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Abstract submitted to 2010 AAEA meeting in Denver

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Why Are Teachers "Overpaid" in Developing Countries?
--The Role of the Nature of Educational Production in Teachers' Labor Markets

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While cognitive skills are important to individual incomes and economic development (Hanushek and Woessmann, 2008), the role of school quality in producing student cognitive skills, as measured by student achievement test scores, is somewhat disappointing in developing countries (Hanushek, 2003). In most existing studies, school quality variables such as teachers' education, class size, physical condition of classrooms, and the availability of instruction materials are usually found to have insignificant impacts on student achievement (Glewwe and Kremer, 2006). Such findings sharply question the effectiveness of public spending on schools in developing countries. If school quality does not improve student achievement, why spend money on schools?

A popular answer is: to promote teachers' welfare. In a widely-cited paper, Pritchett and Filmer (P&F, 1999) posit that teachers' welfare *directly* influences education spending, based on their critical review a large body of education production functions studies. This theory argues that education authorities in developing countries care about improving student achievement only insofar as it increases teachers' welfare. For that reason, schools tend to spend more money on the school characteristics (e.g. brighter classrooms and offices) that can contribute to teachers' welfare, than on school characteristics that contribute purely to student learning (e.g. textbooks).

Not only does this theory help to explain why public spending on school quality has little effect on student achievement, it also sheds some light on the hotly-debated issue of whether teachers are overpaid or underpaid in developing countries (see, e.g. Psacharopoulos et al, 1996, for a review on the teacher payment debate). For example, if teachers' welfare influences school spending, the easiest and perhaps most efficient way to improve teachers' welfare is simply to raise teachers' wage. P&F (1999) suggest a complex linkage between teachers' wage and school quality (via school spending decision). This linkage, which has been largely overlooked in previous studies, suggests that research relying solely upon individual teacher's wage and human capital data might not sufficiently resolve the debate on teacher payment.

Enlightening as their theory is, however, some of P&F's implications are not consistent with a number of observations in the teacher labor markets in developing countries. For example, the influence of teachers' welfare on school spending implies that the teacher labor market is *not* purely competitive. Since teachers derive welfare from school spending, their marginal gains will exceed their marginal contributions on student achievement, which, in most cases, is the only thing that teachers can make contribution to. The marginal gain above teachers' marginal productivity will thus attract more potential teachers to enter the teacher labor market. However, one typically observes high student-teacher ratios in developing countries, indicating a shortage of teachers. In China, for example, teacher retention is a problem that is increasingly attracting policy concerns (Sargent and Hannum, 2005). To better understand the teacher payment debate and the underlying school spending puzzle, a theory of teachers' wage determination is needed, such that (1) it can disentangle the complex link between teachers' wage and school quality, and (2) its implications are consistent with real-world observations in the teacher labor markets.

This paper tends to tackle this question by developing such a model: teachers are paid the value of their marginal contribution to student achievement, while a small change in their quality can lead to a large change in their wages. The model is built on some special features of educational production. For example, the public good nature (e.g. Lazear, 2001) and the sequential production feature (e.g. Kremer, 1993) of educational production imply the difficulty of substituting the *quality* of education with the *quantity* of education. For example, two low-quality teachers cannot substitute for a high-quality teacher in developing a certain amount of cognitive skills. A third-grade teacher's failure in developing sufficient amount of cognitive skills to the third-graders is not easily made up by hiring an additional fourth-grade teacher. The implied *complementarity* among school inputs create a sorting equilibrium in which teachers are matched at the same quality level in a given school. Meanwhile, the level of teacher quality is matched with other school quality characteristics in the same school. As a consequence, other teachers' quality raises an individual teacher's marginal productivity and thus bids up his/her wage. Finally, since teachers are matched at the same quality level, a small increase in teacher quality will lead to a large increase in teachers' wage, resulting in a wage distribution that is skewed to the right. This model helps explain why one observes large variation in teachers' wage, within and across countries, and why in some countries the mean teacher wage is much higher than workers with similar trainings, as surveyed in Psacharopoulos et al (1996).

The empirical specification takes the form of an extended Mincerian (1974) wage equation, which expresses the logarithm of an individual teacher's monthly wage as a linear function of his/her quality (proxied by his/her education and teaching experience), the average teacher quality (proxied by the mean education level and experience of *all* other teachers) in the same school, and other school quality variables. Two main hypotheses are to be tested. If sorting mechanism exists, then (1) the average education level of all other teachers will have significantly positive effect on an individual teacher's wage; (2) other school quality variables will have a (jointly) positive impact on an individual teacher' s wage.

These hypotheses are tested using data from an add-on component of the Gansu Survey of Children and Families (GSCF) conducted in Gansu, China, in 2004. The survey was targeted at a sample of 2000 children (aged 9-12 in 2000) randomly selected from 100 villages in Gansu; detailed information on their families, communities and their schools was collected. The add-on component included three linked questionnaires administered to *all* primary school teachers and principals in schools in every sampled village and their nearby villages. The data include information on 232 rural primary and lower-secondary schools and the employment histories of a sample of 2575 teachers.

The empirical findings confirm the predictions of the proposed sorting model. First, the average teacher quality has a strong positive impact on a teacher's wage. More importantly, the estimated impact of average teacher education on an individual teacher's wage is similar in size to the impact of his/her own education. Second, other school quality variables, e.g. number of books in library, have strong positive impacts

on a teacher's wage. In short, school quality bids up teachers' wage. These findings suggest that teachers' seemingly higher wages than other workers with similar trainings are driven by the sorting mechanism among teachers, due to the public good and sequential nature of educational production.