part 3

Wealth, Production, and Development

Chapter 7. Explaining the Intangible Capital Residual: The Role of Human Capital and Institutions

Chapter 8. Wealth and Production

Chapter 7

EXPLAINING THE INTANGIBLE CAPITAL RESIDUAL: THE ROLE OF HUMAN CAPITAL AND INSTITUTIONS

The Meaning of Intangible Capital

Chapter 2 showed that in most countries *intangible capital* is the largest share of total wealth. What does intangible capital measure in the wealth estimates? By construction, it captures all those assets that are not accounted for elsewhere. It includes human capital, the skills and know-how embodied in the labor force. It encompasses social capital, that is, the degree of trust among people in a society and their ability to work together for common purposes. It also includes those governance elements that boost the productivity of the economy. For example, if an economy has a very efficient judicial system, clear property rights, and an effective government, the result will be a higher total wealth and thus an increase in the intangible capital residual.

As a residual, intangible capital necessarily includes other assets which, for lack of data coverage, could not be accounted in the wealth estimates. As mentioned in chapter 2, one form of wealth is net foreign financial assets. When a country receives interest on the foreign bonds it owns, this boosts consumption and hence total wealth and the intangible capital residual. A similar argument applies to countries with net foreign obligations—to the extent that interest is being paid to foreigners, the residual will be lower. So while there are no comprehensive cross-country data on net foreign financial assets, this variable is measured implicitly in the intangible wealth residual for each country.

Finally, the intangible capital residual also includes any errors and omissions in the estimation of produced and natural capital. The main omissions include fisheries and subsoil water.



Figure 7.1 The Meaning of the Intangible Capital Residual

Source: Authors.

Keeping in mind the caveats above, the goal in this chapter is to disaggregate the intangible capital residual into its major components. The omission of foreign financial assets and some natural resources is not systematic, in that countries may differ widely in their endowments of such assets. For this reason we will concentrate on the more systematic contributors to the residual, such as human capital and institutional quality. The decomposition analysis in the following sections makes it possible to measure the residual as a set of specific assets; these assets in turn may be subject to specific policy measures.

Among the components of intangible capital, perhaps the one that has been most widely analyzed in the economics literature is human capital. For example, table 7.1 shows how growth in output per capita in the Organisation for Economic Co-operation and Development (OECD) countries compares to growth in inputs and in total factor productivity. Growth in labor quality explains an important part of the

| 1960–95 | USA | Canada | UK | France | Germany | Italy | Japan |
|------------------------------------|------|--------|-------|--------|---------|-------|-------|
| Growth in output per capita | 2.11 | 2.24 | 1.89 | 2.68 | 2.66 | 3.19 | 4.81 |
| Growth in capital stock per capita | 1.35 | 2.35 | 2.69 | 3.82 | 3.76 | 4.01 | 3.49 |
| Growth in hours worked per capita | 0.42 | 0.14 | -0.50 | -0.99 | -0.67 | -0.17 | 0.35 |
| Growth in labor quality | 0.60 | 0.55 | 0.44 | 0.85 | 0.43 | 0.31 | 0.99 |
| Growth in productivity | 0.76 | 0.57 | 0.80 | 1.31 | 1.33 | 1.54 | 2.68 |

Table 7.1 Growth in Output and Input per Capita in OECD Countries (percentage)

Source: Jorgensen and Yip 2001.

high rates of growth in output, but productivity growth is still a major component.

Box 7.1 provides a brief and nonexhaustive overview of what is meant by human capital and its measurement.

Box 7.1 The Measurement of Human Capital

While there is currently no monetary measure of human capital, this area of research promises to be very rewarding. Behrman and Taubman (1982, 474) define human capital as "the stock of economically productive human capabilities." Human capital can be increased through education expenditure, on-the-job training, and investments in health and nutrition. The difficulties in measuring human capital are linked to the fact that human capital is accumulated in a variety of ways. Not all of these contributions to human capital formation are easily measured. Even in the cases in which it is possible to have a measure, years of schooling for example, the effect on values of human capital may vary from country.

Physical Measures of Human Capital

The most basic measure of human capital is the average years of education for the population or the labor force. Schultz (1961) and Becker (1964) introduced the explicit treatment of education as an investment in human capital. Schultz (1988) provides a comprehensive analysis of the relationship between investments in human capital and income. Growth accounting exercises show that high levels of education explain high levels of output. The figure below displays this point by plotting average years of education against gross national income (GNI) per capita.



Source: Data on GNI per capita are from World Bank 2005. Data on school years are from Barro and Lee 2000.

Even taking into account years of schooling in growth accounting equations, a large unexplained difference in income across countries persists (Caselli 2003). For this reason, average school year measures are often complemented by attainment ratios, that is, the percentage of the relevant population that completes a given level of education (for example, primary, secondary, higher level). A comprehensive data set covering both school years and attainment is available from Barro and Lee (2000) and it has been used in the quantitative analysis here.

The use of schooling as a proxy for human capital implicitly assumes that one year of schooling in country A produces the same amount of human capital as one year of schooling in country B. If a more accurate measure of human capital is desired, the *quality* of education should be taken into account. This can be achieved by considering variables such as the quality of the teachers, the availability of teaching materials, the student-teacher ratio, test scores, and so on. All these measures are difficult to collect, and country-level data are not widely available.

Toward Monetary Measures of Human Capital

Human capital is the result of investments in improving the skills and knowledge of the labor force. A major step forward in the monetary valuation of human capital is therefore the estimation of the returns to such investments. Psacharopoulos and Patrinos (2004) provide comprehensive measures of the profitability of investment in education across countries. Among their findings is the fact that primary education produces the highest returns in low-income countries. The table below summarizes the results by income group. The entries in the table provide the return to one extra dollar spent on education. Returns decline with the level of schooling—that is, one dollar spent on primary school provides higher returns than one dollar spent on higher education—and with per capita income. The authors show that investments in education constitute a very profitable policy option.

| | Social returns to education investments, % | | | | |
|-------------------------|--|-----------|--------|--|--|
| Country group | Primary | Secondary | Higher | | |
| Low-income countries | 21.3 15.7 | | 11.2 | | |
| Middle-income countries | 18.8 | 12.9 | 11.3 | | |
| High-income countries | 13.4 | 10.3 | 9.5 | | |
| World | 18.9 | 13.1 | 10.8 | | |

Returns to Investment in Education by Level

Source: Psacharopoulos and Patrinos 2004.

The usefulness of the rate of returns on education is very much under scrutiny. Using data for Sweden, Bjorklund and Kjellstrom (2002) find, for example, that results may be driven by the structure imposed by the estimation models. Further investigation is needed to refine such calculations.

Even if reliable data on rates of return were available, the estimation of human capital would require a baseline, that is, a starting level to which we can add successive investments in human capital to obtain the total value of human capital in any given moment in time. Wages for unskilled labor provide a conceptually sensible baseline, but comparable cross-country data are not available.

In the following section we will look at the broader intangible capital residual and attempt to disaggregate the effects of education and other variables, including governance. This will provide a first indication of the relative importance of the assets that constitute the residual.

A Regression Analysis of the Intangible Capital Residual

The intangible capital residual forces us to think of all contributors to wealth other than produced and natural capital. What are left are those assets that are more intangible and less prone to be measured.

Regression analysis can help us pinpoint the major determinants of the intangible capital residual.

Human capital must clearly be an important part of any model specification. A readily available proxy for human capital is schooling. Schooling level per person constitutes an imperfect measure of human capital, since it does not take into account the quality of education of those trained, nor other types of human capital investment such as on-the-job training. Measurement errors of this kind need not bias the coefficient, but would affect the significance. Average years of schooling per capita are used here for lack of better data.

A special form of human capital is represented by workers who have emigrated and send money to their families in the form of remittances. Even if they are not physically present in the country, workers abroad contribute to the country's income and hence they are a part of total national wealth. For this reason we also include remittances in our model.

Institutional quality is another important dimension that needs to be captured. Kaufmann, Kraay, and Mastruzzi (2005) provide data on six dimensions of governance:

- Voice and accountability
- Political stability and absence of violence
- Government effectiveness
- Regulatory quality
- Rule of law
- Control of corruption

The model below uses the rule of law indicator. This measures the extent to which agents have confidence in and abide by the rules of society. It encompasses the respect of citizens and the state for the institutions which govern their interactions. While there is no strong reason to prefer one governance dimension over another, an argument in favor of choosing the rule of law indicator is that it captures particularly well some of the features of a country's social capital. Paldam and Svendsen (forthcoming) associate social capital with trust, and report a *generalized trust* indicator for 20 countries. The correlation between generalized trust and rule of law is high, as shown in table 7.2.¹ The interpretation of the coefficients, in the analysis below, should then be subject to the caveat that there are

several underlying elements explaining the association between rule of law and the intangible capital residual.

| | Trust | Voice | Stab | Goveff | Regqua | Rulelaw | Corr |
|---------|-------|-------|-------|--------|--------|---------|-------|
| Trust | 1.000 | | | | | | |
| Voice | 0.397 | 1.000 | | | | | |
| Stab | 0.309 | 0.675 | 1.000 | | | | |
| Goveff | 0.482 | 0.506 | 0.868 | 1.000 | | | |
| Regqua | 0.240 | 0.450 | 0.807 | 0.878 | 1.000 | | |
| Rulelaw | 0.514 | 0.560 | 0.908 | 0.945 | 0.868 | 1.000 | |
| Corr | 0.517 | 0.595 | 0.892 | 0.965 | 0.865 | 0.975 | 1.000 |

Table 7.2 Correlation Matrix of Social Capital and Governance Dimensions

Sources: The trust indicator is taken from Paldam and Svendsen (forthcoming). The six governance dimensions are taken from Kaufmann, Kraay, and Mastruzzi (2005).

Notes: Voice: voice and accountability; Stab: political stability and absence of violence; Goveff: government effectiveness; Regqua: regulatory quality; Rulelaw: rule of law; Corr: control of corruption.

Our model represents the residual as a function of domestic human capital, as captured by the per capita years of schooling of the working population; human capital abroad, as captured by the amount of remittances by workers outside the country; and governance/social capital, expressed here as a rule of law index. We considered a simple Cobb-Douglas function:

$$R = AS^{\alpha_s} F^{\alpha_F} L^{\alpha_L} \tag{7.1}$$

where *R* is the intangible residual, *A* is a constant, *S* is years of schooling per worker, *F* is remittances from abroad and *L* is the rule of law index (measured on a scale of 1 to 100). The coefficients α_i express the elasticity of the residual with respect to the explanatory variables on the right-hand side of the equation above. So, for example, α_s measures the percentage increase in *R* if schooling is increased by 1 percent. There is also a set of income group dummy variables that take into account differences in the residual linked to income levels.

Elasticities

As table 7.3 shows, the specified model fits the data well. The independent variables explain 89 percent of the variations in the residual.

| Variable | Coefficient | Standard error |
|---------------------------|-------------|----------------|
| School years | 0.53 | 0.2162 |
| Remittances from abroad | 0.12 | 0.0472 |
| Rule of law | 0.83 | 0.3676 |
| Low-income dummy | -2.54 | 0.4175 |
| Lower-middle-income dummy | -1.90 | 0.2911 |
| Upper-middle-income dummy | -1.55 | 0.2693 |
| Constant | 7.24 | 1.6005 |

| Table 7.3 | Elasticities of Intangible Capital with Respect to Schooling, |
|-----------|---|
| | Remittances from Abroad, and Rule of Law |

Source: Authors.

Note: Dependent variable: log of intangible capital. Observations included: 79. R-squared: 0.89. Excluded dummy: high-income countries. All coefficients are significant at the 5 percent level.

All the coefficients estimated are significantly² different from zero at the 5 percent level and positive. The estimation suggests that a 1 percent increase in school years will increase the intangible capital residual by 0.53 percent. A 1 percent increase in the rule of law index is associated with a 0.83 percent increase in the residual. A coefficient lower than one in the model above means that there are decreasing marginal returns to the corresponding factor—for example, one more year of schooling yields higher returns in those countries with lower levels of schooling.

In addition, all the income dummy coefficients are negative. This means that countries in each income group have a lower level of intangible capital residual compared with high-income countries.

We also tested the hypothesis that the sum of the coefficients for schooling, remittances, and rule of law is equal to one. Statistically, this hypothesis cannot be rejected. In other words, if we imagine the three dependent variables as inputs in the production of intangible capital, then this production function exhibits constant returns to scale.

Marginal Returns

Using the elasticities obtained in the regression, it is possible to obtain marginal returns, that is, the unit change in the residual resulting from a unit change in the explanatory variable. In the case of Cobb-Douglas functions, marginal returns, or partial derivatives are easily obtained as:

$$\frac{\delta R}{\delta X} = \alpha_X \frac{R}{X} \tag{7.2}$$

Notice that while the elasticity α_X is constant, the marginal returns depend on the level of *R* and *X*. We evaluated marginal returns using the mean estimates for *R* and *X* in each income group. The information is summarized in table 7.4.

| | Marginal returns to schooling | Marginal returns to rule of law | Marginal returns to foreign remittances |
|-------------------------------|-------------------------------------|---------------------------------------|---|
| Low-income countries | 838 | 111 | 29 |
| Lower-middle-income countries | 1,721 | 362 | 27 |
| Upper-middle-income countries | 2,398 | 481 | 110 |
| High-income OECD countries | 16,430 | 2,973 | 306 |

Table 7.4 Variation in Intangible Capital Resulting from a Unit Variation in the Explanatory Variables, by Income Group (\$ per capita)

Source: Authors.

At the mean level of schooling, a one-year increase in schooling in lowincome countries corresponds to a US\$838 increase in the residual. In comparison, low-income countries spend nearly US\$51 per student per year in primary school (World Bank 2005). This information provides useful insight for policy makers, especially when it comes to comparing costs and benefits of a given policy. With respect to the rule of law variable, the implications for policy making are less obvious since the partial derivative depends on the scale on which the rule of law index is measured (1 to 100 in this instance), not to mention the difficulty in deciding what it means—in terms of changing real institutions—to increase rule of law by one point on the scale.

The returns to schooling also depend on other country-specific characteristics. Looking down the columns of table 7.4, the marginal returns to schooling appear to be higher at higher levels of income. This result is attributable to the unobserved characteristics of countries that are captured by the dummy variables in the model. From equation 7.1 it is clear that country-specific characteristics will affect the level of the constant term *A*. What we are observing in table 7.4 is, in effect, four different functions for intangible capital, one per income group.

Disentangling the Intangible Capital Residual

The Cobb-Douglas specification permits us to go one step further by deriving the following decomposition of the intangible capital residual:

$$R = \frac{\delta R}{\delta S} S + \frac{\delta R}{\delta F} F + \frac{\delta R}{\delta L} L + Z$$
(7.3)

The residual can therefore be decomposed into a schooling component, a foreign remittances component, and a governance component. A fourth component, termed Z, captures the difference between intangible capital and the individual contributions of the explanatory variables. In our specification, if the sum of the elasticities α_s , α_F , α_L equals one—which cannot be rejected econometrically—then Z is equal to zero.

Assuming Z equals zero, we can then estimate the contributions of schooling, remittances, and rule of law to the intangible capital residual (figure 7.2). Rule of law is the largest component. On average, it explains 57 percent of the total residual. Schooling is also important with 36 percent of the total value. Foreign remittances account for 7 percent.

A Tale of Three Countries

Three country examples can increase our intuitive understanding of the decomposition of intangible wealth: El Salvador, Peru, and





Source: Authors.

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| | | Shares of the residual | | | Levels | | | | |
|--|--------|---------------------------------------|--|------------------|-----------------------|-------------------------------|------------------------------------|---------------------------|--|
| Country | Region | Total wealth (\$ per capita) | Intangible capital residual (%) | Schooling (%) | Rule of law (%) | Foreign remittances (%) | Schooling (years per capita) | Rule of law (index) | Foreign remittances (\$ per capita) |
| Turkey | ECA | 47,858 | 75 | 31 | 63 | 6 | 5 | 51 | 68 |
| Peru | LAC | 39,045 | 77 | 47 | 51 | 3 | 8 | 39 | 28 |
| El Salvador | LAC | 36,476 | 86 | 28 | 47 | 24 | 5 | 41 | 284 |
| Lower- middle- income countries | | 23,612 | 60 | 36 | 57 | 7 | 6 | 44 | 84 |

| Table 7.5 | Shares of Residual | and Levels of | Schooling, | Foreign |
|-----------|---------------------------|-----------------|------------|---------|
| | Remittances, | , and Rule of L | aw | _ |

Source: Authors.

Turkey. While enjoying similar levels of total wealth per capita and a very high intangible capital residual, the differences in relative endowments of intangible capital among the three countries are very high. Table 7.5 applies formula 7.3 to decompose the intangible capital residual.

Turkey, located in the Europe and Central Asia region, is the richest of the three countries considered, with a GNI per capita of \$2,980. As seen in appendix 2 its total wealth is 18 percent produced capital and 7 percent natural resources (especially agricultural land). Rule of law is the main contributor to a very large intangible capital residual. The rule of law index is above the regional average.

Peru, in Latin America, has a GNI per capita of \$1,991. Relatively rich in subsoil resources, Peru has natural capital that accounts for 9 percent of total wealth and a level of produced capital that accounts for 14 percent of wealth (see appendix 2). While rule of law is at a much lower level compared with Turkey, the average school years are higher. As a consequence, schooling explains a large share of the intangible capital residual (47 percent).

El Salvador, located in Central America, yields yet another decomposition of the residual. It has a GNI per capita of \$2,075 and a residual that accounts for 86 percent of total wealth. Here remittances play a major role (24 per cent of the residual), reflecting the large share of Salvadoran human capital residing abroad. The data in table 7.5 suggest that there is no one-size-fits-all policy rule. The varying composition of intangible capital across the three countries suggests very different policy options. In Turkey, education is a major priority. Increasing per capita education in Turkey by one year would raise the residual by nearly 10 percent. In Peru, improving the judicial system to a level similar to Argentina's, for example, would increase the residual by 25 percent.

The management of remittances is a key issue in El Salvador. Adams and Page (2003) show that international remittances have a strong statistical impact on reducing poverty, an impact that could be stronger if policies encouraged investment rather than consumption of remittances. In the long term, increasing the dynamism of the Salvadoran economy would provide an incentive for human capital and financial resources to come back to the country.

Conclusions

Cross-country monetary measures of human capital are not available in the literature. The major impediments to valuing human capital include the availability of data on wages and the comparability of data on education. When available, data are difficult to combine across countries because of differences in definitions, measurement methods, and assumptions. The intangible capital residual obtained from the wealth estimates offers an opportunity for advancing work in this domain.

In addition, while there is a rich literature using governance and institutional indicators as explanatory variables in cross-country growth regressions, there has been little work on trying to place an economic value for issues such as institutional quality. The decomposition of the intangible wealth residual takes some first steps in this direction.

The list of assets that potentially constitute the residual includes human capital, social capital, and the quality of institutions. The regression analysis shows that school years per capita and rule of law account for the largest share of the residual: at the aggregate level, rule of law explains nearly 60 percent of the variation in the residual, while human capital explains another 35 percent.

These results present a plausible menu for development policy. In addition, it is hoped that these results will stimulate new research.

Endnotes

1. If the Russian Federation and Indonesia are excluded from the sample, the correlation coefficient between rule of law and trust becomes 0.73, while the correlation coefficient between control of corruption and trust goes up to 0.70.

2. Statistically speaking, saying that a coefficient is significantly different from zero at the 5 percent level means that there is a 95 percent chance that the coefficient is different from zero.