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Why does scholastic achievement differ across prefectures in Japan?☆

Hideki Nakamura *

Faculty of Economics, Osaka City University, 3-3-138 Sugimoto, Sumiyoshi, Osaka 558-8585, Japan

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ABSTRACT

Using prefecture-level data on scholastic achievement tests in Japan, we found that parental income and education level positively affect student achievement. The effect of income on achievement is stronger for the high-scoring prefectures than for the low-scoring prefectures. The presence of grandparents also has a strong positive effect on student achievement. While the cross term between the percentage of absentees and the quantity of teachers is important in identifying the positive effects of teacher quantity, the effects of this quantity on elementary school achievement is nonlinear. We confirm the importance of teacher quality in determining junior high school achievement.

1. Introduction

Since the latter half of the 1990s, and more comprehensively since 2002, the Japanese government has implemented a less strenuous form of school education known as *yutori kyouiku*. The principal aims of this education reform were to decrease the possible negative effects of examinations on students and to reduce the number of school days and amount of course work. At the same time, special classes (*sougou gakushuu*) were introduced to help students develop better morals and social skills.

However, these education reforms have not been without criticism. For example, Kariya (2009) argued that with these reforms, an incentive gap has opened between hardworking students and their peers, alongside a widening gap in achievement. Likewise, Nishimura (2003) suggested that the less rigorous curriculum has diminished the enthusiasm and competition among students, pointing out evidence of deterioration in the quality of education in public schools and an increase in the prosperity of supplementary private schools. Finally, Tachibanaki and Yagi (2009) have suggested that a fall in scholastic achievement during elementary education will widen income inequality.

As of 2008, 98.3% of elementary school students and 91.9% of junior high school students in Japan were being educated through the public school system. Thus, the quality of public education plays a critical role in human capital formation in Japan. As a result, the Japanese government recently reviewed the country's education system. In 2007 and 2008, the Ministry of Education conducted achievement tests, which almost all eligible students were required to take, in order to assess more precisely the scholastic achievement of elementary and junior high school students. One controversial finding

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* Tel.: +81 6 6605 2271; fax: +81 6 6605 3066.
E-mail address: hnakamur@econ.osaka-cu.ac.jp.

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arising from the test results was that average scholastic achievement appears to differ across Japan's 47 prefectures, each of which has its own board of education. Using Spearman's rank correlations, we found that these achievement rankings are stable, not only across both years the testing was undertaken but also across both elementary and junior high school achievement levels.

Why then does achievement differ across the Japanese prefectures? Further, is it possible to identify the factors that can potentially explain these differences? Using the results of questionnaires given to students and schools, the Ministry of Education employed a regression analysis to help evaluate the factors influencing scholastic achievement. The survey included not only the school conditions but also the lifestyles and study habits of the students. For example, questions were included regarding whether students ate breakfast, completed their homework, and/or studied diligently. However, the question of why the lifestyles and study habits of Japanese students differ from one prefecture to another still remains. Moreover, which education policies should be implemented in order to improve student achievement? These questions plainly merit further research, as an econometric analysis is not sufficient to examine the factors affecting achievement.

We assume that school education, studying at home, and parental inheritance form the human capital of children, while inheritance comprises both the income and education levels of their parents. Home- and school-environment attributes differ at the prefecture level in Japan. Considering these attributes, we estimated certain regressions in order to investigate which factors affect the achievement of public elementary and junior high school students. We pooled the prefecture-level data for 2007 and 2008 and estimated our regressions using ordinary least square (OLS) estimation and the generalized method of moment (GMM) estimation. We detected several significant factors affecting scholastic achievement, including the effect of structural changes in income, a cross-term effect relating to teacher quantity, and the nonlinear effect of teacher quantity. We also found certain differences in the estimation results between elementary school achievement and junior high school achievement.

With respect to the home environment, our results show the importance of family income for both elementary school students and junior high school students due to its influence on the use of supplementary private education. Further, the effect of income is significantly stronger on high-scoring prefectures than on low-scoring prefectures. The presence of household members aged 65 and over positively and significantly influences achievement, as grandparents can help supervise and assist their grandchildren. The effect of the percentage of population with a university degree, as a proxy for the level of parental education, is also positive and significant. Moreover, we found evidence that the number of universities in a particular area serves as a positive externality on the achievement of students in that area.

With respect to school environment, our results indicate that the ratio of long-term absentees has a significantly negative impact on scholastic achievement. This suggests the importance of class atmosphere in student achievement. Furthermore, because the presence of skilled teachers is important for maintaining a good atmosphere in class, the significance of the percentage of absentees may also imply the importance of teacher quality. Using the percentage of teachers who graduated from university or graduate school as an indicator of teacher quality, we found a positive and significant influence on junior high school achievement, but not on elementary school achievement.[1] The inclusion of a cross-term effect between the number of teachers per student and the percentage of absentees is important for locating the positive effect of teacher quantity. Furthermore, we found that the effect of teacher quantity on elementary school achievement is nonlinear. That is, as the number of teachers increases, the impact on achievement becomes stronger. We also determined a negative effect from the percentage of female teachers on junior high school achievement, which may imply a gender influence.

To begin, we posit the following. Due to a lack of available data, we used the average scholastic achievement of the students rather than micro-level data. However, we did consider both the home and school environments. Our analysis confirms the importance of both environments on student achievement. In particular, we found that parental income is important for receiving a private education. Further, the effect of income is stronger for high-scoring prefectures than for low-scoring prefectures. That is, the importance of income increases with the level of achievement. The Ministry of Education has emphasized the effects of the lifestyles and study habits of students on their own achievement. However, it may be difficult for children in low-income households to have a high motivation to study due to a lack of incentive.[2] The education level of parents also positively influences their children's scholastic achievements. Although the presence of grandparents living with their grandchildren plays a crucial role in scholastic achievement, such presence has been decreasing in Japanese households due to an increase in the number of nuclear families. Therefore, the effect of the relationship between the human capital levels of parents and their children on achievement has become quite strong. The intergenerational transmission of earnings mobility through education could widen the income inequality in Japan.[3]

We found that the cross-term effect between the number of absentees and number of teachers plays an important role when examining the effect of teacher quantity. We also found that the nonlinear effect of teacher quantity is important for elementary school achievement. Accordingly, in the absence of either effect, the conclusion could be misleading. As for

[1] Although we attempted to include teaching experience and wages, we did not find any significant effects.

[2] Kariya (2009) pointed out an incentive divide among children, while Yamada (2008) and Abe (2010) found that low-income individuals tend to lose hope in escaping their economic situation. Nakamura and Nakajima (2011) showed that a low motivation to study might preclude poorer individuals from accessing higher education.

[3] Arai (2005) found family income and the private costs of education to be important determinants of the advancement to university-level education in Japan. Nakajima and Nakamura (2012, in press); Tachibanaki and Matsuura (2009) concluded that the academic background of parents has a direct effect on the incomes of their children. Nakajima and Nakamura (2009, 2012) examined the effect of an increase in the price of education on income inequality.