Talent, labor quality, and economic development ☆

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ABSTRACT

We develop a theory of labor quality based on (i) the division of the labor force between unskilled and skilled workers and (ii) investments in skilled workers. In our theory, countries differ in two key dimensions: talent and total factor productivity (TFP). We measure talent using the observed achievement levels from the Programme for International Student Assessment (PISA) scores. Our findings imply that the quality of labor in rich countries is about twice as large as the quality in poor countries. Thus, the implied disparities in TFP levels are smaller relative to the standard growth model using a Mincerian measure of labor quality. In our model, the resulting elasticity of output per worker with respect to TFP is about 2.

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1. Introduction

It is well known that the observed cross-country differences in output per worker are large. For example, the richest countries in the world economy are about 30 to 40 times richer than the poorest countries. Klenow and Rodriguez-Clare (1997), Prescott (1998), Hall and Jones (1999), McGrattan and Schmitz (2000), and Parente and Prescott (2000), among others, have documented that these differences are primarily due to differences in total factor productivity (TFP).

To calculate the relative importance of TFP, researchers measure the cross-country differences in the quality of workers, or *labor quality* for short. Traditionally, labor quality has been measured using observations on schooling and Mincerian returns to schooling. Such measurements account for a small fraction of the differences in output per worker; see Caselli (2005) for a review. However, what if TFP differences include *unmeasured* labor quality differences? Recent work follows two approaches to quantify this unmeasured component. One approach uses labor earnings of immigrants from different countries working in the U.S. labor market to quantify cross-country differences in labor quality. Hendricks (2002) and

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Schoellman (2011) are examples of this approach. The other approach involves developing theories of labor quality based on unobserved individual heterogeneity and disciplining the key parameters describing the heterogeneity with observations of U.S. labor earnings. Erosa et al. (2010) is an example of this approach.

In this paper, we take an alternative approach to the measurement of labor quality and the resulting implications for the importance of TFP. We use direct observations of the achievements of individuals prior to their entry into the labor force as an exogenous input to a theory of labor quality. We develop a parsimonious framework in which countries differ in two key dimensions — talent and TFP — and in which individuals endogenously become unskilled or skilled workers.

We construct a measure of talent using the *observed* test scores from the Programme for International Student Assessment (PISA). We then use our measure of talent and our model to construct a measure of labor quality. Our guiding assumption is that individual skills by the end of compulsory schooling are embodied in PISA scores. In this context, we quantify the role of PISA scores relative to TFP in accounting for cross-country differences in output per worker. Specifically, we ask two questions: How large are the differences in labor quality across countries? And what are the resulting magnitudes of TFP differences?

PISA is an internationally standardized assessment of student achievement organized and conducted by the OECD. The tests are administered to 15-year-old students and provide a useful quantification of skills toward the end of the schooling period. One advantage of using PISA scores for our purposes is the common assessment of young people across countries near the end of compulsory schooling. The PISA tests students of the same age in each country independently of the structure of national school systems. By contrast, other studies focus on testing students in specific grades, which may be distorted by the fact that countries differ in their grade-entry ages and grade-repetition rules. Another advantage of PISA is that the tests are constructed to evaluate a range of relevant skills that capture how well young adults are prepared to meet future work demands by being able to analyze, reason, and communicate their ideas effectively. While previous studies are curriculum based, PISA tests the young adults' ability to "use their knowledge and skills in order meet real-life challenges" (OECD, 2001, p. 16). By design, PISA provides a single, comparable measure of skills of individuals prior to their entry into the labor force for each country.

Our model has a representative household with a continuum of members. The members are heterogeneous and are born with some innate efficiency units of labor or *talent*. The household divides its members into two groups: *skilled* workers and *unskilled* workers. Converting a member of the household into a skilled worker is costly: It requires time (forgone earnings) and goods. As more goods are invested, the resulting quality of each skilled worker is higher. Given our guiding assumption, the household invests only in the skilled workers; the quality of an unskilled worker is simply his or her innate talent. The production technology uses capital, unskilled labor, and skilled labor as factors of production. Thus, while the distribution of talent is exogenous in our model, labor quality is *endogenous*. When the elasticity of substitution between unskilled labor and skilled labor is in the empirically plausible range, we show that an increase in TFP increases the fraction of skilled workers as well as the quality of skilled workers. In this sense, differences in TFP have not only the standard effects on output-per-worker differences, but also a novel effect through differences in labor quality.

In a sample of 59 countries, we construct a measure of talent using the observed PISA score. We calibrate two other critical parameters in the model — the importance of goods in the enhancement of the quality of skilled workers and the share of unskilled labor in the aggregate technology. We use only the U.S. data to match the observed expenditures per tertiary student as a fraction of GDP per worker and the fraction of unskilled workers (those with a secondary education or less).

We find substantially *larger* differences in labor quality across countries than standard analyses based on Mincerian returns. Using Mincerian returns, labor quality in the poorest 10 percent of the countries in our sample is about 86 percent of the quality in the richest 10 percent of the countries. In our model, this labor–quality ratio is only about 45 to 55 percent. In the calculation of the Mincerian labor quality, workers in different countries with the same years of schooling are considered to be of the same quality. In contrast, our model treats them differently based on the distribution of the PISA score for the country. For instance, the average PISA score among workers with a high school education or less in the U.S. is nearly 33 percent higher than that in the Kyrgyz Republic — the country with the lowest mean PISA score and lowest output per worker in our sample. In addition, the investment in skilled workers in our model increases the quality of the average U.S. skilled worker even more. Our finding on labor quality differences is similar to that in Schoellman (2011), who also treats workers in different countries with the same years of schooling differently and uses data on immigrants in the U.S. to infer variation in labor quality. He concludes that labor quality differences between poor and rich countries are twice as large as those under conventional measures using Mincerian returns.

As a result of the larger implied differences in labor quality, TFP differences from our model are smaller than those from standard analyses. Stated differently, output per worker in our model reacts more to changes in TFP. The resulting elasticity of output per worker with respect to TFP is around 2.1 in our model. The TFP elasticity is 1.5 in the standard one-sector growth model and roughly 1.7 under a measure of labor quality based on Mincerian returns, as this variable is correlated with output per worker.

Our paper is part of the literature on the determinants of cross-country income differences and, in particular, on the amplification of distortions and TFP differences via human capital. Examples include Bhathacharya et al. (2013), Cordoba and Ripoll (2013), Erosa et al. (2010), Manuelli and Seshadri (2010), and Restuccia (2001). Given our emphasis, Manuelli and Seshadri (2010) and Erosa et al. (2010) are closely related to our paper. Manuelli and Seshadri (2010) develop a model of labor quality based on human capital acquisition in early childhood and over the life cycle. In their model, investments