5 Land

Abstract

Private wealth is comprised in part of capitalized future land rents. The Golden Rule of Accumulation is preserved even if we introduce land into our meta-model. Urban land is far more valuable than agricultural land. The risk tied to land leads to a reduction in its value in the form of a "risk premium" $\alpha > 0$. Land rents can be taxed without any possibility of the tax being passed on to tenants and without loss of efficiency. If the tax is offset by a reduction in income tax, their taxation can even give rise to efficiency gains and positive distributive effects. The possibility of government intervention in the residential rental market represents a further risk for landowners. The sensitivity of the value of land to changes in the interest rate and hence the risk premium α rise with falling interest rates. In light of these many different risks, land as investment can only to a limited extent be a substitute for government bonds and hence for increasing private wealth by way of public debt. We calculate the value of land as asset category in the OECD plus China region. To this end, we primarily rely on data from statistical offices that provide figures for land in their national balance sheets. Our calculations show that the value of land in the countries of the OECD plus China region is about twice annual consumption in the region.

5.1 Land: Theoretical Foundations

5.1.1 The Formal Model

Assets in the form of land are the capitalized, discounted *future values* of land rents. But where do these future values come from? Economists are always well served by recalling the remark of one of the giants of political theory, Thomas Hobbes: "No man can have in his mind a conception of the future, for the future is not yet. But of

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our conceptions of the past, we make a future" (Hobbes 1651). Every prediction is based on an extrapolation of the past into the future.

Here, we will first present how we formally integrate the capitalized values of expected future rents into our steady-state model.

In the chapter on the natural rate of interest, we divided up the net national product per labor year into the interest (at the risk-free interest rate) on total assets $rv(r;\theta)$ and the "remainder" $w(r;\theta)$. We called this remainder the "net net product." As shown there, this net net product is the "more fundamental" variable as compared to the net national product y. At a given real allocation, the amount of the latter depends on the rate of inflation, whereas this is not the case for the net net product. Now, we divide up this net net product in turn into current rental income q and the "remainder," which is now comprised of labor income and other income and which we designate as $x(r;\theta)$. The labor income includes returns that can be understood as returns on "human capital." But $x(r;\theta)$ also includes risk premiums and "Schumpeterian" entrepreneurial profits. We thus obtain the following equation for the net national product per labor year.

$$y = x(r;\theta) + rv(r;\theta) + q(r;\theta).$$

We now look at the capitalized value of future land rents q. We first place q in relation to $w(r;\theta)$: the net net product. Let $\omega = q/w$ be the share of rental income in the net net product. For the capitalized value of future rents per labor year, we write $w(r;\theta)L$. The variable L has the dimension of "time," since it is a coefficient composed of a stock variable ($w(r;\theta)L$ and a flow variable ($w(r;\theta)$). We conceive this variable as the product of two other variables

$$L = \omega l(r;\theta).$$

Since the share of land rents, ω, in the net net product is dimensionless, $l(r;\theta)$ also has the dimension of "time."

Thus, total wealth per labor year, $\hat{v}$, in this economy is

$$\hat{v} = v(r;\theta) + w(r;\theta)(\omega l(r;\theta) + D)$$

The time variable $l(r;\theta)$ is, so to say, the average "*reliability index*" for land rents, as subjectively perceived from the point of view of the current owners of the rent stream. This reliability index will be very different for the many different individual parcels of land. The overall "reliability index" is a weighted average of these individual reliability indices. The latter do not tell us so much about the period of time during which rental income can be expected from each parcel of land. Rather, they tell us something, above all, about the period of time during which current owners of rental income streams can count on the flow of these rents *to themselves* (or to their heirs or to the purchasers of the income streams). We go into some of the details in the present chapter.

5.1.2 The Golden Rule of Accumulation Is Preserved

Before doing so, however, let us note that the Golden Rule of Accumulation is preserved in the model even when we include rental income. As in the chapter on the natural rate of interest, the following equation holds:

$$c(\theta) + gv(r;\ \theta) = w(r;\ \theta) + rv(r;\ \theta).$$

We partially differentiate this equation with respect to θ:

$$\frac{dc}{d\theta} + g\frac{\partial v}{\partial \theta} = \frac{\partial w}{\partial \theta} + r\frac{\partial v}{\partial \theta}.$$

Let θ^* be the value of θ at which consumption reaches its maximum in the set *Theta*. At θ^*, $dc/d\theta = 0$. Moreover, on the assumption of steady-state efficiency, for every r and the associated $\theta(r) = r$,

$$\partial w/\partial \theta = 0$$

holds. Hence, for θ^*, this gives the equation

$$0 + g\frac{\partial v}{\partial \theta} = 0 + r\frac{\partial v}{\partial \theta} = 0 + \theta^*\frac{\partial v}{\partial \theta}.$$

As shown in Chap. 2 on the natural rate of interest, it follows from the "Law of Demand" that $\partial v/\partial \theta < 0$. Hence, it follows from the above equation that

$$\theta^* = g.$$

The only complication that may arise in the land rent model is that *Theta* may not contain any θ that maximizes consumption. In mathematical terms, this means, in effect, that *Theta* is topologically an open set in which for each θ, it is possible that there is another $\hat{\theta}$ at which c is greater than at θ. We will discuss such a case in Sect. 5.1.3.

We can again partially differentiate $w(r;\theta) = x(r;\theta) + q(r;\theta) = x(r;\theta) + w(r;\theta)\omega$ with respect to r. We write

$$w(r;\theta) = \frac{x(r;\theta)}{1-\omega}.$$

If ω is unaffected by a change in r, we obtain

$$\frac{\partial w}{\partial r} = \frac{1}{1-\omega}\frac{\partial x}{\partial r} = -\frac{x(r;\theta)}{1-\omega}T(r;\theta).$$

Here, as previously, we call $T(r;\ \theta)$ the "period of production," since it is equivalent in many models to the average time lag between labor inputs and the availability of consumer goods.

We can—making the necessary modifications—take over still more elements from the chapter on the natural interest rate. As in that chapter, it turns out that for a given work-consumption pattern η of the representative household, the equation

$$\frac{\partial\overline{w}(\eta;r)}{\partial r} = -Z(\eta;r)\overline{w}(\eta;r)$$

holds. From this equation, it follows, as previously, that

$$\frac{\partial U}{\partial r} = \frac{\partial U}{\partial \overline{w}} Z\overline{w}$$

As previously, we can then derive that at $r = g$,

$$T(g) + D(g) + L(g) = T(g) + D(g) + \omega l(g) = Z(g)$$

The left side of the equation stands for the wealth components real capital ($T(g)$), public debt ($D(g)$) and capitalized land rents ($\omega l(g)$). At $r = g$, the right side represents total wealth and desired wealth ($Z(g)$).

As a first approximation, we assume that when holding the interest rate constant at $r = g$, a change in $\omega l(g)$ and a countervailing change in $D(g)$ leave the period of production T unchanged. This means, however, that the two variables D (the public debt ratio) and L (the land rent share) are interchangeable without violating the conditions of the Golden Rule of Accumulation. We will put this finding to use further on.

5.1.3 Is the Steady-State Interest Rate Always Greater Than the Growth Rate?

It is the opinion of some economists that a steady-state interest rate r has always to be greater than the steady-state growth rate. Barro, for example, made this assumption when deriving "Ricardian equivalence" almost half a century ago (Barro 1974). According to this theory, on the assumption of citizens who are acting completely rationally and thinking in the long term, it is simply not possible to stimulate demand with additional public debt, since the increased debt causes citizens to restrict their current demand for consumer goods by exactly the present value of the additional taxes that it will bring about. In order to derive this result, however, Barro had to assume that fiscal authorities are subject to a binding intertemporal budget constraint. And this is only the case, if the relevant interest rate is greater than the growth rate of the economy.

The "generational accounting" method, which was developed by Kotlikoff and applied to Germany and Europe by Raffelhüschen, likewise depends on the assumption that the steady-state interest rate is greater than the steady-state growth rate (Kotlikoff 1992; Raffelhüschen 1999).

In the economic literature, there are models in which land plays a key macroeconomic role. Homburg (1991) is an example. Land is treated here as a homogeneous good. It is a factor of production in a macroeconomic production function. The two other factors of production are labor and capital. This is an expanded Solow production function to which the factor land has been added. In this production function, which also features a constant rate of technical progress, land rent equals the marginal product of land. The supply of land is fixed. If it is a Cobb–Douglas production function, the economy can grow at a constant rate. Land rent grows then proportionally to the national product, such that the share of land rent in the national product remains constant. If the future land rents are converted into a capitalized value of land at the prevailing steady-state interest rate, then this value of land is only finite when the interest rate is greater than the growth rate.

In Homburg's model, the addition of land leads the inequality $r > g$ to be treated as an equilibrium condition. Hence, the set Theta is half-open: For every $\theta \in$ Theta, there is a $\overline{\theta} \in$ Theta with $\overline{\theta} < \theta$. It then also holds that for every $c(\theta)$ with $\theta \in$ Theta, there is a $c(\overline{\theta})$ with $\overline{\theta} \in$ Theta, so that $c(\overline{\theta}) > c(\theta)$. We will show further on that the assumptions of the Homburg model are unrealistic. However, our argument below is different from the one developed by Kim and Lee (1997), criticized by Homburg (2014), but further refined by Hellwig (2020a and b).

5.1.4 Ponzi Scheme

A steady-state equilibrium with a constant interest rate that is lower than the growth rate is not a general equilibrium in the sense of Walras, Arrow and Debreu. For it obviously does not meet the criterion of Pareto optimality. Sustainably profitable Ponzi schemes are conceivable (Blanchard and Weil 2001). There are, however, good reasons why it is illegal for private actors to engage in Ponzi (or "pyramid") schemes. For they collapse as soon as there is competition. The only legitimate operator of a Ponzi scheme is the state, which possesses a *monopoly on the use of violence*. It is the "Leviathan" of Thomas Hobbes (1651). Thanks to this monopoly on the use of violence, the state can even be creditworthy when it has negative equity. This is at least the case as long as it has not completely exhausted its potential for raising tax revenue: i.e., as long as tax rates are low enough so that public finances are still on the rising part of the Laffer curve (Uhlig and Trabant 2011). For in this case, the state can convince its creditors that, "if needed," it can remain solvent by increasing tax rates.

What is decisive in this connection is that there is only *one* actor—the state—operating the Ponzi scheme. If the state were competing with other operators of Ponzi schemes, then this competition would drive interest rates so high that the

Ponzi scheme would no longer work. Inasmuch as we are considering a world in which there are many coexisting states, it is clear that the various fiscal authorities have to coordinate with one another, in order to prevent “cutthroat competition” among the Ponzi schemes operators. We will return to this question of the international co-existence of states as public operators of Ponzi schemes in Chap. 10 on free trade. (On the same topic, cf. also Hellwig and Lorenzoni 2009).

5.1.5 Financial Risks of Land Ownership 1: Agriculture

The question is whether we can regard the outcome of a model like Homburg’s as a realistic description of the real world. We doubt it, and in the following, we explain why.

Models always represent real life in a simplified way. In order for them realistically to represent those points that are crucial for the issue under examination, it must be possible to show, using our economic judgment, that the simplification does not already transport the conclusions to be proven into the model itself.

In our present context, one crucial assumption is that we are dealing in the Homburg model with three factors of production—labor, capital and land—each of which is per se homogeneous. In Chap. 4, we discussed the question of capital as homogeneous factor of production in detail. We do not want to repeat that discussion here. Here, we will be looking at land as factor of production.

Land is far from being a homogeneous good. The location of a piece of land is important, as are its physical properties. In the case of land that is used in agriculture, the fertility of the soil is especially important. In Germany, this characteristic is even measured by a so-called “land value index” [*Bodenwertzahl*]. How land is used is decisive in determining its market value. As a rule, land designated for construction and land that has already been developed has a much greater market value per square meter than land that is used for agriculture or forestry. We will go into this matter in greater detail in Sect. 5.2 using some concrete numerical examples. The reason for this greater value is that the right to build on a piece of land is granted by public authorities in a restrictive manner. Urban and environmental planning play a major role in this connection. But there are also enormous differences in value within the category of urban land-use. The location of the land is decisive. Centrally located urban land is far more valuable than land on the urban periphery. Land for construction in a major metropolis is far more valuable than land for construction in a provincial town. All of this is well known.

In the case of land that is used for agriculture or extractive industries, in addition to the relevant physical characteristics, proximity to transportation links is also important. The potential for or current exploitation of returns to scale by connecting a parcel of land to neighboring land is also significant. In the context of our analysis, it is important that these latter factors are dependent upon decisions that are not made by the owner, but rather by other persons and institutions. These decisions are associated with a large number of externalities that have a positive or negative impact on the land in question.

This means, however, that property in land used for agriculture or extractive industries is, as an asset, connected to considerable *financial risks*. The expected value of the flow of future land rents from any given parcel of land can change "unexpectedly" from year to year: whether upward or downward. Thus in Germany, for example, the value of a great deal of agricultural land has risen, because German energy policy has for some time now been prioritizing renewable energies: including bioenergy. But no one can guarantee that this energy source will continue to be heavily subsidized in future. The risks for landowners posed by agricultural policy are also, of course, well-known: whether due to the reinforcement of protectionist measures or their weakening. But what is at issue is precisely not only such "macrorisks." Highly local decisions about transportation networks or connection to the power grid, and highly local developments, like family matters in the neighboring farm, can sometimes have a massive impact on the expected flow of rental income. And these third-party decisions cannot be predicted with certainty.

5.1.6 Financial Risks of Land Ownership 2: Urban Land

Much the same applies for urban or peri-urban land that has been built on or on which construction is taking place or that has been designated for construction. Apart from macrorisks, like those tied to legislation, there are also a large number of micro- and "meso"-risks involved here. Among the mesorisks, we include events or decisions that affect a city as a whole. The Bundestag's 1991 vote to make Berlin, instead of Bonn, the capital of reunified Germany had an influence, of course, on land prices both in Berlin and the surrounding area and in Bonn and the surrounding area, as well as in Karlsruhe and its surroundings: in the latter case, because Karlsruhe averted the danger of all the country's highest courts being moved to Leipzig. But the unforeseeable establishment or failure to establish a link to the highway system or to high-speed railway lines also contains risks for land values in a city as a whole. Whether and when the Elbe River will be deepened is an issue that affects all property owners in Hamburg and its surroundings.

The microrisks of land ownership include local decisions on public transportation or decisions that bring about positive or negative changes in noise pollution: whether from traffic, flight paths or the construction of nearby wind turbines. The "demographics" of the neighborhood can also undergo both positive and negative change. "Gentrification" is an example.

Building regulations and the urban planning of the municipality in question are, in principle, changeable, and they are not under the control of landowners. How many floors may be built? What landmark preservation restrictions will there be in future?

In short, there are a large number of both risks to which owners of urban land are exposed and opportunities from which they can benefit.

It is also important that risk diversification is not so simple in the real estate sector. If they are to retain their value, buildings cannot be divided up into smaller parts in any way the owner wants. Joint property of many owners is always associated with considerable transaction costs. As a wide variety of experience shows, real estate funds can give rise to massive principal-agent problems. As compared to the possibilities for diversification presented by share-ownership in publicly listed companies, risk diversification is far more expensive in the case of real estate. Just the transaction costs involved in transfer of ownership are already far greater in the case of real estate than in that of publicly traded shares.

5.1.7 A Dual Model of Land Use

Most of the value represented by land is nowadays related not to agricultural land, but rather to urban land that has been built on or on which construction is taking place or that has been designated for construction. This is significant for our analysis, because the supply of land for development is not a fixed quantity, but depends rather on private and public decisions. The model of a fixed supply of land, which came into the economic literature with the Ricardian theory of rent (and has antecedents in the Physiocrats), is at most suitable for agricultural land. It is not appropriate for the far more valuable land used for building.

It might be instructive to draw a parallel here to the subject of labor supply. There has long been a literature on the "dual economy" (Lewis 1954). In the "dual economy" model, which is meant to describe developing countries, there is a "traditional" sector and a "modern" sector. The latter is far more tightly connected to the global economy than the traditional sector and is modeled on the economy of the wealthy countries. The only difference is that, unlike in wealthy countries, the traditional sector, with its lower standard of living, makes a practically unlimited reservoir of labor available to the modern sector. In an analogous manner, we can argue that land that is currently used for agricultural purposes represents a large reservoir of land that can be used to increase the supply of land for construction. We will come back to this point in Sect. 5.2.2. Historically, of course, agricultural land has constantly been converted into land for development. Otherwise, it would have been impossible to satisfy the growing need for built space due to population growth—and, in particular, the growth of the urban population and the increase in its standard of living.

In considering the value of land, it is thus misleading to treat the supply of land as constant regardless of its use.

5.1.8 Macrorisks of Urban Land Ownership 1: Taxation or Increasing Supply

We now turn to the macrorisks faced by the owner of built-up land or land for development. We call such land *urban land*.

We should first point to a fact that is well known to specialists in public economics: Precisely when working with a model in which the quantity of urban land is given, land rents are pure rents in the economic sense. Taxation of the land or a reduction of its value due to other regulations cannot be passed on to others. For by assumption, supply remains the same with or without the taxes or regulations. As every trained economist knows, this is not the case for capital and—up to a certain point—labor as factors of production. If capital income is either directly or indirectly taxed, then, with given saving behavior and constant interest rates, the supply of capital shrinks. This has the effect of increasing interest rates, such that the tax burden can, to a large extent and perhaps even entirely, be shifted to others. Increased taxation of the labor supply that is offset by other tax benefits for households leads to a lower labor supply (a pure substitution effect). But, other things being equal, labor thus becomes scarcer and hence more expensive. Wages rise. The tax can at least be partially shifted to others.

This general finding about tax incidence gets an additional twist in the case of urban land. We are referring here to Arnott and Stiglitz's "Henry George Theorem" (Arnott and Stiglitz 1979). The authors grasp differential urban land rents as the result of the city's making a transport and information infrastructure available to the landowners. They show that in a city of optimal size, aggregate land rents are exactly equal to the costs of the optimal infrastructure. The positive externalities (to the benefit of the landowners) of the municipal infrastructure can, in effect, be internalized, inasmuch as the municipality imposes a land tax on the owners that drains off the entirety of the differential rent.

The more one is stuck in the theoretical universe of a fixed supply of urban land, the more compelling the idea becomes that the economic allocation of resources could be massively improved by heavily taxing land rents and using the tax revenues thus generated to reduce distorting taxes on income and sales proportionally.

Of course, the model of a fixed supply of land—especially of a fixed supply of urban land—is an unrealistic simplification. We are not suggesting here that differential urban land rents should be completely drained off by equivalent taxes. But an important reason why the taxation or regulation of urban land should not be pushed too far is the incentive that is created for private firms to increase the supply of urban land and to improve its quality, if they are allowed to retain part of the increase in value that this brings about.

Anyone who is considering investing their wealth in urban land in the form of real estate will keep in mind that there are good reasons why taxes imposed on land rents either cannot be passed on or can only be passed on with difficulty (if the supply of land is fixed or highly inelastic). Or they will understand that urban land is perhaps not so heavily taxed only because of the potential for additional supply, which will come into competition with the existing mass (if the supply of land is relatively elastic).

The Damocles sword of either increased taxation or increased supply hangs over the head of every owner of urban land. As consequence, considerable risk premiums are expected whenever urban land changes hands.

5.1.9 Macrorisks of Urban Land Ownership 2: Restrictions on the Freedom of Contract—In Particular, Rent Control

This analysis is reinforced by government interference in the freedom of contract between landlord and tenant (also in the case of commercial properties, though to a far lesser degree). All over the world, wherever they occur, these interventions always take the form of regulating rents in the name of "tenants' rights," never in the name of "landlords' rights." The political–economic reason for this universal constant is obvious. Even if, in the long term, there is considerable elasticity of supply for urban land, in the short term, there certainly cannot be. In the short term, introducing freedom of contract on the residential rental market would only have a minor impact: Such a measure cannot be expected to produce much additional supply by the time of the next elections. In all urban agglomerations, wherever rent control is already in place, there is excess demand for residential rental space. Due to rent control, rents are below the level at which supply and demand match. Hence, the first effect of such a legislatively sanctioned transition to freedom of contract would be to raise rents. But it is thus a sure thing that the party that abolished rent control and introduced freedom of contract will lose the next elections—and, as consequence, rent control will be reintroduced. In political–economic terms, rent control, and the excess demand for residential rental space that goes with it, is thus a stable system.

In countries in which rent control has been pushed to an extreme, the private rental market for dwellings has largely dried up, because private investors keep away from investing in rental properties.

As a general phenomenon, rent control is a global constant. But the specific form it takes is variable. This is the case both from country to country and in terms of its evolution over time. Anyone renting out a residential property must thus live with the risk of stricter rent control. Hence, investors will demand a considerable risk premium before investing in rental properties.

In order to encourage more private investment in the construction of rental properties, tax authorities in many countries offer generous tax rules on depreciation for investment in buildings. These are, in effect, tax subsidies, which lead real capital assets in the form of built structures to receive preferential tax treatment as compared to assets in the form of urban land. Since, however, urban land and real capital in the form of buildings are complementary factors of production, if the supply of urban land is inelastic, its value rises with every tax benefit given to investment in urban construction. Thus, a large part of the tax benefit accorded to residential development flows to the landowners and far less than 100% of it to the tenants who rent the residential units. This preferential tax treatment accorded by the government can also be changed, however; hence, it too is laden with risk that figures into a risk premium.

5.1.10 Rent Control as Shared Land Rent

Rent control can also be understood as a legally enforced dividing up of the rent on urban land between landlord and tenant. As already discussed, it regularly leads to excess demand for rental units in urban agglomerations, since the legally permitted rents are below the price level at which supply and demand match. For the property owners, urban land rent is thus less than it would be under conditions of freedom of contract. Consequently, capitalized future land rent is also lower, even if we do not include the risk premium discussed above.

A part of the urban land rent that property owners lose due to rent control is a sort of quasi-rent for tenants, which takes the form of their having to pay lower rent than they would under conditions of freedom of contract. This quasi-rent for the tenant is, however, less than the landlord's loss of rent. For rent control also entails inefficiencies in resource allocation. These are accepted by the majority of voters: In the view of the public, they are the price that the economy has to pay for a "fairer" housing market.

Moreover, if rent control is not pushed to such an extreme that, in the long term, no owners are willing to rent out their property, it no longer holds that land taxation, as taxation of a pure rent, cannot be passed on by landlords. For, in this case, the government must generally allow the periodic taxation of land (or property tax) to be transferred to the tenant in the form of increased rent. Otherwise, even more property owners will flee the rental market. Therefore, even the tenant's quasi-rent is indirectly taxed. In political–economic terms, the fear of rent increases as a consequence of increased property taxes is the common weapon used by landlords and tenants in urban areas to ward off efficiency-increasing tax increases on urban land combined with proportional reductions in income taxes and sales taxes – to the detriment of those who do not have any share in urban lands rents. And hence to the detriment of the regional "equality of living conditions."

5.1.11 The Role of Interest Rate Risk in the Capitalization of Land Rents

We now turn to the specific effect of interest rates in the valuation of land and other rental assets. It is generally accepted that a given expected stream of future land rents or other rental income leads to a higher capitalization, the lower the discount rate that is applied. This discount rate is derived from the market interest rate. In Homburg's simple model (Homburg 1991), this effect of the interest rate is sufficient to show that the long-term equilibrium rate of interest is always higher than the growth rate of the economy. But if, for the reasons discussed above, current and potential landowners use a discount factor consisting of the sum of the risk-free real market rate r and a risk premium $\alpha > 0$, then the risk-free real market rate can also be less than the growth rate of the economy in general equilibrium.

We can, however, go one step further here: The risk borne by the owner of land also includes the risk of a change in interest rate. As we showed in Chap. 2 on the natural rate of interest, a steady-state analysis does not mean that we ignore the risk of interest rate changes (See Sect. 2.9).

Let us assume that a landowner's expected value for future land rent is $R(t) = e^{gt}\overline{R}$. The owner calculates the value of the land part of his or her real estate using the risk-free market rate of interest r plus a risk premium α. The value of his or her land A is thus

$$A = \frac{\overline{R}}{r + \alpha - g}.$$

For a given g and a given α, we are interested in the sensitivity of the value of this asset A to changes in the interest rate. We calculate

$$\frac{\partial A}{\partial r} = -\frac{\overline{R}}{(r + \alpha - g)^2} = -A\frac{1}{r + \alpha - g}.$$

The proportionate sensitivity to changes in the interest rate is thus equal to

$$\frac{1}{r + \alpha - g}.$$

We obtain the same result for the proportionate sensitivity of the asset value with respect to the expected growth rate. This proportionate sensitivity to the interest rate is thus nothing other than the average time gap between the future land rents and the present as weighted by risk-adjusted present values.

Now, we can see from the formula that this proportionate sensitivity to the interest rate is greater, the lower the rate. But this has consequences in turn for the risk premium. The latter, has, after all, to take into account the risk of an interest rate change. Let us assume that the subjective probability distribution for future risk-free interest rates exhibits a spread (e.g., variance) that is independent of the current steady-state real interest rate. Since, however, the relative sensitivity to the interest rate of the value of a parcel of land is greater the lower the rate, there is good reason to think that the risk premium α rises with a falling steady-state interest rate. If purchases of real estate are often financed with loans, this negative sign of the derivative of α with respect to r is already to be expected from the fact that the banks will also take into account the interest rate sensitivity of the market value of the collateral in setting the interest rates on their loans.

There is also a political–economic reason why the lower the interest rate, the higher is the risk premium. For the greater the asset value that results from the capitalization of land rents, the more willing the government will be to do something to lower them: i.e., to lower ω. In other words: *High real estate prices give the government an incentive to do something for tenants and at the expense of landlords*. The current debate and atmosphere in Germany exemplify this political–economic relationship. Inasmuch as buying real estate is becoming more and more difficult and risky for persons with limited savings, due to high prices, rents in urban agglomerations are being targeted by policymakers—and, as a result, rent controls are being introduced or tightened. Thus, the political risk involved in owning real estate rises as interest rates fall.

Finally, fiscal authorities also have in interest in responding to very high real estate prices for the purpose of stabilizing the economy. If, as demonstrated, real estate prices are very sensitive to interest rate changes when interest rates are low, high real estate prices can lead the fiscal authorities to use higher deficits to ensure that the steady-state interest rate rises. In this way, the danger of real estate crises with macroeconomic consequences can be reduced, since both real estate prices and their sensitivity to interest rate changes decrease as a result. Landowners' knowing about these relationships contributes to the fact that the lower is r, the higher is α.

It is worth re-emphasizing that the inverse relationship between interest rate and risk premium presented here is not the same thing as the common argument to the effect that "When interest rates are low, people expect them to rise; when interest rates are high, people expect them to fall." Empirically, this may well be true. Nonetheless, the inverse dependence of the risk of interest rate change on the interest rate level still holds, even if the expectations for interest rates are such that their average expected value is equal to the prevailing rate.

We thus write

$$\frac{\partial \alpha}{\partial r} < 0.$$

In an entirely analogous fashion, we can, using similar arguments, show that

$$\frac{\partial \alpha}{\partial g} > 0$$

holds.

This analysis can be transferred to the macroeconomic level. Here (cf. Sects. 5.1.1 and 5.1.2), we found that

$$\hat{v} = v(r;\theta) + w(r;\theta)(\omega l(r;\theta) + D)$$

and, when $r = g$, that

$$T(g) + D(g) + L(g) = T(g) + D(g) + \omega l(g) = Z(g)$$

Purely formally, we now replace the overall "reliability index" $l(r;\ \theta)$ by a formula corresponding to the one we have just derived:

$$l(r;\theta) = \frac{1}{r + \alpha - g}.$$

Here, g *is* the growth rate of the economy. It is thus a kind of "average" of the growth rates of land rents assumed by individual property owners as expected values. This equation *defines* the average α for the economy as a whole at empirically observed values for $l(r;\ \theta)$, r and g respectively. In the case of the Golden Rule of Accumulation ($r = g$), we obtain

$$l(g;\theta^*) = \frac{1}{\alpha}.$$

On the Golden Rule path, the macroeconomic risk premium defined in this way is thus the inverse of the reliability index. Or vice versa: On the path of the Golden Rule of Accumulation, the reliability index is the inverse of the average risk premium.

We can now undertake a first-order Taylor approximation, in order to estimate the value of $l(r;\ \theta(r))$ for $r \neq g$. At every r, we have

$$\frac{\partial l}{\partial r} = -\frac{1}{(r+\alpha(r)-g)^2}\left(1+\frac{\partial\alpha}{\partial r}\right) = -l^2\left(1+\frac{\partial\alpha}{\partial r}\right).$$

If we designate the risk premium that holds at $r = g$ as α^* and the derivative of α at $r = g$ as $(\alpha^*)'$, then the first-order Taylor approximation reads as follows:

$$l(r;\theta(r)) \approx -\frac{r-g}{(\alpha^*)^2}(1+(\alpha^*)') + \frac{1}{\alpha^*} = \frac{1}{\alpha^*}\left\{\frac{g-r}{\alpha^*}(1+(\alpha^*)')+1\right\}.$$

The proportionate deviation of $l(r;\ \theta(r))$ from its value at $r = g$ is thus

$$\frac{g-r}{\alpha^*}(1+(\alpha^*)').$$

If, for example, $(\alpha^*)' = -1$, the first-order Taylor approximation implies that the reliability index is invariant with respect to a change in the steady-state interest rate. If the absolute value of $(\alpha^*)'$ is less than one, then the reliability index rises with a falling interest rate, but it does so more slowly than it would if the risk premium were not dependent on the interest rate.

We now provide a sensitivity analysis. We are making an estimate for when $r = g$. In this case, the equality of total consumption and net net income also holds. As will be shown in the second part of the present chapter, we estimate the value of $L = \omega l$ to be 1.94 years of total consumption and hence 1.94 years of net net income. The variable ω represents the share of land rents in net net income w. In the following calculations, we assume that $\omega = 1/9$. We thus obtain

$$l(r;\theta(r)) = \frac{L}{\omega} = 17.46 \text{ years.}$$

The one-ninth estimated share of land rent in net net income for the OECD plus China region as a whole is nothing more than an educated guess. Further research is required, in order for us to be able to be more precise. Here, we offer just some very simple considerations. Residential rents are found to represent around one-third of disposable income. Rental income from commercial tenants has to be added to this. We also have to add a hypothetical rent from owner-occupied residential properties, which is not included in the determination of income in the national accounts. Hence, a one-third share of rent in net net product may not be entirely off-track, since, as we have defined it, the net net product is greater than disposable income. Now we have to subtract both the landlord's running costs and the return on the real capital share. If we assume that these two items each account for one-third and hence combined for two-thirds of rents (less in the city centers of major metropolitan areas, more in the countryside or on the urban periphery), then net rental income is equal to approximately one-ninth of the net net product.

The result, a reliability index of around 17½ years, appears to be entirely realistic.

This equation holds for $r = g$. Thus, at $r = g$, we obtain the following value for the risk premium:

$$\alpha^* = \frac{1}{l(g;\theta(g))} \approx \frac{1}{17.5 \text{ years}} = 5.7\% \text{ p.a.}$$

This value seems plausible. It represents the risk premium on land assets when $r = g$. In making the following estimate, we assume a steady-state growth rate of 3% per year for the OECD plus China region. Hence, the hitherto estimated risk premium corresponds to a risk-free real interest rate that also equals 3% per year. We have to keep in mind here that we are considering the OECD plus China region, which includes both lower growth rates in Europe, in particular, and the much higher growth rates of China.

We are interested in estimating l at $r = 0$. If we use the first-order Taylor approximation presented above, we have now to determine a value for $\partial\alpha/\partial r$ at $r = g$ or, in other words, for $(\alpha^*)'$. From the above analysis, we can presume that it is somewhere between –1 and zero. Let us posit that

$$(\alpha^*)' = -\frac{1}{2}.$$

We can thus calculate

$$\begin{aligned} l(0;\theta(0)) &\approx \frac{g}{(\alpha^*)^2}(1 + (\alpha^*)') + \frac{1}{\alpha^*} = l(g;\theta(g)\left[1 + l(g;\theta(g)g\frac{1}{2}\right] \\ &= l(g;\theta(g)\left[1 + \frac{17.5}{100}1.5\right] = l(g;\theta(g)1.2625 = 22 \text{ years.} \end{aligned}$$

The reliability index is 26.25% greater at a real interest rate of zero than at a rate equal to the growth rate. In our calculations of total wealth, we round up to a 30% increase in assets.

At $r = 0$, per our assumptions, the risk premium is

$$\alpha(0) = 5.7\% + 1.5\% = 7.20\% \text{ p.a.}$$

This is a plausible figure.

5.1.12 Distributive Aspects of Land Rent

The formula

$$T(g) + D(g) + L(g) = T(g) + D(g) + \omega l(g) = Z(g)$$

for the Golden Rule of Accumulation is also of interest in light of its distributive implications. It contains two variables that are relatively easily susceptible to being influenced by government policy: ω, land rents as a share of net net product, and the public debt ratio D. The government can adjust the two variables to offset one another, such that the steady-state interest rate remains unchanged. As a first approximation, we can assume that the variables $T(g)$ and $Z(g)$ do not change, if the interest rate stays the same. These variables are, after all, the period of production and desired wealth. Now, it would be possible to increase $D(g)$ and offset this increase by reducing ω. This could take place, for instance, by increasing taxes on urban rents and offsetting the tax revenue thus generated by reducing income and sales taxes (with their well-known distorting effects). We have no need to discuss the details of such a tax reform here. It would to some extent resemble Arnott and Stiglitz's idea that we discussed above. The government has just to be careful not to go so far as to eliminate the incentive for private enterprise to convert agricultural land into land for urban development.

Here, we want only to call attention to the distributive effect of such a measure. The recipients of urban rents figure almost entirely among higher income groups. Fiscal authorities may use the increased tax revenues from the taxation of land rents to decrease income tax and sales tax rates, such that this lightening of the tax burden mainly benefits low-income groups. What is going on here then is a redistribution from "rich" to "poor," which also serves to reduce the distorting effects of the tax system as a whole. The consumer income that could be achieved in the Golden Rule steady state would thus be greater. At the same time, in the Golden Rule steady state, the greater public debt would not result in an additional burden for current or future taxpayers, since the interest on the debt is covered by the state's net borrowing (Weizsäcker 2018) .

Of course, the possibility of this redistribution presupposes that the Arnott-Stiglitz land tax was previously suboptimally low. This can be safely assumed for many of the countries in the OECD plus China region. On the political–economic background to this assumption, see the conclusion of Sect. 5.1.10 above. Owners of urban land will also be aware of the possibility of such a redistribution, so that it will already have an influence on the risk premium α.

In this book, we do not offer any estimate of the supply elasticity of urban land. Depending on the institutional environment, the latter will also vary from country to country. But it is clear that there is a politically explosive issue for future research here.

5.1.13 The Real Estate Inheritance Rate

It is a robust fact that privately owned real estate is left as an inheritance far more often than other types of wealth. It is legally impossible for wealth in the form of social security claims to be inherited. Financial assets are largely used, both directly and indirectly, for retirement: directly, inasmuch as they are amassed precisely for this purpose; indirectly, inasmuch as, for example, life insurance companies and corporate pension funds invest by far the greater part of their reserve funds in relatively liquid financial securities. A debt-free house is also used for retirement purposes. In the overwhelming majority of cases, it is not, however, mortgaged again in old age, but rather left debt-free to one's heirs. The owner-occupied debt-free house or apartment is almost the classic example for the model of making one's heirs into implicit life annuity insurers. We examined this dual use of property in Chap. 3, Sect. 3.6.

If, however, real estate is largely passed on as inheritance, then an erroneous estimate of the total value of real estate is not a serious problem when empirically deriving the negative natural rate of interest. If the total value of real estate is underestimated, then the share of total wealth that is passed on as inheritance will also be underestimated. In this case, however, as noted in Chap. 3, Sect. 3.6, we also underestimate desired wealth.

5.2 Determining the Value of Privately-Owned Land in the OECD Plus China Region

5.2.1 Concepts and Data Sources

In addition to real capital and explicit and implicit public debt, land is another important component of private wealth. The goal of this chapter is to estimate the value of land assets in the OECD plus China region. To this end, we primarily rely on data from statistical offices, which determine figures for land and sometimes for all natural resources in the context of national accounts and report them in the national balance sheets that are especially relevant for our purposes (Lequiller and Blades 2014, pp. 231–254).

In the national accounts, land is assigned to so-called *non-produced non-financial assets* (cf. Fig. 5.1). According to the 2008 SNA and the 2010 ESA, the latter include contracts, leases and licenses, goodwill, marketing assets and *natural resources* (Eurostat 2013, p. 171). In addition to land, natural resources

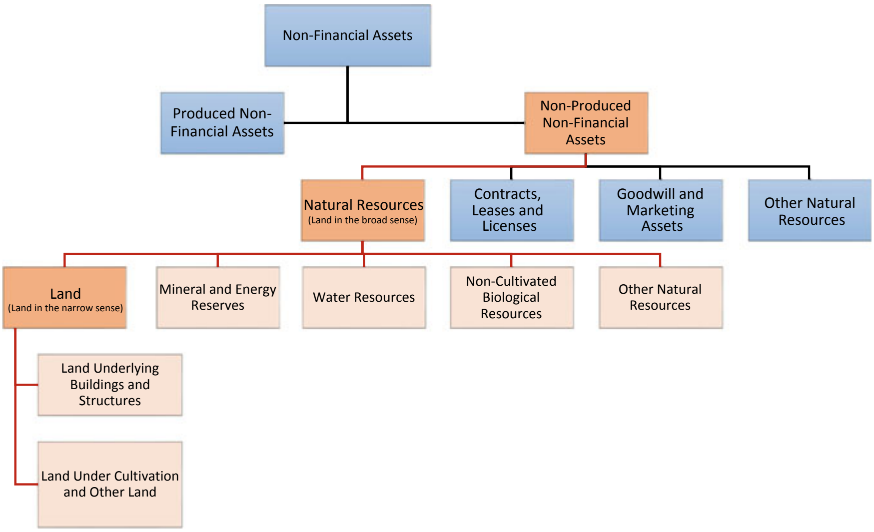

Fig. 5.1 Land in national accounts (2008 SNA). *Source* European Commission et al. (2009); Eurostat (2013). Authors' own presentation

include mineral and energy reserves, non-cultivated biological resources, water resources and other natural resources. Sometimes when discussing land in what follows, we in fact have this more extensive definition of natural resources in mind: what we could call "land in the broad sense." Most countries only include statistics on land in the narrow sense in their balance sheets, not statistics on the natural resources land comprises (like, e.g., mineral and energy reserves). To the extent that the official statistics of some countries in the OECD plus China region provide data on natural resources, we will use this data, but we will continue to designate this extended category of wealth simply as the "value of land."

In accordance with the ESA 2010, land is only regarded as an economic asset and included in the balance sheets, if there are ownership rights to it and these rights confer an economic benefit upon the owner (Eurostat 2013, p. 171). Land that confers no economic benefit is described as *barren land* and consequently does not represent an economic asset. This criterion also applies for other non-produced non-financial assets. Thus, for example, open seas and air are not counted as natural assets, because there are no ownership rights in them (ibid.). Hence, only data on assets that meet these criteria are to be found in the national balance sheets.

One of the major methodological difficulties involved in measuring the value of land consists of separating the value of the assets on the land (buildings, other built structures, trees and plants, etc.) from the value of the land itself, in order to determine just the latter. The value of parcels of land underlying buildings and other structures is, in principle, the difference between the replacement cost of a built structure (as determined, for instance, for insurance purposes) and the market price of the real estate as a whole (including the land) (Ryan-Collins et al. 2017, p. 6).

But such figures are only sometimes available. Hence, it is often difficult in practice to carry out this separation. The official statistics make use of special methods of assessing value and report the value of the land without the assets found on it (Schmalwasser and Brede 2015, p. 44).

A large part of the data on the value of land in the developed economies that we use is provided by the OECD in one of the datasets available under *Annual National Accounts: Detailed Tables and Simplified Accounts* (OECD 2019). In addition, for a limited number of European Union member states, Eurostat (2019) publishes data that is, in part, identical with the data from the above-mentioned OECD dataset. The German figures, which are reported by the Bundesbank and the Federal Statistical Office in the sectoral and national balance sheets (Deutsche Bundesbank and Statistisches Bundesamt 2020), are included in both datasets. Since 2015, the data available for Germany has improved thanks to an expansion of the data on land in the balance sheets. Previously, only estimates of the value of land underlying built structures were published in Germany (Deutsche Bundesbank and Statistisches Bundesamt 2015). Using benchmarks based on actual purchase prices, now data is also provided on the total value of land. But since market prices are not available for all land, estimates are still indispensable. The precise assignment of land to the different institutional sectors is also sometimes difficult (Schmalwasser and Brede 2015, pp. 49–50; Schmalwasser and Müller 2009).

Land is owned both by the state and by households and firms. What is of interest for us is the land that is privately owned. In calculating its value in the OECD plus China region, we will again combine households and firms. For the reasons that we have already presented, we relate the value of land not, as is customarily done, to the flow variable gross domestic product, but rather to the flow variable total consumption. By "total consumption"—or, in what follows, also simply "consumption"—we understand the sum of the expenditures for the consumption of households and for the consumption of the state (public consumption) that were undertaken in the respective reporting year. Thus, we will say, for instance, that the value of land in Great Britain is equivalent to 2.83 times or 283% of (total) consumption.

5.2.2 Land Values and Land Use in Germany

Whereas especially in the last three decades, the value of land has risen sharply in many developed countries, the rise of land values in Germany during this period has been relatively modest by comparison. Nonetheless, in Germany too, land values have clearly increased in recent years. Figure 5.2 shows how the value of all land and of land underlying built structures has evolved in the German economy as a whole and in the private sector from 1999 to 2019. The value of all land in Germany rose from nearly 2.4 trillion euros in 1999 to 5.3 trillion euros in 2019. The value of privately owned land more than doubled in value, reaching around 4.7 trillion euros, during this time. The value of underlying or "built-up" land similarly increased. The accelerated increase in the value of both categories of land

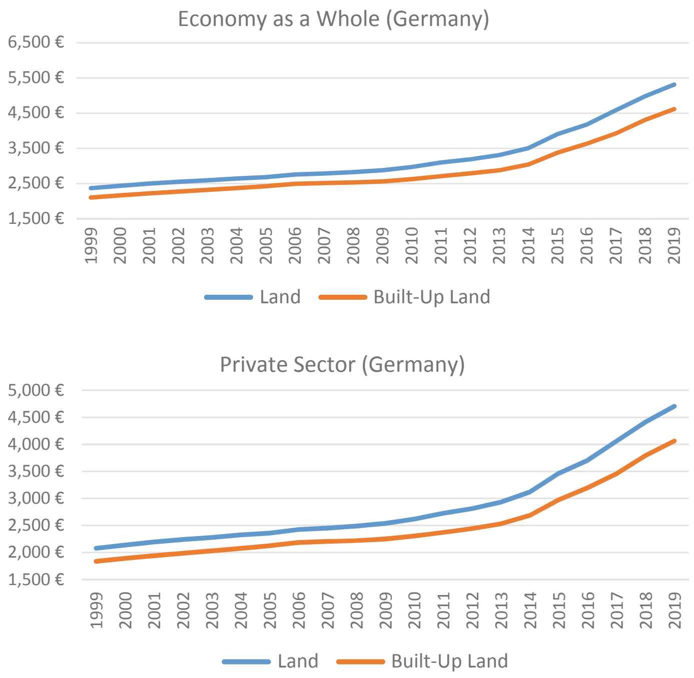

Fig. 5.2 Evolution of total land value and value of built-up land in Germany in Billions of Euros, 1999–2019. *Source* Deutsche Bundesbank and Federal Statistical Office (2020). Authors' own calculations

that began in around 2012 is clearly visible in both graphs. More than half of the growth in value that occurred between 1999 and 2019 thus took place in the last seven years of the 20-year period 1999–2019.

The graphs show the evolution for both total land and built-up land. It should not be forgotten, however, that the value of land varies considerably depending on its economic use (European Union and OECD 2015). The use of land can be roughly subdivided into its use for settlement, transportation, vegetation and bodies of water. The national land use statistics provide detailed information on how land is used.[1] They show that agricultural land accounts for the largest share of economically usable land in Germany, representing somewhat more than half of the total land area. Woodland accounts for the second largest share, representing nearly one-third of the total area. Land underlying and adjoining buildings (approximately

[1]Within the framework of its so-called minimum publication program, the Federal Statistical Office (Statistisches Bundesamt 2020) distinguishes between the following types of land use on the federal level: land underlying and adjoining buildings (for residential, commercial and industrial purposes), recreational land (parks, etc.), (undeveloped) land for industrial operations (including land for mines and quarries), land for traffic (roads, paths, squares), agricultural land (including moor and heath), woodland, surface water, land for other uses (cemetery, barren land).

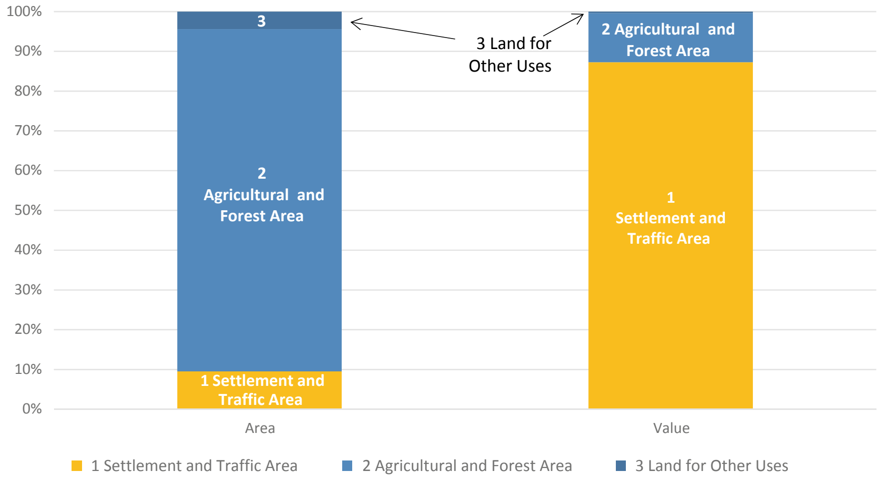

Fig. 5.3 Area and value: shares by type of land use. *Source* Schmalwasser and Brede (2015); Statistisches Bundesamt (2020). *Note* Area shares refer to 2019, value shares refer to 2012. Authors' own calculations

7%) and traffic area (approximately 5%) are far less significant. At barely 2.5%, the share of the total economically usable land area covered by water is roughly equal to that of recreational land, (undeveloped) space for industrial and commercial use and land for other uses combined.

As is well known, land is most valuable when it has been built-up or is designated for construction. Such land has considerably greater value than, for example, land that is covered by woods or that is used in agriculture. In 2012, agricultural land and woodland had a value of, on average, only 1.35 euros per square meter in Germany. By contrast, in the same year, the price of land used for residential buildings was 152.51 euros per m^2. Land used for residential buildings was thus 114 times more expensive than woodland or agricultural land. Land used for non-residential buildings cost, on average, 20.16 euros per square meter in 2012. This is equivalent to less than one-seventh of the value of land used for residential buildings.[2]

Figure 5.3 shows the difference between share of total land area and share of total value of land for the most important types of land use in Germany.[3] No less than 80% of Germany's total land area is covered by agricultural land and woodland; but their share in the total *value* of all land is only around 12%. By contrast, settlement area and traffic area together account for more than 87% of the total value of land in Germany, although they only represent about 9% of the total area. In terms of size, but, above all, in terms of value, land for other uses (e.g., recreational land and associated surface water) plays practically no role.

[2]The cited average prices for the various types of land use are each for one square meter of land and refer to 2012. The data is taken from Schmalwasser and Brede (2015, p. 54).
[3]Total land refers here to total economically usable land. So-called barren land [*Unland*] is not included.

Table 5.1 Value of land in Germany

	1999	2019	Change in value in relation to 1999	1999	2019
	Billions of euros		In %	In years of consumption	
Economy as a whole					
Total land	2,367.7	5,314.6	125.3	1.4	1.9
In particular built-up land	2,101.6	4,616.8	120.6	1.3	1.7
Private sector					
Total land	2,064.8	4,703.9	127.3	1.2	1.7
In particular built-up land	1,823.5	4,062.4	122.2	1.1	1.5

Sources Deutsche Bundesbank and Federal Statistical Office (2020), World Bank (2020). Authors' own calculations
Notes Consumption = Total consumption

As already discussed in Sect. 5.1.7, it is not only an increase in unit price (land price per hectare or square meter) that can give rise to increases in the value of land. Since the value of a parcel of land is heavily influenced by its use, an increase in the value of land can also be the result of the conversion of land from one use to another: for instance, agricultural land being converted into land for settlement. To illustrate this with a concrete example: From 2011 to 2012, the value of built-up land in Germany rose by 78.1 billion euros. This was due both to changes in price and changes in quantity. According to Schmalwasser and Brede (2015, p. 55), the increase in the value of built-up land was largely the result of the increase in land prices, which accounted for nearly four-fifths of the total increase in value. However, the remaining 22.6% of the rise in the value of land can be attributed to an increase in land for settlement and traffic, which was brought about, above all, by the conversion of agricultural land and woodland. Although the total supply of land has to be regarded as more-or-less fixed, this shows that (economically more valuable) land can certainly be obtained by converting existing land to new uses. Over time, such changes in land use can give rise to significant increases or losses in wealth.[4]

We now come back again to the evolution of the value of land in general and of built-up land in particular in Germany. From 2000 to 2019, the value of land rose in Germany by 123% (from 2359 billion euros to 5315 billion euros; cf. Table 5.1). The value of land in Germany thus increased from 1.4 times to 1.9 times the value of consumption.

The most important type of land use in terms of value is built-up land, representing nearly four-fifths of the total value of land. At 121%, the increase in value was somewhat less for built-up land than for land in general. Nonetheless, here too

[4]Change in socio-economic relations also brings about change in the value of the different types of land. According to Piketty and Zucman (2014), land used in agriculture accounted for more than half of total national wealth in Great Britain at the beginning of the eighteenth century. Today, its share is almost totally insignificant.

the growth was considerable. The value of built-up land increased from 1.3 times consumption in 1999 to 1.7 times in 2019.

With a share of 89%, most land in Germany is privately owned. In 2019, its value came to 4704 billion euros. According to the sectoral balance sheets of the Bundesbank and the Federal Statistical Office (Deutsche Bundesbank and Statistisches Bundesamt 2020), the value of privately owned land thus increased by 127% from 1999 to 2019. Private sector wealth invested in land grew by some two and a half trillion euros during this time.[5] Within the private sector, households and non-profit institutions predominate. In 2019, they owned land worth 3500 billion euros, representing two-thirds of the total value of land in Germany. Corporations accounted for about one-fifth of the value of land in 2019. The rest of the land, which is not privately owned, is public land. Its share in the total value of land fell from barely 13% in 1999 to around 11% in 2019.

Expressed in years of total consumption, in 2019, the German private sector as a whole owned land worth 1.7 times consumption. This is a considerable increase as compared to 1999, when the value of land represented only 1.2 times consumption. The value of built-up land also increased. At somewhat more than 1.5 times consumption (1999: 1.1 times), built-up land is, in value terms, the largest component of the land that is privately owned. The evolution that the value of land has undergone in the last 15 years or so in Germany represents a significant increase in the wealth of the private sector.[6] But as we will see in the following section, the growth of private wealth in land has (up to now) been relatively modest in Germany by comparison to the corresponding evolution in France.

5.2.3 Land as a Component of Real Assets: A Franco-German Comparison

Table 5.2 makes clear the growth in the value of land and its increasing importance as a component of all real assets. In 2000, land accounted for about one-quarter of total non-financial assets in the German economy as a whole. This share continually increased up to 2019, when it reached 31.7%. With an increase of nearly 120%, the value of land (here in the narrow sense) thus rose much more sharply than the value

[5]In the view of Baldenius et al. (2019, Footnote 3), the Federal Statistical Office's estimates of the value of real estate assets in Germany are “certainly” too low, “since the price index used does not match market data and deviates from the usual international methods of calculation.” According to their information, the Statistical Office itself also regards “an undervaluation as likely.” Consequently, the 4.7 trillion euros figure for the value of land in 2019 should also undoubtedly be regarded as the lower limit for any estimate.

[6]Land and the real estate situated on it are very unevenly distributed in Germany. According to Bundesbank data (Deutsche Bundesbank 2019, p. 27), only 44% of households own the dwelling in which they live. The first five deciles in the wealth distribution have almost no real estate assets (Krämer 2021). Hence, it can hardly be surprising that the recent increase in real estate prices in Germany has had appreciable distributive effects. According to the calculations of Baldenius et al. (2019), half of the increase in wealth brought about by the rise in real estate prices since 2011 has gone to the richest 10%.

Table 5.2 Value and percentage shares of land in all non-financial assets in Germany and France, 2000–2019

	2000		2005		2010		2015		2019	
	In years of consumption	In %	In years of consumption	In %	In years of consumption	In %	In years of consumption	In %	In years of consumption	In %
Germany										
Economy as a whole										
Total non-financial assets	5.7	100	5.7	100	5.9	100	6.2	100	6.7	100
In particular land	1.5	26.4	1.5	27.1	1.5	26.1	1.8	28.5	2.1	31.7
Private sector										
Total non-financial assets	4.9	100.0	4.9	100	5.1	100	5.6	100	5.8	100
In particular land	1.3	27.0	1.3	27.5	1.3	26.5	1.7	29.0	1.9	32.1
France										
Economy as a whole										
Total non-financial assets	5.3	100	7.7	100	8.3	100	8.0	100	8.7	100
In particular natural resources[a]	1.3	24.9	3.5	45.3	3.7	44.6	3.3	40.8	3.8	43.7
In particular mineral and energy reserves and other natural assets[b]	0.01	0.19	0.01	0.12	0.01	0.10	0.01	0.09	0.01	0.07
Private sector										
Total non-financial assets	4.4	100	6.6	100	7.1	100	6.9	100	7.5	100
In particular land	1.1	25.6	3.1	46.0	3.2	45.1	2.8	41.1	3.3	44.0

Sources OECD (2020); World Bank (2020); Deutsche Bundesbank and Federal Statistical Office (2020), Authors' own calculations
Notes: [a]Land and other natural resources (mineral and energy reserves, non-cultivated biological resources, water resources, etc.)
[b]Mineral and energy reserves and other natural assets (non-cultivated biological resources, water resources, etc.)
Consumption = Total consumption

of all non-financial assets, which merely increased by some 81% during the same period.

Expressed in years of total consumption, the value of non-financial assets, which was equivalent to 5.7 years of consumption in 2000, came to 6.7 years of consumption by 2019. The growth in the value of land, one of the most important components of real assets in value terms, significantly contributed to this increase. The value of land rose from 1.5 years of consumption in 2000 to 2.1 years of consumption in 2019.

If we turn now to the private sector, we can observe that the importance of land as an asset in relation to all non-financial assets is somewhat greater in the private sector than in the economy as a whole. The share represented by land in all non-financial assets also grew considerably in the private sector between 2000 and 2019: increasing from 27 to 32.1%. As a result, the value of privately owned land increased from 132% of consumption to 187% in 2019.

France is one of the few countries whose official statistics also cover mineral and energy reserves and other natural assets and that hence can provide data for all natural resources (i.e., for land in the narrow sense plus mineral and energy reserves and other natural assets). If we compare Germany and France, it is striking that the growth in the value of natural resources in France from 2000 to 2019 is considerably greater than the growth in the value of land in Germany. As shown in Table 5.2, the value of all natural resources in the French economy—99% of which is contributed by the value of land—increased from 1.3 times consumption in 2000 to 3.8 times in 2019. This is equivalent to an increase of around 192%. In the same period, all non-financial assets as measured in yearly consumption only increased by around 66%.

As can be seen, the French figures are significantly higher than the corresponding German numbers. This has nothing to do with the fact that the official French statistics also cover mineral and energy reserves and other natural assets, since the value of the latter is too low to make a significant difference. From the point of view of the economy as a whole, the value of mineral and energy reserves and other natural assets in France is minimal, amounting to barely 12 billion euros or 0.01 years of consumption. In the period under consideration, moreover, this value remained practically unchanged.[7] On the other hand, the higher real estate price level in France provides a clue to what is presumably the main source of the increase in value recorded in the French statistics.[8] It is safe to assume that not only total real estate prices, but also the prices, in particular, of land have risen far more

[7]At around 11 billion euros, the value of other natural assets in France is estimated to have been somewhat higher in 2015 than that of mineral and energy reserves, for which a value of only 658 million euros is shown (OECD 2019).

[8]Lower house prices in Germany as compared to France and other countries like Great Britain is often attributed to relatively low demand for owner-occupied homes and condominiums and the large number of inexpensive houses that were added to German supply after reunification in 1989 (cf. van de Ven and Fano 2017, p. 411).

sharply in France than in Germany in recent decades.[9] If we compare German and French land values in 2000, we see that at 1.5 times annual consumption, the German figure was still higher than the French Fig. 1.3 at the time. Subsequently, in the last one-and-a-half decades, land values have undergone far more rapid increase in France than in Germany. This can also be noted for the French as compared to the German private sector. In 2000, the value of privately owned land in France was only 110% of consumption. By 2019, this figure had risen to 330% of consumption. The share of land in total non-financial assets increased accordingly: from 25% in 2000 to around 44% in 2019.

A considerable part of the increase in private wealth that took place in France in recent years can be attributed to the evolution of the value of land. Strong growth in the value of privately owned land also occurred in some other countries; but this does not apply to the same extent for all countries (Homburg 2015; Piketty 2014; Piketty and Zucman 2014; van de Ven 2017).

5.2.4 The Value of Privately Owned Land

We now turn to the calculation of the value of privately owned land in the OECD plus China region. In order to preserve comparability to the other types of assets we are considering, viz., real capital and public debt, in what follows, we calculate the value of privately-owned land in 2015. We can use data from Eurostat (2019) and the OECD (2019) to determine the value of privately owned land in the countries of the OECD plus China region. Data on the value of land is available for 26 countries from this region, of which data for 23 of them comes from the OECD or Eurostat. The latter countries are: Australia, Belgium, Denmark, Germany, Estonia, Finland, France, Greece, Great Britain, Ireland, Italy, Japan, Canada, Luxembourg, Mexico, the Netherlands, Norway, Austria, Poland, Sweden, Slovakia, South Korea and the Czech Republic. For the USA, we rely on calculations done by the Bureau of Economic Analysis (Larson 2015). We also have data for China and Spain, which we have taken from the WID.world database.[10] No data on land is available for nine, mostly smaller, OECD countries. Nonetheless, with the data from the above-mentioned countries, we have enough data to be able roughly to estimate the value of land in the whole OECD plus China region. The 26 countries for which data is available accounted, after all, for around 93% of the total consumption of all the countries of the OECD plus China region in 2015.

Columns A to C in Table 5.3 show the value of land in 2015 in the respective local currency. Only some of the countries—namely, Australia, France, Japan, Canada, Mexico, South Korea and the Czech Republic—provide data on all natural

[9]Land prices in fact fluctuate more than house prices, which are principally determined by production costs. In many countries, their tendency is also to rise more rapidly than house prices. In Great Britain, for example, house prices have approximately doubled since the beginning of the 1990s, whereas land prices have increased around sixfold (Ryan-Collins 2017, p. 8).

[10]The figure for China comes from a study on wealth and its distribution in the People's Republic of China by Piketty et al. (2017) and was included in the WID.world database.

Table 5.3 Privately owned land in the OECD plus China region, 2015

Country	*A*	*B*	*C*	*D*	*E = C / G*	*F = D / G*	*G*	*H = E / F*
	Land economy as a whole	Public land	Private land[d]	Total consumption	Land	Total consumption	Conversion factor	Private sector land
	Billions LCU	Billions LCU	Billions LCU	Billions LCU	Billions Int'l $	Billions Int'l $	LCU in Int'l $	In years of consumption
Australia[a, c]	5,799.0	986.0	4,813.0	1,222.2	3,265.1	829.1	1.5	3.94
Austria	554.8	63.3	491.4	249.4	615.4	312.3	0.8	1.97
Belgium	…	…	851.3	308.1	1,064.4	385.2	0.8	2.76
Canada[a, c]	4,014.5	253.8	3,760.7	1,562.6	3,013.4	1,252.1	1.2	2.41
Chile	…	…	…	…	…	…	…	…
Czech Republic[c]	9,508.2	7,518.3	1,989.9	3,035.3	153.8	234.7	12.9	0.66
Denmark	…	…	1,491.6	1,478.0	204.2	202.4	7.3	1.01
Estonia	54.1	5.3	48.8	14.7	90.8	27.4	0.5	3.32
Finland	195.3	36.4	158.9	167.1	175.1	184.1	0.9	0.95
France[c]	5,613.0	745.4	4,867.6	1,711.6	6,020.7	2,117.0	0.8	2.84
Germany	3,835.7	427.7	3,408.1	2,218.3	4,381.1	2,851.6	0.8	1.54
Greece[a]	…	…	269.2	159.1	442.1	261.2	0.6	1.69
Hungary	…	…	…	…	…	…	…	…
Iceland	…	…	…	…	…	…	…	…
Ireland	…	…	217.7	119.2	55.5	30.4	3.9	1.83
Israel	…	…	…	…	…	…	…	…
Italy	…	…	3,421.9	1,318.3	4,633.6	1,785.2	0.7	2.60
Japan[a, c]	1,157,359.8	115,761.5	1,041,598.3	406,507.6	10,068.6	3,929.5	103.4	2.56
Korea[a, c]	6,614,467.3	1,739,147.7	4,875,319.6	1,006,005.6	5,686.4	1,173.4	857.4	4.85
Luxembourg	…	…	113.0	24.6	128.3	27.9	0.9	4.60
Mexico[a, c]	32,762.8	14,401.2	18,361.5	14,450.4	2,205.4	1,735.6	8.3	1.27
Netherlands	982.3	31.1	951.3	483.2	1,174.8	596.7	0.8	1.97
New Zealand	…	…	…	…	…	…	…	…

(continued)

Table 5.3 (continued)

Country	*A*	*B*	*C*	*D*	*E = C / G*	*F = D / G*	*G*	*H = E / F*
	Land economy as a whole	Public land	Private land[d]	Total consumption	Land	Total consumption	Conversion factor	Private sector land
	Billions LCU	Billions LCU	Billions LCU	Billions LCU	Billions Int'l $	Billions Int'l $	LCU in Int'l $	In years of consumption
Norway[f]	…	…	2,901.2	2,083.0	292.2	209.8	9.9	1.39
Poland	…	…	695.4	1,376.2	394.1	779.9	1.8	0.51
Portugal	…	…	…	…	…	…	…	…
Slovak Republic	71.6	20.5	51.1	58.5	104.0	119.1	0.5	0.87
Slovenia	…	…	…	…	…	…	…	…
Spain[b]	…	…	2,703.6	834.9	4,068.3	1,256.4	0.7	3.24
Sweden[c]	6,557.0	763.1	5,793.9	2,975.7	654.5	336.2	8.9	1.95
Switzerland	…	…	…	…	…	…	…	…
Turkey	…	…	…	…	…	…	…	…
United Kingdom[c]	4,681.7	158.7	4,522.9	1,596.5	6,532.6	2,305.9	0.7	2.83
United States[e]	22,982.0	1838.6	21,143.4	14,907.2	21,143.4	14,907.2	1.0	1.42
China[b]	…	…	58,700.4	36,226.7	16,929.2	10,447.8	3.5	1.62
Total OECD					76,567.6	37,850.0		2.02
Total OECD plus China					93,496.8	48,297.8		1.94

Notes Unless otherwise indicated, the original data comes from Eurostat (2019)
[a]Data from OECD (2019)
[b]Data from WID.world (2019)
[c]Land and other natural resources (mineral and energy reserves, non-cultivated biological resources, water resources, etc.)
[d]Belgium, Denmark, Ireland, Italy, Luxembourg, Canada, Norway, Poland: only households and non-profit institutions
[e]2009. Lower 48 states. Data from Larson (2015)
[f]2014
Authors' own calculations
Sources Columns A-C Eurostat (2019). Balance sheets for non-financial assets; OECD (2019): Dataset 9B, Balance sheets for non-financial assets; WID.world (2019); cf. notes
Column D World Bank (2019). World Development Indicators, Final consumption expenditure (current LCU)
Column G World Bank (2019). World Development Indicators, PPP conversion factor (GDP) (LCU per international $)
LCU: Local currency unit

resources: i.e., not only land, but also mineral and energy reserves and other natural assets.[11] For some of the countries, data is only available on the land owned by households. This is the case for Belgium, Denmark, Ireland, Italy, Luxembourg, Canada, Norway and Poland.[12] Where additional data is available, we are also able, in columns A and B respectively, to provide data on the value of land in the economy as a whole and land that is publicly owned. The individual national figures for land belonging to the private sector can be found in column C in the respective local currency. Column D contains data on total consumption (the sum of private and public consumption) in the respective local currency. Column E and column F show the value of land and total consumption in purchasing-power-adjusted international dollars. The conversion rates used come from the World Bank.

Finally, column H shows the value of privately owned land in each of the individual countries, as expressed in years of consumption. As can be seen, the total value of privately owned land varies greatly from country to country. The lowest figures are found for three Eastern European countries: namely, Poland, the Czech Republic and Slovakia, where private land assets represent 51, 66 and 87% of their respective annual consumption. South Korea and Luxembourg have the highest figures for privately owned land assets, at more than four times their respective annual consumption. At more than three times the value of their consumption, Australia, Estonia and Sweden also have a relatively large amount of private land assets by international standards. On average, the value of land in the OECD countries is *twice annual consumption*. If we add China, we obtain average private land assets for the OECD plus China region of 194% of consumption.

At 1.54 times and 1.42 times their annual consumption respectively, Germany and the USA are below the average for the OECD countries, whereas European countries like France and Great Britain are above it. We can assume that the clear difference between France and the UK, on the one hand, and Germany and the USA, on the other, is due to the fact that house and land prices are lower in Germany and the USA than in France and Great Britain. Whereas in Germany, the lingering consequences of both the Second World War and the country's roughly 40-year-long division into East and West Germany are responsible for these low prices, land assets in the USA were always relatively low by international standards due to the abundance of land available (Piketty 2014; van de Ven 2017, p. 211). In addition, German economic activity is regionally more broadly distributed than economic activity in France and Great Britain, where the overall value of land is especially heavily influenced by the greater metropolitan areas of Paris and London, respectively.

[11] In Australia's case, the value of mineral and energy reserves and other natural assets in 2015 was quite considerable, accounting for 11% of all natural resources.

[12] For the USA as well, the OECD only provides data on the value of land owned by households. Hence, we draw on a study in which the value of all land and the value of land owned by the US federal government is calculated for the period 2000–2009. In the value of land for 2009, we are using the last number from a period that was heavily marked by the formation and bursting of the last real estate bubble in the USA. The value of land in 2009 roughly corresponds to the average for the period (Larson 2015, Fig. 3).

To sum up:

Our calculations for 2015 show that the private wealth invested in land is equivalent to 1.94 times total consumption in the countries of the OECD plus China region.

We are presumably more likely to be underestimating the actual figure here than overestimating it. We can cite the following three reasons in support of this supposition. Firstly, less than one-third of the countries of the OECD plus China region collect data on their mineral and energy reserves and their other natural assets.[13] Secondly, around one-quarter of the countries only provide the value of land owned by households and non-profit institutions. Land belonging to firms is thus not included in the statistics. The value that is thus missing from the statistics should not be negligible.[14] And, thirdly, for the USA, which has great significance for the region as a whole, we can only provide a figure for 2009. We can assume that land prices have risen again since the end of the great recession. Hence, it is highly probable that the value of land in the USA is somewhat greater than the 142% of US total consumption that we determined for 2009. Finally, there are also general data collection and valuation problems in determining the value of natural resources (including land), which could lead most statistical offices in our region to tend to understate their value (Schmalwasser and Müller 2009; Schmalwasser and Weber 2012).

As already discussed above, a certain degree of error in estimating the value of land would not be all that problematic, because privately owned land is largely passed on debt-free to heirs, along with the real estate on it. This is to say that an erroneous estimate of land assets would entail an erroneous estimate of the assets that are supposed to be reserved as an inheritance and that are not intended for consumption in old age. Hence, an erroneous estimate of land assets would not have a major impact on calculating the wealth required for retirement planning.

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[13]However, the impact of this underreporting presumably only concerns private wealth to a small extent. We can draw this conclusion based on the OECD countries that do report data on mineral and energy reserves and other natural assets, since by far the greater part of the latter are assigned to the public sector.

[14]In Germany, for example, land owned by financial and non-financial corporations accounts for 20% of the value of all domestic land.

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