5

Direct estimations of land

Introduction

5.1. There are various estimation methods (broadly labelled as direct or indirect) used by countries to estimate the value of land depending on what sources of information are available in a given country. The estimation of land using a direct method may be viewed as a physical inventory method where the area of each parcel of land is multiplied by an appropriate price. By summing up the value of each parcel of land that is within the asset boundary across a nation, the total value of land in a given country can be obtained.

5.2. Because detailed price and quantity information may not be available — especially when the land has a structure on it — many countries use an indirect method to value the land underlying a structure. In this chapter, the direct method is discussed. The three indirect methods will be explained in Chapter 6.

5.3. This chapter begins with the general methodology of estimating the value of land using the direct method as well as its data requirements and ends with a discussion on the method's strengths and weaknesses. The methodology will be illustrated by numerical examples and a case study from Korea.

Description of the method

5.4. Generally, the direct approach can be described by

(1) $$LV_t = \sum_{i=1}^{n} p_{i,t} * x_{i,t}$$

where LV_t is the total value of land in the observed year t. p_{it} reflects the price for land type i in the observed year t and x_{it} the corresponding area measure. Summing up all land types yields the total value of land for that particular year. Since the value of land is highly dependent on the location and land use, it is recommended that this calculation is done at the lower regional level by each land type. The direct method can be described by the following procedure with which the countries can conduct adjustments in a few steps, if needed.

a) Estimation of land area by land types in a single year or over a couple of years
b) Estimation of changes in the land types annually to produce time series
c) Estimation of representative unit prices for each relevant land type for a single year or a couple of years
d) Modelling the price changes for each land type over time (specifying price indices) in order to produce unit price time series
e) Bringing together the area and price information to produce time series on land value (balance sheet information)
f) Specifying volume changes and price changes per year for the other changes in the volume of assets account and the revaluation account

5.5. If annual data are available — for the whole period to be covered — it might be needless to conduct steps b) and d). In this case, the procedure can be conducted using only steps a), c), e), and f).

a) Estimation of land area by land types in a single year or over a couple of years

5.6. This section is directly linked to Chapter 3 because several land types of the minimal classification shall be used here as a reference.

5.7. Measuring the area of a country constitutes the basis for an economic valuation of land. Typically, this information is provided in square kilometres or any other surface measure [24]. The process of estimating the area of land can generally be described in three steps. The first step consists of the registration of the total territory of a country to ensure the area of interest. In the second step, the economic territory of a country is determined according to the SNA 2008 definition of asset (see SNA 2008 paragraph 1.46). In the third, the economic territory is classified to land types according to the use of the land (usually based on land use statistics). This classification should be done at least at the minimum level of categories as proposed in Chapter 3 of this compilation guide.

5.8. If countries have a more detailed classification of land then they should use this in their estimation if the level of price information is also available at the same level. As was stated earlier, a high level of disaggregation in land types will ensure that price differences for different land use types are adequately captured. However, in order to facilitate international comparisons, it is recommended that the detailed categories be grouped in such a way that they add up to the minimal classification [25]. Thus, following these three steps countries shall be able to gather detailed information on surface area measures for one or more years. Potential data sources for area measures by land use types are presented in Chapter 4. To illustrate the general procedure of direct estimation, Table 5.1 provides an example of the total economic area of land in a given country allocated to different land use types based on the minimum classification:

[24] Information on this is provided by land use - land cover statistics.
[25] For detailed information on the proposed classification, such as definitions of the categories and examples of their application, see Chapter 3 of this compilation guide.

Table 5.1: Area data by land types and year
(km^2)

Year	Land underlying buildings and structures		Land under cultivation			Recreational land	Other land	Total
	Land underlying dwellings	Land underlying other buildings and structures	Agricultural land	Forestry land	Surface water used for aquaculture			
2007	21 000	30 000	178 000	110 000	800	2 500	700	343 000
2008	22 000	31 000	177 000	109 000	900	2 500	600	343 000
2009	22 000	32 000	177 000	107 000	900	3 500	600	343 000
2010	23 000	32 000	176 000	107 000	1 000	3 500	500	343 000
2011	24 000	33 000	174 000	106 000	1 200	4 300	500	343 000
2012	24 000	34 000	174 000	105 000	1 200	4 400	400	343 000

Source: TF on Land and other non-financial assets; fictitious data

b) Estimation of changes in the land types annually to produce time series

5.9. Area data are not published on an annual basis by many countries and therefore it might be difficult to produce representative time series illustrating the area changes (per year) between the different land types. If these data are not available yearly but are available on a less frequent schedule (e.g. every five years) the following example illustrates how these changes can be calculated:

Table 5.2: Changes of area by land type
(km^2)

Land use type	Change 2008-2010			Change 2010-2012		
	Area 2008	Area 2010	Change	Area 2010	Area 2012	Change
Land underlying dwellings	22 000	23 000	1 000	23 000	24 000	1 000
Land underlying other buildings and structures	31 000	32 000	1 000	32 000	34 000	2 000
Agricultural land	177 000	176 000	-1 000	176 000	174 000	-2 000
Forestry land	109 000	107 000	-2 000	107 000	105 000	-2 000
Surface water	900	1 000	100	1 000	1 200	200
Recreational land	2 500	3 500	1 000	3 500	4 400	900
Other land	600	500	-100	500	400	-100
Total	343 000	343 000	0	343 000	343 000	0

Source: TF on Land and other non-financial assets; fictitious data

5.10. Table 5.2 shows data by land types for the years 2008, 2010, 2012 ([26]). Columns 4 and 7 provide information on how area data have changed between the observation points subdivided by land types ([27]). To produce representative time series a simple (linear) interpolation approach can be conducted here.

5.11. The volume of land is usually assumed to be constant across years for many productivity analyses. In the SNA 2008, however, differences in quality are, generally, treated as differences in volume. In other words, the change in value of the stock of land due to changes in its economic use should be regarded as the appearance of additional amounts of land and recorded as changes in volume of land. As large changes in the value of land are due to reclassification from agricultural land and forestry into building sites, the result of reclassification should be measured as changes in volume.

5.12. Consequently, a differentiation between volume and price changes requires data on changes of area between several types of land and — if possible — within one land type for different qualities of land.

([26]) Time lags may vary between countries.

([27]) Ideally, area changes between different land types should sum up to zero. However, this might not always be the case, since areas might be demolished by some sort of disaster and not captured in the asset category anymore (which leads to negative numbers), or new areas have entered the asset boundary and have to be valued which leads to positive numbers. In the example presented, these factors are held constant across time.

5.13. It might be quite difficult to assign these changes to the different land types ([28]) or quality categories. A general way to separate price and volume changes is introduced in step f) of the above mentioned procedure.

5.14. For the numerical example presented here, the total area of land is held constant across time, which corresponds with the idea that in practice an entry or exit of land within the asset boundary is most likely minimal.

c) Estimation of representative unit prices for each relevant land type for a single year or a couple of years

5.15. The direct estimation of the value of land not only requires data on surface areas but also appropriate price information. The price should reflect the actual market transaction price or its equivalents, as required by SNA 2008 paragraph 13.44. The actual market transaction price, if available, is the most preferred. If that price is not available, other sources may be used, such as: publicly-appraised market-price equivalent, property tax information converted to a market price, market price of a nearby parcel of land of similar use, generalised standard land values, an artificial price based on a nearby parcel of land that is adjusted by a certain conversion factor, etc. For the purposes here, price data shall be documented specifically and differentiated according to the classification of land proposed in Chapter 3, because price differences between the land use types have to be taken into account when valuing land ([29]).

5.16. Table 5.3 provides an illustration of unit price ([30]) information differentiated by various land use types.

5.17. Experience has shown that many issues may arise regarding adequate price information. For instance, price data can be quite old or even missing for some land types or years, since less frequent transactions of land may lead to data gaps. Furthermore, price information can be provided by different sources and it is necessary to match these different data sources to obtain reliable price data. Differences in land use types are not the only consideration when constructing a representative price, regional aspects have to be taken into account (e.g. by using stratification) since the same land use type of different regions might have significantly different price values. In addition, various land parcel sizes might not have a similar price per square metre. Larger land parcels are likely to have a lower price per square metre. To allow for this, representative prices may need to be stratified according to the size of the land parcel on which each price is based.

5.18. It can be concluded, that collecting reliable price information for the estimation of land can be very difficult especially for land underlying dwellings and buildings. If separate information on the price of land is not available then one could consider deriving the price indirectly as discussed in the indirect method chapter under the hedonic approach (see Chapter 6.4). Depending on the sources and institutional circumstances in a given country, issues that arise may differ significantly amongst countries. How to handle these issues depends on each country's expertise, abilities, and data sources regarding these types of information. Nevertheless the representativeness of the price used for calculations should be guaranteed.

Table 5.3: Price data by year and land types
(EUR per m^2)

Year	Land underlying buildings and structures		Land under cultivation			Recreational land	Other land
	Land underlying dwellings	Land underlying other buildings and structures	Agricultural land	Forestry land	Surface water used for aquaculture		
2007	120.00	15.00	5.00	2.00	1.00	3.00	0.50
2008	115.00	13.00	4.50	2.00	1.00	4.00	0.40
2009	115.00	13.00	4.50	1.50	1.50	3.50	0.50
2010	120.00	14.00	4.00	1.50	1.00	4.00	0.40
2011	120.00	14.00	4.00	1.00	1.50	3.50	0.40
2012	125.00	15.00	3.50	1.00	1.00	4.00	0.50

Source: TF on Land and other non-financial assets; fictitious data

([28]) For instance, it might be very difficult to assign certain gains of land underlying dwellings or land underlying other buildings and structures to losses of, for instance, agricultural area or forestry area.

([29]) Sources for price and area data are discussed in Chapter 4.

([30]) This price represents the price valid as of the balance sheet date since intra-annual price data may be difficult to obtain for some countries. Moreover, the price as proposed here may also be interpreted as the average price across the year.

d) Modelling the price changes for each land type over time (specifying price indices) in order to produce unit price time series

5.19. Because the availability of unit price data by land type may only be available in specific years, indicators may be needed to produce unit price time series. Since the source data may differ significantly by country general advice is very difficult to give. However, whatever data are used to model the price change, countries should ensure the method applied meets the claim of representativeness concerning price information.

e) Bringing together the area and price information to produce time series on land value (for all relevant years)

5.20. As mentioned before, estimating the total value of land requires matching information about different land types and the corresponding prices. To determine the sub-values by types and, subsequently, the total value of land, a simple multiplication and summation is used. The first step consists of multiplying the area size with the appropriate price for each type of land in the observed year. For example, the total value for land underlying dwellings of the year 2009 is 22 000 square kilometres x 115.00 EUR per square metre = EUR 2 530 billion. This procedure is conducted across all land use types. Secondly, the resulting values of all land use types are summed up to determine the total value of land. These steps are repeated for each year to establish a time series. The results for this example are presented in Table 5.4.

f) Specifying volume changes and price changes per year

5.21. It is necessary to decompose the changes in the value of land per year into changes in volumes and in prices for the other changes in the volume of assets account and the revaluation account, respectively. For the direct method this decomposition can be conducted with the steps described below.

5.22. Depending on data availability, the change in the value of land can be decomposed into holding gains and losses and volume changes in two different ways. In the following example it is important to note that the equations presented are from the perspective of the total economy and do not show transactions. Transactions have to be treated separately [31]. In general, holding gains and losses are estimated by deducting from the total change in the value of assets those changes in value that can be attributed to transactions and to other changes in volume [32]. If information on the price developments of land is available, it might be possible to estimate the holding gains and losses separately and derive one of the other flow components as a residual [33]. However, both principles lead to the same results for volume changes and the corresponding holding gains and losses and vice versa.

5.23. Both principles have in common that in the first step the change in the value of land (per land type i) for period t+1 can be estimated by

$$(2)\quad \Delta LV_{i,t+1} = LV_{i,t+1} - LV_{i,t} = p_{i,t+1} * x_{i,t+1} - p_{i,t} * x_{i,t}$$

where $LV_{i,t+1} - LV_{i,t}$ reflects the change in the value of land (per land type i) in the next observation period.

Table 5.4: Value of land across time
(billion EUR)

Year	Land underlying buildings and structures		Land under cultivation			Recreational land	Other land	Total
	Land underlying dwellings	Land underlying other buildings and structures	Agricultural land	Forestry land	Surface water used for aquaculture			
2007	2 520.0	450.0	890.0	220.0	0.8	7.5	0.4	4 088.7
2008	2 530.0	403.0	796.5	218.0	0.9	10.0	0.2	3 958.6
2009	2 530.0	416.0	796.5	160.5	1.4	12.3	0.3	3 916.9
2010	2 760.0	448.0	704.0	160.5	1.0	14.0	0.2	4 087.7
2011	2 880.0	462.0	696.0	106.0	1.8	15.1	0.2	4 161.1
2012	3 000.0	510.0	609.0	105.0	1.2	17.6	0.2	4 243.0

Source: TF on Land and other non-financial assets; fictitious data

(31) SNA 2008 12.84 gives a solution for including transactions.
(32) See paragraph 2.73.
(33) See paragraph 2.74.

5.24. If information on the price developments of land is available holding gains and losses (per land type) can be estimated by

(3) $$Hold_{i,t+1} = x_{i,t} * (p_{i,t+1} - p_{i,t})$$

and the corresponding, volume changes (per land type i) can be deduced by

(4) $$\Delta Vol_{i,t+1} = \Delta LV_{i,t+1} - Hold_{i,t+1}$$

5.25. Holding gains and losses can also be deduced as the residual of the total change in the value of land and the corresponding volume changes. Therefore, in the first step the volume change can be estimated by

(5) $$\Delta Vol_{i,t+1} = p_{i,t+1} * (x_{i,t+1} - x_{i,t})$$

and the corresponding holding gains and losses can be deduced by

(6) $$Hold_{i,t+1} = \Delta LV_{i,t+1} - \Delta Vol_{i,t+1}$$

5.26. To illustrate the procedure of separating annual price changes and the annual volume changes, area data, price data and the corresponding value of land are necessary. This information can be deduced by using the data provided by Table 5.1, 5.3 and 5.4 in this chapter. Based on data provided by Table 5.4 total annual changes in the value of land by land use type were estimated and are presented in Table 5.5.

Table 5.5: Value changes of land across time
(billion EUR)

Year	Land underlying buildings and structures		Land under cultivation			Recreational land	Other land	Total
	Land underlying dwellings	Land underlying other buildings and structures	Agricultural land	Forestry land	Surface water used for aquaculture			
2008	10.00	-47.00	-93.50	-2.00	0.10	2.50	-0.11	-130.01
2009	0.00	13.00	0.00	-57.50	0.45	2.25	0.06	-41.74
2010	230.00	32.00	-92.50	0.00	-0.35	1.75	-0.10	170.80
2011	120.00	14.00	-8.00	-54.50	0.80	1.05	0.00	73.35
2012	120.00	48.00	-87.00	-1.00	-0.60	2.55	0.00	81.95

Source: TF on Land and other non-financial assets; fictitious data

5.27. As mentioned before, the annual value changes presented in Table 5.5 can be separated in holding gains and losses and volume changes. It is assumed that information on the price developments of land is available and, therefore, holding gains and losses can be estimated separately.

5.28. For the numerical example the total holding gains and losses and annual holding gains and losses for each land type are estimated and presented in Table 5.6.

Table 5.6: Estimated holding gains and losses of land across time
(billion EUR)

Year	Land underlying buildings and structures		Land under cultivation			Recreational land	Other land	Total
	Land underlying dwellings	Land underlying other buildings and structures	Agricultural land	Forestry land	Surface water used for aquaculture			
2008	-105.00	-60.00	-89.00	0.00	0.00	2.50	-0.07	-251.57
2009	0.00	0.00	0.00	-54.50	0.45	-1.25	0.06	-55.24
2010	110.00	32.00	-88.50	0.00	-0.45	1.75	-0.06	54.74
2011	0.00	0.00	0.00	-53.50	0.50	-1.75	0.00	-54.75
2012	120.00	33.00	-87.00	0.00	-0.60	2.15	0.05	67.60

Source: TF on Land and other non-financial assets; fictitious data

5.29. Correspondingly, the estimated total volume changes and annual volume changes for each land type were estimated residually and are presented in Table 5.7.

Table 5.7: Estimated volume changes of land across time
(billion EUR)

Year	Land underlying buildings and structures		Land under cultivation			Recreational land	Other land	Total
	Land underlying dwellings	Land underlying other buildings and structures	Agricultural land	Forestry land	Surface water used for aquaculture			
2008	115.00	13.00	-4.50	-2.00	0.10	0.00	-0.04	121.56
2009	0.00	13.00	0.00	-3.00	0.00	3.50	0.00	13.50
2010	120.00	0.00	-4.00	0.00	0.10	0.00	-0.04	116.06
2011	120.00	14.00	-8.00	-1.00	0.30	2.80	0.00	128.10
2012	0.00	15.00	0.00	-1.00	0.00	0.40	-0.05	14.35

Source: TF on Land and other non-financial assets; fictitious data

5.30. Apart from changes in economic use of land, if the value of a certain piece of land changes mainly due to surrounding amenities, it is recommended to record this change as holding gain or loss (revaluation) rather than a volume change. For example, if the value of land underlying dwellings located right next to a park decreases because the park is replaced by a factory, these value changes shall be recorded as holding gains or losses. Even if, conceptually, changes in the value of land that are due to changes in the surrounding amenities of the land should be recorded as a volume change. For practical reasons recording these types of changes as revaluations is prudent given that it may be very difficult to make such a nuanced distinction between other changes in volume versus revaluation changes. (See the annex of Chapter 2 and Chapter 8.2 for further discussion).

Case study: alternative way for estimating holding gains and losses

Equations (3) to (6) of this chapter explain one possibility to decompose value changes ($\Delta LV_{i,t+1}$) into holding gains and losses ($Hold_{i,t+1}$) and other changes in volume ($\Delta Vol_{i,t+1}$) by

(7) $\Delta LV_{i,t+1} = x_{i,t} * (p_{i,t+1} - p_{i,t}) + p_{i,t+1} * (x_{i,t+1} - x_{i,t})$

This approach decomposes holding gains and losses as $Hold_{i,t+1} = x_{i,t} * (p_{i,t+1} - p_{i,t})$ and other changes in volume as $\Delta Vol_{i,t+1} = p_{i,t+1} * (x_{i,t+1} - x_{i,t})$. Characteristic of this decomposition method is that holding gains and losses refer to area data at time t ($x_{i\,t}$) and other changes in volume to price data at time t+1 ($p_{i\,t+1}$). The final results are not influenced by the order of estimating or in other words it makes no difference if holding gains and losses or other changes in volume are calculated first. If holding gains and losses are calculated first the corresponding residual of the total value change belongs to other changes in volume or vice versa.

Alternatively, a different decomposition method is feasible. In this case, the total value change is estimated by the following identity

(8) $\Delta LV_{i,t+1} = \bar{x}_{i,t} * (p_{i,t+1} - p_{i,t}) + \bar{p}_{i,t} * (x_{i,t+1} - x_{i,t})$

where $\bar{x}_{i,t}$ is defined as $\bar{x}_{i,t} = \frac{(x_{i,t+1} + x_{i,t})}{2}$ and $\bar{p}_{i,t}$ as $\bar{p}_{i,t} = \frac{(p_{i,t+1} + p_{i,t})}{2}$.

In this approach holding gains and losses are estimated by $Hold_{i,t+1} = \bar{x}_{i,t} * (p_{i,t+1} - p_{i,t})$ and other changes in volume by $\Delta Vol_{i,t+1} = \bar{p}_{i,t} * (x_{i,t+1} - x_{i,t})$. In contrast to the previously presented decomposition method, holding gains and losses are calculated based on the average land area of adjacent years and other changes in volume on the average of price data of adjacent years. Similar to the original decomposition method the order of estimation does not have an impact on the final result. If holding gains and losses are calculated first the remaining amount of the total value change belongs to other changes in volume and vice versa. A notable advantage of this procedure is that it will lead to a smoother decomposition, particularly, when large changes happen either in prices or in volume.

For both approaches, the identities among value changes, price changes and other changes in volume still hold. Countries might choose a way depending on how land and price data are obtained and which method can be implemented more appropriately given the circumstances in the respective country.

Strengths and weaknesses

5.31. Before applying the direct method users should consider its major strengths and weaknesses. Besides its general advantage as a very simple and easy computational methodology, the focus on area measure moreover ensures that all relevant areas are considered and only those areas that should be excluded from the SNA 2008 asset boundary (SNA 2008 paragraph, 1.46) are left out. Therefore, it can be stated that using an area measure as a basis for, or at least together with, the valuation is the only possibility to guarantee the full coverage of all land within the asset boundary.

5.32. Additionally, in some cases practical experiences have shown that the direct method might lead to more smoothened results compared to indirect approaches since the results estimated by the direct method are not as sensitive to key assumptions as the results estimated by the indirect method (e.g. perpetual inventory method assumptions when using the indirect method).

5.33. Apart from its general application when land is not underlying a structure, the direct method can be used when indirect methods are not feasible or combined values of both land and structures are not available. The direct method is normally preferred by countries for the valuation of agricultural land on which no buildings or structures are situated. While the indirect method can be used in cases where combined values of buildings and underlying land are available — as is the case in the actual real estate transaction of buildings or structures — the direct method may still be a suitable alternative because not all countries have access to such data.

5.34. Although the direct method seems very simple and easy in computational methodology, it demands huge data requirements. For the direct method to be applied, ideally, the price and area information of every parcel of land should be available, which will not be the case for most countries. Data on land area is available quite extensively in most countries, but area data should be available on a high level of disaggregation to ensure that price differences for different land use types are adequately captured.

5.35. How to obtain the current market-price information for each parcel of land by different land types will be an inevitable prerequisite for this approach. Since the value of land is highly dependent on several factors e.g. location, land use and the presence of nearby facilities, such information should be incorporated in the land price data. This can be illustrated by the fact that agricultural land is generally lower priced than land underlying dwellings. Also, the presence of a nearby road will likely influence the value of the surrounding land. The latter implies that a certain type of land may be differently priced, depending on the region where it is located. As a consequence, it is important that the direct method employs land prices that are precisely specified and reflect such conditions. It must be born in mind that representative prices are crucial for a realistic estimation of the values of the different plots and the corresponding total value of land within a country.

Case study direct method: Korea

The value of the stock of land was officially published in the Korean national balance sheets for the first time on May 14, 2014. The stock of land valued at market prices is computed using the direct method. That is, the value of land is estimated at the regional level by multiplying land areas by type and region by their corresponding market price equivalents to obtain the total value of the stock of land across the nation. The distinctive characteristics of Korean land valuation lie in the way in which the market price equivalents for land are obtained.

Estimating the land area

Based on the Act on land survey, waterway survey and cadastral records land area in Korea is currently classified into 28 categories. For the purpose of international comparison and valuation of land, these 28 categories are reclassified into the proposed minimum classification suggested by this compilation guide: 1) land underlying dwellings, 2) land underlying other buildings and structures, 3) agricultural land, 4) forestry land, 5) surface water used for aquaculture, 6) recreational land and 7) other land, as shown in the Korean case study (Table 3.4) in Chapter 3. Attention should be paid to the fact that land underlying dwellings and land underlying other buildings are not separated at this stage. Table 5.8 summarises the Korean data sources for land area and prices.

Table 5.8: Data sources for land area and price

Area/price	Sources	Information
Land area	Cadastral records	Parcel number, land use category (28 types), ownership (government, private, judicial person, others, etc.)
Land price	Real estate price public notification system	Almost all individual land is publicly appraised and notification of the results given every year as of January 1. The publicly-noticed price of an individual parcel of land serves basically for taxation purposes, its value is known to be considerably lower than the market price.
	Real estate actual transaction price reporting system	A real estate broker is obliged to report to a local government body concerned the actual price of a transaction between a buyer and a seller, within 60 days after the contract date.
	Precedent Appraisal information	As actual real estate transaction data are not sufficient for some regions or land types, precedent appraisal information is added to supplement the transaction data.

Source: Bank of Korea

Estimating the market price of land

The two major sources for land price data are the real estate price public notification system and the real estate actual transaction price reporting system. The real estate price public notification system provides publicly appraised and notified prices (PNPs) for almost all individual parcels of land. For clearer understanding, the process of how each individual parcel of land is publicly appraised is explained further. As of January 1st, around 500 000 parcels of land are sampled (this is called standard land or reference land), making up 1.3 % (in 2011) of the total number of parcels of land nationwide. This sample of parcels (standard land) are publicly appraised by around 1 300 appraisers (in 2011), led by the Minister of Land, Infrastructure and Transport (MOLIT) with support from the Korea Appraisal Board. The prices of individually registered parcels of land (equation 9) across the nation can then be computed by referring to the publicly appraised prices of adjacent standard land and to the land price conversion index. The land price conversion index is used to convert the standard land price into the individually registered parcels of land price by taking into account several attributes of the parcel of land. These attributes include differences in land use, the configuration of the ground, access to roads, any existence of adjacent noxious facilities, the fertility of arable land, the readjustment of arable land, etc. The PNPs of individual parcels of land are finalised after verification by the appraisers, reviews of appeals from the land owners, and deliberations of the real estate valuation committees of the municipalities concerned. These individual land prices are then publicly announced by the MOLIT.

(9) *PNP of an individual land parcel = PNP of an adjacent standard land parcel * land price conversion index*

At this stage, the PNP of an individual parcel of land is available across the nation. The PNPs serve as guidance information for participants in the real estate market, and as the basis for imposing taxes and various charges and providing compensation for any publicly expropriated land.

The weakness is that a PNP does not fully reflect the market price since its basic purpose is for taxation. The real estate actual transaction price reporting system makes up for and overcomes this weakness. For most countries, market price data related to land transactions in the real estate market is not easy to obtain, especially on the nationwide dimension. In Korea, fortunately, national accountants have had access to these market prices or market price equivalents since 2006, when it became mandatory for a real estate agent brokering a deal regarding residential buildings or land between a buyer and a seller to report the actual transaction price (ATP) to the local government body concerned within 60 days following the contract date. These ATP data can be compared with PNPs and then used to value the stock of land at market prices or market price equivalents. Meanwhile, for some regions or land types, cases of actual real estate transactions might be non-existent or very sparse. Precedent appraisal information, held by the Korean Association of Property Appraisers and analysed by the Korean Real Estate Research Institute is accordingly added to supplement the transaction data. ATPs and PNPs play key roles in Korean land valuation at the market price equivalents.

Estimating the total value of land

A full set of land area and price data are available from the PNPs and ATPs. As mentioned above, the distinctive characteristics of Korean land valuation lie in how the market prices (or equivalents) for land are calculated. Following the SNA 2008 land valuation principle, the PNPs of individual parcels of land need to be readjusted to the market price equivalents in accordance with the steps listed below, using the ATPs obtained from the MOLIT together with precedent appraisal data. The caveat is that the ATPs are available for only a tiny portion of the total land. Since 2006, the amount of land traded has constituted from 5 to 7 % in number of parcels of land and from 1 to 3 % in terms of area, depending upon real estate market conditions.

Table 5.9: Portion of traded land over total land

	2006	2008	2010	2012
Total land area (km^2)	99 678	99 828	100 033	100 263
Total number of parcels of land (1 000)	36 983	37 332	37 605	37 725
Traded land area (km^2) (1)	3 334	2 312	1 972	1 824
	[3.3]	[2.3]	[2.0]	[1.8]
Traded parcels of land (1 000) (1)	2 643	2 289	2 071	2 045
	[7.2]	[6.1]	[5.5]	[5.4]

(1) Figures in [ ] indicate a proportion (%) of traded land in total land.

Source: Ministry of Land, Infrastructure and Transport of Korea

The readjustment of PNPs to their market price equivalents proceeds as follows.

Step 1

The unit prices per square metre (UPNPs) from the PNPs of individual parcels of land are computed by land use type at the regional level. The unit prices per square metre (UATPs) from the reported ATPs are then computed for the same land use type and regions as for the UPNPs.

Step 2

The UATP-to-UPNP ratios (market price conversion ratios; MPCRs) are computed for the same regions and usages as for the UPNPs. An MPCR is assumed to be equal across the same region and usage. A given year's MPCR at the year-end is computed as the average of the UATPs for two years — that is year t and year t+1 — divided by the UPNP at the end of year t. The average of two years of UATPs is used to reduce the possible bias incurred from small samples by doubling the number of ATPs observed in the real estate market.

Step 3

The value of each parcel of land is computed by equation (10). In this equation, the multiple 0.9 is used to avoid the possibility of overvaluation incurred from a small sample of transaction prices. The risk of overvaluation is considered greater than that of undervaluation in the case of stock of land valuation. The total value of Korea's stock of land is computed by summing up the values of land across regions and uses.

(10) $$\sum_{j=1}^{m}\sum_{i=1}^{7} UPNP_{i,j}^{t} * MPCR_{i,j}^{t} * Land_{i,j}^{t} * 0.9$$

where i, j and *land* indicate types, regions and area of land concerned respectively, the UPNP and MPCR indicate the unit price per square metre from PNP and the market price conversion ratio, t is the time of estimation.

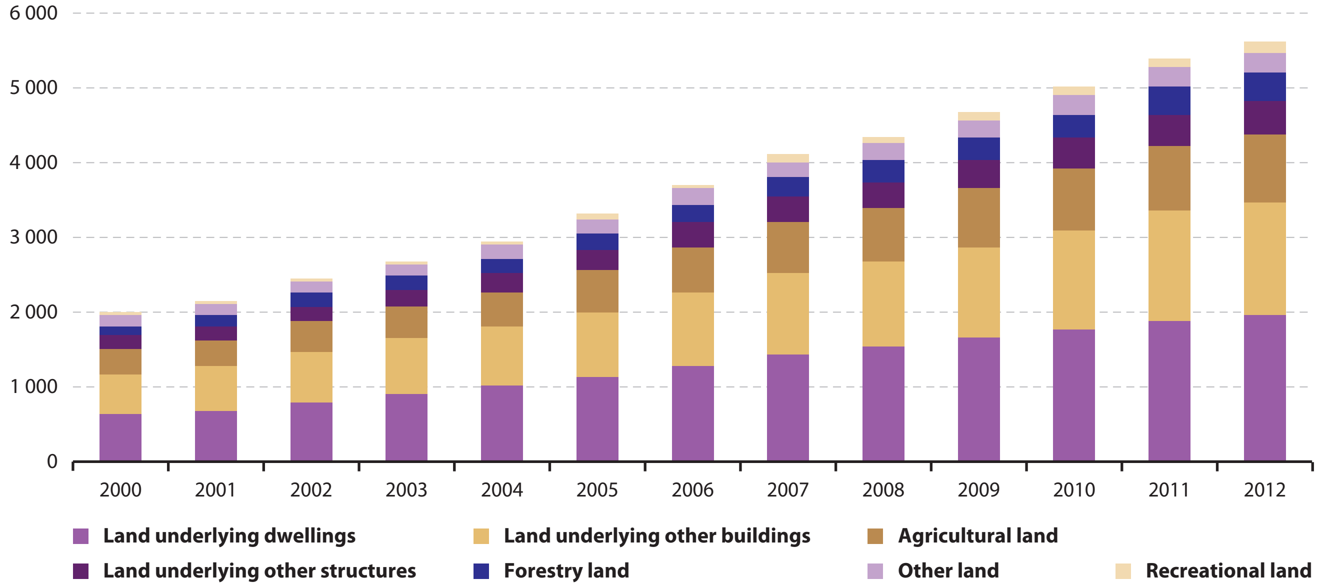
As this process is implemented with matrices of information by region, by use and by ownership, the value of the stock of land is now computed at the national level as well as by institutional sector. Market price equivalents are in addition applied to both publicly-notified and un-notified land to obtain the total value of stock of land across the nation without any missing un-valued land. The following Figure 5.1 shows that the estimate of stock of land value at the market price equivalents through the method just described stands much higher than that using the publicly notified prices. Since 2000, the value of total land based on publicly notified prices ranged from 68 to 82 % of the market price-based total land value.

Figure 5.1 Comparison of stock of land values based on market prices or publicly-noticed prices
(trillion KRW)

Source: Bank of Korea and Statistics Korea

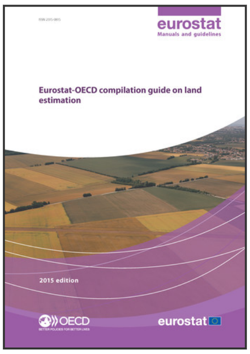
Figure 5.2 shows the values of land by classification and how they have evolved since 2000. The value of land underlying buildings (dwellings or other buildings) makes up 56 % of the total value of land, although its share in the total land area equals no more than 4 %.

Figure 5.2 Value of land of Korea by classification
(trillion KRW)



Note: Surface water used for aquaculture is included with agricultural land.

Source: The Bank of Korea and Statistics Korea



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