PART 1

WEALTH ACCOUNTING

Chapter 1

Introduction: The Millennium Capital Assessment

Can poverty reduction be sustained? The end of the 20th century saw a renewed commitment to ending poverty embodied in the Millennium Development Goals. However, deep concerns remained that current rates of depletion and degradation of natural resources may undermine any progress achieved. Achieving sustainable outcomes will require sustaining the total wealth—produced, human, natural—on which development depends.

Building on several years of effort, including *Expanding the Measure of Wealth* (World Bank 1997), this volume assesses the wealth of the planet in the year 2000. In speaking of *wealth* we are returning to the ideas of the classical economists, who viewed land, labor, and produced capital as the primary factors of production. The chapters that follow detail the levels and changes in these different productive factors across the developing and the developed worlds.

This volume represents the most recent achievement in a long-term program to estimate wealth and its components for a large set of countries. It improves the work in *Expanding the Measure of Wealth* by extending country coverage and by basing the estimation of produced capital and natural capital on a broader set of data. Details on the estimation procedure are provided in appendix 1, while box 1.1 gives a basic exposition of the theory underlying this book.

The composition of wealth varies considerably by region and particularly by level of income. While this disparity may be obvious in comparing a mental image of, say, Malawi and Sweden, subsequent chapters measure this variation rigorously by providing figures for nearly 120 countries on the per capita values of agricultural land, minerals, forests, produced

assets, and an aggregate[1] termed *intangible capital*. Intangible capital includes raw labor, human capital, social capital, and other factors such as the quality of institutions. Tables 1.1 and 1.2[2] present the big picture on the composition and levels of wealth per capita by income group and for the world as a whole.[3]

Table 1.1 Total Wealth, 2000

— $ per capita and percentage shares —

Income group	Natural capital	Produced capital	Intangible capital	Total wealth	Natural capital share	Produced capital share	Intangible capital share
Low-income countries	1,925	1,174	4,434	7,532	26%	16%	59%
Middle-income countries	3,496	5,347	18,773	27,616	13%	19%	68%
High-income OECD countries	9,531	76,193	353,339	439,063	2%	17%	80%
World	4,011	16,850	74,998	95,860	4%	18%	78%

Source: Authors.
Notes: All dollars at nominal exchange rates. Oil states are excluded. OECD: Organisation for Economic Co-operation and Development

Table 1.2 Natural Capital, 2000

— $ per capita —

Income group	Subsoil assets	Timber resources	NTFR	Protected Areas	Cropland	Pastureland	Total natural capital
Low-income countries	325	109	48	111	1,143	189	1,925
Middle-income countries	1,089	169	120	129	1,583	407	3,496
High-income countries (OECD)	3,825	747	183	1,215	2,008	1,552	9,531
World	1,302	252	104	322	1,496	536	4,011

Source: Authors.
Notes: NTFR: Nontimber forest resources. Oil states are excluded.

If development is approached as a process of portfolio management, then the figures make clear that both the size and composition of the portfolio vary hugely across levels of income. Managing each component of the portfolio well and transforming one form of asset into another most efficiently are key facets of development policy.

Changes in real wealth determine future prospects for well-being. Accordingly, an important element of the analysis that follows is the measurement of *adjusted net* or *genuine* saving. Estimated saving rates for over 140 countries show that rates of wealth accumulation are much higher in proportion to gross national income (GNI) in rich countries than in poor countries. This is particularly the case when population growth is factored into the analysis. Evidence suggests that higher natural resource dependence coincides with lower genuine saving rates. Chapters 3 and 5 detail these results.

While the analysis of wealth sheds light on sustainability, it is also directly relevant to the question of growth. Growth is essential if the poorest countries are to enjoy increases in well-being. However, growth will be illusory if it consists primarily of consuming the assets, such as soil nutrients, that underpin the economy.

The linkage between measured changes in real wealth and future well-being only holds if our measures of wealth are suitably comprehensive. This is the prime motivation for expanding the measure of wealth to include a range of natural and intangible capital. This richer picture of the asset base also opens the door to a range of policy interventions that can increase and sustain growth.

Where Is the Wealth of Nations?

The total wealth estimates reported here are built upon a combination of top-down and bottom-up approaches. These are presented briefly in the next chapter and detailed in appendix 1. Total wealth, in line with economic theory, is estimated as the present value of future consumption. Produced capital stocks are derived from historical investment data using a perpetual inventory model (PIM).[4] Natural resource stock values are based upon country-level data on physical stocks, and estimates of natural

resource rents are based on world prices and local costs. Intangible capital then is measured as the difference between total wealth and the other produced and natural stocks.

While table 1.1 reports an average global wealth per capita of roughly $96,000, this average clearly masks huge variety. The results by income group are more informative.

Total wealth per capita clearly varies significantly between developed and developing countries.[5] Beyond these large ratios are three other facts displayed in table 1.1:

- The share of produced assets in total wealth is virtually constant across income groups.
- The share of natural capital in total wealth tends to fall with income, while the share of intangible capital rises.
- The value of natural capital per capita is substantially higher in rich countries than in poor, while the share of wealth is much lower.

The wealth estimates suggest that the preponderant form of wealth is intangible capital, an expected result and an insight that goes back at least to Adam Smith.[6] A huge variation in intangible capital per capita occurs across income levels. Taking the ratio of intangible capital to produced capital offers a different insight: this ratio varies from 3.8 in low-income countries to 3.5 in middle-income and 4.6 in high-income—a rather small variation. This suggests that over the course of economic development intangible capital and produced capital are accumulated roughly in the same proportion, with a tendency toward produced capital intensiveness at middle-income levels and intangible capital intensiveness at high-income levels.

Does the 2 percent share of natural capital in total wealth for high-income countries mean that natural resources are somehow unimportant in these countries? Table 1.2 suggests not. Per capita values of each of the natural resource categories—subsoil assets, timber and nontimber resources, protected areas, and agricultural land—are higher in rich countries than in poor. What the low natural-capital share suggests is that the development process primarily entails growth in the modern sectors of manufacturing and services, while the primary sectors are relatively static. The estimates of natural wealth presented in this book are also limited by

data—for example, fish stocks are not measured in the estimates, while the environmental services that underpin human societies and economies are not measured explicitly.

Natural Resources and Development

Natural resources are special economic goods because they are not produced. As a consequence, natural resources will yield economic profits—rents—if properly managed. These rents can be an important source of development finance, and countries like Botswana and Malaysia have successfully leveraged natural resources in this way.

There are no sustainable diamond mines, but there are sustainable diamond-mining countries. Implicit in this statement is the assumption that it is possible to transform one form of wealth—diamonds in the ground—into other forms of wealth, such as buildings, machines, and human capital. Achieving this transformation requires a set of institutions capable of managing the natural resource, collecting resource rents, and directing these rents into profitable investments. Resource policy, fiscal policy, political factors, institutions, and governance structure all have a role to play in this transformation.

Exhaustible resources, once discovered, can only be depleted. Consuming rents from exhaustible resources is, therefore, literally consuming capital, which motivates the Hartwick policy rule for sustaining development—invest resource rents in other forms of capital.

Living resources are unique because they are a potentially sustainable source of resource rents—truly a gift of nature. Sustainable management of these resources will be the optimal policy, but the question of the optimal stock size is complex. For example, clearing forest land for agriculture will be optimal up to the point where the land rent on the marginal cleared hectare is just equal to the total economic value of the standing forest.[7]

Land resources are potentially sustainable if managed well. Land is particularly important in the poorest countries because it is a direct source of livelihood and sustenance for many poor households. As table 1.2 shows, cropland and pastureland make up 70 percent of natural wealth in low-income countries and 18 percent of total wealth.

Natural resources play two basic roles in development:

- The first, mostly applicable to the poorest countries and poorest communities, is the role of local natural resources as the basis of subsistence.
- The second is as a source of development finance. Commercial natural resources can be important sources of profit and foreign exchange. Rents on exhaustible, renewable, and potentially sustainable resources can be used to finance investments in other forms of wealth. In the case of exhaustible resources these rents *must* be invested if total wealth is not to decline.

While the preceding discussion has focused on natural *goods,* chapter 3 will also show the importance of measuring environmental *bads* in the form of marginal damages from local and global air pollutants. Pollution, which does not appear directly in the wealth stock estimates, is included implicitly in the form of lowered labor productivity linked to ill health. This depresses income generation, limiting consumption, and accordingly, total wealth.

From a development perspective a key message from table 1.1 is that natural resources make up a very significant share of the total wealth in low-income countries—26 percent—and that this is substantially larger than the share of produced capital. Sound management of these natural resources can support and sustain the welfare of poor countries, and poor people in poor countries, as they move up the development ladder.

Policies and Institutions

A major focus in this analysis is on placing economic values on stocks of natural resources and changes in the values of these stocks. This information is used to illuminate the role that natural resources play in development, particularly in poor countries. The analysis suggests that changes in natural resource management are needed to increase economic benefits, and the need for these changes will lead to reforms of policies and institutions.

From an economic perspective, inefficiencies in resource exploitation can potentially take the form of under- or overexploitation. In practice, incentives for resource management generally encourage excess exploitation, which will depress genuine saving relative to its level under efficient exploitation. Reforming resource management practices can play a significant role in boosting saving levels in highly resource-dependent economies.

Extensive literature exists on policies and institutions for natural resource management, dealing with the very different problems of open- or common-access, exploiting exhaustible resources such as minerals and energy, and managing living resources such as forests and fish. This literature thoroughly explores the roles that different types of policy instruments, property rights, and institutional structures can play in ensuring efficient resource management. This study will not attempt to summarize or add significantly to this literature.

However, an important set of institutions—ministries of finance and treasury—often overlooks the analysis of natural resource issues. The fiscal policy implications of natural resource management in developing countries will be explored below.

Saving and Investment

Saving is a core aspect of development. Without the creation of a surplus for investment, there is no way for countries to escape a state of low-level subsistence.

Adjusted net or genuine saving measures the true level of saving in a country after accounting for depreciation of produced capital; investments in human capital (as measured by education expenditures); depletion of minerals, energy, and forests; and damages from local and global air pollutants. Economic theory suggests that current net saving should equal the change in future welfare, specifically the present value of future changes in consumption (Hamilton and Hartwick 2005).

Resource dependence complicates the measurement of saving effort because a depletion of natural resources often occurs but is not visible in standard national accounts. As will be seen in chapter 3, the dissaving associated with resource depletion is a particular problem in low-income countries.

The saving tests using historical data reported in chapter 6 suggest that a particular variant of genuine saving—one that excludes education expenditures, damage from carbon dioxide emissions, and the immiserating effects of population growth—is a good predictor of future changes in welfare. Genuine saving is therefore an important indicator to guide development policy.

Saving in Developed and Developing Countries

The analysis in chapter 6 includes a further key result: When the sample of countries is limited to high-income countries, there is no apparent empirical relationship between current net saving and future welfare. This raises an important distinction between developed and developing countries. It says quite clearly that asset accumulation, the apparent driver of future welfare when all countries are tested, is not a significant factor in rich countries. This result makes eminent sense—in the richest countries it is clear that technological change, institutional innovation, learning by doing, and efficient institutions, to name a few factors, are fundamental drivers of growth.

It is in developing countries, therefore, where genuine saving is most likely to be a useful indicator to guide policy. As chapters 3 and 5 will show, the poorest countries have the lowest genuine saving rates. The tests of genuine saving suggest that investments in produced capital, combined with saving efforts aimed at offsetting the depletion of natural resources, can lead to future welfare increases in developing countries.

Finally, the step from saving to investment is crucially important. If investments are not profitable, the effect on wealth is equivalent to consumption, but without the boost to well-being presumed to accompany consumption.

Fiscal Policy and Comprehensive Wealth

Expanding the measure of wealth to include natural resources raises an important set of fiscal issues concerning revenues, expenditures, fiscal space, boom-and-bust cycles, and the quasi-fiscal impact of state-owned enterprises (SOEs). Dealing with these issues will not likely turn finance

ministers into environmentalists, but a sharper focus on the fiscal aspects of natural resources can have a substantial impact on macrobalances and economic performance in many countries.

Revenue issues with respect to commercial natural resources are well understood. The government, as the owner of the resource, should be taxing natural resource rents to the point where the private sector is just willing to risk capital in natural resource exploitation. This applies equally to minerals, forests, and fisheries. For forests and fisheries there is the additional concern with sustainability: if sectoral policies encourage overexploitation of the resource, then fiscal revenues from the sector may not be sustained. Finally, there is the issue of rent capture from foreign tourists. If a country's natural resources attract foreign tourists, then taxes on entry and hotels are important instruments for resource rent capture.

For government *expenditures* major questions revolve around the use of resource revenues. In principle, the government should seek to reinvest royalties on exhaustible resources in other assets—thereby maintaining the total wealth of the nation. The caveat to this basic rule is that public investments must be profitable. The issue of profitability may raise questions of absorptive capacity—the capacity of governments to make productive investments—which is typically constrained by the availability of factors such as skilled labor and infrastructure. Countries with significant debts have the option of investing resource rents in debt reduction. Whether this is a good investment depends on the social returns to the best alternative project. In addition, certain types of development expenditures, for example, on national parks, may not appear to be particularly profitable from the treasury's viewpoint; a broader view, though, may suggest that investments in parks will increase tourist sector growth and increase fiscal revenues from tourists.

The phenomenon of *fiscal boom-and-bust* is common for many resource exporters where government revenues are highly dependent on resource royalties. *Easy money* in the form of resource revenues tempts governments to increase consumption expenditures when commodity prices are buoyant. These expenditures are often difficult to rein in when the inevitable commodity bust arrives, leading to major fiscal imbalances. Generally, investing resource rents requires a system to help governments stabilize resource revenues, as well as instruments, such as medium-term expenditure frameworks, to control expenditures.

Comprehensive wealth accounts offer new insights into the question of *fiscal space,* that is, the ability of the government to increase expenditure without jeopardizing its ability to service its debt. Generally, the measure of a government's change in fiscal stance is the change in its net worth. This suggests that tax revenues from exhaustible resources do not fully increase fiscal space because a portion of these taxes represents the consumption of natural capital. While the news that fiscal space is not as large as conventionally measured will not be welcomed by most treasuries, prudent governments will heed the bad news.

SOEs are common in the resource sectors and present *quasi-fiscal* risks of their own. The low efficiency of these enterprises may lead to the growth of liabilities. If the enterprises are off-budget, then these contingent fiscal liabilities are typically not factored into the government's fiscal stance. If the enterprises are on-budget, then they often do not have retained earnings out of which to finance capital expenditures; the result is that the investment needs of the SOE become part of the government development budget. In this case there is a risk of undercapitalization of SOEs.

Botswana provides an example of sound management of many of these fiscal issues with respect to its diamond wealth. The treasury calculates a sustainable budget index to determine whether consumption expenditures are being financed out of resource rents and adjusts expenditures accordingly. It also holds diamond revenues offshore in order to deal with issues of absorptive capacity, revenue stabilization, and Dutch disease effects from currency appreciation.

Investing in the Intangible Capital Residual

From a policy perspective a potential problem may arise with calculating such a large intangible capital residual. Since the residual necessarily includes a wide array of less-tangible assets—for example, raw labor, human capital, social capital, or quality of institutions—it raises the question of whether virtually *any* component of public spending could be considered to be a type of investment. To explore this question using cross-sectional data, chapter 7 estimates the major factors contributing to the intangible capital residual, and tables 1.3 and 1.4 present some key results.

Table 1.3 Factors Explaining the Intangible Capital Residual

Factor	Elasticity		
School years per capita	0.53	R-squared	0.89
Rule of law index	0.83		
Remittances per capita	0.12		

Source: Authors.
Note: Coefficients are significant at the 5 percent level.

Table 1.4 Marginal Returns to Different Factors

Income group	School years per capita	Rule of law index	Remittances per capita
Low-income countries	838	111	29
Middle-income countries	1,954	404	39
High-income countries (OECD)	16,430	2,973	306

Source: Authors.
Note: Figures represent the increase in the intangible capital residual associated with a 1-unit increase in the given factor.

Any model of the intangible residual must include only factors that are not already captured in the value of produced capital and natural resources, since these have been subtracted from total wealth in order to calculate the residual. Table 1.3 shows that three such factors—average years of schooling per capita, rule of law, and remittances received per capita—explain 89 percent of the total variation in the residual across countries.

Policy makers, therefore, can be reasonably confident that investments in education and the justice system, as well as policies aimed at attracting remittances, are the most important means of increasing the intangible-capital component of total wealth. The elasticities reported in table 1.3 show that, on average, for all countries a 1 percent increase in rule of law pays large dividends, boosting intangible capital by 0.83 percent; 1 percent increases in the stock of schooling or remittances per capita will increase intangible capital by 0.53 percent and 0.12 percent, respectively.

Table 1.4 reports the marginal returns, measured at the mean, to unit increases in the three factors for each level of income. Increasing the

average stock of schooling by one year per person increases total wealth per capita by nearly $840 in low-income countries; nearly $2,000 in middle-income countries; and over $16,000 in high-income countries. The wide range reflects the *gearing* effect of having larger stocks of produced capital at higher-income levels, as well as the use of nominal exchange rates. A one-point increase in the rule of law index (on a 100-point scale) boosts total wealth by over $100 in low-income countries, over $400 in middle-income countries, and nearly $3,000 in high-income countries.

Setting aside the smallest factor, remittances, it is worth considering how finance ministries can invest in the factors explaining the intangible capital aggregate. Education expenditure can obviously play a role, but these expenditures have to be effective in actually creating human capital. Investing in rule of law is clearly complex. Issues of judicial salaries, for example, can be important. However, the larger problem is building trusted, competent legal institutions, thereby creating confidence in the minds of citizens and entrepreneurs that their rights will be protected. The returns to doing so, reported in chapter 7, are potentially very large.

Conclusions

The notion of development as portfolio management is powerful. Certain assets in the portfolio are exhaustible and can only be transformed into other productive assets, such as infrastructure or human capital, through investment of the resource rents. Other assets are renewable and can yield sustainable income streams. Economic analysis can guide decisions concerning the optimal size of these assets in the portfolio. Some assets, such as produced capital, depreciate over time. National savings can be used to invest in natural assets, produced capital, or human capital. The choice of investment will depend on the asset with the highest marginal return on investment, a standard tenet of public finance.

Each year from 10 to 20 developing countries have negative genuine saving rates. What should the policy response be? Monetary and fiscal policies affect saving behavior, and public sector dissaving can be a key target of policy. If investment in human capital is measured as saving, then efforts to increase effective education expenditures can boost overall

saving. For natural resources the general prescription is not to simply reduce exploitation, but rather to reduce incentives for overexploitation, which will typically entail reforms in the resource sectors.

The evidence presented in subsequent chapters shows that low or negative saving is primarily an issue in low-income countries and some resource-dependent middle-income countries. For resource-dependent middle-income countries, negative saving is almost always a reflection of excessive government consumption expenditure. Conversely, for the poorest countries a prescription to boost saving by reducing consumption is clearly unpalatable. A better policy response is to boost the productivity of all assets, including resource assets, in these countries through policy and institutional reforms, leading to a cycle of rising consumption and saving.

BOX 1.1 The Theory of Wealth, Welfare, and Sustainable Development

Wealth, welfare, and sustainability are closely interlinked. Pezzey (1989) suggested a straightforward definition of sustainability: a development path is sustainable if utility does not decline at any point along the path. Dasgupta (2001) offers a more general definition: a development path is sustainable if *social welfare* does not decline at any point along the path. Social welfare is in turn defined to be the present value of utility along the development path—it is a measure of intertemporal wellbeing.

While a useful concept, utility is not directly observable. This raises a measurement challenge: can we define an index of measurable quantities that can be shown to be related to social welfare? The suggestion that *total wealth* can provide such a measure is presented in Samuelson (1961): "…the only valid approximation to a measure of welfare comes from computing *wealth-like* magnitudes not income magnitudes." According to Samuelson, the work of Irving Fisher (1906) pointed the way: current wealth should equal the present value of future consumption. Hamilton and Hartwick (2005) show that the sum of the values of a heterogeneous set of assets (total wealth) is equal to the present value of future consumption. These notions of wealth and welfare underpin the basic calculation of total wealth in this book.

It follows that if total wealth is related to social welfare, then changes in wealth should have implications for sustainability—this is the basic intuition of Pearce

and Atkinson (1993). For optimal economies, economies where a planner can enforce the maximization of social welfare, a number of results have made the link explicit (it is implicit in Weitzman [1976], but not derived). Aronsson and others (1997, equation 6.18) show that net saving in utility units is equal to the present value of changes in utility, using a time-varying pure rate of time preference. Hamilton and Clemens (1999) show that net or 'genuine' saving adjusted for resource depletion, stock pollutant damages, and human capital accumulation is equal to the change in social welfare measured in dollars; they also establish that negative genuine saving implies that future utility must be less than current utility over some interval of time. This motivates the focus on savings in chapter 3 below.

These results depend on the assumption that governments maximize social welfare. Dasgupta and Mäler (2000) show that net investment is equal to the change in social welfare in a nonoptimizing framework where a resource allocation mechanism is used to specify the mapping from initial capital stocks to future stocks and flows in the economy. This result depends on accounting prices for assets being defined as the marginal changes in social welfare resulting from an increment in each asset (that is, accounting prices are the partial derivatives of the social welfare function). Arrow and others (2003a) explore the accounting issues under a variety of resource allocation mechanisms.

In this book resource stocks and resource depletion are valued using world prices and local costs of extraction and harvest. The use of border prices is consistent with how projects would be evaluated using social cost-benefit analysis, but it is not explicitly linked either to assumptions about optimality or to any specific resource allocation mechanism as in Dasgupta and Mäler (2000).

Hartwick (1977) provided the canonical rule for sustainability in resource-dependent economies–if genuine saving is set equal to zero at each point in time (that is, traditional net saving just equals resource depletion), then consumption can be maintained indefinitely, even in the face of finite resources and fixed technology. Hamilton and others (forthcoming) show that this can be generalized to a rule with constant positive genuine saving; such a rule will yield unbounded consumption. Chapter 4 calculates countries' produced capital stocks under the alternative Hartwick rules during 1970–2000; these calculations are then compared with actual year 2000 capital stocks.

If population grows over time, as in virtually all developing countries, then changes in total wealth should take into account the change in population. Dasgupta (2001) shows that wealth per capita is the correct measure of social

welfare if certain conditions are met: (i) population grows at a constant rate; (ii) per capita consumption is independent of population size; and (iii) production exhibits constant returns to scale. This book calculates wealth per capita as the measure of social well-being under these assumptions, as do Arrow and others (2004). The measure of the change in wealth per capita derived in chapter 5 below includes a specific adjustment for the immiserating effects of population growth. Arrow and others (2003b) identify the correct welfare index in more general situations.

Finally, the result linking net saving to changes in social welfare in Aronsson and others (1997) can be extended to show that current saving equals the present value of changes in consumption in an optimizing economy. Dasgupta (2001) shows that the same is true in nonoptimal economies where accounting prices are defined as above. Hamilton and Hartwick (2005) show that this relationship holds in an optimal economy, but their proof clearly only requires that the economy be competitive. This relationship between current saving and the present value of future changes in consumption is exploited in an empirical test of genuine saving in chapter 6.

Endnotes

1. Intangible capital includes raw labor, human capital, social capital, and other important factors such as the quality of institutions.

2. All references to dollars ($) are in U.S. dollars.

3. Oil states (where oil rents exceed 20 percent of GNI) are excluded and are discussed separately in later chapters. The very large resource endowments of these countries make them outliers in the analysis of wealth.

4. Pritchett (2000) argues that cumulating investments in this way is likely to overstate the value of capital stocks in developing countries, because the method does not account for the profitability of these investments.

5. The use of nominal exchange rates explains part of the high variation. Purchasing Power Parities (PPP) are typically used to compare welfare between developed and developing countries. Welfare measurement is not the prime concern in this volume, where the focus is on variation in the composition of wealth across income levels, changes in wealth, and the role of natural assets in development.

6. In *An Inquiry into the Nature and Causes of the Wealth of Nations*, Adam Smith (1776) wrote: "The annual labour of every nation is the fund which originally supplies it with all the necessaries and conveniences of life which it annually consumes." Smith recognized "the skill, dexterity, and judgment with which [. . .] labour is generally applied" as a precondition for generating supply "whatever be the soil, climate, or extent of territory of any particular nation."

7. Total economic value in this instance would include the rents on sustainable timber and nontimber off-take, value of carbon sequestration, and local (and potentially global) willingness to pay for the external services that forests provide.

Chapter 2

The Wealth Stock Estimates

What constitutes wealth? Traditionally attention has been focused on produced capital such as buildings, machinery, equipment, and infrastructure. The wealth estimates introduced below extend these measures by accounting for exhaustible resources, renewable resources, and agricultural land. The estimates also include *intangible* capital, which encompasses raw labor, human capital (the stock of human skills and know-how), social capital, and the quality of institutions.

Economic theory tells us that there is a strong link between changes in wealth and the sustainability of development—if a country (or a household, for that matter) is running down its assets, it is not on a sustainable path. For the link to hold, however, the notion of wealth must be truly comprehensive. This is a major motivation for expanding the measure of wealth.

We are also interested in several basic questions concerning the wealth of nations:

- What is the most important component of wealth across countries?
- How do the shares of different types of wealth vary with income? Does the value of natural wealth increase or decrease as countries develop?

These and other questions are examined below.

This chapter presents wealth stock estimates for 120 developing and developed countries for the year 2000. The details of the wealth estimation procedure and country-level data can be found in Appendixes 1 and 2.

The Richest and the Poorest

Aggregate wealth estimates are presented in tables 2.1 and 2.2, which highlight the 10 wealthiest and poorest countries. The results are hardly surprising. Switzerland heads a list in which the top performers are all Organization for Economic Co-operation and Development (OECD) countries. European countries—two in Scandinavia—dominate the list along with the United States and Japan. The composition of wealth is very consistent across these countries, with the exception of Norway and Japan. Norway's natural capital, which includes oil and gas resources from the North Sea, accounts for 12 percent of total wealth. Japan stands out for its large share of produced capital—30 percent of the total.

The list of the 10 poorest countries is presented in table 2.2. If Europe heads the top-10 list, Sub-Saharan Africa dominates the bottom-10 list. Countries in table 2.2 are characterized by high levels of natural capital—at least 25 percent of the total. Ethiopia has the lowest level of total wealth, combined with a very low share of produced capital. A similar pattern can be observed in Burundi, Niger, Chad, and Madagascar. Nepal is the only country in the table that is not in Sub-Saharan Africa.

Table 2.1 Total Wealth: Top-10 Countries, 2000

Country (descending order of per capita wealth)	Wealth per capita ($)	Natural capital (%)	Produced capital (%)	Intangible capital (%)
Switzerland	648,241	1	15	84
Denmark	575,138	2	14	84
Sweden	513,424	2	11	87
United States	512,612	3	16	82
Germany	496,447	1	14	85
Japan	493,241	0	30	69
Austria	493,080	1	15	84
Norway	473,708	12	25	63
France	468,024	1	12	86
Belgium-Luxembourg	451,714	1	13	86

Source: Authors.

Table 2.2 Total Wealth: Bottom-10 Countries, 2000

Country (descending order of per capita wealth)	Wealth per capita ($)	Natural capital (%)	Produced capital (%)	Intangible capital (%)
Madagascar	5,020	33	8	59
Chad	4,458	42	6	52
Mozambique	4,232	25	11	64
Guinea-Bissau	3,974	47	14	39
Nepal	3,802	32	16	52
Niger	3,695	53	8	39
Congo, Rep. of	3,516	265	180	–346
Burundi	2,859	42	7	50
Nigeria	2,748	147	24	–71
Ethiopia	1,965	41	9	50

Source: Authors.

Intangible capital appears with a negative sign in some instances, which is an empirical possibility given that it is calculated as a residual—the difference between total wealth and the sum of natural and produced resources. Box 2.1 explores what it means to have a negative intangible capital residual.

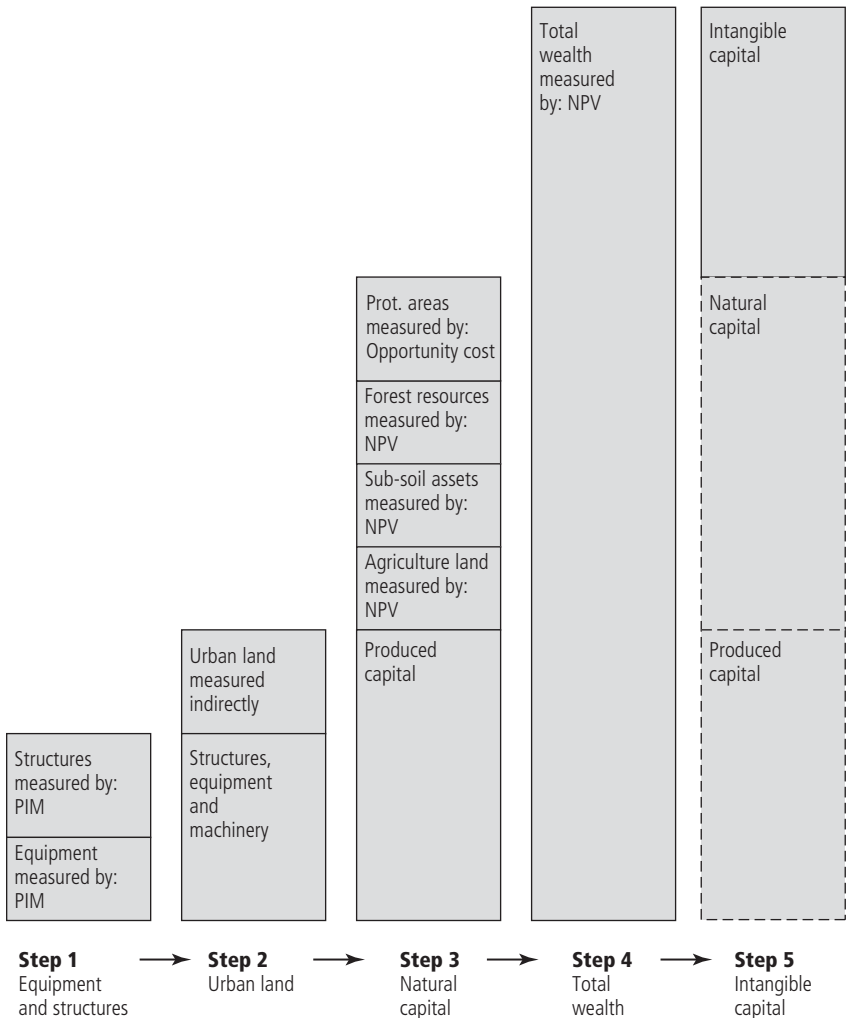
The Architecture of the Wealth Estimates

Measuring capital stocks is a complex task. Capital can be valued using two basic methods:

- It can be valued as the sum of the additions, minus the subtractions, made over time to an initial stock—summing up the value of gross investments and subtracting depreciation of produced capital, for example.
- Alternatively, capital can be valued as the net present value (NPV) of the income it is able to produce over time. This is what an investor would be willing to pay for a capital good.

As a practical matter we employ the first method, also called the *perpetual inventory method* (PIM), to estimate the value of produced capital stocks,

Figure 2.1 Estimating the Components of Wealth



while the second method is used to value stocks of natural resources. Figure 2.1 represents the steps in estimating wealth components.

Produced capital is the sum of machinery, equipment, and structures (including infrastructure). Urban land is not considered to be a natural resource, and so is lumped in with produced capital in the wealth estimates. The value of urban land is calculated as a percentage of the value of machinery, equipment, and structures.

Natural capital is the sum of nonrenewable resources (including oil, natural gas, coal, and mineral resources), cropland, pastureland, forested areas (including areas used for timber extraction and nontimber forest products), and protected areas. The values for nontimber forest resources and protected areas are estimated only crudely. In the case of nontimber forest products, world average values of benefits per hectare, distinguishing developed and developing countries, are applied to a share of the country's forested area (values are derived from Lampietti and Dixon 1995). Protected areas are valued using country-specific per-hectare values for cropland or pastureland (whichever is lower). This severely undervalues the Serengeti Plain, for example, but possibly overvalues some of the Arctic parks.

As noted above, most natural resources are valued by taking the present value of resource rents—the economic profit on exploitation—over an assumed lifetime. While forests can, in principle, yield benefits forever if sustainably managed, we account for overexploitation by calculating the effective lifetime of the resource given current harvest rates.

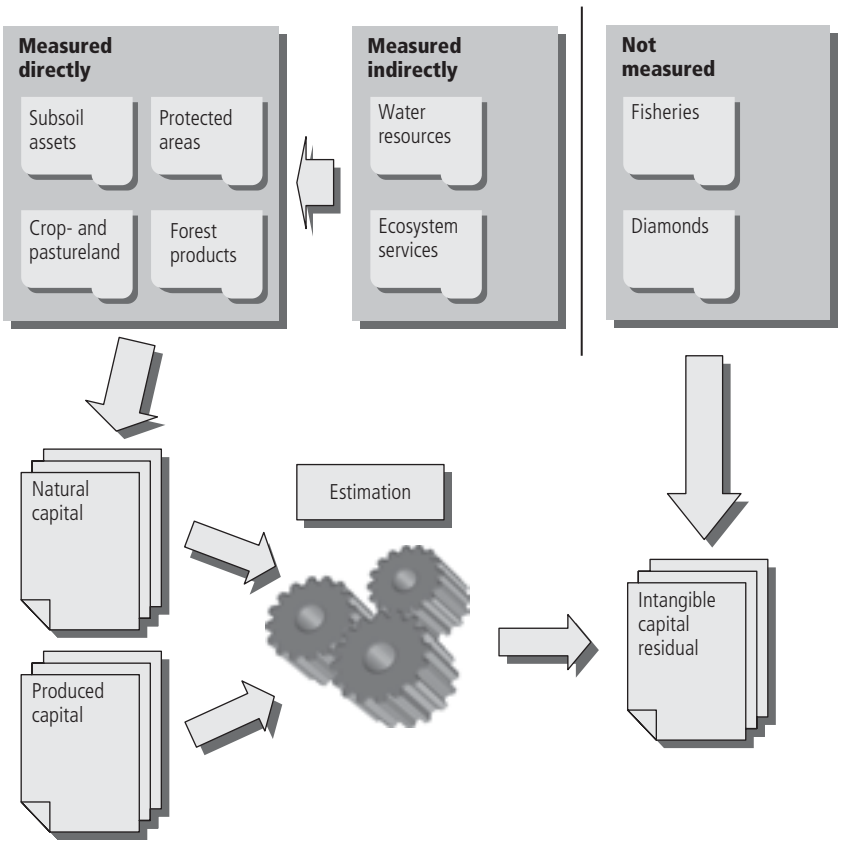
The next step is the measurement of total wealth. Measuring total wealth as the sum of its components makes intuitive sense, but this is limited by data and methodological constraints. We have few good tools for valuing human capital, for example, and even fewer for valuing social or institutional capital. In other cases, such as fisheries, we simply lack data. The alternative is to rely on economic theory, which defines total wealth as the net present value of future consumption. We therefore measure total wealth by assuming a future consumption stream and calculating the net present value in year 2000. However, some countries have unsustainable levels of consumption, which is signaled by negative net or genuine saving levels (see chapter 3). In these cases consumption is decreased by the amount of negative saving in order to arrive at a sustainable level of consumption.

Intangible capital is calculated as a residual, the difference between total wealth and the sum of produced and natural capital. Since it includes all assets that are neither natural nor produced, the residual necessarily includes human capital—the sum of knowledge, skills, and know-how possessed by the population. It also includes the institutional infrastructure of the country as well as the social capital—the level of trust among people in a society and their ability to work together toward common goals. Finally, the residual includes net foreign financial assets through the returns generated by these assets. For example, if a country is a debtor, then interest payments on the foreign debt depress consumption, reducing total wealth and therefore the intangible residual.

A special caveat applies to natural capital. While the wealth estimates include a large number of assets, the exercise is far from perfect. Assets for which data are lacking include subsoil water, diamonds, and fisheries. To the extent that countries profit from these resources, their value is implicitly included in the total wealth aggregate and, hence, ends up in the intangible capital residual.

The services provided by ecosystems, such as the hydrological functions of forests and the pollination services of insects and birds, are indirectly captured in the natural wealth estimates through the values of cropland and pastureland, but no explicit value for ecosystem services is estimated, owing to data limitations. Figure 2.2 summarizes what is captured and what is not in the wealth estimates.

Figure 2.2 The Inclusion of Environment and Natural Resources in the Wealth Estimates



The lack of data on fisheries may be particularly important in a number of countries. Food and Agriculture Organization of the United Nations (FAO) figures show that the roughly 90 million tons of captured fish have a landed value of $78 billion annually. The export value of the total world trade of fish and fisheries products (including aquaculture) was $58.2 billion in 2002. Half of this value comes from developing countries, many of which also generate substantial additional income from licensing foreign access to their fisheries.

Similarly, missing data on diamonds has a serious impact on the wealth accounts of countries such as Botswana. Lange and others (2003) report diamond wealth of $7,400 per capita in Botswana in 1997. This would increase Botswana's value of natural capital to roughly $10,600 per person (25 percent of the total), and reduce intangible capital to about $21,000 (52 percent of the total).

Since many wealth components are estimated as a net present value of a flow of benefits, the calculations require assumptions regarding the time horizon and the discount rate. Throughout the calculations, we assumed a time horizon of 25 years, which coincides roughly with a human generation. So, for example, total wealth is calculated as the net present value of sustainable consumption from the year 2000 to 2025. With respect to discounting, since the focus is on sustainable development, the discount rate used is the one a government would choose in allocating resources across generations. This is an argument in favor of using a social discount rate instead of a private discount rate. Estimates of the Social Rate of Return on Investment (SRRI—another name for the social discount rate) for industrialized countries report values between 2 and 4 percent (Pearce and Ulph 1999). We assume an SRRI at the upper limit, 4 percent. This would likely be too low for fast-growing economies such as China, while being high for slow-growing economies in Sub-Saharan Africa. We choose a single discount rate for all countries in order to facilitate comparisons.

What the Data Reveal

Having explained the methods and caveats in the estimation of wealth, the remainder of the chapter is devoted to an overview of the wealth estimates. Subsequent chapters deal with specific aspects and go deeper into the

Table 2.3 Wealth per Capita by Region and Income Group, 2000

	$ per capita				% share of total wealth		
Region	Total wealth	Natural capital	Produced capital	Intangible capital	Natural capital	Produced capital	Intangible capital
Latin America and the Caribbean	67,955	8,059	10,830	49,066	12	16	72
Sub-Saharan Africa	10,730	2,535	1,449	6,746	24	13	63
South Asia	6,906	1,749	1,115	4,043	25	16	59
East Asia and the Pacific	11,958	2,511	3,189	6,258	21	27	52
Middle East and North Africa	22,186	7,989	4,448	9,749	36	20	44
Europe and Central Asia	40,209	11,031	12,299	16,880	27	31	42
Income group							
Low-income countries	7,216	2,075	1,150	3,991	29	16	55
Lower-middle-income countries	23,612	4,398	4,962	14,253	19	21	60
Upper-middle-income countries	72,897	10,921	16,481	45,495	15	23	62
High-income OECD countries	439,063	9,531	76,193	353,339	2	17	80
World	90,210	4,681	16,160	69,369	5	18	77

Source: Authors.
Note: The data in this table include oil-exporting countries.

analysis. The discussion here is focused on the estimates aggregated by region and income group, while appendix 2 provides the country-level estimates.

Table 2.3 summarizes total wealth by region and income group. Worldwide, natural capital accounts for 5 percent of total wealth, produced capital for 18 percent, and intangible capital 77 percent. The average world citizen has a total wealth of $90,000, an amount similar to the per capita wealth of Brazil ($87,000), Libya ($89,000), or Croatia ($91,000). Most of this wealth is in the form of intangible capital. Tangible assets include produced capital, totaling $16,000, and natural capital, $5,000. Natural capital is dominated by land resources (cropland, pastureland, and protected areas), which constitute 51 percent of total natural resources (see table 2.4, where natural wealth is broken down into its components). Subsoil assets account for 41 percent, and timber and nontimber forest resources account for the remaining 8 percent of natural capital.

Table 2.4 The Composition of Natural Capital by Region and Income Group, 2000

Region	Natural capital	Subsoil assets	Timber resources	NTFR	PA	Cropland	Pastureland
Latin America and the Caribbean	8,059	3,845 48%	359 4%	424 5%	411 5%	1,942 24%	1,077 13%
Sub-Saharan Africa	2,535	979 39%	225 9%	129 5%	64 3%	925 36%	213 8%
South Asia	1,749	189 11%	53 3%	13 1%	109 6%	1,183 68%	202 12%
East Asia and the Pacific	2,511	710 28%	140 6%	43 2%	79 3%	1,415 56%	125 5%
Middle East and North Africa	7,989	6,002 75%	14 0%	14 0%	58 1%	1,510 19%	390 5%
Europe and Central Asia	11,031	6,532 59%	225 2%	688 6%	779 7%	1,622 15%	1,185 11%
Income group							
Low-Income countries	2,075	487 23%	119 6%	49 2%	104 5%	1,134 55%	182 9%
Lower-middle-income countries	4,398	1,933 44%	159 4%	182 4%	189 4%	1,526 35%	409 9%
Upper-middle-income countries	10,921	7,031 64%	265 2%	206 2%	463 4%	1,872 17%	1,084 10%
High-income OECD countries	9,531	3,825 40%	747 8%	183 2%	1,215 13%	2,008 21%	1,552 16%
World	4,681	1,933 41%	247 5%	134 3%	343 7%	1,477 32%	547 12%

Source: Authors.
Note: The data in this table include oil-exporting countries. NTFR: Nontimber forest resources. PA: Protected areas. Figures are in dollars per capita and in percents.

Of course, using world averages obscures important differences. The level of total wealth per capita and the distribution of different types of wealth vary hugely across regions and income groups.

Table 2.4 shows that endowments of natural capital vary substantially across regions of the world. Subsoil assets abound in the Middle East and North Africa, Europe and Central Asia, and Latin America and the Caribbean. Agricultural land (cropland plus pastureland) has a relatively high importance in East Asia and the Pacific, South Asia, and Sub-Saharan Africa.

From this broad analysis of the wealth estimates a few stylized facts emerge.

Intangible Capital Is the Largest Share of Total Wealth

The most striking aspect of the wealth estimates is the high values for intangible capital. Nearly 85 percent of the countries in our sample have an intangible capital share of total wealth greater than 50 percent. This outcome validates the classical economists' intuition that human capital and other intangibles play a major role in economic development. Intangible capital varies widely across income groups and across regions. In the developing world, the Latin America and the Caribbean region has the highest level of intangible capital, $49,000 per capita. The lowest levels are in South Asia, $4,000 per capita, and Sub-Saharan Africa, less than $7,000 per capita.

Chapter 7 uses a production function framework to divide the intangible capital residual into the components that explain its variation across countries. Human capital (measured through years of schooling) and governance (measured through a rule of law index) together explain nearly 90 percent of the variation in intangible capital.

Intangible capital comprises 80 percent of the total wealth in high-income countries. It is close to zero, and often negative, in major oil exporters such as Nigeria, Algeria, and Venezuela. What is special about oil states? Box 2.1 analyzes this issue.

Box 2.1 Why a Negative Level of Intangible Capital

As seen in table 2.2 in appendix 2, a number of countries appear to have negative levels of intangible capital. This is the case for the Republic of Congo, Nigeria, Algeria, the Syrian Arab Republic, and Gabon. Although positive, very low levels of intangible capital are estimated for República Bolivariana de Venezuela, Moldova, Guyana, and the Russian Federation (see table on the next page).

A negative level of intangible capital is possible by construction because it is calculated as a residual—the difference between total wealth (the present value of future consumption) and the sum of produced and natural capital. The real question is how to interpret a negative or extremely low value of intangible capital.

Intangible Capital and the Composition of Wealth in Highly Resource-Dependent Countries

		Percentage share of total wealth		
Country	Intangible capital per capita ($)	Natural capital	Produced capital	Intangible capital
Russian Federation	6,029	44	40	16
Guyana	2,176	65	21	14
Moldova	1,173	37	49	13
Venezuela, R. B. de	4,360	60	30	10
Gabon	–3,215	66	41	–7
Syrian Arab Rep.	–1,598	84	32	–15
Algeria	–3,418	71	47	–18
Nigeria	–1,959	147	24	–71
Congo, Rep. of	–12,158	265	180	–346

Source: Authors.

Recall that total wealth is the present value of *sustainable* consumption. What the low and negative values of intangible capital are really saying is that the level of GNI is *too low* in these countries. If it were higher, then higher levels of consumption per capita could be sustained and both total wealth and intangible wealth would be higher. GNI is too low in these countries in the sense that they are achieving extremely low rates of return on their produced, human, and institutional capital. This is a classic symptom of the *resource curse* as documented by Auty (2001) and Gylfason (2001).

Lower Shares but Higher Levels of Natural Capital in Richer Countries

High-income countries have a relatively low ratio of natural resources to total assets compared with poorer countries. Is income in poorer countries constrained by a high level of natural-resource dependence? Without further analysis it is not possible to draw a general conclusion regarding the causal link between asset composition and income. The fact

that lower-income countries are more dependent on natural resources than their richer peers seems to be an intrinsic feature of the development process.

While rich countries clearly were more heavily forested and had more abundant wildlife and fish resources in the past, it is striking that the value of natural capital per person is higher today in high-income countries than in low- and middle-income countries. In high-income countries it is likely that preferences linked to higher incomes are playing a key role in fostering more careful management of natural capital, while higher levels of other forms of capital may interact positively with the value of natural capital—specialized knowledge and greater mechanization, for example, boosts the yields on cropland in rich countries compared with the yields in poor countries.

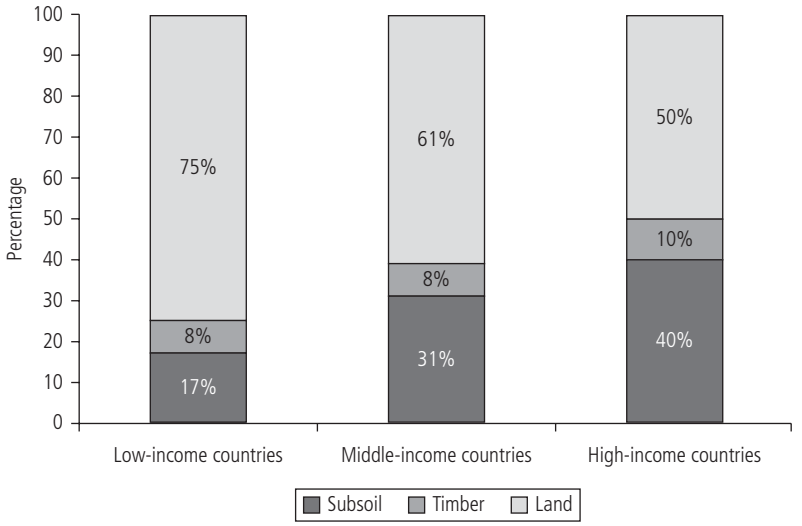
Poorer Countries Rely on Land Resources

Given the importance of natural capital in the wealth of poor countries, the individual subcomponents merit consideration. Excluding large oil-exporting countries, land resources are very important in low-income countries, with a 75 percent share of natural wealth (69 percent consisting of cropland and pastureland), followed by subsoil assets at 17 percent. By comparison, in middle-income countries land resources account for 61 percent of natural capital, while subsoil assets account for 31 percent. Figure 2.3 summarizes these findings.

The importance of land resources (cropland, pastureland, and protected areas) decreases with the level of income. This suggests a potential poverty-land-dependence trap in low-income countries. Countries in which land resources account for more than one third of total wealth, such as Niger, Burundi, and Moldova, all belong to the low-income country group.

By contrast, low-income countries, as a group, are not particularly dependent on subsoil assets. Countries rich in mineral and energy resources may be found in each of the income groups.

Figure 2.3 The Composition of Natural Capital (High Oil Exporters Excluded)



Source: Authors.

Key Conclusions on Wealth

The ranking of countries by total wealth per capita in appendix 2 does not differ hugely from the ranking by gross domestic product (GDP) per capita. It would be surprising if it did, since GDP is the return on total wealth. There are important exceptions to this, particularly the highly resource-dependent economies featured in box 2.1. But the primary interest in measuring wealth is not to rank countries. It is to better understand the composition of wealth and how this composition varies across levels of income.

The main conclusions from the wealth analysis include:

- Low-income countries are highly dependent on natural resources. The share of natural capital is greater than the share of produced capital in these countries.
- Cropland and pastureland is the largest share, nearly 70 percent, of natural wealth in poor countries (excluding oil exporters).

- Overall, intangible capital is the preponderant share of wealth in virtually all countries, with the share increasing with income. The particularly inefficient use of produced and intangible assets in the most resource-dependent economies leads to the anomalous result of apparently negative shares of intangible capital in these economies.
- The level of natural wealth per capita actually rises with income. This contradicts the common assumption, that development necessarily entails the depletion of the environment and natural resources.

The declining *share* of natural wealth as income increases is not an argument that natural resources are somehow unimportant—food, fiber, timber, minerals, and energy are all plainly needed to sustain lives and economies, but it does indicate a decline in relative importance. The key point is that low-income countries are highly dependent on natural resources *now*. How these resources are managed will affect both current welfare and the prospects for development in poor countries.