Official duty or private practice ? Teachers and markets for tutoring in poor countries

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Abstract

This paper expands Basu and Van's (1998) model of child labour to include educational provision, school infrastructure and publicly employed teachers who allocate their time between official duties and the provision of private tutoring. While increasingly common both in rich and poor countries, the problems with public employees taking on such double roles are not well understood. To explore this issue in depth, we focus on a development context where monitoring and incentive mechanisms are hard to implement. We study the existence and properties of a market for private tutoring and the relationship between the structure and other attributes of this market and equity and efficiency in human capital production. While educational outcomes are found to vary across rural (monopoly) and urban (competitive) settings, we show that the co-existence of government schools and private tutoring has an intriguing relationship to economic progress; benignly motivated rural development interventions aimed to raise rural incomes may adversely affect the educational attainments of children from poor households.

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1 Introduction and motivation

The division of labour between private and public provision is not only a hotly contested political topic, but one that has occupied economists since Adam Smith. Recent work in regulation theory has been complemented by empirical studies identifying the efficiency gains and distributional impacts of private provision of water, electricty and similar services in industrial and developing countries (e.g. Laffont and Tirole 1993, Vickers 1997, Besley 1998, Grout et al. 2004, Kirkpatrick et al. 2006). Curiously, the provision of key services such as health care and education has received much less rigorous scrutiny. In this paper, we study school teachers in developing country contexts who in addition to performing official duties may sell tutorial services to supplement their incomes. In spite of a high and growing prevalence of private tutoring, the agency problems associated with this double role are not well understood.

There is a broad consensus that the provision of free and widely available primary education is the duty of development-oriented governments.[1] Micro - and macroeconomic evidence documents the considerable economic returns to and positive externalities associated with such investments (e.g. World Bank 1993; Schultz 1993; Psacharopoulos 1994; Mingat 1998). Even so, the provision of quality schooling in developing countries is riddled with challenges; alarming levels of teacher absenteeism and the poor state of infrastructure have been reported in government run primary schools and other educational institutions in North-India (Dreze and Gazdar 1996; Kingdon and Muzammil 2003). More generally, Chaudury et al. (2006) report average figures of absenteeism of 19 per cent among teachers and 35 per cent among health workers in primary schools and health clinics in Bangladesh, Ecuador, India, Indonesia and Peru. Such weak performance by government schools is partly to blame for the proliferation of new, fee-charging private outfits creating two-tiered educational and health care systems (UNESCO 2003).

In India, private tutoring covers general studies at all levels. In rural India, where 75 per cent of the country's population reside, villages often have a single school with private tutoring likely to be structured around individual teachers. According to a 1993 nationwide survey, 30 per cent of students

[1] The achievement of universal primary education by 2015 is the second among eight United Nations Millennium Development Goals (http://www.un.org/ millenniumgoals/index.html).

were paying for private tuition (National Sample Survey Organization, 42nd round) and among these, 65 per cent were public school students. Moreover, two thirds of the private tutors instructors were full time teachers in public or private schools (Majumdar and Vaidyanathan 1994). Newspaper reports, anecdotes and occasional public demands for disciplining the teachers suggest that teachers often succumb to the temptation of neglecting their official duties to pursue their private interests. In response, several state governments have introduced complete bans on private tutoring by teachers employed in government schools. Whether supported by law or not, shortfalls in law enforcement make such bans unlikely to be effective. In spite of the 25 per cent absentee rate and the presence of official rules supporting punitive actions against transgressors, only a single head teacher in the 3,000 government run school included in Chaudury et al's (2006) sample, reported dismissing a teacher because of absenteeism (ibid. 93).[2] To remedy or preferably resolve problems of this kind, a better understanding of the efficacy of alternative policy routes that recognise the agency problems associated with teachers' double roles in contexts of widespread poverty and limited administrative capacity on the part of the state is urgently required.

1.1 Literature review

The impacts of shifts from public to private ownership and from public to private provision have received considerable recent attention (e.g. Laffont and Tirole 1993, Megginson and Netter 2001). In two papers, Biswal (1999a and b) argued that governments, by setting teachers salary sufficiently low, can ensure that the combined income from private tuition and salaries match reservation income levels. Based on US-data, Sylvan et al (2000) argue that students purchase private tuition in order to outperform their peers since earning higher grades is like winning races. In short, the tournaments that characterise modern education systems are partly responsible for the emergence of markets for private tuition. Moreover, while recognising that the monopoly case is problematic, Biswal (1999b) does not analyse the equity and efficiency effects of private tutoring, nor how these effects may vary with initial standards of living, across rural and urban settings and their relationship to economic progress. There is also no attempt to integrate school

[2] As shown by Duflo and Hanna (2006), improved monitoring and incentives have the potential for critically reducing absence and strengthening teaching quality and educational outcomes.

infrastructure in the analysis of tutoring, an issue that has received some recent empirical attention (Dang 2006).

In order to fill these gaps we use and extend Basu and Van's (1998) theory of child labour in several novel directions. Firstly, we specify an education production function that integrates different dimensions of school infrastructure and teacher effort within and beyond official duties involving classroom teaching. Secondly, we derive the conditions under which a market for tutoring will emerge and study educational attainments under two alternative assumptions about the structure of this market, (a) perfect competition, which we take to mimic an urban economic environment and (b) monopoly in the private tuition market which we interpret to echo a typical rural, village setting. Thirdly, we study the impacts of economic change (in the urban setting) and development interventions aimed to increase local income levels (e.g. micro-credit and similar schemes) in the rural setting.

The plan of the paper is as follows. Section 2 outlines the model which comprises N households, a government school, a private tutorial market and firms that hire adult and child labour. Section 2.1 articulates the education production function in the public school. Section 3 focuses on tutoring in an urban, competitive setting while section 4 presents the case of monopoly in the tutorial market, echoing the rural, village setting. In section 5 we analyse the impacts of uneven development caused by development interventions (rural) and liberalisation or similar policies (urban). Section 6 concludes.

2 The Model

We consider a model with N low income households, a public school and a private tutorial market. Household are initially assumed to be identical and resemble those in Basu and Van (1998) (BV from now onwards). Households consist of one parent and one child and the parent inelastically supplies one unit of labour and decides on how much time the child will devote to education and how much time to work. The public school system consists of a school inspector in the local education department and one teacher. The teacher decides on whether to undersupply effort while performing government school duties and on how much private tuition to supply outside his official duties. Throughout, the school inspector's role is taken to be exogenous. We retain the luxury and substituion axioms of BV and assume that parents invest in their children's education only after subsistence consumption is met. Moreover, child and adult labour are viewed by firms as (imperfect) substitutes.[3]

2.1 The education production function

As an important modification to the BV-model, we introduce an education (or human capital) production function (see Glewwe, 2002) whereby a child's educational outcome depends on time devoted to schooling and the effective learning inputs received.

Let the education production function be

$$h = Min \quad [t; s + x], \tag{1}$$

where h denotes the child's educational outcome and t is child time devoted to schooling, $t \in [0; 1]$, and s and x are learning inputs received from the government school and private tutorial sessions, respectively. Notice that the two learning inputs appear as perfect substitutes, while the total learning input $(s + x)$ is a perfect complement to time spent in school. The building blocks of s are further articulated in Section 2.2 below. Here it suffices to note that s will depend on school infrastructure and teacher effort. When the government school meets an ideal (according to some exogenous norm) standard, s attains a maximum value of 1. In an environment where this ideal standard is met (i.e. $s = 1$) a child's education will depend only on the time spent in school. In this case, maximum education or full schooling is attained through government school attendance and the demand for private tuition will be zero. However, if the ideal standard is not met (i.e. $s < 1$), maximum education is achievable only if school education is supplemented by private tutoring. However, full schooling (i.e. $t = 1$) may not be optimal if private tuition is prohibitively costly.

Figure 1 presents the L-shaped 'iso-education' curves for three different levels, below $h < s$, $h = s$ and $h > s$. If the lowest curve is chosen, the child is not benefitting fully from the education available in the government school. Conversely, when the highest curve is chosen, private tuition of amount x is added to the learning input s to match with time spent in school.

[3] **Luxury axiom**: A household will completely withdraw a child from school when the houshold's consumption drops below the subsistence level. **Substitution axiom**: Adult and child labour are regarded as imperfect substitutes in firms' production functions.

INSERT FIGURE 1 HERE

As in BV, parental preferences are represented by a Stone-Geary utility function, which is maximized with respect to (t, c):

$$\begin{aligned} U &= (c - \bar{c})h \quad if \;\; c \geq \bar{c} \\ &= (c - \bar{c}) \quad if \;\; c < \bar{c} \end{aligned} \tag{2}$$

subject to (1) and,

$$w_A + (1 - t)w_C = c(1 + \beta) + px,$$

where c is parental consumption, $\bar{c}$ parental subsistence consumption and x private tuition bought at price p. The child's consumption is represented by βc ($\beta < 1$).

The solution to the above problem resembles and differs from that of BV. As in BV, attending school is optimal only if w_A exceeds $\bar{c}(1+\beta) - w_C$. But the optimal allocation of time between school and work will depend on s and the tution price. In BV, s is implicitly set equal to 1. The optimal allocation of the child's time is now:

1. If $w_A \leq \bar{c}(1 + \beta) - w_C$, $t = x = 0$ and time devoted to work is 1, i.e. $l = 1$, where l refers to child labour.

2. If $\bar{c}(1 + \beta) - w_C < w_A < \bar{c}(1 + \beta) - w_C + 2sw_C$, $t < s$ and given by,

$$t = \frac{w_A + w_C - \bar{c}(1 + \beta)}{2w_C}. \tag{3}$$

   Accordingly, $x = 0$ and the supply of child labour is:

$$l = \frac{w_C - w_A + \bar{c}(1 + \beta)}{2w_C}. \tag{4}$$

3. If $\bar{c}(1 + \beta) - w_C + 2sw_C \leq w_A \leq \bar{c}(1 + \beta) - w_C + 2sw_C + ps$, $t = s$, $x = 0$ and $l = 1 - s$.

4. If $\bar{c}(1+\beta) - w_C + 2sw_C + ps < w_A < \bar{c}(1+\beta) + w_C + p(2-s)$, demand for private tuition becomes positive, and we get

$$t = \frac{w_A + w_C - \bar{c}(1+\beta) + ps}{2(w_C + p)}, \tag{5}$$

$$x = \frac{w_A + w_C(1-2s) - \bar{c}(1+\beta) - ps}{2(w_C + p)} \tag{6}$$

$$l = \frac{w_C - w_A + \bar{c}(1+\beta) + p(2-s)}{2(w_C + p)}. \tag{7}$$

5. If $\bar{c}(1+\beta) + w_C + p(2-s) \leq w_A$, we have $t = 1, x = 1-s$ and $l = 0$.

In our model, tutorial demand will emerge under two conditions, firstly when the learning input provided by the government school is inadequate, represented by the case of s $<$ 1, and secondly when households can afford to buy tutorial services. The latter condition requires the adult wage to be at least $\bar{c}(1+\beta) - w_C + 2sw_C + ps$. Before deriving aggregate tutorial demand and aggregate labour supply, we impose the substitution axiom and set $w_C = \gamma w_A$, where $\gamma < 1$ is the scaling factor translating child labour into adult labour equivalents. Substituting this relation into various critical wage levels that apply to equations (3) through (7) we now introduce the following notation:

$$w_A^- = \frac{\bar{c}(1+\beta)}{1+\gamma},$$

$$\tilde{w}_A = \frac{\bar{c}(1+\beta)}{1+\gamma(1-2s)},$$

$$\hat{w}_A = \frac{\bar{c}(1+\beta) + ps}{1+\gamma(1-2s)},$$

$$w_A^+ = \frac{\bar{c}(1+\beta) + ps + 2p(1-s)}{1-\gamma}.$$

Tutorial demand: Using equation (6), we aggregate tutorial demand across households for the entire economy and present it below using the above notations.

$$
\begin{aligned}
X_D &= 0 \quad for \;\; w_A \leq \hat{w}_A, \\
&= N\left[\frac{w_A[1+\gamma(1-2s)] - \bar{c}(1+\beta) - ps}{2(\gamma w_A + p)}\right] \quad for \;\; \hat{w}_A < w_A < w_A^+ \\
&= N(1-s) \quad for \;\; w_A \geq w_A^+. \qquad (8)
\end{aligned}
$$

It can be readily checked that the tutorial demand curve is downward sloping in p, increasing in w_A and decreasing in s.[4]

Aggregate labour supply: Similarly, we derive aggregate labour supply by using equations (4) and (7) after taking into account the inelastic supply of labour from adult workers. Modifications to child labour supply are noteworthy when the child's education is constrained to s over an intermediate region of the adult wage.

The aggregate labour supply expressed in adult labour units is

$$
\begin{aligned}
L_S &= N(1+\gamma) \quad for \;\; w_A \leq w_A^-, \\
&= N(1+\frac{1}{2}\left[\frac{\bar{c}(1+\beta)}{w_A} - (1-\gamma)\right] \quad for \;\; w_A^- < w_A < \tilde{w}_A, \\
&= N(1+\gamma(1-s)) \quad for \;\; \tilde{w}_A \leq w_A \leq \hat{w}_A, \qquad (9) \\
&= N\left[1+\gamma\frac{\bar{c}(1+\beta) + p(2-s) - w_A(1-\gamma)}{2(\gamma w_A + p)}\right] \quad for \;\; \hat{w}_A < w_A < w_A^+, \\
&= N \quad for \;\; w_A^+ \leq w_A.
\end{aligned}
$$

Contrast this with the BV-model. In BV $s = 1$ (and also $p = 0$) implicitly, $\tilde{w}_A = \hat{w}_A = w_A^+$, and consequently child labour will be lower over the range $(\tilde{w}_A, w_A^+)$ than in our model. Hence, the low quality of schooling infrastructure may contribute to low school attendance especially among children from poor households.

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[4] For the elastic part of X, the following holds:

$$
\begin{aligned}
\frac{\partial X_D}{\partial p} &= -N\left[\frac{\gamma s w_A + [w_A - \frac{\bar{c}(1+\beta)}{1+\gamma(1-2s)}][1+\gamma(1-2s)]}{2(\gamma w_A + p)^2}\right] < 0, \\
\frac{\partial X_D}{\partial w_A} &= N\left[\frac{[p(1+\gamma(1-2s))] + \bar{c}(1+\beta)\gamma}{2(\gamma w_A + p)^2}\right] > 0, \\
\frac{\partial X_D}{\partial s} &= -N\frac{[2\gamma w_A + p]}{2(\gamma w_A + p)} < 0.
\end{aligned}
$$

Moreover, $|\frac{\partial X_D}{\partial s}| < N$, or $|\frac{\partial x_D}{\partial s}| < 1$ where $N x_D = X_D$.

Figure 2 presents the labour supply function. Below w_A^- all children work full time and aggregate labour supply attaints a maximum equal to $N(1+\gamma)$. Conversely, above w_A^+ children attend government school full time and purchase $(1-s)$ amount of tuition. Over the intermediate range $(\hat{w}_A, \tilde{w}_A)$ children attend school only up to s fraction of time and there is no demand for tutorial services.

Proposition 1 *Compared to Basu and Van (1998), our model predicts more child labour over a given wage range. This discrepancy is most pronounced when school infrastructure is of poor quality.*

INSERT FIGURE 2 HERE

Labour demand: Finally we specify the labour demand function. Suppose that a representative firm facing a competitive labour market hires workers by maximizing $\pi = f(L_A + \gamma L_C) - w_A L_A - w_C L_C$. The firm will be indifferent between the two types of workers if $w_C = \gamma w_A$, which has already been imposed in our model. As in BV, this condition must be fulfilled in equilibrium for both types of workers to be hired. Assuming that this condition holds, we note that the aggregate labour demand (expressed in units of adult labour) function is a standard, downward sloping curve:

$$L_D = L(w_A). \tag{10}$$

2.2 The public school

The analytical focus is on a setting where a village (or city) school is run by a single teacher contracted by the local education authority to supply 1 unit of labour, which we may interchangeably call effort, assuming that effort is observable and hence contractable. The teacher's effort translates into a learning input which is received equally by N students. The teacher is monitored only randomly (because of costs and limited administrative capacity) and may supply less than the contracted effort so that $e < 1$.

As noted overleaf, learning outcomes depend not only on the teacher's effort, but also on school infrastructure (denoted by k), which we interpret to include an appropriate classroom environment (which is sensitive to N) as well as access to proper textbooks and other learning aids.[5] The combined provision of these is evaluated against a norm – for a class of size N. Let the ideal standard be 1, so that the highest value the infrastructure variable k can attain is 1.[6]

Let the learning input provided by the government school be determined by the following function:

$$s = ke, \qquad 0 < k, s \leq 1. \tag{11}$$

As noted, the teacher is accountable to the local education department and it's school inspector who is responsible for overseeing the schools' activities, monitoring and penalising the teacher and supplying school infrastructure.[7] The education departent thus remains in the background assuming an exogenous monitoring role, and there is no collusion between school inspectors and teachers.

The teacher's objective function is assumed to be given by

$$u_T = y(1 - \mu(1 - e)\theta) + bpx(\bar{e} - e). \tag{12}$$

The teacher is endowed with $\bar{e}(\geq 1)$ units of labour, of which he inelastically supplies $(\bar{e} - 1)$ hours to tutoring. The teacher might increase this supply by cutting into school hours, if this is optimal. If shirking school duties by $(1 - e)$ hours, the probability of detection is μ, in which case a penalty of $(1 - e)\theta y$ Rupees $(1 < \theta < 1/\mu)$ is imposed. But shirking allows for the supply of $x(\bar{e} - e)$ amount of private tutoring. The function $x(.)$ is assumed to be increasing and concave in $(\bar{e} - e)$.[8]

The positive parameter b in (12) captures the teacher's valuation of supplementary income. The case of an honest and dutiful teacher can be captured by setting $b = 0$. Also by assuming $\bar{e} > 1$ we allow for teacher diligence

[5] A considerable empirical literature has addressed the relationship between school infrastructure and educational outcomes. See Glewwe (2002) for an overview. In a study of schooling in Ghana, World Bank (2004) reports that while improvements in school buildings enhance enrolment, improvements in textbook quality and teaching strengthen learning outcomes.

[6] One can write $k = (a\frac{B}{\bar{B}} + (1 - a)\frac{K}{\bar{K}})$, where $0 < a < 1$ and B refers to books, and K to physical resources; $\bar{B}$ and $\bar{K}$ represent their ideal standards.

[7] The education department's role can potentially be broader and include the design of monitoring rule, school curriculum and interactions with parents. We abstract from all these to focus on educational outcomes and teacher effort.

[8] We can readily accommodate leisure, but this is not essential.

and the possibility that private tutoring may not always be at the expense of classroom teaching. However, if $\bar{e} = 1$, tutoring will replace and be at the expense of class room effort.

This specification can now account for a spectrum of neglects of official duties by government employed teachers. Suppose that the probability of being caught shirking is zero (because of poor monitoring) or that no penalties are incurred on shirkers. In such a case, a selfish teacher will regard y as the equivalent of a government stipend and be at liberty to pursue tutoring and other activities. As in Dreze and Gazdar's (1996) observations in Uttar Pradesh, India shirking may become endemic: all human capital production is privatised and generated through tutorial sessions.

The externality from the teacher's effort on tuition demand is a key feature of our model. By shirking classroom duties, the teacher automatically enhances the demand for private tuition; however, while aware of this externality, the teacher may not be able to internalize it unless he has market power. To highlight this aspect, we therefore consider two types of market structure in the tuition market, perfect competition and monopoly. In the first case, the teacher has no power to internalize, while in monopoly internalisation can be complete. Under monopoly, therefore, one purpose of shirking would be to manipulate tuition demand.

The assumption of a competitive tuition market fits an urban setting with many able and educated tutors, in contrast to a rural setting where the monopoly assumption is more appropriate. Indeed, in developing countries rural areas comprise villages, often with a single school, with low literacy rates and geographic isolation, and where a tutorial market is likely to form around individual school teachers.

3 Private tutoring in the city - the competitive case

We first consider the competitive (i.e. urban) case. For a given (k, y) and maximizing the teacher's objective function with respect to e, we get the following first order condition:

$$y\mu\theta - bpx'(.) = 0. \tag{13}$$

From this we derive the optimal effort as $e(p)$ and in turn the teacher's tuition supply as $x_S^T = x(\bar{e} - e)$. Since $x''(\bar{e} - e) < 0$, $e(p)$ is decreasing in p

while $x_s^T(p)$ is increasing in p. Notice also that the teacher's effort e responds positively to y.[9]

Moreover, there is a critical value of p below which the teacher will find it optimal to supply full effort in the government school. If p falls below $\hat{p} = y\mu\theta/[bx'(\bar{e}-1)]$, $e(p) = 1$ and $x_s^T = \bar{e} - 1$ which we denote as $\underline{x}$.

Finally, the competitive tutorial market has m independent and identical suppliers (apart from the teacher), and their individual supply decisions may be summarised by a positively sloped supply curve $x_S(p)$. We can now write the aggregate tutorial supply as

$$\begin{aligned} X_S(p) &= mx_S(p) + \underline{x}, \quad if\ p \leq \hat{p}, \\ &= mx_S(p) + x_S^T(p), \quad if\ p > \hat{p}. \end{aligned} \tag{14}$$

INSERT FIGURE 3 HERE

Figure 3 depicts the aggregate tuition supply curve given by (14). Below $\hat{p}$ the school teacher inelastically supplies $\underline{x}$ along with the m independent tutors. This segment is drawn linear for the sake of simplicity. Above $\hat{p}$ the teacher begins to shirk and his tuition supply becomes price elastic. We next consider the equilibrium of our model economy.

3.1 Equilibrium

The equilibrium of this economy can be characterized by (w_A^*, p^*) conditional on the education department's choice of k and y. Exploiting the fact that child labour is given by $1-t = 1-s-x_D(w_A, p; s)$ we write aggregate labour supply as $L_S(w_A, p; s)$, where s now depends only on k. The following two market clearing conditions give the competitive equilibrium:

$$L_D(w_A) - L_S(w_A, p; s) = 0, \tag{15}$$
$$X_D(w_A, p; s) - X_S(p) = 0. \tag{16}$$

[9] More specifically,

$$\frac{\partial e}{\partial p} = \frac{x'(.)}{px''(.)} < 0,$$
$$\frac{\partial e}{\partial y} = -\frac{\mu\theta}{bpx''(.)} > 0.$$

Though a variety of solutions are admissible, we focus on a stable interior solution, which requires that $0 < x < (1 - s)$; hence, children from poor families enhance their human capital through supplementary tuition, but also work part time in the labour market.[10] Since $X_D(.)$ is downward sloping and $X_S(.)$ upward sloping, equilibrium in the tutorial market, if it exists, will be unique and stable. It is further seen that this existence can be easily guaranteed.[11] In the labour market, we assume that the labour demand curve cuts the labour supply curve from left (both declining) which secures a stable unique equilibrium within the interval $(\hat{w}_A, w_A^+)$ as illustrated in Figure 4a. For stability of the equation system we assume that the matrix formed by the partial derivatives of (15) and (16) is negative definite.

There are two possibilities that we need to take note of. If the number of independent tutors, m, is sufficiently large, the equilibrium price may settle below $\hat{p}$, in which case we will not observe shirking by the teacher who will inelastically supply $\underline{x}$ amount of tuition (provided $\bar{e} > 1$). On the other hand, if m is not large enough, equilibrium p may exceed $\hat{p}$, and the teacher will shirk by $(1 - e^*)$ hours, and devote those hours to additional tutoring, which is shown in Figure 4b. Shirking will reduce the level of learning input at school, s, which can be more than compensated by private tution. As long as m is not too small, this will be generally true.

Proposition 2 *In the competitive equilibrium if $p^* \leq \hat{p}$, the teacher does not shirk official duties; yet students buy private tuition if $s < 1$. On the other hand, if $p^* > \hat{p}$ shirking is optimal, reducing the value of s in equilibrium. In either case, children also participate in the labour market as part time workers. As the number of independent tutors m increases, p^* falls and the tutorial market plays a more complementary role in the provision of education by compensating for deficiency in government school infrastructure.*

[10] If multiple equilibria arise as in BV, we may get an equilibrium in which the tuition market does not operate, with education restricted by inadequate school infrastructure s. In this case, the supply curve in the tuition market must lie above the demand curve and the lowest supply price must be sufficiently high.

[11] As p approaches zero, X_S is bounded below by $\underline{x} > 0$, while X_D will approach at least $N\left[\frac{w_A(1+\gamma(1-2s)) - \bar{c}(1+\beta)}{2\gamma w_A}\right]$. We assume that N is large enough to ensure that $X_D(0) > X_S(0)$. On the other hand, as p approaches a very large number, X_D approaches zero and X_S exceeds $\bar{x} > 0$. Hence, at any given $w_A \in (\hat{w}_A, w_A^+)$, X_D will intersect X_S at some intermediate price.

INSERT FIGURES 4a AND 4b HERE

The competitive equilibrium has well-behaved comparative static properties. We focus on the effects of (i) an exogenous increase in labour demand, and (ii) an increase in s caused by improvements in the provision of k (i.e. new textbooks, blackboards and other teaching aids). Suppose that competition is sufficient to secure that $p^* < \hat{p}$ so that the teacher chooses not to shirk.[12] If the labour demand curve shifts upward, the adult wage will rise, leading to a drop in child labour and higher educational attainments. However, this educational gain will materialise via the tutorial market, where both the equilibrium price and quantity will rise because parents are prepared to invest their higher earnings in more education for their children. This closely resembles BV's results with adult labour demand playing a key role in reducing child labour.

Next, if s increases due to improvements in government school infrastructure, parents are encouraged to keep their children in school a bit longer, causing child labour supply to decline and the adult wage to rise. Educational outcomes also improve. However, the effects on the tutorial market are ambiguous because of two conflicting effects on tutorial demand: the direct effect of a higher s is negative, while the secondary effect of a rise in w_A is positive. The net effect on p is indeterminate and the tutorial market may expand or contract. Even so, the net effect on education is positive. See Appendix 1 for the derivation of these results.

The existing literature on child labour has primarily focused on educational gains from interventions in adult (i.e. BV) and child labour markets (e.g. ILO 2006), but we show that the effects can go either way. Educational policies may also improve labour market outcomes and the private tutorial market can be a hurdle or a facilitator. On the one hand, the tutorial market offers a route for compensating for public school failures; but sometimes the tutorial price may rise sharply, choking off some of the positive effects of s. In general it can be argued that if the tuition market is competitive, supplementary education will be bought at its marginal cost with a Pareto improvement being the most likely outcome.

Proposition 3 *A positive shock in the demand for adult labour or an improvement in school infrastructure will both increase the adult wage and chil-*

[12] The case of $p^* > \hat{p}$ can be easily accommodated. See Appendix.

dren's human capital, while reducing child labour. In the first case, the increase in human capital is generated mainly through the tutorial market. In the second case, the tutorial market may contract and the gain in human capital can be attributed entirely to school infrastructure improvements.

4 The village school and monopoly in the tutorial market

In a typical village setting, and for reasons explained above, we expect the school teacher to be the sole supplier of tuition (i.e. $m = 0$). The total amount of tuition services sold will therefore equal $x(\bar{e} - e)$. Recognizing this the teacher will be able to internalize the effects of his choice of effort on tuition demand.

We begin by replacing p with the inverse demand function for tuition $p(X)$ (obtained from (8)) in the teacher's objective function. Then setting $X = x(\bar{e} - e)$, or simply $X(\bar{e} - e)$, and maximizing with respect to e, we get the following first order condition:

$$y\mu\theta - bX'(\bar{e} - e)[p(.) + p'(.)X(\bar{e} - e)] = 0. \tag{17}$$

This is nothing but the familiar marginal condition for monopoly with the first term being the marginal cost of shirking. The second term is the marginal revenue productivity of shirking (or effort going into tuition). The term inside the bracket is the familiar marginal revenue (MR) term for a monopolist.[13] Since X_D is inversely related to e, the village teacher will now supply much less classroom effort than his urban counterpart facing a competitive tutorial market. Consequently, the tutorial demand curve will shift further out than before. Because of this shift of demand and the market power wielded by the teacher, the tuition price will rise above the competitive level and also above the marginal cost $y\mu\theta$.

The equilibrium for the economy as a whole can now be derived by simultaneously solving equation (17) and the labour market equilibrium conditon (15) as before. Let us denote $bX'(.)[p + p'(.)X(\bar{e} - e)]$ as $\phi(e, w_A)$. We know

[13] The second order condition is satisfied. Let the FOC be written as $y\mu\theta - bX'(\bar{e} - e)[MR_X] = 0$. Differentiate this with respect to e. We get $bX''(.)[MR_X] + bX'(.)[\frac{\partial MR_X}{\partial X}X'(.)]$. since $X''(.) < 0$ and $\frac{\partial MR_X}{\partial X} < 0$ the whole expression is negative.

that $\frac{\partial \phi}{\partial e} > 0$. Now rewrite the equilibrium conditions as,

$$L_D(w_A;\rho) - L_S(w_A, p(X(\bar{e}-e)), s(e)) = 0 \quad (18)$$
$$y\mu\theta - (\bar{e}-e)\phi(e, w_A) = 0. \quad (19)$$

Assume that the Jacobian matrix of this system of equations with respect to w_A and e is negative definite, which is needed for stability. We can now ensure that there exists a pair (w_A^M, e^M) which solves the monopoly problem and determines the equilibrium price of private tuition.

The nature of this monopoly equilibrium can be understood from the following thought experiment. Suppose first w_A is given, so that we can ignore the effects on w_A. In the tuition market, as compared to the competitive case, the tutorial price will be higher, because the teacher will shirk more (i.e. $e^M < e^*$). Two effects prompt this price rise. Shirking by the government school teacher induce parents to seek more tuition (the demand effect), and the teacher's monopoly power allows pricing above marginal cost (the market power effect). This combination results in a higher market price for tuition, and manipulation of tuition demand via shirking. Reduced learning inputs from school (as compared to the competitive case) and reduced tuition leads to an overall decline in educational attainments. In Figure 5 the monopoly equilibrium is shown. The expected penalty from shirking appears as constant marginal cost to the monopolist, while incremental tutorial earnings give rise to the so-called marginal revenue curve. Optimal shirking is determined where MC=MR.

Now let the adult wage be free. The reduction in educational attainment results in more supply of child labour, and consequently, the wage will drop below its competitive level. Thus in equilibrium we have, $w_A^M < w_A^*$, $p^M > p^*$ and $e^M < 1$.[14] That is, in a representative village setting the teacher is likely to shirk more, charge a higher tuition fee while the adult wage will also be lower compared to an urban area, assuming otherwise identical households. This theoretical prediction roughly matches with Indian evidence.

Proposition 4 *Monopoly in the market for private tutoring reduces educational attainments through several routes - firstly, the teacher will shirk more which reduces human capital generation in the government school. Secondly, the higher price of tutoring implies that less additional human capital will be*

[14] With concave $x(.)$ this conclusion remains the same with monopoly generating an inferior outcome compared to the competitive case.

generated through private tutoring compared to the competitive case. Finally, there will be more child labour as a result and lower adult wages when compared to the competitive case. Combined, we observe an increased risk of a local poverty trap. Notice that the more lax the school monitoring regime, the higher this risk.

INSERT FIGURE 5 HERE

It remains to be seen whether an increase in labour demand, or in teacher's salary leads to an unambiguous improvement in educational outcomes. The comparative static effects show that an exogenous shift in labour demand will raise the adult wage, but reduce the teacher's effort. [15] Nevertheless, child labour will decline and child education will rise. This will be coupled with an increase in tutorial service provision and its price. On the other hand, if the teacher's salary is increased, his effort will improve causing an improvement in s. This creates some ambiguity about the adult wage, and also about child labour and educational outcome. However, invoking a regularity assumption (see Appendix 2 for details), we ascertain that child education will rise and child labour will decline. These comparative static effects are not as strong as in the competitive case. In general, it can be argued that the school teacher who also enjoys market power in the tuition market, will shirk severely in order to manipulate tutorial demand, and then charge a price in excess of the marginal cost.

5 Uneven development

Starting from a benchmark where all households are poor, we now consider the impacts of a process of uneven development. We model uneven development by assuming that a fraction of households, say α, experience a discrete income gain, M, from an exogenous source which varies across rural and urban settings. At the village level, uneven development may be caused by a benignly motivated policy scheme with incomplete outreach so that some groups among the poor may be excluded. For instance micro-credit or more targeted interventions are often found to have limited and selective outreach

[15] This also implies that if poor households' experience a negative income shock, the tuition market becomes less attractive and the teacher will increase his effort in school.

(Zeller and Meyer 2002). In urban settings, in contrast, it is widely documented that the effects of economic liberalization often are uneven with some groups experiencing distinct income gains, while others are less fortunate (Corina 2003). For simplicity, we assume that M is sufficiently large to cover the subsistence consumption need $\bar{c}(1+\beta)$. Household preferences are unchanged, and the higher income households participate in the same labour and tuition markets as others. We denote the development beneficiaries as α-households. Formally, their utility maximization problem as given in (2) implies a modified budget constraint given by

$$c(1+\beta)+px=w_A+(1-t)w_C+M.$$

As before we derive the tutorial demand and child labour supply functions by maximizing household utility subject to (1) and the above budget equation. Their optimal choices, after substituting $w_C=\gamma w_A$, are given by:

$$\begin{aligned}
x_\alpha &= 0, \quad for \quad w_A \leq \hat{w}_{A\alpha}, \\
&= \frac{w_A[1+\gamma(1-2s)]+M-\bar{c}(1+\beta)-ps}{2(\gamma w_A+p)} \quad for \quad \hat{w}_{A\alpha}<w_A<w_{A\alpha}^{+}, \\
&= 1-s \quad for \quad w_{A\alpha}^{+} \leq w_A,
\end{aligned}$$

and

$$\begin{aligned}
l_\alpha &= 1-s, \quad for \quad w_A \leq \hat{w}_{A\alpha}, \\
&= \frac{\bar{c}(1+\beta)+p(2-s)-w_A(1-\gamma)-M}{2(\gamma w_A+p)} \quad for \quad \hat{w}_{A\alpha}<w_A<w_{A\alpha}^{+} \\
&= 0 \quad for \quad w_{A\alpha}^{+} \leq w_A,
\end{aligned}$$

where

$$\begin{aligned}
\hat{w}_{A\alpha} &= \frac{\bar{c}(1+\beta)+ps-M}{1+\gamma(1-2s)}, \\
w_{A\alpha}^{+} &= \frac{\bar{c}(1+\beta)+ps+2p(1-s)-M}{1-\gamma}.
\end{aligned}$$

It is noteworthy that $x_\alpha \geq x$ and $l_\alpha \leq l$, where x and l represent tuition demand and child labour supply for the $(1-\alpha)$ households that are excluded from the rural scheme or, in the urban case, from the benefits of liberalisation. It is also important to note that the critical wage levels (at which labour supply decisions change) for the two groups compare as, $\hat{w}_{A\alpha} < \hat{w}_A$ and $w^+_{A\alpha} < w^+_A$, implying that in α-households, children will be sent to tutorial sessions much earlier than in the $(1-\alpha)$-households. Children also drop out of the labour market sooner. Moreover, these children are assured of at least some education, because M secures subsistence consumption. [16] Here, we focus on one segment of the labour supply and tuition demand curves that permit an interior solution and standard comparative static exercises. To start with we consider the competitive tutorial market for which the tuition supply curve, it can be readily checked, remains unchanged. Similarly, the labour demand curve will also, for obvious reasons, be unchanged.

Starting with the urban setting with competition in tutorial provision, various possibilities exist. The α-group may achieve maximum education and their children may completely withdraw from the labour market. If so, they may push up the price of tuition to a level where the $(1-\alpha)$-group is forced to drastically reduce tuition consumption and as a result their overall educational attainments. We now witness distinct dualism in educational outcomes mirroring disparities in household incomes. We shall focus here on a more general outcome, where the α-group generates higher tuition demand and less child labour supply. This affects the $(1-\alpha)$-group in two ways. In the labour market the adult wage goes up, with all households benefiting as a result; at the same time the tuition price will also increase, adversely affecting tuition consumption, especially of the less well-to-do $(1-\alpha)$ group. While the α-group as a direct beneficiary of the income effect will be better off, the welfare of the other group may improve or deteriorate. In particular their children may end up working longer hours in spite of a higher equilibrium wage. In all cases, the educational outcomes of the two groups will differ with children from $(1-\alpha)$-households receiving less education.

We present this argument formally by focusing on aggregate labour supply and tuition demand within the interval $[\hat{w}_A, w^+_{A\alpha}]$, assuming of course that p is such that $\hat{w}_A < w^+_{A\alpha}$. In this interval, $x_\alpha = x + \frac{M}{2(\gamma w_A + p)}$, and $l_\alpha = l - \frac{M}{2(\gamma w_A + p)}$. The additional income of the α households raises tuition demand and lowers child labour supply by the same amount.

[16] Since these critical wage levels are sensitive to the equilibrium tuition price, the two groups may now behave quite differently for a given adult wage rate. This makes expressions for the aggregate labour supply and tuition demand quite cumbersome and we therefore relegate the full characterization of these two functions to the Appendix.

The aggregate tuition demand and labour supply are,

$$X_D^n = N\left[\alpha x_\alpha(w_A, p; M) + (1-\alpha)x(w_A, p)\right] \qquad (20)$$
$$L_S^n = N\left[\alpha l_\alpha(w_A, p; M) + (1-\alpha)l(w_A, p)\right]. \qquad (21)$$

The tuition supply curve remains unchanged from (14). However, the equilibrium conditions (15) and (16) are modified as,

$$L_D(w_A) - L_S^n(w_A, p; M) = 0, \qquad (22)$$
$$X_D^n(w_A, p; M) - X_S(p) = 0. \qquad (23)$$

Suppose the market clearing wage and price are (w_A^n, p^n), and $w_A^n \in [\hat{w}_A(p^n), w_{A\alpha}^+(p^n)]$. How does (w_A^n, p^n) compare with (w_A^*, p^*)? One way to answer this question is to derive the comparative static property of (w_A^n, p^n) with respect to M. Formally,

$$\frac{\partial w_A^n}{\partial M} = \frac{\alpha\gamma N}{\Delta^n}\left[\frac{\partial x_\alpha}{\partial M}\frac{\partial X_S}{\partial p}\right] > 0 \qquad (24)$$
$$\frac{\partial p^n}{\partial M} = \frac{\alpha N}{\Delta^n}\left[-\frac{\partial x_\alpha}{\partial M}\frac{\partial L_D}{\partial w_A}\right] > 0, \qquad (25)$$

where

$$\Delta^n = \left[\frac{\partial L_D}{\partial w_A} - \frac{\partial L_S^n}{\partial w_A}\right]\left[\frac{\partial X_D^n}{\partial p} - \frac{\partial X_S}{\partial p}\right] + \frac{\partial L_S^n}{\partial p}\frac{\partial X_D^n}{\partial w_A}.$$

We relegate the formal derivation of our results to Appendix 3. For stability $\Delta > 0$, and we also know that $\frac{\partial x_\alpha}{\partial M} > 0$. Further, since $\frac{\partial L_D}{\partial w_A} < 0$ and $\frac{\partial X_S}{\partial p} > 0$, the effects of M on w_A^n and p^n are unambiguously positive. Thus, making a section of the poor 'richer' benefits everybody by raising the adult wage in equilibrium. But it will also, at the same time, raise the price and costs of private tutoring.

We know for sure, despite tuition being costlier, that the α group will increase their tuition consumption and reduce child labour supply. But the same cannot be said about the $(1-\alpha)$-households. If the effect of the tuition price increase dominates that of the wage increase on their tution demand, educational attainments will fall and child labour will increase for this group.

The education levels of the α- and $(1-\alpha)$-groups are $h_\alpha = s + x_\alpha$ and $h = s + x$ respectively. The effects on an increase in M on their levels of education can be read directly from the effects on their tuition consumption:

$$\begin{aligned}\frac{\partial x_\alpha}{\partial M} &= \frac{\partial x_\alpha}{\partial w_A}\frac{\partial w_A^n}{\partial M} + \frac{\partial x_\alpha}{\partial p}\frac{\partial p^n}{\partial M} + \frac{\partial x_\alpha}{\partial M} \\ \frac{\partial x}{\partial M} &= \frac{\partial x}{\partial w_A}\frac{\partial w_A^n}{\partial M} + \frac{\partial x}{\partial p}\frac{\partial p^n}{\partial M}.\end{aligned}$$

Consider the expression for $\frac{\partial x}{\partial M}$. The first term is positive, but the second term is negative (because $\frac{\partial x}{\partial p} < 0$). Once we substitute the expressions for $\frac{\partial w_A^n}{\partial M}$ and $\frac{\partial p^n}{\partial M}$, we get

$$\frac{\partial x}{\partial M} = \frac{\alpha\gamma N}{\Delta^n}\frac{\partial x_\alpha}{\partial M}\left[\frac{\partial x}{\partial w_A}\frac{\partial X_S}{\partial p} - \frac{\partial x}{\partial p}\frac{\partial L_D}{\partial w_A}\right].$$

If the labour demand curve is steeper than the tuition supply curve, the second term inside the bracket is likely to dominate. If so an increase in M will reduce the tuition consumption of the $(1-\alpha)$-group, whose child labour supply will also be greater. But this is not the only possibility. Their tuition consumption can also increase if the first term inside the bracket dominates. For the α-group, however, tuition consumption tuition will invariably increase. As the total sale of X increases due to an increase in M, the α group will never settle for a decrease in its consumption. The third term in the expression for $\frac{\partial x_\alpha}{\partial M}$ is positive, and this will ensure that the overall effect is positive. In all cases, $x_\alpha > x$, establishing that the education level of the α group always is higher.[17]

Proposition 5 *In the urban, competitive case, for children from the α-group, educational attainments will increase through more private tutoring. For the $(1-\alpha)$ group, the effect is ambiguous. While higher adult wages will increase the demand for tutorial services, the price of private tutoring will also surge. If the latter effect dominates, the impacts of uneven liberalisation will more adversely affect the educational attainments of children from poor and excluded households if the quality of government school infrastructure already is low.*

[17] This result is less sharp when the teacher's tuition production function is concave. In that case the teacher will shirk and s could no longer be treated as fixed. Nevertheless, under some reasonable conditions the results will go through.

In the presence of a private tutorial market, human capital generation is bound to vary across children from different socio-economic backgrounds. In other words, educational inequality will closely reflect income disparities among households. This happens despite a free public education system whose very purpose was to prevent such educational disparities. The solution does not necessarily lie in banning the private tutorial market (because that can be counter-productive), but by making it redundant. This is possible, if public schools satisfy two crucial conditions, - provide higher quality infrastructure in government schools, an issue routinely neglected by developing country governments, and more effectively address the agency problem inherent in class-room teaching. The latter is a tougher call, especially in rural settings where incentives for manipulation by teachers are particularly strong. As shown by Duflo and Hanna (2006), mechanisms for improving teacher accountability do, however, exist.

INSERT FIGURES 6a AND 6b HERE

Figures 6a and 6b present the impacts of an increase in M on the tuition and labour markets for the competitive case. In the tutorial market tuition demand increases leading to rises in both price and quantity. However, increased tuition price adversely affects the $(1-\alpha)$ group, and therefore, their consumption of tution actually falls. For the α group the effects are clearly positive. In the labour market the negative effect experienced by the poorer households is displayed in Figure 6b. Child labour supply increases and the equilibrium wage also falls.

We next consider uneven development with monopoly or proximate monopoly in the tutorial market. As noted, development intervention such as a micro-credit schemes while raising the income of some, are often found to leave others out.

The equilibrium conditions are similar to (17) and (18) with the modification that the teacher now recognizes the presence of the α group:

$$L_D(w_A) - L_S^n(w_A, p(X(\bar{e}-e)), s(e); M) = 0 \tag{26}$$

$$y\mu\theta - \phi^n(e, w_A; M) = 0. \tag{27}$$

Suppose (w_A^n, e^n) is the solution to these equations. Now differenting w_A^n

and e^n with respect to M, we get:

$$\frac{\partial w_A^n}{\partial M} = \frac{1}{D^n}\left[-\frac{\partial \phi^n}{\partial e}\frac{\partial L_S^n}{\partial M} + \frac{\partial L_S^n}{\partial e}\frac{\partial \phi^n}{\partial M}\right], \quad (28)$$

$$\frac{\partial e^n}{\partial M} = \frac{1}{D^n}\left[\frac{\partial \phi^n}{\partial M}\left(\frac{\partial L_D}{\partial w_A} - \frac{\partial L_S^n}{\partial w_A}\right) + \frac{\partial L_S^n}{\partial M}\frac{\partial \phi^n}{\partial w_A}\right] < 0 \quad (29)$$

where

$$D^n = -\left[\frac{\partial \phi^n}{\partial e}\left(\frac{\partial L_D}{\partial w_A} - \frac{\partial L_S^n}{\partial w_A}\right) + \frac{\partial L_S^n}{\partial e}\frac{\partial \phi^n}{\partial w_A}\right] > 0.$$

As before $D^n > 0$ is needed for stability. Since $\frac{\partial \phi^n}{\partial M} > 0, \frac{\partial \phi^n}{\partial w_A} > 0$, $\frac{\partial e^n}{\partial M}$ is unambiguously negative. The details of the derivation are provided in Appendix.

But the sign of $\frac{\partial w_A^n}{\partial M}$ remains ambiguous. Assuming $\frac{\partial L_S^n}{\partial e} < 0$ on regularity ground, and $\frac{\partial \phi}{\partial e} > 0$ (for stability of the monopoly equilibrium in the tuition market), the sign of the numerator is ambiguous. If the effect of M on the marginal revenue function $\phi^n(.)$ dominates the effect on the labour supply cruve $L_S^n(.)$, we have a perverse effect. An increase in M will reduce the wage rate, implying that child labour will increase.

Thus we see that the monopolist teacher will reduce his in-class effort while raising the tuition price sufficiently to appropriate the large potential surplus that is now available from the α group. This will make the $(1-\alpha)$-group doubly worse off. Therefore, the adult wage can sometimes fall in the labour market. Even for the α-group a strict improvement in educational outcome may no longer be taken for granted. It is quite possible that their increased consumption of tutorial services might be offset by a strong reduction in the teacher's classroom effort in the village school. In any event, the educational gap between the two groups will widen dramatically.

Proposition 6 *(a) When the tuition market is monopolistic, uneven development can worsen the educational outcomes of both groups. The excluded group will be clearly worse off because of lower teacher effort and higher tuition price. As a consequence, child labour supply will increase and the adult wage will fall.*

(b) Though the group which has benefited from development intervention is likely to be better off, its educational outcome may not necessarily will improve. As the monopolist teacher manipulates tuition demand by reducing his in-class effort, in some cases the educational attainment can fall.

6 Conclusion

This paper developed a theory to explore the double role and vested interests of teachers who are in a position to supply private tutoring to supplement their incomes. Focusing on efficiency and equity in the accumulation of human capital in a poor economy, we considered this problem under two alternative assumptions about the structure of the market for tutoring and interpreted these assumptions as mimicking the contexts of urban and rural (village) settings. We introduced an education production function where educational outcomes depend on teachers' effort, on various dimensions of school infrastructure and on household decisions about children's time use, with the latter depending on adult wages and the price of private tutoring. Starting with a situation where all households were poor we also considered the equity and efficiency effects of a process of uneven development caused by liberalisation in urban areas and benignly motivated development interventions aimed to alleviate poverty in rural areas.

In our model, the market for private tutoring emerges as a response to limitations in the quality of grovernment schools caused by poor infrastructure, and/or by teachers failing to fulfil contractual obligations on classroom teaching and by households having sufficient purchasing power to afford private tutoring. As attested to by the labour supply function in figure 2, the latter cannot be taken for granted. Compared to Basu and Van (1998) our model predicts more child labour over a given wage range with the discrepancies between the two frameworks being most pronounced when the quality of school infrastructure is poor.

A key element in our model is the externality from the teacher's effort on tuition demand where the contrast across rural and urban areas is startling. In urban areas where competition in the tutorial market can be safely assumed, private tuition complements government school education, compensates for infrastructure shortfalls in government schools and as a result enhance educational outcomes. In urban areas, therefore, a ban on private tutoring may be misguided and reduce human capital accumulation. Such a ban may be particularly misguided if the infrastructure in government schools is of poor quality. Turning to the rural case of monopoly in the tutorial market, human capital accumulation is now reduced through several routes: Firstly, teachers will shirk more reducing educational attainments in the government school. Secondly, the higher price of tutoring implies that less human capital is generated through tutoring compared to the competitive case. There will be more child labour as a result, putting a downward pressure on and resulting in lower adult wages compared to the competitive case. This unfortunate combination generates a higher risk of a local poverty trap. Moreover, the laxer the school monitoring regime the higher this risk. In contrast to the urban case, a ban on private tutoring may now be welfare-enhancing.

Finally, the analysis of uneven development produced intriguing insights. We uncovered compelling contrasts in the effects of uneven economic progress in urban and rural areas: in the rural case, educational outcomes for the excluded group are unambiguously lower as the teacher shirks classroom obligations and raises the price of tutorial services. In a lax monitoring regime, even the better off group may now be stuck with an inferior educational outcome.

In light of this analysis we are now in a position to evaluate the possible effects of banning private tuition by publicly employed school teachers. If the ban is effective, teachers will be forced to improve class room efforts, which will help students both in urban and rural areas. If this ban is extended to independent tutors, human capital accumulation in urban areas will suffer as a result. The basic point is that when government schools are severely underfunded, the private tuition market can play a complementary role, with its activeness being vital for educational attainment. However, as we have shown, such a complementary, constructive role is critically dependent on the structure of the tutorial market.

Appendix

1. Comparative static properties of the competitive equilibrium:

Suppose ρ is a shift parameter that affects labour demand positively. How does an increase in ρ affect w_A^* and p^*? We present our analysis in two cases.

Case 1: Assume $p^* < \hat{p}$, so that the teacher does not shirk. By differentiating (15) and (16) with respect to ρ, we derive the following:

$$\frac{\partial w_A^*}{\partial \rho} = -\frac{\frac{\partial L_D}{\partial \rho}\left[\frac{\partial X_D}{\partial p} - \frac{\partial X_S}{\partial p}\right]}{\Delta} > 0, \tag{30}$$

$$\frac{\partial p^*}{\partial \rho} = \frac{\frac{\partial L_D}{\partial \rho}\frac{\partial X_D}{\partial w_A}}{\Delta} > 0, \tag{31}$$

where

$$\Delta = \left[\frac{\partial L_D}{\partial w_A} - \frac{\partial L_S}{\partial w_A}\right]\left[\frac{\partial X_D}{\partial p} - \frac{\partial X_S}{\partial p}\right] + \frac{\partial L_S}{\partial p}\frac{\partial X_D}{\partial w_A}.$$

For the stability of equilibrium it is required that $\Delta > 0$.[18] Combine with it $\frac{\partial X_D}{\partial w_A} > 0$ and $[\frac{\partial X_D}{\partial p} - \frac{\partial X_S}{\partial p}] < 0$. We get the above two comparative static effects positive, and they also imply that $[\frac{\partial X^*}{\partial \rho}] > 0$, and $[\frac{\partial L^*}{\partial \rho}] < 0$.

Next, we consider the effects of an increase in k which causes s to rise.

$$\frac{\partial w_A^*}{\partial k} = \frac{1}{\Delta}\left[\frac{\partial L_S}{\partial s}[\frac{\partial X_D}{\partial p} - \frac{\partial X_S}{\partial p}] - \frac{\partial L_S}{\partial p}\frac{\partial X_D}{\partial s}\right]\frac{\partial s}{\partial k} \quad > 0, \tag{32}$$

$$\frac{\partial p^*}{\partial k} = -\frac{1}{\Delta}\left[\frac{\partial X_D}{\partial s}[\frac{\partial L_D}{\partial w_A} - \frac{\partial L_S}{\partial w_A}] + \frac{\partial L_S}{\partial s}\frac{\partial X_D}{\partial w_A}\right]\frac{\partial s}{\partial k}. \tag{33}$$

While $\frac{\partial w_A^*}{\partial k}$ is clearly positive, the sign of $\frac{\partial p^*}{\partial k}$ appears to be ambiguous. However, substituting $\frac{\partial L_S}{\partial s} = -\gamma[\frac{\partial X_D}{\partial s} + N]$ into the numerator, and writing $[\frac{\partial X_D}{\partial s} + N] = N[\frac{\partial x_D}{\partial s} + 1]$ we can simplify it as,

$$\frac{\partial p^*}{\partial s} = -\frac{1}{\Delta}\left[\frac{\partial X_D}{\partial s}[\frac{\partial L_D}{\partial w_A} - \frac{\partial L_S}{\partial w_A}] - \gamma N[\frac{\partial x_D}{\partial s} + 1]\right]\frac{\partial s}{\partial k}.$$

If the absolute value of $\frac{\partial x_D}{\partial s} > 1$, then $\frac{\partial p^*}{\partial k}$ will be negative. But if $\frac{\partial x_D}{\partial s} < 1$, which is the case in our model, the effect of k on p^* is ambiguous. Effect on X^* is also ambiguous.

Case 2: Now suppose $p^* > \hat{p}$, so that the teacher shirks to some extent. Therefore, p will affect e which in turn will affect s and L_S and X_D will have some additional effect. Now,

$$\frac{\partial L_S}{\partial p} = \frac{\partial L_S}{\partial p} + \frac{\partial L_S}{\partial s}\frac{\partial s}{\partial e}\frac{\partial e}{\partial p}.$$

The additional term on the right hand side is solely due to shirking. However, this term is positive just like the direct effect of p on L_S.

[18] It is straight forward to see that for stability the downward sloping inverse labour supply curve must intersect the downward sloping inverse labour demand curve from above, which requires that the slope of the ordinary demand curve exceed the slope of the ordinary supply curve. In other words, $|\frac{\partial L_D}{\partial w_A}| > |\frac{\partial L_S}{\partial w_A}|$, or $[\frac{\partial L_D}{\partial w_A} - \frac{\partial L_S}{\partial w_A}] < 0$. That $[\frac{\partial X_D}{\partial p} - \frac{\partial X_S}{\partial p}] < 0$ is obvious. The second term is a product of two positive terms. $\frac{\partial L_S}{\partial p} > 0$ at all $w_A > \frac{\bar{c}(1+\beta)}{1+\gamma(1-s)}$ which is definitely true for all $w_A > \tilde{w}_A$. Finally, $\frac{\partial X_D}{\partial w_A}$ is clearly positve as evident from the tutorial demand function.

Now consider
$$\frac{\partial X_D}{\partial p} = \frac{\partial X_D}{\partial p} + \frac{\partial X_D}{\partial s}\frac{\partial s}{\partial e}\frac{\partial e}{\partial p}.$$
Here the first term on the RHS is negative, but the second term (due to shirking) is positive. However, for stability in the tuition market we need to assume that $[\frac{\partial X_D}{\partial p} - \frac{\partial X_S}{\partial p}] < 0$.

Therefore, the signs of $\frac{\partial w_A^*}{\partial \rho}$ and $\frac{\partial p^*}{\partial \rho}$ remain unchanged from (30) and (31) respectively.

Similarly, the effects of k also remain unchanged from (32) and (33).

2. Comparative static properties of the monopoly equilibrium: We consider the effects of an increase in ρ an y.

$$\frac{\partial w_A^M}{\partial \rho} = \frac{1}{D}\left[\frac{\partial L_D}{\partial \rho}\frac{\partial \phi}{\partial e}\right] > 0, \tag{34}$$
$$\frac{\partial e^M}{\partial \rho} = -\frac{1}{D}\left[\frac{\partial L_D}{\partial \rho}\frac{\partial \phi}{\partial w_A}\right] < 0, \tag{35}$$

where

$$D = -\left[\frac{\partial L_D}{\partial w_A} - \frac{\partial L_S}{\partial w_A}\right]\frac{\partial \phi}{\partial e} - \frac{\partial \phi}{\partial w_A}\frac{\partial L_s}{\partial e} > 0.$$

Now from an increase in y we get,

$$\frac{\partial w_A^M}{\partial y} = -\frac{\mu\theta}{D}\frac{\partial L_s}{\partial e} > 0 \tag{36}$$

under a regularity assumption that the teacher's increased effort should have a net effect of a decrease in (child) labour supply, i.e.

$$\frac{\partial L_s}{\partial e} = \left[\frac{\partial L_s}{\partial s}s'(e) - \frac{\partial L_S}{\partial p}p'(X)X'(.)\right] < 0.$$

Finally,
$$\frac{\partial e^M}{\partial y} = -\frac{\mu\theta}{D}\left[\frac{\partial L_D}{\partial w_A} - \frac{\partial L_S}{\partial w_A}\right] > 0 \tag{37}$$

3. Uneven development: Comparative statics for competition

Let us first note the aggregate tuition demand and labour supply curves take the following form:

$$\begin{aligned}
X_D^n &= 0 \quad for \;\; w_A \leq \hat{w}_{A\alpha}, \\
&= \alpha N x_{A\alpha} \quad for \;\; \hat{w}_{A\alpha} < w_A < \hat{w}_A \\
&= X_D^o + \alpha N \left[\frac{M}{2(\gamma w_A + p)} \right] \quad for \;\; \hat{w}_A < w_A < w_{A\alpha}^+ \\
&= X_D^o + \alpha N(1-s) \quad for \;\; w_{A\alpha}^+ < w_A < w_A^+ \\
&= N(1-s) \quad for \;\; w_A \geq w_A^+;
\end{aligned}$$

and

$$\begin{aligned}
L_S &= N[1 + \gamma\alpha(1-s) + \gamma(1-\alpha)] \quad for \;\; w_A \leq w_A^-, \\
&= N\left[1 + (1-\alpha)\frac{1}{2}\{\frac{\bar{c}(1+\beta)}{w_A} - (1-\gamma)\} + \alpha\gamma(1-s)\right] \quad for \;\; w_A^- < w_A < \tilde{w}_A, \\
&= N(1 + \gamma(1-s)) \quad for \;\; \tilde{w}_A \leq w_A \leq \hat{w}_{A\alpha}, \\
&= N\left[1 + \gamma\alpha l_\alpha + \gamma(1-\alpha)(1-s)\right] \quad for \;\; \hat{w}_{A\alpha} \leq w_A \leq \hat{w}_A, \\
&= L_S^o - \alpha N\gamma \left[\frac{M}{2(\gamma w_A + p)} \right] \quad for \;\; \hat{w}_A < w_A < w_{A\alpha}^+, \\
&= (1-\alpha)L_S^o \quad for \;\; w_{A\alpha}^+ < w_A < w_A^+, \\
&= N \quad for \;\; w_A^+ \leq w_A.
\end{aligned}$$

These curves are based on the assumption that $\tilde{w}_A < \hat{w}_{A\alpha} < \hat{w}_A < w_{A\alpha}^+ < w_A^+$.

We shall focus on an equilibrium that occurs within the wage interval $[\hat{w}_A, w_{A\alpha}^+]$. In this interval both the α-households and the $(1-\alpha)$-households will be buying tuition, but their educational outcomes will be strictly less than 1.

The equilibrium conditions are

$$\begin{aligned}
L_D(w_A) - L_S^n(w_A, p; M) &= 0, \\
X_D^n(w_A, p; M) - X_S(p) &= 0,
\end{aligned}$$

where $L_S^n(.)$ and $X_D^n(.)$ specifically correspond to the interval $[\hat{w}_A, w_{A\alpha}^+]$.

Suppose (w_A^n, p^n) solves this system of equations, and also assume $p^n < \hat{p}$, so that the teacher gives full effort. Now by allowing change in M, we first derive $\frac{\partial w_A^n}{\partial M}$:

$$\frac{\partial w_A^n}{\partial M} = \frac{1}{\Delta^n}\left[\frac{\partial L_S^n}{\partial M}\left(\frac{\partial X_D^n}{\partial p} - \frac{\partial X_S}{\partial p}\right) - \frac{\partial L_S^n}{\partial p}\frac{\partial X_D^n}{\partial M}\right],$$

where,

$$\Delta^n = \left[\frac{\partial L_D}{\partial w_A} - \frac{\partial L_S^n}{\partial w_A}\right]\left[\frac{\partial X_D^n}{\partial p} - \frac{\partial X_S}{\partial p}\right] + \frac{\partial L_S^n}{\partial p}\frac{\partial X_D^n}{\partial w_A}.$$

It can be noted that,

$$\frac{\partial L_S^n}{\partial M} = -\gamma\frac{\partial X_D^n}{\partial M} = -\gamma\alpha N\frac{\partial x_\alpha}{\partial M},$$

and

$$\frac{\partial L_S^n}{\partial p} = -\gamma\frac{\partial X_D^n}{\partial p}.$$

Substituting these into the expression of $\frac{\partial w_A^n}{\partial M}$ we get

$$\frac{\partial w_A^n}{\partial M} = \frac{\alpha\gamma N}{\Delta^n}\frac{\partial x_\alpha}{\partial M}\frac{\partial X_S}{\partial p}$$

which is clearly positive.

Similarly,

$$\frac{\partial p^n}{\partial M} = \frac{1}{\Delta^n}\left[-\frac{\partial X_D^n}{\partial M}\left(\frac{\partial L_D}{\partial w_A} - \frac{\partial L_S^n}{\partial w_A}\right) - \frac{\partial L_S^n}{\partial M}\frac{\partial X_D^n}{\partial w_A}\right].$$

Substituting in the above $\frac{\partial L_S^n}{\partial M} = -\gamma\alpha N\frac{\partial x_\alpha}{\partial M}$ and $\frac{\partial L_S^n}{\partial w_A} = -\gamma\frac{\partial X_D^n}{\partial w_A}$ we obtain

$$\frac{\partial p^n}{\partial M} = -\frac{\alpha N}{\Delta}\frac{\partial x_\alpha}{\partial M}\frac{\partial L_D}{\partial w_A} > 0.$$

Comparative statics: The monopoly case

Recall the equilibrium (26) and (27) which give (w_A^n, e^n) as a solution. Now carry out total differentiation on (26) and (27) with respect to M.

$$\begin{aligned}\left[\frac{\partial L_D}{\partial w_A} - \frac{\partial L_S^n}{\partial w_A}\right]\frac{\partial w_A^n}{\partial M} - \frac{\partial L_S^n}{\partial e}\frac{\partial e^n}{\partial M} - \frac{\partial L_S^n}{\partial M} &= 0 \\ -\frac{\partial \phi^n}{\partial w_A}\frac{\partial w_A^n}{\partial M} - \frac{\partial \phi^n}{\partial e}\frac{\partial e^n}{\partial M} - \frac{\partial \phi^n}{\partial M} &= 0\end{aligned}$$

From these we derive (28) and (29).

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FIGURES

Figure 1: Education production function

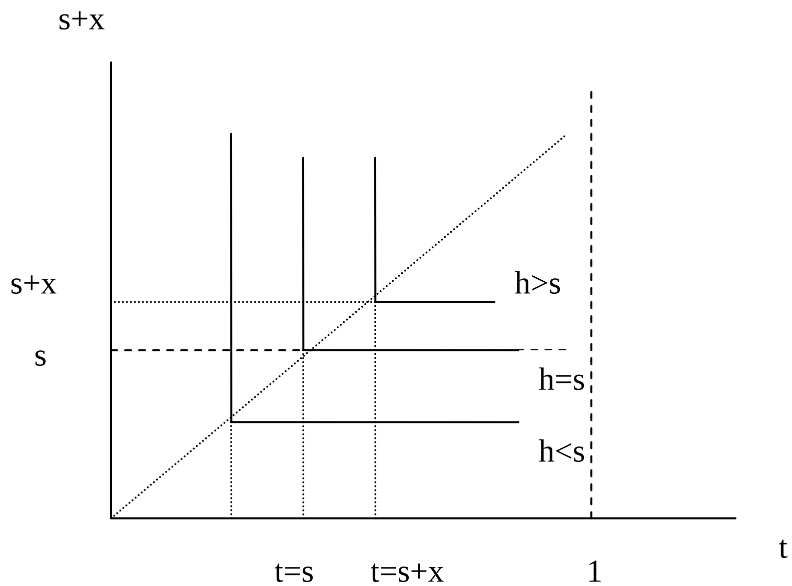

Figure 2: Labour supply function

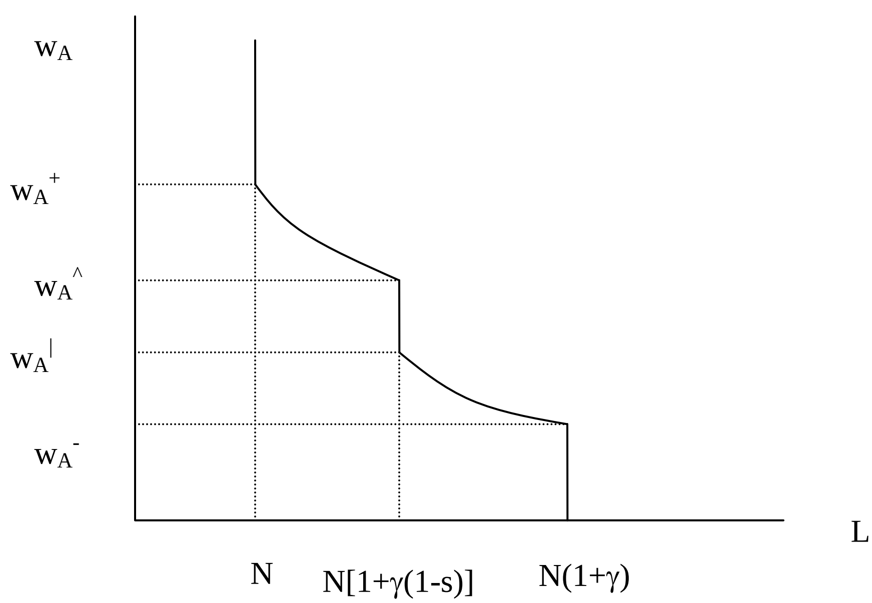

Figure 3: Tutorial supply function

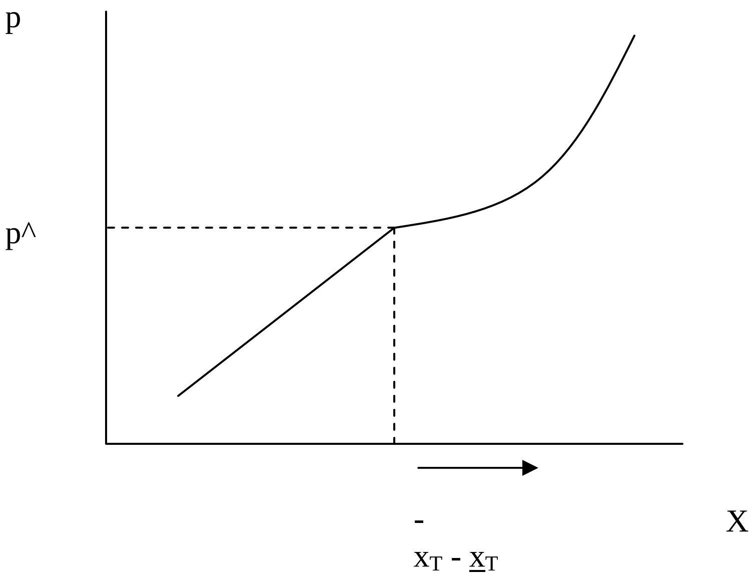

Figure 4a: Labour market equilibrium

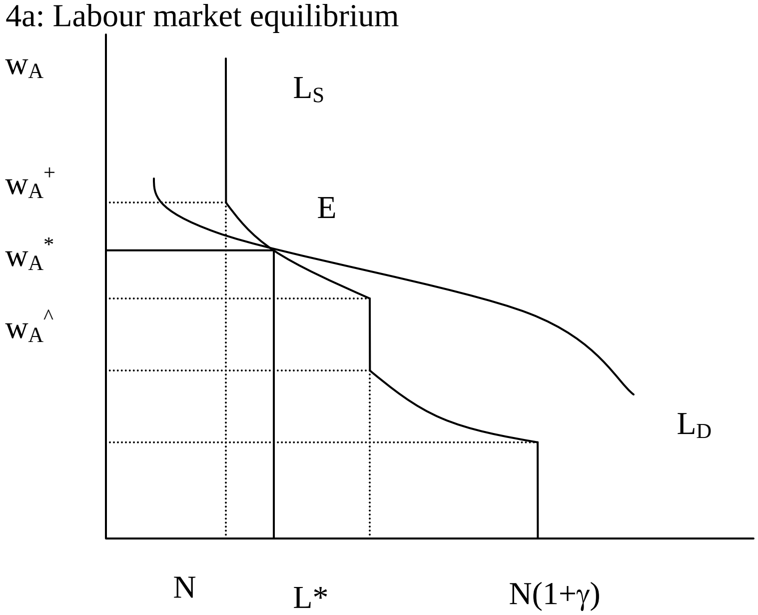

Figure 4b: Tuition market equilibrium

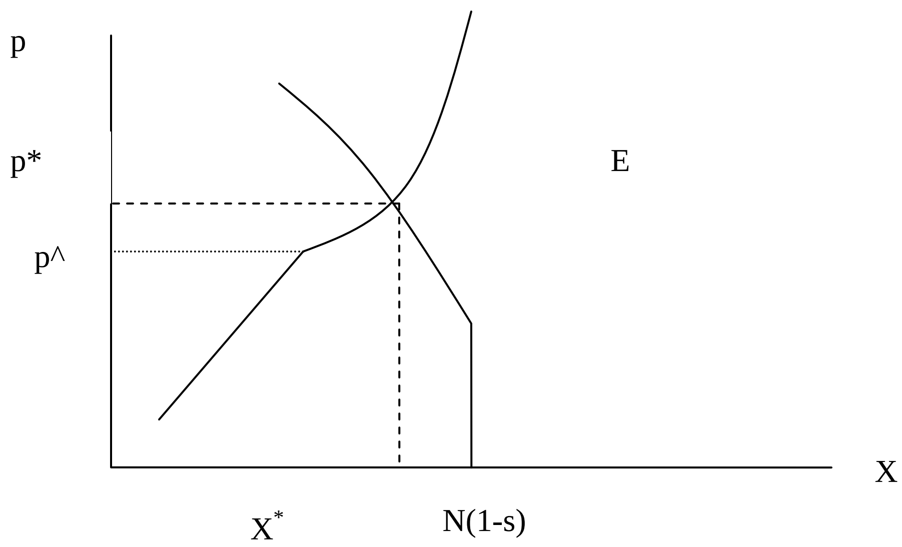

Figure 5: The monopoly case

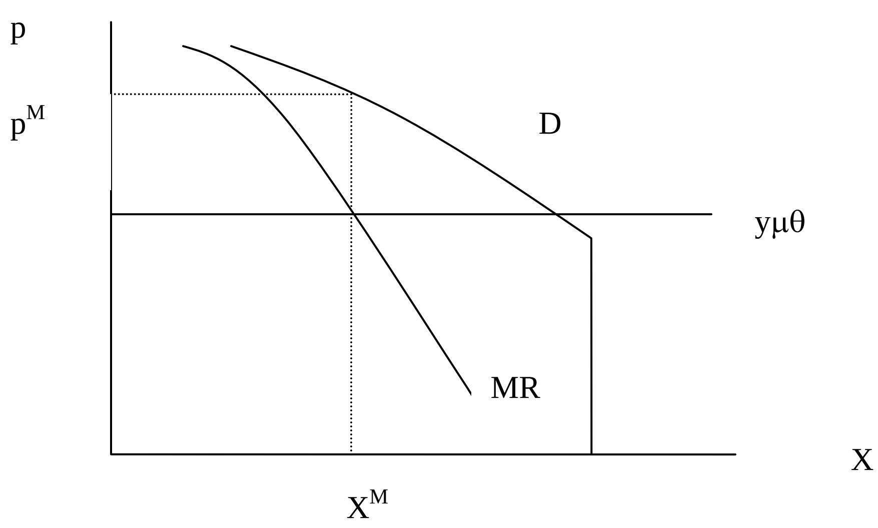

Figure 6a: Effects of an increase in M on the tuition market (competitive case)

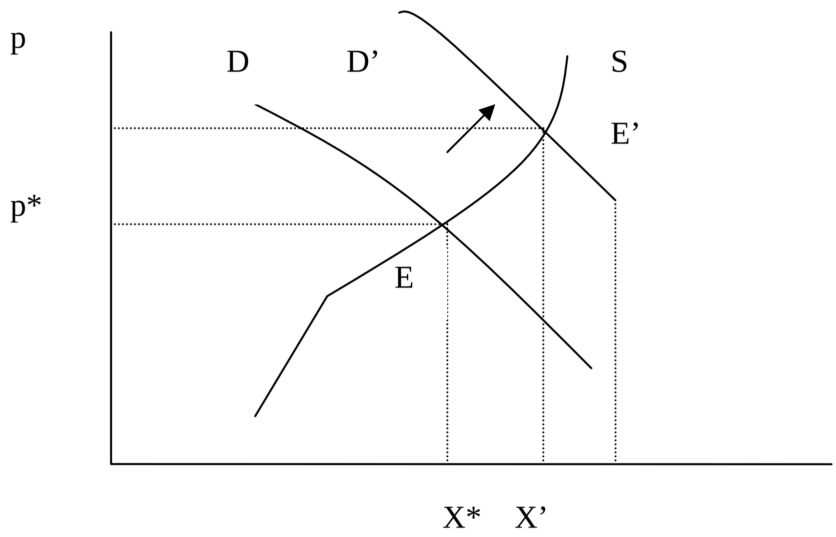

Figure 6b: Effects of an increase in M on the labour market (Competitive case)