables in order to find how the global financial crisis and the difficulties that followed have impacted the input structure of the construction industry.
- It will analyze the construction column in the input-output tables.

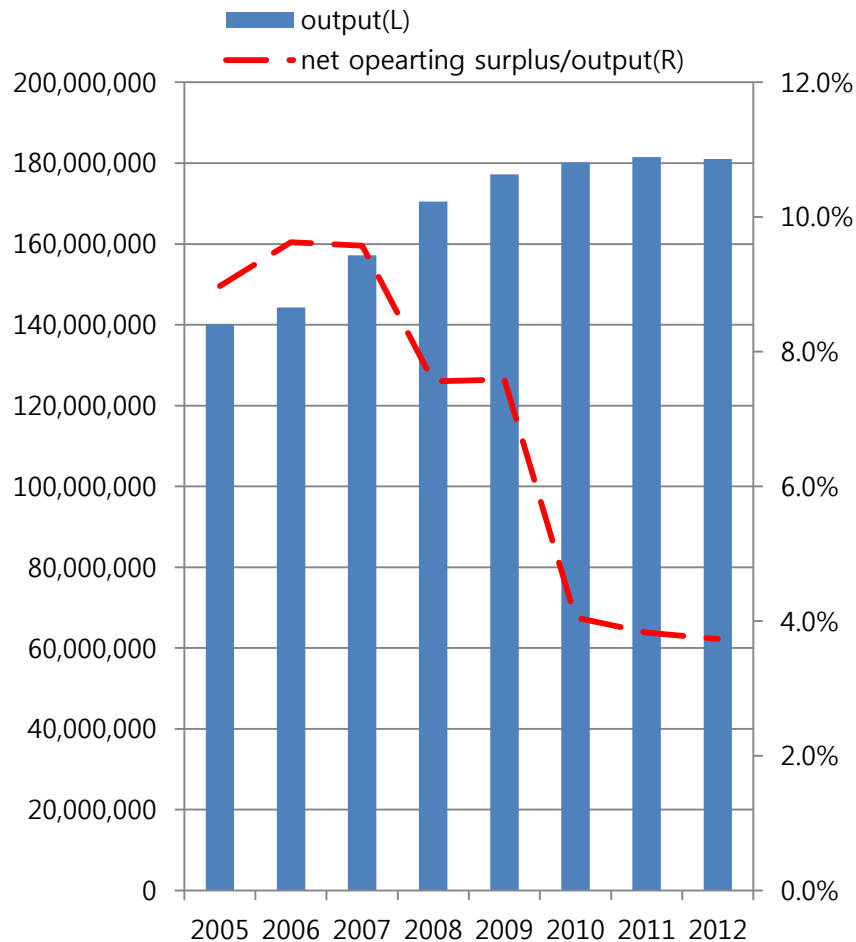
# Input-Output Table

- It describes the interconnectedness of the industries, households, and government entities in an area.
- The construction column shows the supply side of the industry.
- It comprises intermediate inputs from the other industries, besides gross value added (compensation of employees, consumption of fixed capital and net operating surplus).

# The Korean Construction Industry's Current Difficulties

- The housing market slump has continued for 6 years after the global financial crisis.
- Credit crunch → the rise of non-performing loans → 20 of the country's 105 savings banks went into bankruptcy.
- The household debt problem as one of potential risk factors which are supposed to threaten the stability of the macroeconomic stability.
- In 2012, the size of the household debt was 1.6 times that of the national disposal income, compared with an average 1.3 for the OECD.
- Consequently, 35 construction contractors out of top 100 went to the brink of bankruptcy

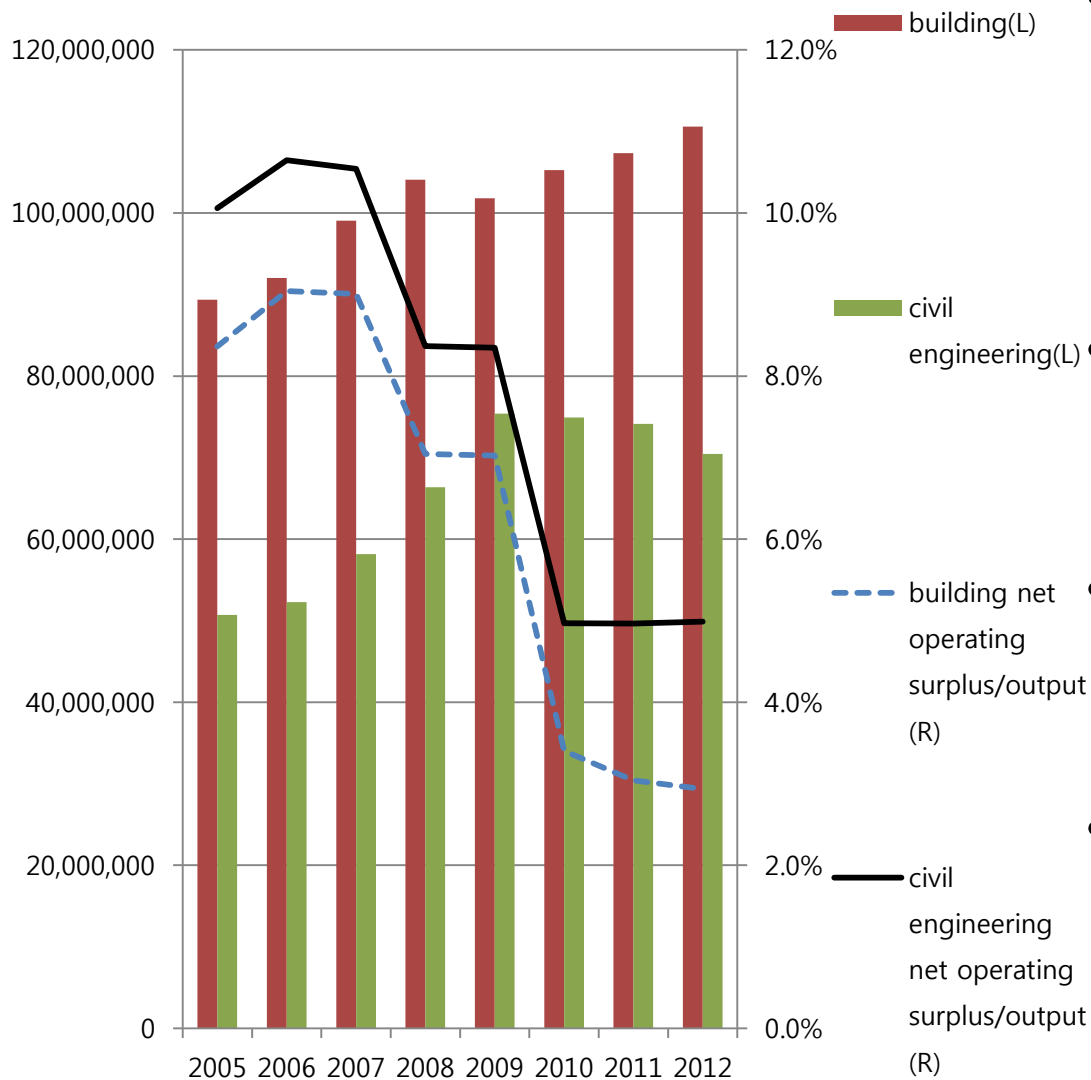
# The Construction industry's output



- The recession is not expressed in terms of the output but in terms of the profitability.
- The average annual growth rate of the output over the period is 3.8%.
- The rate of net operating surplus to output fell from 9.6% in 2007 to 3.7% in 2012.

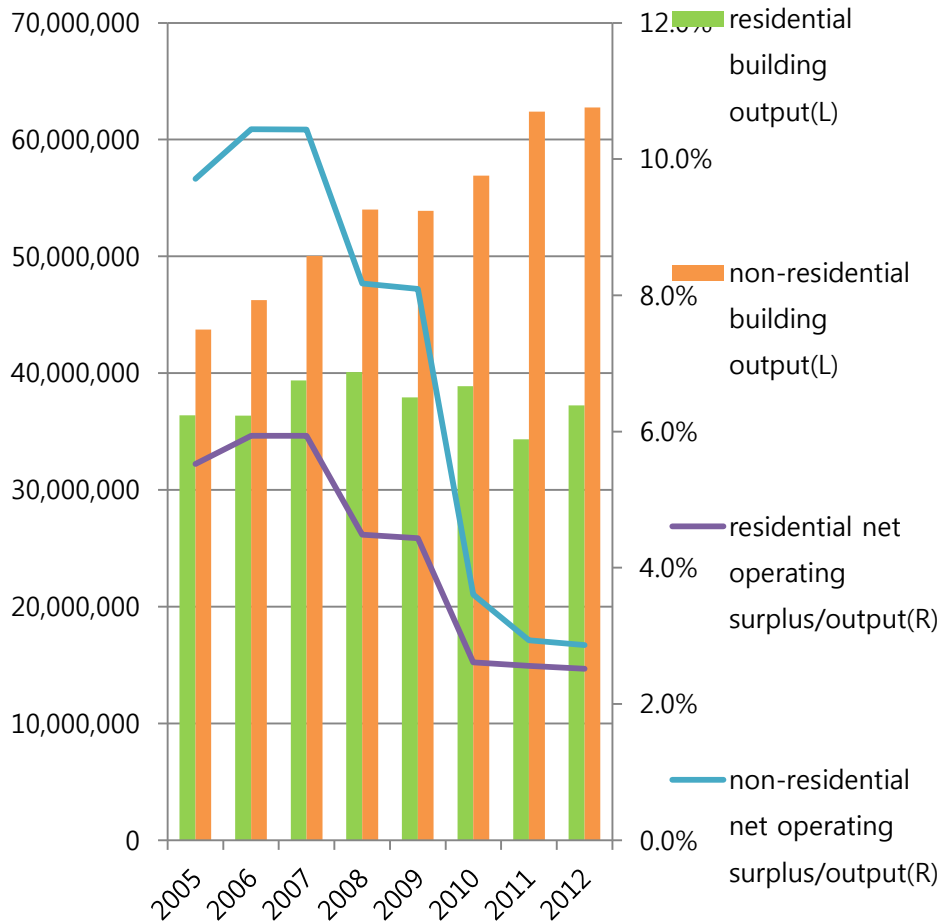


# Building Construction & Civil Engineering



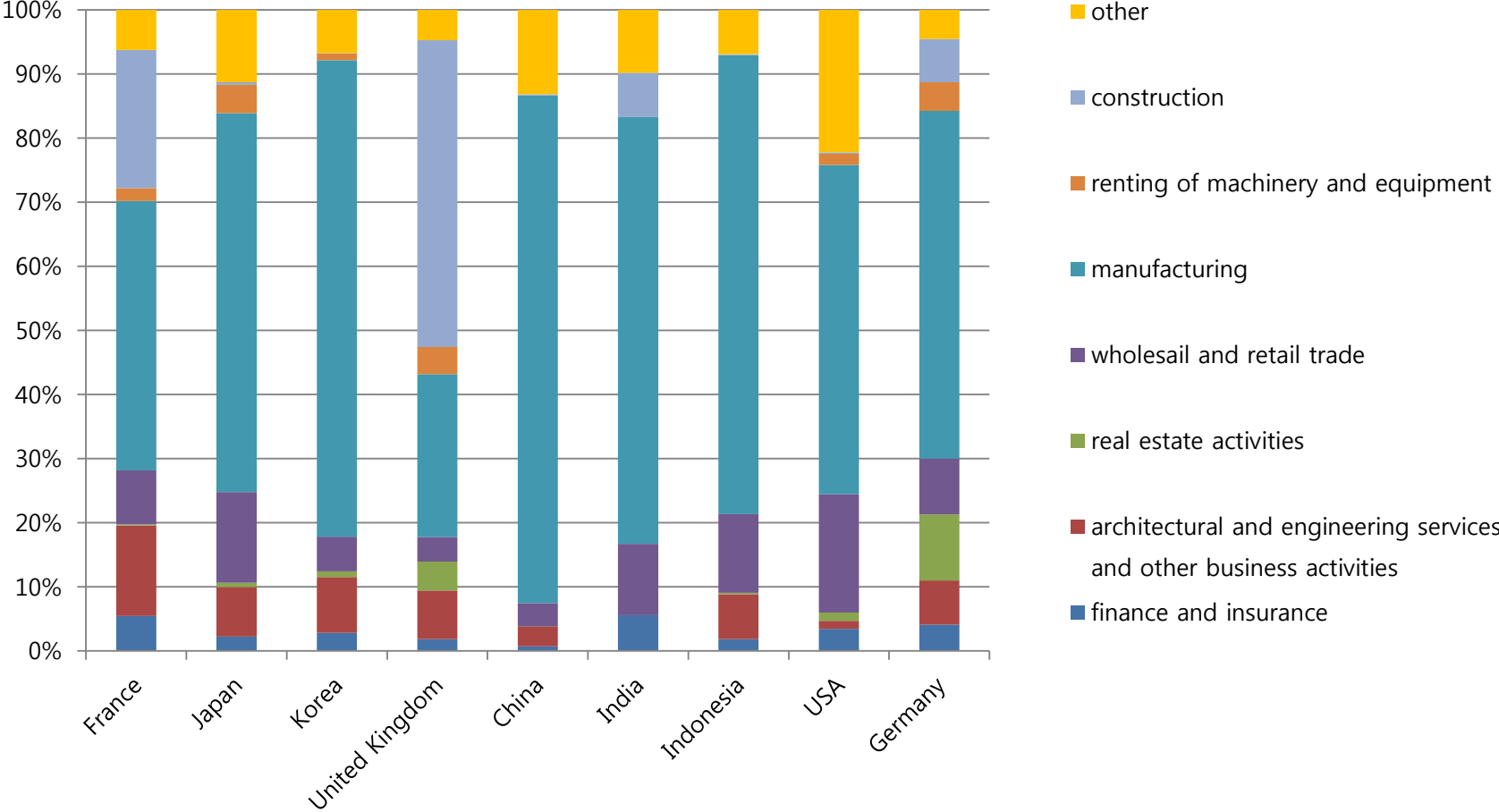
- Having decreased in 2009, the output of the building construction regained the growing trend and went beyond the level of 2008 in 2010.
- The rate of net operating surplus to output fell from 9.0% in 2007 to 2.9% in 2012.
- Having reached the highest level in 2009, the civil engineering's output has decreased since then.
- The rate of net operating surplus to output suffered a decrease from 10.6% in 2006 to 5.0% in 2010.

# Residential & Non-Residential Building



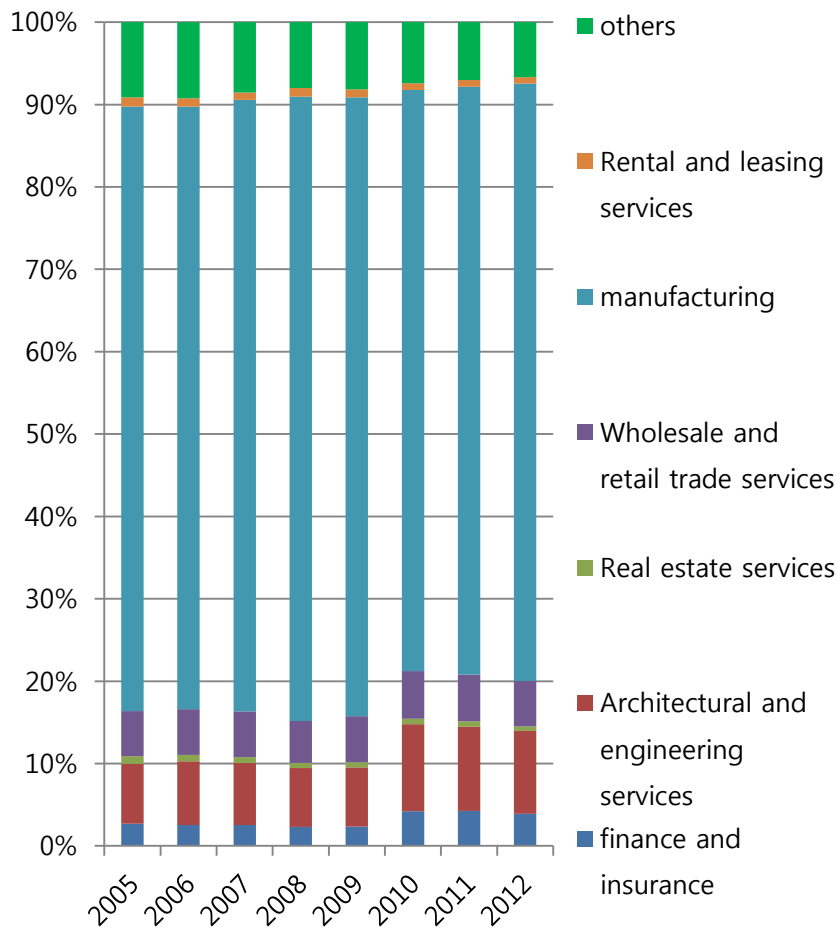
- The output of the residential building construction fluctuated continuously during the period.
- The rate of net operating surplus to output suffered a decrease from 5.9% in 2007 to 2.5% in 2012.
- The output of the non-residential building construction showed an increasing trend.
- The rate of net operating surplus to output suffered a fall from 10.4% in 2007 to 2.9% in 2012.

# Construction Industry's Input Structure Comparison



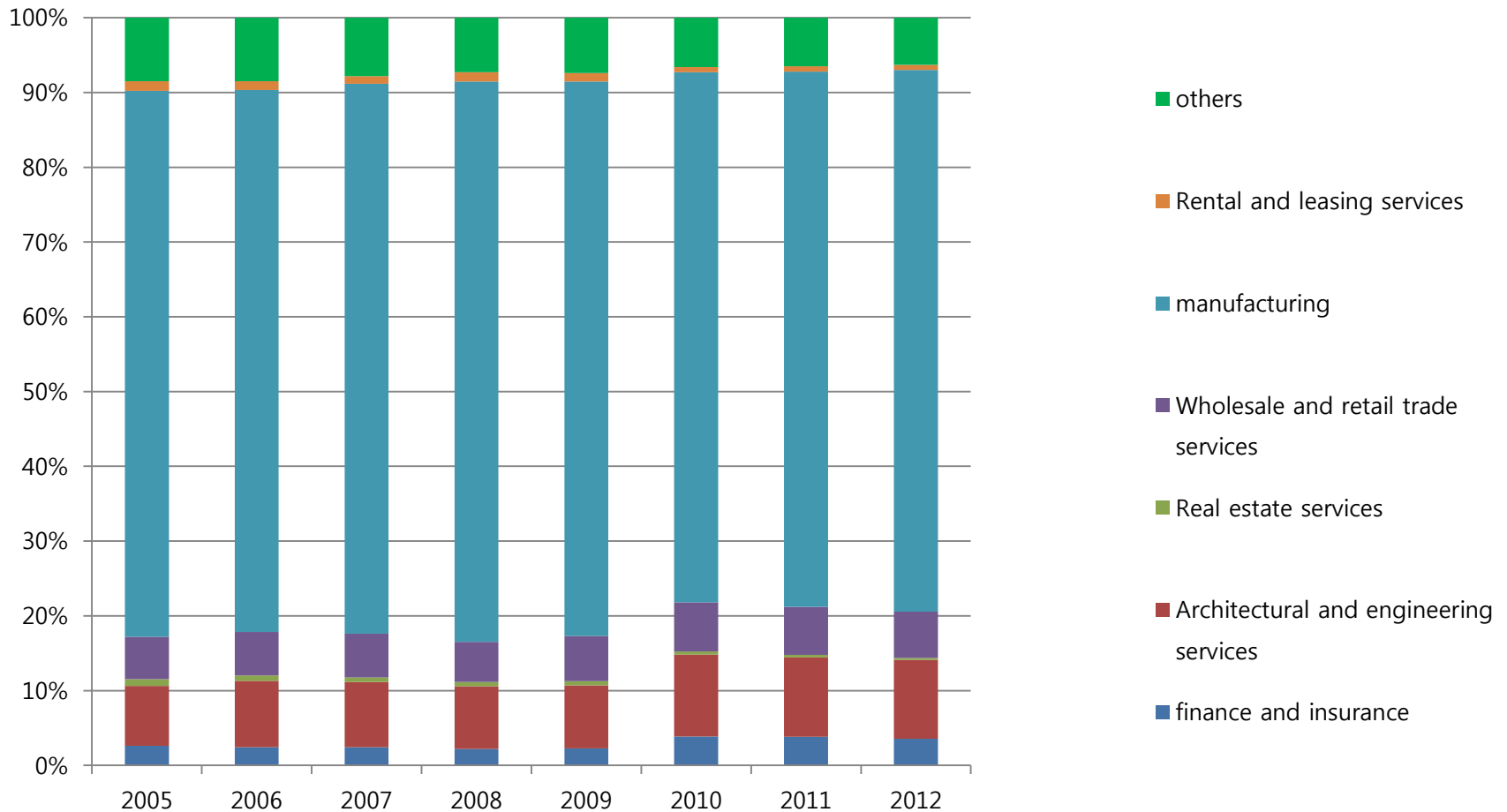
- With the transformation, the shares of services and construction industry in the construction input structure has sensibly risen as much as the share of the inputs from manufacturing has shrunk.
- The shares are 36.2% for France, 26.6% for the UK and 38.7% for Germany while those are 25.5% for Korea.
- The share of the inputs from the construction industry itself is relatively higher in United Kingdom(47.5%), France(21.4%) and Germany(6.7%) among developed countries.
- The construction industry of these countries uses considerable amount of intermediate inputs produced in the construction itself.

# Korean Construction Industry's Input Structure

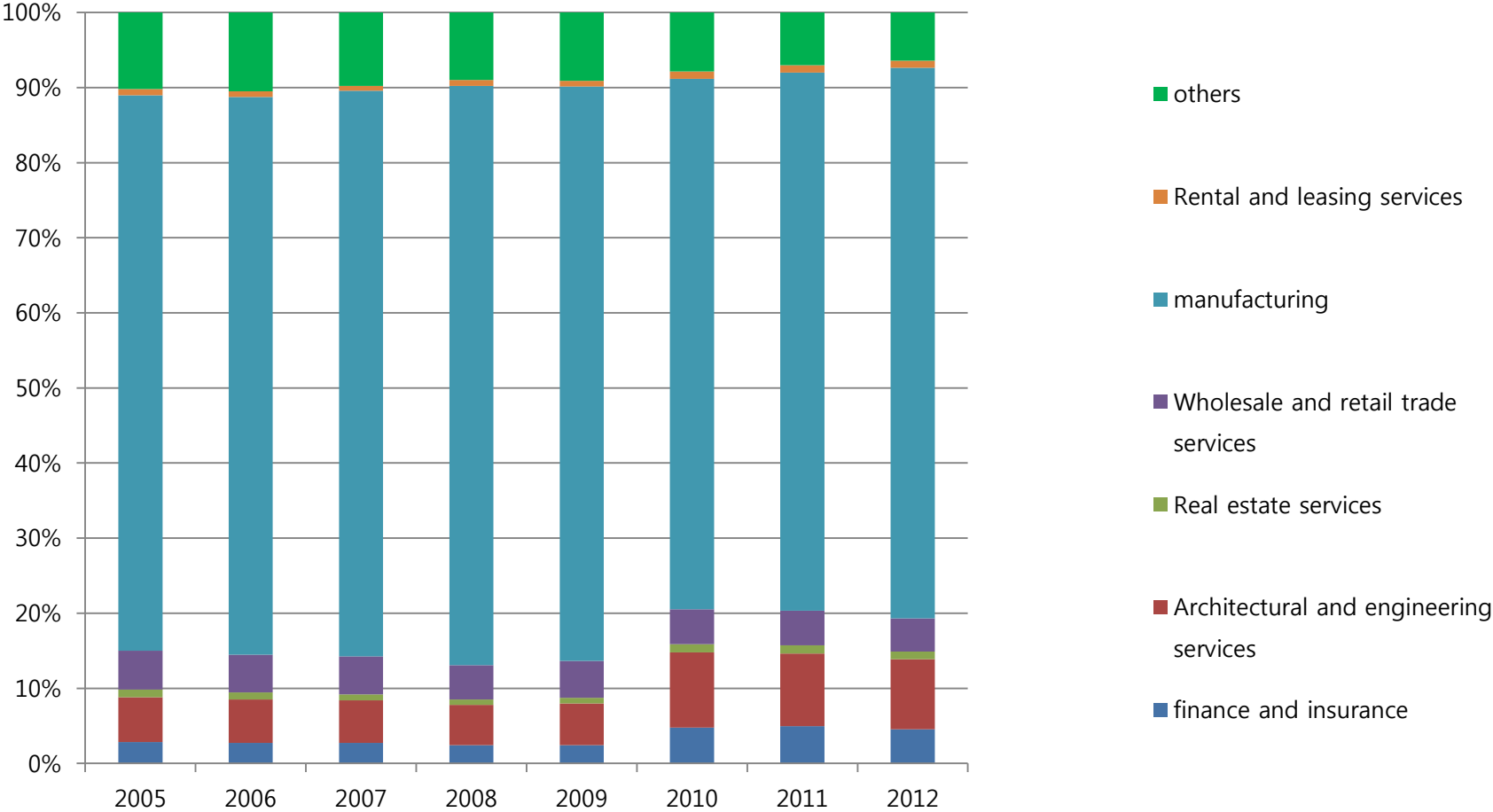


- The share of the inputs from services reached the lowest level of 23.5% in 2008, but turned back to 26.7% in 2010 and was placed at 25.1% in 2012.
- Two components of the construction industry's input structure are worthy of notice: 'finance and insurance' and 'architectural and engineering services'.

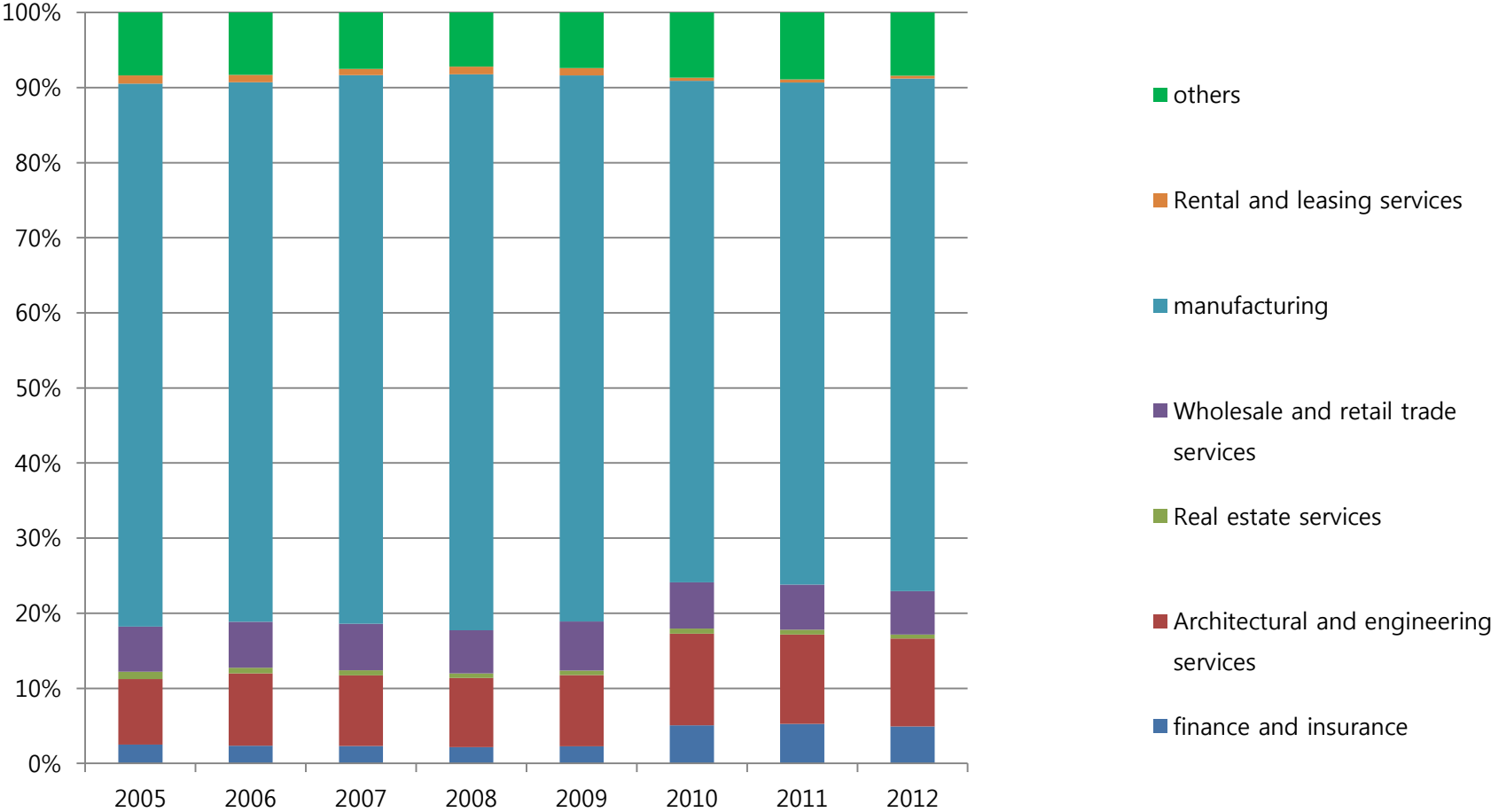
# Building Construction's Input Structure



# Civil Engineering's Input Structure

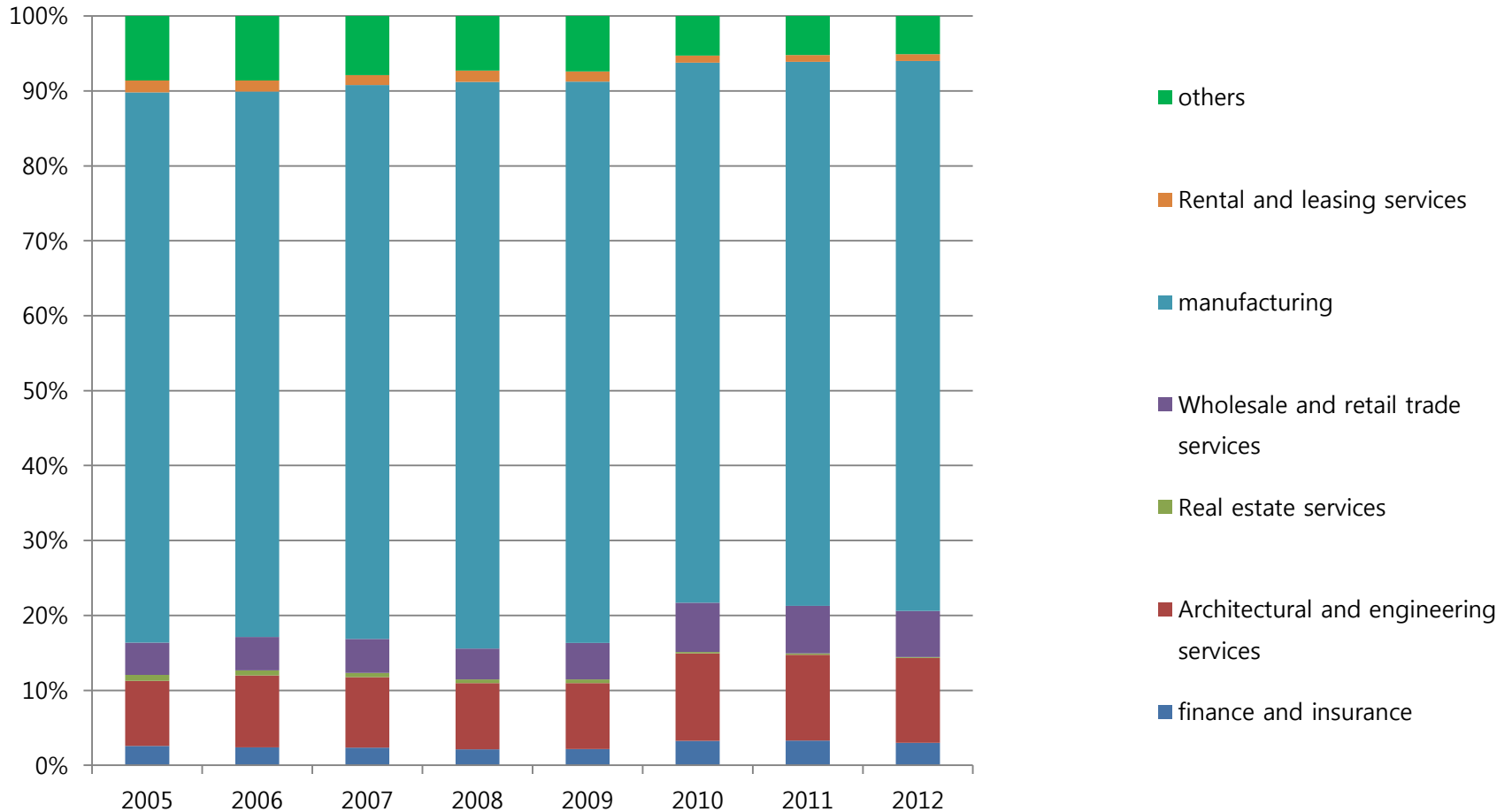


# Residential Building Construction's Input Structure

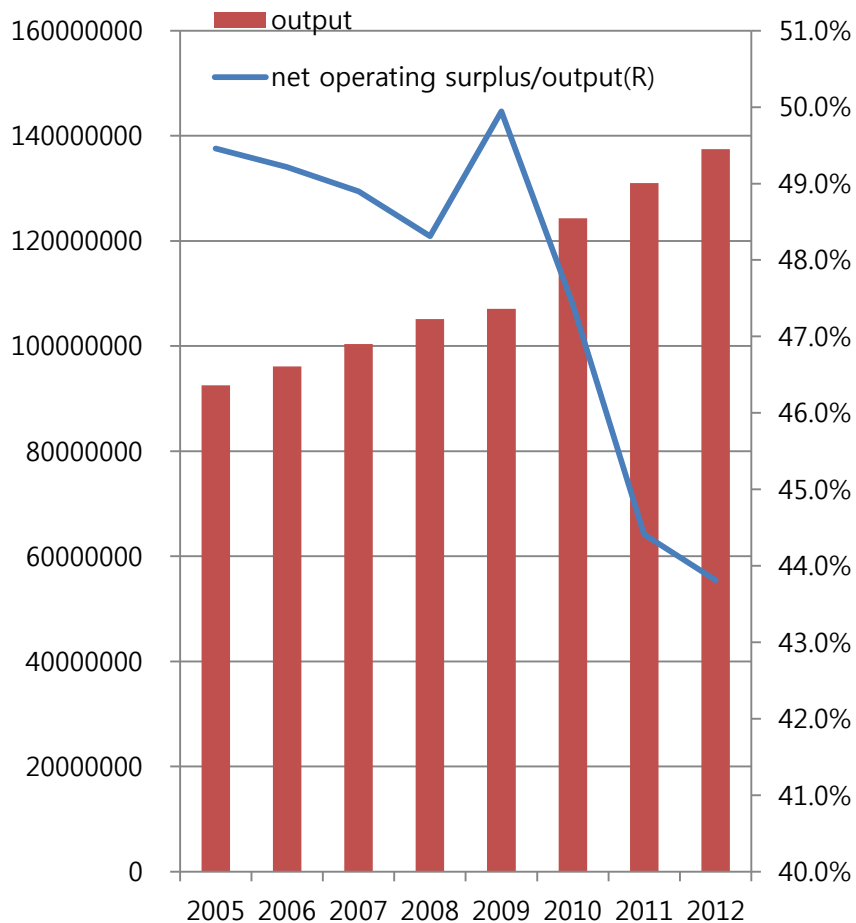




# Non-Residential Building Construction's Input Structure

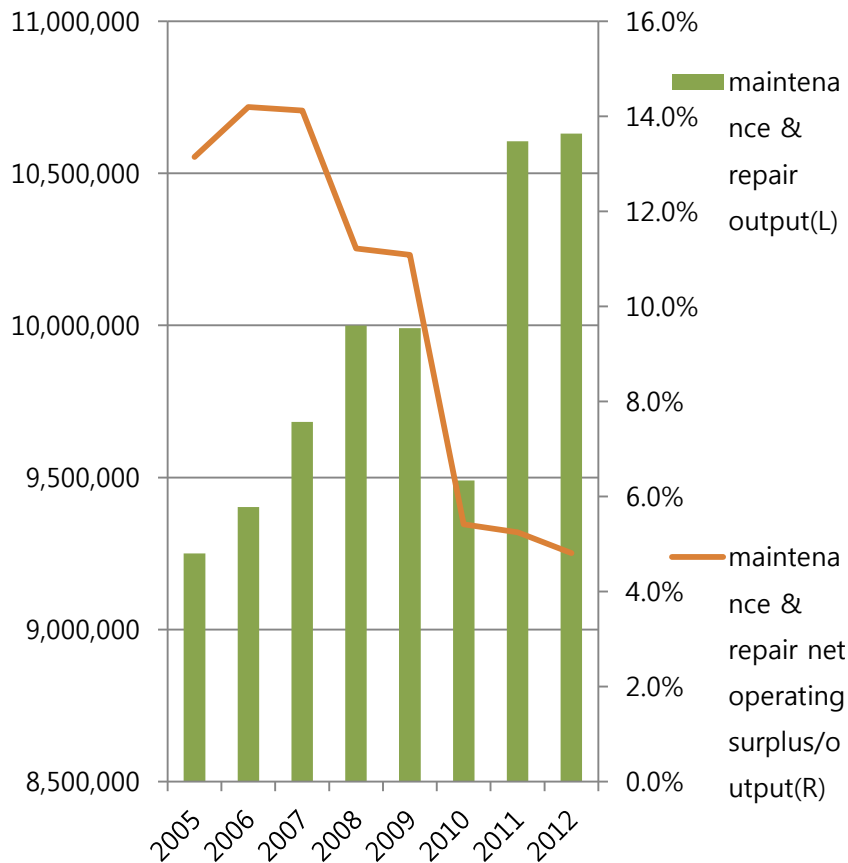


# Real Estate Services



- Real estate services' output kept on increasing and rose 48.6% au total during the period.
- The size of the out of real estate services was 1.24 times that of building construction in 2012, compared with 1.03 in 2005.
- The ratio of net operating surplus to output has maintained a substantially high level, even though it shows a decreasing tendency.

# Building Maintenance & Repair



- The output of building maintenance & repair rose insistently except 2009 and 2010.
- On the other hand, the rate of net operating surplus to output suffered a decrease from 14.2% in 2006 to 4.8% in 2012.

# Korean Construction Sector

- Around the global financial crisis, the outputs of real estate services and building maintenance & repair grew consistently in Korea.
- The share of the inputs from manufacturing lessened somewhat; the most significant reduction occurred in the residential building construction; the least reduction did in the non-residential building.
- The share of the inputs from services fluctuated.
- The shares of both “finance and insurance” and “architectural and engineering services” increased markedly; the increase was substantial in residential building construction and civil engineering.

- However, although the inputs from services have increased, it is not possible to conclude that services sector substituted for the manufacturing as main suppliers of the construction industry.
- In this respect, we think that the unshrinking output of the construction industry has been a barrier to the transformation.
- However, the current difficulties from which the Korean construction industry is suffering may in the end come to accelerate the transformation of the Korean construction industry.
- For the fall of the ratio of operating surplus to output may imply that the industry would not do business any longer in the way it used to.

Thank you!