The Effects of Infrastructure Development and Taxation on Current and Future Earnings

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ABSTRACT

This dissertation is a collection of three essays, each of which studies a policy in India that provides a unique circumstance affecting directly or indirectly earnings. The purpose of this work is to analyze how taxation and infrastructure development affects the current and future earnings using these policies.

In the first essay, I use a national infrastructure development program initiated in India in 2001 to construct new all-season roads (roads that can be used in all-weather especially monsoons) in villages that previously had only had dry-season roads (roads that are difficult to use in monsoons). In the second, I use a new tax on fringe benefits initiated in India in 2005, seeking evidence for the hypothesis that the difference in higher marginal tax rates on wages, relative to lower rates on fringe benefits, induces a reallocation of the total compensation package toward fringe benefits. In the final essay, which uses the same policy as that of first I am interested behind the economic motives of manipulation by the local community to obtain public good road in their locality.
The Effects of Infrastructure Development and Taxation
on Current and Future Earnings

BY

Mukta Mukherjee

DISSERTATION

Submitted in fulfillment of the requirements for degree of Doctor of Philosophy in Maxwell School of Citizenship and Public Affairs.

SYRACUSE UNIVERSITY

MAY 2012
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To my biggest critic-

My mother

&

A father who is present with me in soul
ACKNOWLEDGMENT

This dissertation is a product of a long journey which when I embarked I did not know it will be full of uncertainties. Along the way not only I have developed as a researcher but became a new person. There were people whose encouraging words allowed me to sustain this path. Foremost, I would like to thank my advisor Jeffrey Kubik who taught me the art of thinking out of the box. With his kind nature he made me comfortable to put forth my stupid questions and translated them into intelligent ones. I am also thankful to my other committee member Devashish Mitra who gave me constructive inputs at various points during my work.

A word of sincere thanks to those teachers Abhijit Banerjee, Debabrata Datta, Indira Rajaraman who saw in me some potentiality when I could see none and kept their faith in me. I will be ungrateful if I omit to mention Chiwa Kao and Badi Baltagi for their decision which enabled me to be a part of the Department of Economics of Syracuse University.

I am especially thankful to my friends in Albany Sohini Sahu, Arindam Mandal and Siddhartha Chattopadhay whose caring attitude sustained me in my most difficult part of the dissertation. I am also grateful to two of my seniors Asha Sundaram and Fariha Kamal for their help in the initial stage of my dissertation. A word of thanks to my other beloved friends Oindree, Gitu and Muna, whose faith in my potentiality cheered me up in many bad days.

I am grateful to god to have a loving brother who provided me encouragement in times when he was going through great personal worries. Lastly this is a tribute to two persons- my mother who taught me to take criticism with a positive note and without whom my world will not be the same; the thoughts of my father who was
present with me in soul that inspired me even in most difficult times.
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1 Introduction

India is a country where one would find individuals with wide variation in earning’s capacity. Whereas in one hand exists CEO’s of multinational draws prince’s ransom, on the other hand there are people living in villages who can barely meet their necessity. Therefore, the factors that can affect the earnings of an individual especially in a developing country context are an important area of study. This dissertation is a collection of three essays, each of which studies a policy in India that provides a unique circumstance affecting directly or indirectly earnings of individuals drawn from different stratum of the society. The purpose of this work is to analyze how taxation and infrastructure development affects the current and future earnings using these policies.

In the first essay, I use a national infrastructure development program initiated in India in 2001 to construct new all-season roads (roads that can be used in all-weather especially monsoons) in villages that previously had only had dry-season roads (roads that are difficult to use in monsoons). The eligibility rule that was used for undertaking construction of new all-season roads in these villages was that a minimum population of 500 had to be benefit from this road. This eligibility rule induced a nonlinear relationship between the population and the number of new all season roads in the villages of India today. In order to control for factors like communities’ collective action ability that simultaneously determine the timing of completion of roads and students’ enrollment in the schools, I instrument new roads with the population eligibility criteria. Exploiting the exogenous nature of the
program eligibility criteria I compare students’ enrollment in schools between villages on either side of the population cutoff. The most conservative estimates show that an improved access to school by better roads increases school enrollment by 22 percent in 2009. I find no spurious effects in 2002 when the same villages did not have a road. The effect of better access to roads on students’ enrollment is heterogeneous depending on the age cohort and the caste (social background) to which they belong.

In the second, I use a new tax on fringe benefits initiated in India in 2005, seeking evidence for the hypothesis that the difference in higher marginal tax rates on wages, relative to lower rates on fringe benefits, induces a reallocation of the total compensation package toward fringe benefits. Firm-level panel data on employee total compensation and wages across all industries is used to link their marginal tax rate on fringe benefits and choice of compensation. The key finding is that a tax on fringe benefits only affects the wage allocation of highly paid employees relative to employees lower on the pay scale. Using the most conservative estimate, the research shows that a doubling of the fringe-tax increases wages by one percent. Further, I find that this reallocation is more evident for fringe benefits, such as private pensions (private-fringe benefit) relative to travel and lodging expenditures which can enhance a firm’s productivity (productive-fringe benefit).

In the final essay, which uses the same policy as that of first I am interested behind the economic motives of manipulation by the local community to obtain public good. I use data from a universal scheme initiated in India in 2001 to build new all-season roads in villages of India to understand how the various eligibility thresholds for the road policy has been manipulated at the district level during the period of implementation. Results show that the higher economic returns drive the desire to
obtain a road in the locality. The better off sections of the economy are driven by the complementary role between the roads and other facilities, whereas the poorer sections try to substitute with a poor provision of other public goods. Further, I find the politicians in a particular state are substituting the better-off voters with the poor voters with a motive of maintaining high representation in the government.
2 Do Better Roads Increase School Enrollment? Evidence from a Unique Road Policy in India

2.1 Introduction

Physical distance to school is cited as a major barrier to participation for rural children in India (UNICEF, 2006; Ward, 2007). Similarly, in many other developing countries schools are not easily accessible\(^1\), thus social scientists and policy makers are interested considerably in whether better access to schools increases students’ enrollment (Duflo, 2001; Filmer, 2007; Handa, 2002). For example, in India, on average in most villages primary schools are one km away, middle schools are at three km away and secondary and higher secondary are five km away from the village center (Census, 2001; Ward, 2007). A considerable travel time is involved in accessing these schools. This time lost in travelling cannot be used either for productive activities or for leisure. It is just the additional cost that has to be borne to acquire education and is not used in actual learning. In many instances, the distances have to be covered on foot which leads to physical discomfort especially in hot summers and monsoons. The time lost is a major implicit cost in schooling decision.

Irrespective of this considerable interest in consequences of better access for school enrollment, measuring casual effects of access to school on schools’ enrollment has proved to be very difficult. One of the common measures used is the new school availability in the locality (Duflo, 2001; Foster and Rosenweig, 1996; Jalan and Glin-

\(^1\)The average distance required by a child to travel to reach the nearest primary schools ranges from 0.2 km in Bangladesh to 7.5 km in Chad. The distance to the nearest secondary schools ranges from 2 km in Bangladesh to 71 km in Mali (Filmer, 2007).
skaya, 2003). However, the placement of schools is not random. Usually the new schools are constructed in localities which previously suffered from low enrollment. This will lead to under estimation of the impact of the benefits of an improved access to schools on enrollment. On the other hand, if families who value schooling move towards localities with better schooling or schools are constructed in areas where the people value more education, the impact on enrollment will be over estimated. Another measure that has been used in cross-country studies is the average distance to the nearest primary or secondary schools or travel time on enrollment (Filmer, 2007; Bommier and Lambert, 2000; Handa, 2002). A robust pattern observed in most of these studies (Duflo, 2001; Jalan and Glinskaya, 2003; Filmer, 2007) is that the impact is highest for those who are interiorly located; usually these are the poorer sections.

In this study I use the regression discontinuity technique to surmount the fundamental problem of identification that the previous literature suffered from. This study uses a new measure for better access to schools by exploiting the provision of new all-season roads (roads that can be used in all weather especially monsoons) as a part of a national infrastructural program which was initiated in 2001 in India. The provision of new all-season roads (roads that can be used in all weather especially monsoons) in villages which previously only had dry-season roads (roads that are difficult to use in monsoons) were done on the basis of a population eligibility criteria. This rule generates a potentially exogenous source of variation in the provision of new all-season roads which can be used to estimate the effects of better access to schools on the students’ enrollment in rural India.

The importance of the population criteria rule in this study is that it can be used to
determine the provision of new all-season roads in villages on the basis of their villages’ population as in 2001. The implementation of the policy is as follows. According to the population criteria rule, there is no provision of all-season roads in villages when the population recorded is between 100 and 499, but when the population recorded is more than 500 then there is a sharp increase in the provision of all-season roads. In this study, villages with more than 500 populations as recorded in 2001 have a twenty five higher probability of being provided with a new all-season road. This study uses a novel dataset compiled from administrative reports linking school enrollment at the village level to the number of new all-season roads.

Usually, in India the provision of public goods is simultaneously determined by many other factors. According to Banerjee, Iyer and Somanathan (2008) the communities’ collective action ability is a major factor determining both the provision of public goods like roads and facilities in schools, affecting students’ enrollment in India. In this study, I use the population rule to construct instrumental variable estimates of better roads effects. The most conservative estimates show that an improved access to school by better roads increases school enrollment by 22 percent in 2009. Further, the effect of better access to roads on students’ enrollment is heterogeneous depending on the age cohort and social background to which they belong. The development of roads brings forth both intended and unintended effects on students’ enrollment in school. Whereas for the younger students’ participation rate in school increases, for the older students’ participation rate in school decreases. The participation response of enrollment to a development of better roads is much higher for students from higher caste (students belonging to the higher social hierarchy scale) compared to those from backward caste (students belonging to the lower social hierarchy scale).
A possible explanation of the heterogeneous effects of roads on students on the basis of their age and social background is the following. The first phenomena can be explained in a child economy context with outside job opportunities. In comparison to the younger age cohort the higher age cohort students are physically able to reap the benefit of better job opportunities that a better connectivity brings forth; therefore their incentive to participate in school decreases with a development of a road. A possible explanation of the second phenomena is that the backward caste students in one hand benefits most from the development of better roads as they stay in the vicinity of the village, but in the other hand these students reaps less from an investment in schooling as the social restrictions they face constraints their future wage earnings.

The contribution of this paper is manifold. This study provides new insight into the question of whether students’ enrollment increases with better access to school which has always interested economist and policy makers simultaneously. The study also contributes to a scanty body of literature on the measurement of economic benefits that comes with a better connectivity (Jacoby, 1998; Jacoby, 2008). Usually the benefits of an improved connectivity are calculated on the basis of hypothetical projects in countries like Nepal and Madagascar due to the lack of real instances. This unique road scheme allows study of the economic benefits from a wide scale real construction of roads. This paper overcomes limitations in the other past studies as it uses a novel dataset constructed from the administrative reports on eligible villages and their new roads completion information.

The remainder of the paper proceeds as follows: Section 2 lays down the details of the national infrastructure road development program introduced in India. Section
3 provides a brief theoretical framework of human capital investment and time lost in travelling. Section 4 discusses the identification technique and the data used for the analysis. Section 5 explores the empirical findings, with some robustness checks. Section 6 summarizes our findings and some limitations of the study.

2.2 Background

In India, roads form the life-line of villages as the access to schools, market and health centers is dependent on it. According to Bell (2010) the benefits of better roads in villages is manifold. First, as consumers they enjoy a reduced prices and as producers they can negotiate for higher price for their marketable surplus. Second, as students they can access schools located outside village. Finally, with a better access to medical amenities and crucial drugs not only can their health condition improve but it actually can make a difference between life and death in several scenarios. However, forty percent of all villages in 2000 were still unconnected by roads.

In 2001, a national infrastructure development program PMGSY was initiated to fulfill the gap of roads in villages. The primary objective of this policy was to provide all-season roads to hamlets that previously did not have any all-season roads within 0.5 km. A secondary objective of this scheme was to upgrade the already existing all-weather roads based on the roads’ deterioration. This gave emphasis to more populated areas, however only 20 percent of the funds were to be allocated towards this goal and the other 80 percent of the funds would be allocated towards

---

\(^2\)The policy was declared on 25th December, 2000.

\(^3\)A hamlet is a cluster of population, living in an area, the location of which does not change over time.

\(^4\)The eligibility condition for new all weather roads for hilly states (North-East, Sikkim, Himachal Pradesh, Jammu & Kashmir, Uttarakhand), desert areas (districts, blocks eligible for Desert Development Projects) and Schedule 5 areas (constitution prescribed districts, block and villages with high populations of schedule castes and tribes) is that within a radius of 1.5km no all-weather roads exist and the minimum benefited populations has to be 250 at least.
the fulfillment of the primary objective.

The provision of new all-season roads followed an eligibility rule. The eligibility rule for a new all-season road \((NR)\) linking several unconnected\(^5\) hamlets \((h_1, h_2, \ldots, h_n)\) whose populations as recorded in Census 2001 \((p_1, p_2, \ldots, p_n)\) that would be considered for construction is given in equation (2.1). Equation (2.1) captures the fact that the PMGSY rule allows the unconnected hamlets with a population greater than 500 to receive new roads but hamlets eligible by virtue of distance with a population of 100-499 do not receive a new road. The discontinuity created by the 500 population threshold will be used as an identification strategy in this study.

\[
NR = \begin{cases} 
1 & \text{if } \max (p_1, p_2, \ldots, p_n) \geq 500 \\
0 & \text{if } \max (p_1, p_2, \ldots, p_n) < 500 
\end{cases} \tag{2.1}
\]

The PMGSY was a national policy with an estimated cost of $14 billion (Rs 600 billion) and more emphasis was given to states that had eligible unconnected hamlets. However, there is a great deal of state-wise variation in the progress of the construction and completion of new roads, depending on the local government initiative. In some states the federal grants were a part of a loan sanctioned by the World Bank (Jharkhand, Rajasthan, Uttar Pradesh, Himachal Pradesh) and Asian Development Bank (Assam, West Bengal, Orissa, Madhya Pradesh, Chhattisgarh). In return these states had to meet some conditions for safeguarding local environment and communities\(^6\). However, the eligibility rule for new all-season roads did not vary

\(^5\)The hamlet would be considered unconnected if it does not have an all-weather road within a 0.5km radius.

\(^6\)The existing standards were appraised and modified to minimize impacts on communities and
between the World Bank and ADB sponsored states and other non-sponsored states.

### 2.3 Human Capital Investment with a Travel Cost

This section presents a simple human capital investment model that informs the empirical analysis.

**Optimal level of Schooling**

Given that there is no productivity growth, the present value of life-time earnings of a "representative" individual with \( s \) years of education, evaluated at the age of school entry is

\[
V(s, r) = \int_0^n y(s, \tau) e^{-r(s+\tau)} d\tau - C(s, \tau), \tag{2.2a}
\]

where \( \{y(s, \tau)\} \) is based on the estimated statistical earnings and \( r \) is the discount rate. The life-time earnings in (2.2a) can be expressed as

\[
V(s, r) = \frac{\{y(s, \tau)\} e^{-rs} (1 - e^{-rn})}{r} - C(s, \tau), \tag{2.2b}
\]

The individual maximizes the life-time earnings in (2.2b) w.r.t. choice of schooling \( s \). The first order condition is given by

\[
\frac{\{y_s - ry\} e^{-rs} (1 - e^{-rn})}{r} - C_s = 0, \tag{2.3}
\]

With an improvement in the state of connectivity the equilibrium choice of schooling is (refer Theory Appendix)

\[
\frac{ds}{d\tau} = -\frac{e^{-rs} (1 - e^{-rn}) [y_{sr} - ry_{s\tau} - rC_{ss}]}{e^{-rs} (1 - e^{-rn}) [y_{ss} - ry_s + ry^2] - rC_{ss}}, \tag{2.4}
\]
In (2.4) the denominator would always be negative to satisfy the second order condition for maximization. Therefore, the equilibrium choice of schooling would depend on the numerator. The first term \([y_{sr} - ry_r]\) denotes the present value of net gains from additional schooling after adjusting for forgone earnings. With an improved state of connectivity there would be two effects operating in the opposite direction; \((y_{sr})\) the benefits from earnings from an additional period of schooling and \(ry_r\) the forgone earnings adjusted for the interest rate. With a better access to the employment opportunities the potential wage earnings \(y_r\) would also increase, thus the latter term also increases. Hypothetically, \(y_{sr} \geq 0\), but in reality for a short span of time \(y_{sr} < 0\) can be ruled away. This implies that better connectivity leads to higher competition and that the returns from schooling decreases. But, such a scenario would take considerable time even after development in the level of transport. The second term \(rC_{sr}\) denotes the present value of cost of travelling to school after there is an improvement in connectivity. This term is always negative on the basis of assumption that travel cost to school decreases with an improvement in connectivity. The schooling choice of the individual would depend upon which of the two effects dominate as is given in (2.5)

\[
\frac{ds}{d\tau} \geq 0 \text{ if } [y_{sr} - ry_r] \geq 0. \tag{2.5}
\]

There are three possible cases depicted in Figure 1, but with each of them, with an improved state of connectivity the individual can reach a higher iso-wealth curve and is always better off than in the earlier state. The individual would choose a higher (lower) schooling level, when the net earnings gained from an additional period of schooling dominates (is dominated by) the loss of forgone earnings. If the two effects
exactly offset each other the schooling level will remain unchanged.

**Hypothesis 1** In an improved state of connectivity, the lower the outside wage earnings potential the higher is, the higher the incentive to remain in school. Thus in an economy with child-labor opportunities increasing with an improved connectivity, the lower age group who are not physically fit to work have higher incentive to participate in school than a higher age group who can work (Basu, 1999). This leads to a following ranking of the schooling choice among different age groups less than 5 years, 5 to 9 years, 10 to 14 years and more than 14\(^7\).

\[
\frac{ds}{dT \text{ less than 5 yrs}} > \frac{ds}{dT \text{ 5–9 yrs}} > \frac{ds}{dT \text{ 10–14 yrs}} > \frac{ds}{dT \text{ 15–18 yrs}}. \tag{2.6}
\]

**Hypothesis 2** In an economy where there is heterogeneity among sections by economical and social background, the benefits of an improved connectivity on different sections’ students is ambiguous. In India, the schools are usually spatially clustered in the high caste\(^8\) dominant areas and the low castes reside outside the villages. Therefore, the lower caste students would still be a considerable walking distance for these students. Therefore, the lower caste students would reap the benefit of an improved connectivity more than the higher caste students who usually reside within the village. However, the low castes are usually economically disadvantaged thus outside wage opportunities poses for more incentive to drop out of school. Henceforth, there are two effects that are simultaneously operating in opposite directions, and the decision to participate in school for different castes depends on which of these effects are dominant.

---

\(^7\)According to the Child Labor Act, work by children less than 15 is considered as child labour. The Age group 5-14 years is the most vulnerable and in the age group 10-14 years the prominence of child labor is highest.

\(^8\)In India, the Hindu caste system the society is divided into different caste on the basis of the profession they used to perform.
I test this by taking these hypotheses to the data accounting for various econometric challenges outlined below.

2.4 Estimation Strategy and Identification Assumptions

The identification strategy is intended to exploit the quasi-experiment created by the Indian rural road scheme using a fuzzy regression discontinuity (FRD) approach.

The estimating equation at the village-level is the following:

\[
(y)_{i,2009} = \alpha + \pi (NR)_{i,2009} + \varepsilon_{i,2009}; \ i = \text{village} \tag{2.7}
\]

where \((y)_{i,2009}\) is village-level total school enrollment of students in year 2009. The regressor of interest \((NR)_{i,2009}\) is a dummy variable which equals 1 if a new all weather road has been constructed in the village as of year 2009 and 0 if it is either under-construction or no-construction have been undertaken; \((\varepsilon_{i,2009})\) is the error term.

The coefficient of interest \((\pi)\) indicates the causal effect of an improved access to schools by the construction of all weather roads in a village on its total school enrollment. The problem of inference is that provision of new all-season roads is non-random. Usually political factors like caste, community and collective actions determine public good provisions in developing countries (Banerjee, Iyer and Somanathan, 2008). These factors will affect both the provisions of new roads in villages and enroll-

\[ \frac{ds}{d\tau_{\text{low caste}}} \leq \frac{ds}{d\tau_{\text{high caste}}}. \]

9 The regression discontinuity with perfect compliance i.e. treated=1, others=0 is called sharp RD. Whereas with imperfect compliance, i.e. difference in the probability of treatment between treated and others, is known as fuzzy RD.
ment of students in school causing them to be spuriously correlated and suffer from political endogeneity. The power of collective action at a local level will both determine the timing of completion of the road construction and provision of school facilities and thus enrollment, causing them to be correlated. Thus, an ordinary OLS estimate will be inconsistent. This problem can be overcome by a fuzzy regression discontinuity (FRD) approach. The regression discontinuity technique which compares individuals to the left and right of an exogenous cutoff has gained popularity in recent empirical literature (Angrist and Lavy, 1999; Card, Chetty and Weber, 2006; Carrell, Hoekstra and West, 2010) as it is closer to "gold standard" randomized experiments than other program evaluation methods (Lee and Lemieux, 2009).

The fuzzy regression discontinuity approach exploits the fact that the regressor of interest (new road) is partly determined by a known discontinuous function of an observed covariate \(X_{i,2001}\) —the population of the hamlets as recorded in census 2001. It is also the village population for this sample. The other observable characteristics are smooth around this threshold. The fuzzy regression discontinuity can be analyzed in an instrumental variables framework (Lee and Lemieux, 2009; Imbens and Lemieux, 2007). In this case, instrumental variables estimates of equation (2.7) use discontinuities or nonlinearities in the relationship between new roads and village population; while at the same time, any other relationship between the population of the village and total enrollment is controlled by including smooth functions of village population as a covariate as in equation (2.8). Equation (8) represents the first stage where the new roads are being instrumented by the population threshold criteria and equation (9) represents the second stage.
\[ (NR)_{i, 2009} = \gamma + \delta T + g(X_{i, 2001} - 500) + \nu_{i, 2009}, \quad (2.8) \]

\[ (y)_{i, 2009} = \alpha + \pi (NR)_{i, 2009} + f(X_{i, 2001} - 500) + \eta_{i, 2009}. \quad (2.9) \]

where \( T = 1 [X_{i, 2001} \geq 500] \) indicates whether the population of the villages exceeds the eligibility threshold 500; \( f(X_{i, 2001} - 500) \) and \( g(X_{i, 2001} - 500) \) are respectively control functions\(^\text{10}\) and \( \eta_{i, 2009} \) is a stochastic error term. As the control functions are smooth at the population threshold of 500 whereas the new road is discontinuous, this allows the coefficient \( \pi \) to be identified. In practice, the control function is unknown and has to be approximated by a smooth flexible function, such as a lower order village population polynomial term centered at the threshold 500.

Selection around Discontinuity. A concern for the validity of this technique is that, the eligibility threshold for new roads is common knowledge; this criterion can be manipulated by the local administration those are also aware about the benefits of the roads. Such self-selection or sorting will invalidate the FRD approach estimate \( \pi \) as there will be discontinuous differences in the village’s characteristics to the left and right of the cutoff. Lee and Lemieux (2009), prescribe two checks to validate the crucial assumption of absence of self-selection or sorting around the threshold.

First, the density of the population of the villages should be smooth around the 500 threshold. A test outlined in McCrary (2008) is used to test this assumption. As is evident from Figure 2, there is an absence of any jump at the 500 person threshold.

\(^\text{10}\) The control functions are smooth functions of village population controlling for any relationship between population and enrollment of the village. It is depicted as \( E(\varepsilon|X_{2001}) = f(X_{2001}) \); \( \varepsilon = \text{error} \)
(refer to Appendix 1). However, McCrary cautions that this test can only be useful for discerning manipulation provided manipulation is monotonic. It is reasonable to assume that manipulation would occur only in the upward direction in this case as none of the villages that are legitimately eligible would like to drop out. Further, this is a rare scenario where for the entire sample the true population as collected and reported by the Census 2001 and the administrative reported village population information are both simultaneously available. This makes it possible to control for manipulation additionally. In the entire sample the true population as reported in the Census 2001 has been considered (refer Data Appendix -Step 6).

Second, Lee and Lemieux (2009) pointed out that the observable baseline covariates should trend smoothly around the given threshold of 500. As a second check, I test some of the baseline covariates along with the total enrollment in academic year 2002 for discontinuity. A requirement of the regression discontinuity technique is that the baseline covariates have to be assigned before the Census 2001 village population information has been collected. In order to fulfill this requirement, I was limited to consider only those covariates which by construction had been assigned before 2001. As is evident from Table 2 there are negligible differences in the number of primary schools, middle schools, bank facilities and electric facilities between eligible and ineligible villages around the 500 person threshold. Although the eligible villages are on average located 2 km further to the interior than the ineligible villages, the difference in the distance to the nearest town between the eligible and ineligible villages is statistically insignificant. This indicates that there is no systematic bias around the 500 person threshold. This lends confidence that the estimate of $\pi$ should be purged of any endogeneity.
2.5 DataCharacteristic: PMGSY, Census Village Directory and NUEPA

The data used in this paper has been drawn from three main sources: the primary data has been constructed from the assorted reports of Pradhan Mantri Gram Sadak Yojana (PMGSY), the 2001 Census Village Directory and the School Report Cards of National University of Educational Planning and Administration (NUEPA) (refer to data appendix for details on the data construction method and definitions of variables). All three sources provide information at the village level.

The PMGSY provides information on the population size and connectivity status of hamlets which are eligible by distance to get a new all-season road. It also provides their respective census villages, new roads considered for construction, their progress and completion status (refer data appendix).

The 2001 Census Village Directory provides the population demographic information on all the villages in India collected as a part of the decennial census between 9th February, 2001 and 28th February, 2001. It also provides information on different facilities available in these villages like primary schools, middle schools, banking facilities and electricity.

The School Report Cards published by NUEPA provide comprehensive information on enrollment for more than 1.3 million primary and upper-primary schools located across India, for academic year\textsuperscript{11} 2002-2009. In addition to total enrollment NUEPA also collects disaggregated information enrollment based by gender, age, grade and caste. The same database is used to derive official enrollment statistics in India (DISE)\textsuperscript{12}. The disaggregated information of enrollment based on age and caste,\textsuperscript{11}\textsuperscript{12}

\textsuperscript{11}The academic year is between September to August.

\textsuperscript{12}This figures is suspected to suffer from upward bias and manipulation (Dre‘ze and Kingdon,1998)
is available only for academic year 2005-2009.

I utilize a subset of the original data. First, the entire analysis is conducted for all unconnected villages, which otherwise satisfy the distance criteria and have a population between 350 and 650. Second, to avoid self-selection problems in this study only those states were considered that individually satisfied the McCrary test (2008) limiting the sample to four states (Rajasthan, Madhya Pradesh, Andhra Pradesh and Kerala). Third, only those villages are considered that are simultaneously eligible by distance and also have at least a primary or middle school\textsuperscript{13}. Fourth, only those villages are considered where the entire village population\textsuperscript{14} is eligible for the new road. Lastly, to avoid results being driven by changes in sample composition only those villages are considered in the analysis that are tracked consecutively for 8 years, resulting in 3326 villages for each cross-section from 2002-2009.

Table1 summarizes the total enrollment, completed new roads and other facilities like the number of primary and middle schools for the entire sample of villages considered in this study. Although, the average total enrollment in academic year 2009 is 98 students, the sample exhibits a wide dispersion indicating very small and large schools. Only seventeen percent of the entire sample of villages has a new road as of 2009. However, half of them actually satisfy the population criteria; fifty percent of the villages that were eligible for an all-season road had construction completed as of 2009. The majority of the construction was completed by 2007\textsuperscript{15}. Almost every

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\textsuperscript{13}Ideally one would like to consider all the schools which are within 3 km and 5 km radius of the eligible villages. But due to data limitation this strategy could not adopted.

\textsuperscript{14}The PMGSY rule considers the hamlet population. In order to avoid cases eligibility occurring due to distribution of hamlets I restrict only to those cases where the hamlet population is equivalent to the entire village population.

\textsuperscript{15}The majority of construction was completed in Rajasthan for the entire sample.
village had a primary school (grade 1-grade 5), and very few had a middle school (grade 6-grade 8) in 2001, when the decennial census survey was conducted\textsuperscript{16}. This indicates that for higher education a student has to travel outside the village, validating the relevance of the issue for this study. The spatial dispersion of villages is very high, some being close to the town while others are located further inland. The average village population is approximately near the 500 threshold. Therefore, the entire sample is equally divided on either side of the threshold and there is no systematic bias around the threshold as discussed previously.

2.6 Effects of Improved Access on School Enrollment

2.6.1 Basic Results

This section presents results on the effect of new all weather roads on school enrollment. I begin with a graphic overview and then provide a numerical estimate. The core analysis draws on the total enrollment and on disintegrated information of enrollment based on gender for the academic years 2002 and 2009. However, for the entire analysis only the latest cross-section of 2009 is used and 2002 only serves as a base year.

2.6.2 Graphical Analysis

Figure 3 depicts the PMGSY rule stated in equation (2.1) that governs the provision of new all-season roads. The vertical axis measures the probability\textsuperscript{17} of a new all-weather road in a village that was previously unconnected and the horizontal axis

\begin{footnotesize}
\begin{enumerate}
\item In 2002, as a part of a new scheme of Sarva Shiksha Abhiyan (SSA) new schools were built in villages which previously did not have schools. In this sample more schools were built on average in the ineligible villages.
\item Average number of new roads completed as on 2009.
\end{enumerate}
\end{footnotesize}
measures the population\textsuperscript{18} of all villages in the sample that are otherwise eligible by distance. For visual reference, I superimpose a local polynomial regression model fit separately to points on the right and left of the 500 eligibility threshold. Although there can be other factors affecting a village obtaining a new road in India, there is a high correlation between the PMGSY rule and the new roads. There is a significant jump in the probability of gaining a new road for villages that have crossed the 500 person threshold and for those which have failed to do so. The villages that marginally satisfy the threshold have an approximately 20 percent higher probability of getting a new road than those that marginally fail.

Figure 4 plots the mean total enrollment for all grades versus the village population. For visual reference, I superimpose a local polynomial regression model fit separately to points on the right and left of the 500 person eligibility threshold. We observe a discrete jump in the mean total enrollment at the threshold. However, as is evident from the figure the (mean) total enrollment suffers from noise or high fluctuations. The increase in total enrollment at the threshold is not discernible by the naked eye. A concern in this regard is that the increase in total enrollment is driven by a higher base enrollment prior to the construction of new roads.

Figure 5 plots the trends in total enrollment of eligible (exceeds the 500 person population threshold) and ineligible (falls below the 500 population threshold) villages over the time. As is evident from figure 5, the eligible villages as of 2002 had marginally lower total enrollment than that of the ineligible villages. However, as of 2009 there is a significant increase in total enrollment. Further, in general the trends for total enrollment in the economy are similar indicating that the other factors are smooth at the 500 threshold.

\textsuperscript{18}The population of the village as recorded in the Census 2001.
2.6.3 Empirical Analysis

To formally identify the impacts of new roads on total enrollment, I estimate equation (9) using the fuzzy regression discontinuity approach. The results of the analysis are reported in Tables 3-5.

Table 3 provides the first stage results from equation (2.8). There are five columns for different discontinuity samples. The dependent variable in each regression is the new road, which is instrumented by population at the 500 threshold point. The additional regressors are distance to town and the number of primary, middle, secondary and higher secondary schools in the village. The standard errors have been clustered both at the district and block level. The results across the five samples display a robust pattern. The villages that are marginally above the 500 population threshold have an additional twenty five percent point probability of obtaining the new road, compared to those that are marginally below the threshold. Since the standard errors are clustered and therefore non-i.i.d, Kleibergen-Paap rk statistic is calculated. A statistic above 10 indicates a strong instrument.

Table 4 provides second stage results from equation (9). There are nine columns, showing the effects of new road on three alternative measures of total school enrollment (all, boys and girls) in academic year 2009-10 using three different specifications. Specification 1 of Table 4 includes only the linear polynomial and district fixed effects. In Specification 2, base line covariates are added: distance to the town, number of primary, middle, secondary and higher secondary schools in the village,

\[ AIC = N \ln \hat{\sigma}^2 + 2p, \text{ where } \hat{\sigma}^2 = MSE \& p = \# \text{ of regressors} \]

\[19\] When the errors are non-i.i.d the critical values complied by Stock and Yogo (2005) can not be used, then the Kleibergen-Paap rk statistic is calculated (Baum, Schaffer and Stillman, 2007).

\[20\] The total enrollment for all, boys and girls are individually winzorized at one percent to adjust for extreme outliers at both the tails of the distribution.

\[21\] The order of the polynomial is chosen by the minimum AIC. AIC = N ln \hat{\sigma}^2 + 2p, where \hat{\sigma}^2 = MSE & p = \# of regressors.
bank, electricity and newspapers facilities. In Specification 3, the total enrollment as of base year 2002 is included. Irrespective of the specification a robust pattern is observed. Better access to schools by new all season roads leads to an additional total enrollment of approximately 29 students in the schools per eligible village. This effect is equally contributed by both boys and girls: Per eligible village there was an additional total school enrollment of 14 students of each gender.\textsuperscript{22}

The empirical estimates validate the fact that improved access to schools through the construction of new roads has increased students’ enrollment in schools in rural India. Further, the benefits of better access to schools within villages can be reaped equivalently across different genders. This is an important finding because usually in a country like India there are social taboos for girls travelling far, since it may impose personal safety issues for them (Holmes, 2003). This may impose a hindrance for the higher education of girls compared to boys when the schools are located outside villages. This implies that girls’ enrollment for schools outside the village would increase more than the boys, but due to data restriction this phenomena cannot be observed here.

A concern for this analysis is that it could be sensitive to the size of the discontinuity sample whereas it should be robust even if half of the sample has been discarded (Lee and Lemieux, 2009). Table 5 provides estimates of Specification 3 for different discontinuity samples. As is evident, irrespective of the discontinuity sample, the impact of roads on total school enrollment is robust. The discontinuity sample +/- 80 represents the case when only half of the entire sample has been used. Using the most conservative measure, I find that the villages which obtain a new all-weather

\textsuperscript{22}The discrepancy in increase of all students with that addition of each gender individually is caused by winzorization.
road experience an additional total school enrollment of 21 students in the academic year 2009-10. This is equivalent to a twenty two percent increase in total enrollment compared to the mean enrollment per village in that year. Further, goodness of fit of the model is also tested. The goodness of the fit model compares the parametric model with that of a general non-parametric alternative (unrestricted graph). In this test a set of bin dummies is added to the polynomial regression and the joint significance of the bin dummies is tested (Lee and Lemieux, 2009). The square bracket represents the P-value for the joint significance tests. As one moves across columns left (full sample) to right (very restricted sample), non-parametric becomes a better alternative compared to the parametric model. Also, the optimal order of polynomial is tested for different samples. The optimal order of the polynomial was chosen by the minimum AIC after comparing up to fourth order polynomials. For all the alternatives the optimal order of polynomials is linear.

Another concern is that some other factors like mid day meal schemes or new schools opening could also be potentially driving this result. First, except for the unaided private schools (which is a small percentage of the entire composition) all schools in this analysis are eligible for the mid day meal scheme (refer Appendix 2). As the mid day meal is smooth at the 500 threshold point or in other words there is no kink in the mid day meal scheme for the 500 population villages, therefore the trend should be similar for schools in villages both marginally above and below the 500 threshold point. Secondly, new schools that have opened since the 2001Census was conducted were on average in villages with marginally less than 500 inhabitants. Therefore, we can reasonably rule out these factors as contributing to the increase in

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23Mid-Day Meal (MDM) scheme was introduced in Indian schools to help students’ nutrition and reduce the dropout rate.
school enrollment.

Up to this point in the analysis, the inherent assumption was that the effect of better access to school on students’ enrollment is homogenous for all age cohorts and different sections of the economy. However, these are very restrictive assumptions I relax these assumptions in the following sections.

2.7 Impacts of New Roads on Students’ Enrollment across Different Age Cohorts

In this section, I test the first hypothesis of the theoretical model that states in an economy with child labour\textsuperscript{24} prevalence as the age increases the impact of new roads on higher cohorts’ total school enrollment will decrease. The lower the outside wage earnings potentiality is, the higher is the incentive to stay in school. Therefore in an economy with child labour opportunity, the lower age group who are not physically fit to work always participate more than a higher age group who are physically able to work. Incorporating the child labour assumption is crucial as incidence of child labour is high in three of the four states considered in this study (refer to Appendix 3). Further, the children in the age group ten to fourteen the most vulnerable to child labour.

Table 6, provides the main results for various versions of Specification 3 in equation (9). There are four columns, with each column representing a cohort. Officially the age group five to fourteen is considered to be vulnerable to child labour. Depending on their degree of vulnerability to child labour I divide the entire sample into four

\textsuperscript{24}According to Child Labour (Prohibition and Regulation) Act 1986 in India, a child less than 14 years of age employment is prohibited from employment in certain occupations. Further according to the International Labour Organization (ILO) all forms of work by children under the age of 12 should be considered as child labour.
cohorts. The four cohorts are less than five, five to nine years, ten to fourteen years and above 15 years. As one moves across the columns (1) to column (4) i.e. from cohorts less than five to more than fifteen, the impact of the new roads decreases. Statistical significance is observed for only the cohort five to nine, but the mean enrollment in some other cohorts is itself small. Although, the magnitude of the coefficient is small for certain cohorts, the estimate in terms of the percentage change compared to the mean enrollment for that cohort is large. Therefore, the cohorts’ partial elasticity i.e. the percentage change in total enrollment in a cohort with a new road in the village compared to the mean enrollment is more meaningful for the analysis.

Consistent with the hypothesis of monotonically decreasing impact of new roads on total enrollment with an increase in age, I find the magnitude of partial elasticity decreases as the age of the cohort increases. As one moves from column (1) to column (4) respectively, the percentage change in total enrollment with a new road changes direction from being positive to negative. The largest impact of the new roads occurs on the two extreme cohorts, that is, less than five and more than fifteen age groups. For the five to nine and ten to fourteen age groups, the percentage change in total enrollment is thirty and nineteen respectively. This indicates the fact that with an improved connectivity both positive and negative effects on total enrollment exist as both the access to school and potential for work in the outside job market is increasing simultaneously.

The empirical estimates validate the fact that there are both intended and unintended consequences of an improved connectivity through the development of new roads on students’ enrollment in schools. With new roads the students’ access to
schools is improved causing to an increase in enrollment. The flip side of the better connectivity is that it simultaneously increases the availability of outside job options for the students. However, in order to reap the benefit of outside job options, physical fitness is required. Henceforth, the higher age cohort students who are physically fit to work compared to the lower age cohorts have less incentive to participate in schools.

Until now in this analysis it has been assumed that the benefit of roads is homogenous across students from different social background. This assumption is actually invalid for India where access to schools and the potentiality of reaping future benefits from higher schooling is contingent on the social background of students. In the following section I relax this restrictive assumption.

2.8 Impacts of New Roads on Students’ Enrollment across Different Social Background

In this section, I test the second hypothesis of the theoretical model which states that effects of new roads on students’ enrollment is ambiguous and contingent on their social background. Investment in schooling is dependent on future benefits of schooling and the travel cost involved in acquiring schooling. Usually in India schools are spatially clustered in areas dominated with high castes\textsuperscript{25}. In many states the backward castes (especially schedule tribes) are interiorly located or reside outside the vicinity of villages. Banerjee and Somanathan (2007), use data for the Indian parliamentary constituencies and find that in the early 1970s the population share of Brahmans in a constituency is positively correlated with access to primary, middle

\textsuperscript{25}In India an example of the high castes in the Hindu society are Brahmans.
and secondary schools, to post offices and to piped water. Hence, even within villages
the distance to schools varies for different castes. The backward caste students’ access
to schools will improve from the development of new roads as for them travel cost is
higher, new roads therefore positively influence their participation in schooling. On the
other hand, social mobility is an important determinant in predicting future earnings
from higher levels of schooling. The backward caste have more restrictions on social
mobility; thus they can reap less benefit from future earnings from schooling. This
will negatively impact current investment decisions for students of backward castes;
they have more incentive to drop out from the schools. Accordingly the impact of
better connectivity on enrollment will be dependent which of the two effects dominate,
and will be heterogeneous across castes.

Table 7 provides the main results for various versions of Specification 3 in equation
(9). There are two columns, with each column representing different castes. The
column (1) represents general castes and column (2) represents backward castes. The
backward castes are comprised of schedule castes, schedule tribe and other backward
class. The general castes are comprised of other castes beside backward castes. For
both the castes the students’ enrollment in schools increases with the development of
road and improvement in connectivity. While the magnitude of the coefficient terms
is only considered then with new roads the enrollment of students in schools from
backward castes are higher compared to the general castes, but in terms of partial
elasticity the results reverse. The percentage change in total enrollment compared to
the mean for general caste students is more than hundred percent, whereas for the
backward caste students it is only twenty one percent.

The empirical estimates indicate the fact that irrespective of caste, better access to
schools increases students’ enrollment in schools. However, the response of enrollment to an improvement in connectivity is much higher for general caste students compared to the backward caste students. This indicates the fact that restrictions in social mobility are an important factor in determining investment decisions of schooling. The general (backward) castes those face low (high) restrictions in social mobility and can reap high (low) future earnings from an investment in schooling. The social mobility restrictions of the different castes influence their current participation decisions on schooling.

2.9 Robustness Check: Placebo Test

A crucial assumption internal in this analysis is that the other factors affecting total enrollment are uncorrelated with the village population at the 500 threshold. If the other factors are correlated then the increase in total enrollment due to new-roads would be spuriously correlated. As a possible mechanism to discern the spurious from the casual effect I create a simulated threshold point at the left and right medians 422 and 573 threshold respectively. Lee and Lemieux, 2009 suggests that the power of the test is highest at the medians. If the effect is casual then at the left and right median threshold points there should not be any increase in total enrolment.

In Figure 6 the top panel represents the simulated threshold at the left median point 422 and the bottom panel represents the simulated threshold at the right median point 573. As is evident from the top panel, there is an increase in the total enrollment at the left median point. In the bottom panel we observe that at the right median point the increase in total enrollment is absent. This indicates that the increase in total enrollment at the left median point is due to the high fluctuations in the total
enrollment caused by a noisy data.

This gives confidence to the fact that the increase in total enrollment at the 500 threshold point is a casual effect.

### 2.10 Conclusion

This paper presents a variety of instrumental variable estimates of the effect of better roads on students’ enrollment in schools in rural India. Instrumental variable estimates constructed by using population rules as instruments for new all-season roads show a positive association between new all-season roads and students’ enrollment. The most conservative estimates show that an improved access to school by better roads increased school enrollment by 22 percentage in 2009. These effects vary across different age cohorts. The effect is largest for students of younger cohorts. Further, I find that the enrollment of students is heterogeneous across different social background. The results indicate that the restriction in social mobility that determines their future earnings is an important factor for their participation in schooling. This paper also extends the human capital investment model and introduces cost of travel time to motivate an empirical analysis. The model provides some hypotheses, for virtually all of which I find empirical support.

The effects are larger than those that are reported by Duflo (2001) Jalan and Glinskaya (2003). However, for poorer sections of the economy the authors found a large impact on students’ enrollment in schools with a better access. The findings reported here are important because they show that a large government intervention has been effective in increasing education in India. In India where the low caste resides in the vicinity of the villages the physical distance imposes a major hurdle
to participation in school. Thus, these sections would especially benefit from an improved access to schools. An improved access is especially beneficial for girl children for whom travelling a long distance becomes additional barrier to participation in schools. In many countries there are social taboos for unmarried young girls for travelling far from home, but no such taboos exists for boys (Holmes, 2003). Travelling a long distance by foot may pose a personal safety issue for young girls but not for boys. Distance increases the opportunity cost of schooling for girls and will lead to an increase in the enrollment gap between boys and girls.

It is worth considering that the results for India are likely to be relevant for other developing countries as well. The schools in India are located at comparable distances compared with those in Bangladesh and Philippines (see Filmer, 2007). Culturally, India and Bangladesh are more similar than that of Phillipines. So, the results presented here may be showing evidence of an effect of an improved access to schools on students’ enrollment for most developing countries.

There is usually a tradeoff between quantity and quality. This analysis have concentrated towards the quantity of education and left aside the quality aspect. Although, it cannot be tested here there is likelihood that this would also increase the quality of education. In developing countries the quality of education is highly sensitive to the time teachers allot to task (Epstein and Karwait, 1983). With an improved connectivity the perceived threat of monitoring increases subsequently reducing the absence rate (Kremer et al., 2004). A reduction in the teacher’s absence rate will enhance the quality of education.
2.11 Tables and Figures

Figure 1a-Schooling Increases with Better Connectivity

Figure 1b-Schooling Remains Same with Better Connectivity
Figure 1c - Schooling Decreases with Better Connectivity

Figure 2 - McCrary (2008) Test for Manipulation at 500 cutoff

Figure 3-New Roads Construction between Eligible vs Ineligible Villages

Note: Villages above(below) 500 population are eligible(ineligible) for newroads. Source: PMGSY

Figure 4-Total Enrollment (All) between Eligible vs Ineligible Villages.

Note: Villages above(below) 500 population are eligible(ineligible) for newroads. Source: NUEPA and PMGSY.
Figure 5 - Trends in Total Enrollment across years for Eligible vs Ineligible Villages.

Legend with/without Diamonds are eligible/ineligible villages for new roads. Source: NUEPA
Figure 6-Placebo Test (Top Panel-Left Median),(Bottom Panel-Right Median)
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<th>N</th>
<th>Mean</th>
<th>S.D.</th>
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<td>Distance to town</td>
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Variable definitions are as follows: Enrollment = Total enrollment in schools from September 2009-September 2010, Distance to town = Distance of the village from the nearest town in kms, Population = Total Village Population as of 2001 Census.

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</tbody>
</table>

The unit of observation is the village. Each cell represents results for separate regression where a key independent variable is an indicator for a new road. Standard errors are clustered both at district and block level in parentheses. The base year is the Total Enrollment in academic year 2002. Primary (Middle) is the number of schools in villages in 2001. Distance is the distance to the nearest town. Bank and Electricity are indicators for those facilities in the villages in 2001.
Table 3-First Stage Results for Discontinuity Samples

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Discontinuity Sample-</th>
<th>New Road</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>(150)</td>
</tr>
<tr>
<td></td>
<td>Discontinuity of Population at 500</td>
<td>0.26**</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.06)</td>
</tr>
<tr>
<td></td>
<td>K-P rk Wald F Statistics</td>
<td>18.45</td>
</tr>
<tr>
<td></td>
<td>Baseline Covariates</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Base Year</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>District Fixed Effects</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Optimal order of Polynomial</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Population Polynomial</td>
<td>Linear</td>
</tr>
<tr>
<td></td>
<td>Observations</td>
<td>3326</td>
</tr>
</tbody>
</table>

**(5% significance level)***(10 % significance level). The unit of observation is the village. Each cell represents results for separate regression where the dependent variable is a new road and a key independent variable is an indicator for population at 500. Standard errors are clustered both at district and block level in parentheses. Staiger and Stock(1997), states that the F statistic should be at least 10 for weak identification not to be considered a problem.
### Table 4-2SLS Estimates for All grades in 2009 (Full Sample)

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Total Enrollment</th>
<th>Total Enrollment</th>
<th>Total Enrollment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All</td>
<td>Boys</td>
<td>Girls</td>
</tr>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
</tr>
<tr>
<td></td>
<td>All</td>
<td>Boys</td>
<td>Girls</td>
</tr>
<tr>
<td></td>
<td>(4)</td>
<td>(5)</td>
<td>(6)</td>
</tr>
<tr>
<td></td>
<td>All</td>
<td>Boys</td>
<td>Girls</td>
</tr>
<tr>
<td></td>
<td>(7)</td>
<td>(8)</td>
<td>(9)</td>
</tr>
<tr>
<td>New Road</td>
<td>26.95**</td>
<td>12.97</td>
<td>13.25**</td>
</tr>
<tr>
<td></td>
<td>(13.38)</td>
<td>(8.12)</td>
<td>(6.22)</td>
</tr>
<tr>
<td>Baseline Covariates</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Base Year</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>District Fixed Effects</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>3326</td>
<td>3326</td>
<td>3326</td>
</tr>
<tr>
<td>Population Polynomial</td>
<td>Linear</td>
<td>Linear</td>
<td>Linear</td>
</tr>
<tr>
<td>Discontinuity sample</td>
<td>-/+150 Population</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note:** The enrollment has been winzorized at 1 percent to take care of extreme values.**(5% significance level)***(10 % significance level).

The unit of observation is the village. Each cell represents results for separate regression where the dependent variable is the total enrollment and a key independent variable is an indicator for a new road. Standard errors are clustered both at district and block level in parentheses. The base year is the academic year 2002. Baseline covariates include distance to the town, number of primary, middle, secondary and higher secondary schools in the village. Other covariates are indicators of bank facilities, electricity and newspaper in the village as of year 2001.
<table>
<thead>
<tr>
<th>Discontinuity Sample-+</th>
<th>Total Enrollment (All )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(150)</td>
</tr>
<tr>
<td>New Road</td>
<td>29.74**</td>
</tr>
<tr>
<td></td>
<td>(12.35)</td>
</tr>
<tr>
<td></td>
<td>[0.00]</td>
</tr>
<tr>
<td>Partial Elasticity</td>
<td>+0.30</td>
</tr>
<tr>
<td>Baseline Covariates</td>
<td>Yes</td>
</tr>
<tr>
<td>Base Year</td>
<td>Yes</td>
</tr>
<tr>
<td>District Fixed Effects</td>
<td>Yes</td>
</tr>
<tr>
<td>Optimal order of Polynomial</td>
<td>1</td>
</tr>
<tr>
<td>Population Polynomial</td>
<td>Linear</td>
</tr>
<tr>
<td>Observations</td>
<td>3326</td>
</tr>
</tbody>
</table>

***(5% significance level)***(10 % significance level). The unit of observation is the village. Each cell represents results for separate regression where the dependent variable is the total enrollment and a key independent variable is an indicator for a new road. Standard errors are clustered both at district and block level in parentheses. Base year is the academic year 2002. P-values from the goodness-of-fit test in square brackets. The goodness-of-fit test is obtained by jointly testing the significance of a set of bin dummies included as additional regressors in the model. The bin width used to construct the bin dummies is 5. The optimal order of the polynomial is chosen using Akaike’s criterion.
| Outcome                  | Total Enrollment (All) | Age-Group (in years) | (less than 5) | (5-9) | (10-14) | (15 above) | New Road  
(0.79) | 19.68** | 6.35 | -0.57 | 
|-------------------------|------------------------|----------------------|---------------|-------|---------|------------|-----------|---------|-------|-------|       |
| Mean of Enrollment      |                        |                      | 2.07          | 63.53 | 33.29   | 1.05       | 0.42      | +0.30   | Yes   | Yes  | Yes  |       |
| Partial Elasticity      |                        |                      |               |       |         |            | (+0.42)   |         |       |       |       |
| Baseline Covariates     |                        |                      |               |       |         |            | Yes       |         |       |       |       |
| Base Year               |                        |                      |               |       |         |            | Yes       |         |       |       |       |
| District Fixed Effects  |                        |                      |               |       |         |            | Yes       |         |       |       |       |
| Population Polynomial   |                        |                      |               |       |         |            | Yes       |         |       |       |       |
| Observations            |                        |                      |               |       |         |            | Linear    |         |       |       |       |
|                         |                        |                      |               |       |         |            | Linear    |         |       |       |       |

***(5% significance level)** *(10% significance level)*. The unit of observation is the village. Each cell represents results for separate regressions where the dependent variable is the total enrollment and a key independent variable is an indicator for new roads. Standard errors are clustered both at district and block level in parentheses. The base year is the academic year 2002.

Baseline covariates include distance to the town, number of primary, middle, secondary and higher secondary schools in the village. Other covariates are indicators of bank facilities, electricity and newspaper in the village as of year 2001.
<table>
<thead>
<tr>
<th>Type of Caste</th>
<th>Outcome</th>
<th>Total Enrollment (All)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>(General)</td>
</tr>
<tr>
<td>New Road</td>
<td>9.76*</td>
<td>18.92**</td>
</tr>
<tr>
<td>-</td>
<td>(5.44)</td>
<td>(9.38)</td>
</tr>
<tr>
<td>Mean of Enrollment</td>
<td>9.75</td>
<td>86.40</td>
</tr>
<tr>
<td>Partial Elasticity</td>
<td>+1.00</td>
<td>+0.21</td>
</tr>
<tr>
<td>Baseline Covariates</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Base Year</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>District Fixed Effects</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Population Polynomial</td>
<td>Linear</td>
<td>Linear</td>
</tr>
<tr>
<td>Observations</td>
<td>3114†</td>
<td>3114†</td>
</tr>
</tbody>
</table>

†Observations are lost due to absence of caste information in the village school. ***(5% significance level)***(10 % significance level).

The unit of observation is the village. Each cell represents results for separate regression where the dependent variable is the total enrollment and a key independent variable is an indicator for new roads. Standard errors are clustered both at district and block level in parentheses.

The backward caste comprise of schedule caste, schedule tribe and other backward class. The base year is the academic year 2002.

Baseline covariates include distance to the town, number of primary, middle, secondary and higher secondary schools in the village.

Other covariates are indicators of bank facilities, electricity and newspaper in the village as of year 2001.
3 The Effect of Fringe Benefit Tax on Wages: Evidence from India

3.1 Introduction

Between 1989 to 1996, the allocation of fringe benefits\(^{26}\) to wages in a typical compensation package was 32 percent in an Indian industrial sector. This has increased to 42 percent by 2000, as illustrated in Figure 1.\(^{27}\) The existing literature offers three main motivations behind a firm’s rationale to offer these fringe-benefits to its employees instead of providing an equivalent monetary compensation. The first postulated viewpoint in the corporate finance literature (Grossman and Hart, 1980; Jensen, 1986) is that this is a means for managers to misappropriate some of the surplus the firm generates. This is managerial excess and hard to observe by investors of the firms. The second argument for providing some of these fringe benefits (like travel benefits) is to enhance the productivity of its employees. They are provided by firms from a rationale of positive external benefit (Rajan and Wulf, 2006), as the employees themselves cannot fully internalize the value. One final argument (Gruber and Poterba, 1994; Woodbury, 1983) is that firms weigh the relative tax burden on each component of the compensation package and provide the cheaper component in larger amounts. This creates a distortion in optimal allocation of fringes and wages in the compensation packet.

This paper examines whether taxation creates a distortion in the optimal allocation of fringe benefits and wages. Using a new tax imposed on fringe benefits

\(^{26}\)Fringe benefits are nonmonetary compensation firms offers to employees. These can take various forms, ranging from pension funds or welfare benefits to club membership and use of an executive jet.

\(^{27}\)Industry-wise data on total compensation and its break up is unavailable for the service sector.
beginning in Fiscal Year (FY) 2005 in India, I study its effect on the average wage allocation in the employees’ compensation package. Using firm-level panel data on total employee compensation and wages across all industries, I link the marginal tax rate on fringe benefits to the choice of compensation. The two major data sources used are industry-level data for FY 2000-FY 2005 from the Annual Survey of Industries (ASI) and data at the firm level for FY 1999-FY 2006 from the Center for Monitoring Indian Economy (CMIE). I utilize a two-way fixed effect method, which is equivalent to a difference in differences method\(^{28}\) in panel data to conduct this analysis. I find that an increase in the tax rate on fringe benefits induces a higher allocation toward wages in compensation packages\(^{29}\). Further, this effect is more pronounced for highly paid employees. Using my most conservative estimate, I find that a doubling of the fringe-tax increases wages by one percent.

The difference in differences strategy used here has several advantages over some of the past methods used in the literature. First, one body of literature (Woodbury, 1983; Sloan and Adamache, 1986; Taylor and Wilensky, 1983) studies a single cross-section and studies the impact of tax-rates on fringes (health insurance, insurance coverage) consumed by individuals. But these studies usually suffer from omitted variable bias which affects both the tax-rate and fringe-benefit allocation choice. For example, in the presence of children, the health insurance fringe benefit will be consumed more and taxes will also be affected by tax benefits. This causes the estimation of distortion created by the tax-wedge of fringe benefits and wages to be inconsistent.

\(^{28}\)This method has become widespread in the literature (Gruber and Poterba, 1994; Marquis and Phelps, 1987). In this approach the difference in treatment effect between the control group (does not have tax-preferences) and treatment group (tax-preferences) is considered, both pre and post tax treatment. The cross section differences control for the time spurious correlation and the time difference between controls and treatment individually controls for cross-section spurious correlation.

\(^{29}\)The allocation of compensation observed is an equilibrium value of employee’s demand and employer’s supply.
It is difficult to discern the tax effect from other individual-specific effects (behavioral differences) and study its impact on fringe benefits. Second, other research (Truner, 1987; Long and Scott, 1982) studies how fringe benefits have changed as the tax-rate changes over time. But these studies usually suffer from time series spurious correlations. This is due to the fact that the time-series tax trend may be correlated with fringe benefit trends like shifts in unionization or wide divergence in income. It is difficult to discern the effect of time trends and tax-rate changes. The above studies usually suffer from cross-section or time-series spurious correlation problems.

This paper makes three main contributions to the empirical literature on distortion of compensation package allocation due to taxation. First, it exploits the direct evidence of taxes’ impact on fringe benefits and their effect on employees’ wages which has not been previously analyzed due to an absence of instances of taxation on fringe benefits. Second, the study finds systemic evidence of highly paid employee’s compensation being more sensitive to taxation than those in a lower pay scale. This is consistent with the hypothesis of employees’ choice of fringe benefits being affected by taxation, the higher tax gap between marginal wages and fringe benefits, the greater is the incentive to allocate towards fringe benefits. Third, for one part of the analysis it overcomes the drawback of difference in differences method being affected by a sample composition change, by concentrating only on those firms which were present both pre and post tax reform in the industry.

In addition, this paper also provides some insight into corporate literature on fringe benefits as being purely managerial excess (Jensen, 1976; Grossman and Hart, 1980; Rajan and Wulf, 2006). The literature is brief as data on fringe-benefits is limited. The popular consensus is that managers misappropriate some of the surplus
the firm generates, as it is hard to discern through the naked eye. A robust finding in
the current study is that allocation of fringe benefits which are productivity enhancing
in nature remain relatively unchanged after a tax imposition for the executives of the
firm than for managers of lower rank. Therefore, this indicates that the firms are
aware of the benefits of providing these fringes to executives and that these are not
purely managerial excess. Consistent with the work of Rajan and Wulf (2006), I find
a hierarchy in provision of productivity enhancing fringes by firms from executives to
lower rank managers.

The remainder of the paper proceeds as follows. Section 2 lays down the details
of the Fringe-Benefit Tax introduced in India. Section 3 provides a brief theoretical
framework of distortion between wages and fringes created by taxation. Section 4
discusses the identification technique and the data used for the analysis. Section 5
explores the empirical findings which are supplemented by two sets of data, the CMIE
and ASI, with some robustness checks. Section 6 summarizes my findings and some
limitations that exist in the study.

3.2 Implementation and Abolishment of the Fringe Benefits

    Tax (FBT)

In 2005 a new tax on fringes (FBT) was introduced which taxed a certain class of
employers\footnote{Tax payable as per definition of employer by section 115W of the Income Tax Act.} (not employees) on the value of the fringes (perquisites or benefits) that
employees derived due to employment. Although there is provision per the Indian
Income Tax Act for taxing perquisites and allowances, the employers could directly
reimburse employees for expenses incurred, making it difficult to effectively capture
the true extent of a perquisite due to the problem of tracking cash flow. Further, there are facilities or amenities collectively enjoyed by the employees and difficult to attribute to an individual employee for taxation purpose. Therefore, the FBT was introduced to remove tax evasion. It taxed employers on the basis of the value of fringes provided or deemed. The base rate for valuation varies from 5 to 100 percent, depending upon the expenditure head under which the fringes have been provided and are taxed at a flat rate of 30 percent with an applicable surcharge and cess\(^{31}\), (Jhanwar, 2005; Kishore, 2008). The complete details in the variation of valuation of each expenditure item considered for FBT is provided in Table 1.

Table 2 reflects the variation of the effective tax rate a firm faces on the basis of ownership and the industry it is engaged in. It has nine columns, representing the taxation on three\(^{32}\) different expenditures of fringe benefits firms of various ownership faces. Certain industries receive concession in certain expenditure heads for the valuation of fringe compared to the others (see appendix A1). In most cases, the effective tax rate difference between the concession and non-concession sector is 5 percentage points. For example a firm in computer software (NIC-722) is valued at 5 percent for travel expenditures but a firm in business process outsourcing (NIC 723) is valued at 20 percent for the same (see appendix A1). This leads to a difference in effective tax rates of approximately 5 percentage points between these two industry. Similarly, if a domestic firm belongs to the airline and air-cargo, hotel or shipping industry it faces an effective tax of 1.6 percent on every amount it spends on hospitality but the firms in other industries face a 6 percent tax for the same. The highest effective tax rate

\(^{31}\)There is variation in surcharge rate between domestic, non-domestic and cooperative firms. See Finance Bill, Union Budget India for details.

\(^{32}\)Due to data limitation only the effective tax-rate on these three types of expenditure can be exploited in this study.
that a firm faces is for expenditure on private benefits such as superannuation funds and employee stock options (ESOP). For this type of expenditure on fringe benefits there is no concession; the only variation observed is due to the ownership type. The effective tax-rate on superannuation funds had a break in FY2006. Initially, in FY2005, for every positive amount contributed towards superannuation the fund was taxed at approximately 33 percent; however after FY2006 it was only taxed if the amount exceed Rs 1000000.

Although the revenue collection from this tax as a percentage of total direct tax has been a meager 3 percent (see Figure2) i.e. Rs. 8500 crore (FY2008), it has generated considerable controversy. The grounds of objection from corporate firms are that it has increased compliance costs and that it is taxing true business expenditures as deemed fringes (perceived inefficiency). This caused the government to finally abolish the tax on the employers in 2009 and retain it for employees. The few empirical studies (Kishore, 2008; Kishore, 2009) that have studied this tax have concentrated on the revenue collection pattern from various sectors of the economy. In the current study I analyze the effect of implementing this tax on wages of the employees. The variation of effective tax rate across firms is used as an identification strategy.

3.3 Modeling Preferences of Employees for Compensation Components

To motivate the empirical work, I present a simple theoretical framework which modifies the Woodbury(1983) model. Let's assume that there are only two components of compensation (wages and fringes) and an employee's utility \( U \) (well-behaved), is a function of the quantities of wages \( z_w \) and quantities of fringes \( z_f \). In order to com-
pare non-monetary fringes with monetary wages we will assume an implicit price for both components of the compensation. The employee faces different prices individually at the market than that the employer for various components of compensation package. This assumption is logical on the basis of the fact that employers have economies of scale due to which a price difference can occur for the same component. For example, when the employers provides health insurance it can provide it at a much cheaper rate using the pool of employees than the market rate for the same coverage.

Lets assume that the employee individually faces implicit prices \( (p_w) \) for wages and \( (p_f) \) for fringes and maximizes her utility

\[
U = U(z_w, z_f), \quad (3.1a)
\]

w.r.t. to the budget constraint of \((3.1b)\)

\[
z_wp_w + z_fp_f = M. \quad (3.1b)
\]

Thus, the employees indirect utility function \( (V) \) is a function of the implicit prices he faces for wages \( (p_w) \) and fringes \( (p_f) \) and the total compensation package \( (M) \).

\[
V = V(p_w, p_f, M). \quad (3.2)
\]

However, if the employee receives this component from the employer she receives them at different prices, the employer’s price of wages being \( (q_w) \) and fringes \( (q_f) \). The employer can provide this component and would allow the worker to choose a mix
of compensation package which lies on the following locus \((M)\) in (3.3),

\[
z_w q_w + z_f q_f = M. \tag{3.3}
\]

Thus, the employee if purchasing from the employer at implicit prices \((q_w)\) for wages and \((q_f)\) for fringes would maximize utility

\[
U = U(z_w, z_f),
\]

w.r.t. to the budget constraint of (3.3)

\[
z_w q_w + z_f q_f = M. \tag{4}
\]

Let us begin with a basic model where neither fringes nor wages are taxed. Solving the maximization problem and manipulating the first order conditions under both the scenarios the following optimal allocation condition is derived. Under the optimal allocation condition provided in (3.5) there is no distortion between employers provided allocation and individual allocation of wages and fringes, as both of them face the same price ratio. The allocation condition of fringes and wages in the compensation will depend on the price ratios given in (3.5)

\[
\frac{p_w}{p_f} = \frac{q_w}{q_f}. \tag{3.5}
\]

Into this previous scenario let us introduce a taxation on wages such that now the wages are taxed at a marginal rate \((t_w)\) but fringes are not taxed. In this new
scenario where her wage income is taxed at a constant tax rate \(^{33}(t_w)\), her new budget constraint is provided in (3.6).

\[ z_w p_w (1 - t_w) + z_f p_f = M, \quad (3.6) \]

After solving the maximization problem with the budget constraint in (3.6) a new optimal allocation condition is obtained provided in (3.7).

\[ \frac{p_w}{p_f} = \frac{q_w}{q_f} \frac{1}{(1 - t_w)}, \quad (3.7) \]

As is evident from the optimal allocation condition in (3.7) there is a difference in the price ratio faced by the employer and employees. The employee’s implicit price ratio of wages to fringes is higher than that of her employer. Thus, for the employee wages have become more expensive than fringes. This would induce a higher allocation of compensation in fringes than in wages compared to a no-tax case (assuming there is no change in preferences i.e. utility remains unchanged and both fringes and wages are normal good); it distorts the allocation of compensation. Further, this effect would be prominent for those employees for whom the difference between the marginal tax rate of wages and fringes is greatest. Thus, compared to a secretary or clerk an executive will have a higher incentive to distort the fringe-wage

\[^{33}\text{Woodbury}(1983)\text{ assumes a constant tax-rate for simplification.}\]
allocation.

I extend the Woodbury (1983) model by considering a scenario where both wages and fringes are taxed. Let the marginal tax rate of wages be \((t_w)\) and of fringes be \((t_f)\) respectively. The statutory liability of fringe tax \((t_f)\) is on the employers which on the basis of the value of fringes they provide to their employees. Thus the employer’s locus \((M)\) is transformed to the following in (3.8).

\[
zwq_w + zfq_f(1 + t_f) = M, \tag{3.8}
\]

Solving the maximization problem of the employee with the new budget constraint provided in (8) provides the optimal allocation condition in (3.9).

\[
\frac{p_w}{p_f} = \frac{q_w}{q_f} \frac{1}{1 - t_w} \frac{1}{(1 + t_f)}. \tag{3.9}
\]

As both \(|t_w| < 1\) and \(|t_f| < 1\), therefore

\[
\frac{p_w}{p_f}_{\text{wage–tax}} > \frac{p_w}{p_f}_{\text{wage–tax, fringe–tax}}, \quad \text{but,} \tag{3.10a}
\]

\[
iff \; |t_f| \leq |t_w|
\]

\[
\frac{p_w}{p_f}_{\text{wage–tax, fringe–tax}} > \frac{p_w}{p_f}_{\text{no–tax}}, \tag{3.10b}
\]

Compared to the tax on wages (only) situation the distortion of wages and fringes would reduce. This is because the implicit price ratio of wages to fringes faced by the employees is less than the previous case of a tax on wages only. This would cause more wages to be preferred than fringes in the compensation basket in the post fringe tax era. However, as long as the taxes on fringes are less than on wages the distortion
would exist.

The model yields a number of testable implications. With respect to wages in the compensation basket of an employee, it predicts that an increase in taxation on fringes should be associated with an increase in the wages of the employees, the effect being prominent for highly paid employees relative to those in the lower on the pay scale. The marginal tax rate difference between wages and fringes at the heart of the model implies that the higher the difference is between the two rates the higher the incentive is for employees to allocate more towards fringes than is optimal. I test these predictions, accounting for various econometric challenges which I outline below.

3.4 Identification technique

Usually factors like unions, average age of employees and ownership (domestic and foreign) which determine the workers’ compensation are also correlated with nature of the industry. In a simple cross section analysis some of these factors would be correlated both with the FBT tax rate in an industry and the compensation it offers to its employees, leading to a spurious correlation. For example, foreign ownership firms in most cases offer higher fringes on average (like recreation facilities, performance linked non-monetary compensation awards) than their domestic counterparts to improve efficiency and performance. The presence of unions and senior employees increases the fringes proportionate to wages in the employee’s basket. Marby (1973) and Freeman (1978) argue that union leaders can inform their members regarding advantages of the fringe benefits and force the management to provide them, by collective bargaining power. They would also like to retain them because the bureaucracy
and administration increases their power and increases their probability of survival
thus, factors like proportion of high skilled workers (managers), union dominance
and foreign ownership will determine the compensation mix of the industry. If the
industries which obtain concession (lower FBT) have a higher proportion of skilled
workers, foreign firms or unions then this would cause a spurious negative correlation
between wages and tax rate of the industry. Similarly, we need to control for spurious
correlation in time series data between wages and tax-rate.

Generally I use two identification strategies to solve this problem:

(i) Cross-Section: Difference in tax rate between concession versus non-concession
industries (suffers from cross-section spurious correlation $\text{cov}(\mu_i, FBT_{it}) \neq 0$).

(ii) Time Series: Before versus after FBT imposition in 2005 (suffers from time-
series spurious correlation $\text{cov}(\lambda_t, FBT_{it}) \neq 0$).

Individually, they would give us a spurious correlation but combination by panel
removes the spurious correlation in cross section by firm fixed effect and in time
series by time fixed effects. This methodology is reasonable under the assumption
that factors like union and ownership are time-invariant. Thus, I am conducting an
equivalent to difference in differences technique by employing a two-way fixed effect
panel estimation technique.

The equation of interest at the industry-level is the following:

\[
(\log W)_{jt} = \alpha_0 + \beta_1 (FBT)_{jt} + \beta_2 (X)_{jt} + \mu_j + \lambda_t + \gamma_j(t) + \nu_{jt}; \quad j = \text{industry}, t = \text{year}
\]

(3.11)

where $(\log W)_{jt}$ is log of the average wages of an employee engaged in an industry
in a given year. During industry level analysis an average manager’s wage can be isolated from that of an average ordinary worker’s wage. The regressor of interest 
\((FBT)_{jt}\) is the effective tax rate on different expenditure heads that an industry faces depending on its concession or non-concession status; \((\mu_j)\) is industry fixed effects, \((\lambda_t)\) year dummies with \((t=2000,...,2005)\) and \((\nu_{jt})\) stochastic error term.

The equation of interest at the firm-level is the following:

\[
(\log W)_{it} = \alpha_0 + \beta_1 (FBT)_{it} + \beta_2 (X)_{it} + \mu_i + \lambda_t + \gamma_j(t) + \nu_{it}; \ i = \text{firm}, \ j = \text{industry}, \ t = \text{year}
\]  

(3.12)

where \((\log W)_{ijt}\) is the log of average wage of an executive engaged in a firm in a given year. The regressor of interest \((FBT)_{ijt}\) is the effective tax rate on different expenditure heads that a firm faces depending on its concession or non-concession status and provision of a superannuation fund.; \((\mu_i)\) is firm fixed effects, \((\lambda_t)\) year dummies with \((t=2000,...,2007)\) and \((\nu_{ijt})\) stochastic error term.

The coefficient of interest \((\beta_1)\) would state the change in average wages due to an increase in the effective tax rate, and is expected to be positive. As the FBT was introduced by a sudden policy change this is equivalent to a natural experiment, where the effective tax rate of a firm is exogenously determined by the industry’s concession and non-concession status or provision of superannuation fund in a firm. Later, I do a robustness check on whether, the average wage increase of an employee can be completely attributed to the tax imposition.

A concern in our analysis is that some of this wage increase may be caused by industries’ past wage trends, evident in Figure3. Ideally, we would like to compare only industries with similar past wage growth trends. The simplest technique is to
control for the industry linear trend $\gamma_j(t)$, which is controlled at the 3 digit level (4 digit level) NIC for the industry-level(firm-level) analysis.

I adopt a two way within effect-panel with individual and time effect that removes any correlation between individual effect, time specific and effective tax rate, \( \text{cov}(\mu_i, FBT_{it}) \neq 0 \) & \( \text{cov}(\lambda_t, FBT_{it}) \neq 0 \). Thus, it is equivalent to a random assignment and the stochastic error term and the individual tax rate are uncorrelated (there is no correlation between the individual firm’s or its operating industry’s wage trend and the FBT effective rate that was imposed on it), \( \text{cov}(\nu_{it}, FBT_{it}) = 0 \). These estimates should be purged of any endogeneity.

3.5 Data Characteristic: CMIE and ASI

The data used in this paper are drawn from two sources: the Center for Monitoring Economy (CMIE) and the Annual Survey of Industries (ASI), both of which are panel data. ASI is a representative sample survey of mainly the manufacturing industries extending from FY1987-FY2005. It extends to the entire country except the States of Arunachal Pradesh, Mizoram, and Sikkim and Union Territory of Lakshadweep. From 1997 onwards, it covers all factories registered under Sections 2m(i) and 2m(ii) of the Factories Act, 1948\(^{34}\) hiring more than 100 workers. 12 States/UTs, namely, Himachal Pradesh, Jammu & Kashmir, Manipur, Meghalaya, Nagaland, Tripura and Pondicherry, A&N Islands, Chandigarh, Goa, Daman & Diu, D&N Haveli, which were industrially backward, were surveyed on complete enumeration basis. The rest of the universe was covered on sampling basis through an efficient sampling design adopting State X 3 digit industry group as stratum so as to cover all the units in a

\(^{34}\)Factories employing 10 or more workers using power; and those employing 20 or more workers without using power.
span of three years.

ASI provides information at the aggregate level (NIC 4 digit onwards) on industry’s total emoluments and its breakdown analysis in total wages, total provident fund (social security of permanent employees), staff-welfare and other expenditures, total number of workers, total number of employees engaged (includes paid and unpaid workers, contractual workers and managers). A major advantage of this data is that it provides a breakdown of the total wages (excluding bonuses) of all employees into managers’ wages (excluding bonus) and workers’ wages (excluding bonus), see Data Appendix for variable details. However, it does not provide information on private fringe like superannuation fund of an employee in an industry. CMIE data supplements the information on private fringes of an employee.

The CMIE is a micro-data repository tracking more than 10,000 audited firms for over 10 years, which are publicly listed and report to the Security Exchange Board of India (SEBI). However these firms are a sample of the entire industry. Besides providing information on individual firm characteristics (ownership type, economic activity the firms are engaged in with NIC5 digit classification, location of plants) it also gives details about the boards of directors’ compensation packages as is the required norm for all publicly listed companies under SEBI from 2001 onward.

The entire analysis is conducted both at the industry level and firm-level. The ASI employment module provides information on workers’ and managers’ wages at the industry level, for 128 industries at 4 digit NIC from 2000FY to 2005FY resulting in 768 balanced panel observations. CMIE has been used to track executive compensation at the firm level over a period from 1999FY to 2006FY resulting in

\[^{35}\text{There was a change in the NIC classification during our study period between 2003 and between 2004 at 4 digit level, we adjust our ASI data and follow the NIC98 classification definition.}\]
3816 unbalanced panel observations. In order to ensure that the results of the study are not driven by change in sample composition only those firms are retained that are present in both the pre FBT period and the post-FBT period.

Table 3 summarizes the effective tax rate for various fringes and the average wage rate across industries in the industrial sector. Managers earn approximately Rs 117700 (2615$\textsuperscript{36}) more than the workers on average in a year. However, as we take logarithmic form the dispersion in the average wage is low for both workers and managers. The taxation of fringes that can be considered in the industrial sector are on travel expenditures and lodging expenditures, which are productive fringes. The variation in concession and non-concession industries can be exploited in these two cases; however the dispersion in the effective tax rate of fringes is low across industries. The unavailability of data on private fringes expenditure at industry level does not allow exploiting the taxation scenario of private fringes.

Table 4 summarizes the effective tax rate for both private and productive fringes and average wages of the executives at firm level for all sectors of the economy combined and for the industrial sector only. As is evident from the table the average wages of the executives of all the sectors and the industrial sector is similar but the dispersion is slightly higher for all sectors than for the industrial sector alone. Executives on average have slightly more tenure,\textsuperscript{37} and there are more regular directors on a board in the industrial sector in comparison to the economy as a whole. Both for all the sectors of the economy and for the industrial sector alone, the effective tax rate on private fringes have more variation across firms than productive fringes.

\textsuperscript{36}1$=45Rs

\textsuperscript{37}The tenure here is calculated by the total number of periods each executive has spent on the board from 1990.
funds) for executives is more dependent on firm management decisions. In the industrial sector there are more sales on average than in rest of the economy and they are more concentrated.

A noteworthy point is that if the dependent variable is noisy (vertical outliers which cannot be detected by naked eye from the residual of the model as it suffers from masking effect) this may cause bias in our analysis as the mean is sensitive to outliers. A fixed effect would aggravate such bias. The average wages of the employees have huge variation and are negatively skewed. This problem is partly taken care of by taking a logarithmic form of the dependent variable. The problem becomes more acute when the independent variables are noisy (leverage outliers), the analysis becomes both biased and inconsistent (Baltagi, 2009). Ideally, we should use a robust estimator technique for fixed effect analysis as has been proposed by Bramati and Croux (2007). There are two potential problems with adopting the robust estimator technique in this case. Firstly, for higher skilled workers (executives and managers) these observations may be representing true compensation and not mere outliers. Second, the authors’ methodology is valid for only balanced panel and does not allow for clustering, although it is heteroscedastic robust.

3.6 Result

3.6.1 Basic Results

The core analysis draws on the ASI module of wages and emoluments, a panel on employees’ compensation at the four digit NIC level on 128 Indian industries from FY2000-FY2005. A few simplifications are done in order to do this analysis. First, the cross-section variation is at the industry level, thus the analysis can be conducted
for only two taxes (travel and lodging);\textsuperscript{38} where I assume all the firms belong to
the domestic sector. There was a change in the NIC classification in 2004, thus to
maintain uniformity I follow the NIC 98 definition and adjust the data accordingly
(see appendix A2).

Table 5 provides the basic results for various version of equation (3.11). There are
six columns separating the average employee’s wage into the average manager’s wage
and the average ordinary worker’s wage. The analysis is conducted for two alternative
taxes on fringes. Columns(1)-(3) presents the effect of a tax on travel expenditure.
Column (4)-(6) presents the effect of a tax on lodging expenditure. The dependent
variable in column (1) and column (4) is the average manager’s wage while in column
(2) and column (5) it is the average wages of all employees engaged in an industry,
and that of column (3) and column (6) is the average ordinary worker’s wage in an
industry. I control in all specifications for year effects and industry linear trend at
the three digit NIC level.

Irrespective of the kind of tax on fringes, a robust pattern is observed. As one
moves from column (1) (column(4)) to column (3) (column(6)) respectively, the
positive significant effect of taxation disappears. There are two key findings. First,
consistent with the theory of distortion, I find that an imposition of tax on fringes has
a positive and significant effect on average employee’s wage. This reflects that a higher
marginal tax rate on wages compared to that of fringes induces an allocation of com-
ensation towards fringes than optimal. Second, the effect is prominent for highly\textsuperscript{39}
paid employees (manager) compared to low paid employees (ordinary worker). This

\textsuperscript{38}The ASI data does not provide a higher classification beyond NIC 0400. I assume that all those
industries are in the construction sector.

\textsuperscript{39}Managers earns approximately Rs 117700(2615\$) additional than that of the workers on average
in a year.
fact further strengthens the assumption of distortion, which states that the higher the marginal tax rate on wages the employee faces the greater is the incentive to induce the compensation towards fringes than is optimal. Thus, a low-paid ordinary worker who has a low marginal tax rate would have less incentive to induce changes in fringes, compared to a highly paid manager who faces higher marginal income taxes.

Two key assumptions are internal to the analysis. First, an effect of tax on both productive fringes (travel, lodging) and private fringes (superannuation fund) have been assumed to be homogenous. Productive fringes enhance the productivity of the employees of a firm and they are provided by the firm as the employee herself may not be able to fully comprehend the benefit. In contrast, the employees only benefit from private fringes. Therefore the allocation of these two fringes should not be similar at optimal. Heterogeneity in the effect of tax on productive and private fringes is a more reasonable expectation. Second, it is assumed that the effect of tax is homogenous across all categories of managers. In reality, there is a hierarchy in a firm from CEO to lower rank managers on the basis of productivity, thus the effect of a tax on productive fringes should also be heterogeneous. However, the ASI data provides wages at an aggregate level and further does not provide information on private fringes. The following section relaxes these assumptions and exploits the information obtained on the executive directors’ compensation in the CMIE.

3.6.2 Heterogeneous Effect of Fringe Benefits Tax

In this section, I relax the assumption of a homogenous effect of taxes on both productive and private fringes. Fringes for travel, lodging, hospitality are time-saving; increases the productivity of the employees. These perks benefits the firms more than
the employees, the employees cannot fully internalize the full value of this category of perks. On the other hand, fringes like superannuation funds benefit the employees alone. The former fringes can be categorized as productive fringes whereas the latter are private fringes (Rajan and Wulf, 2006). It is in the interest of the firm that executives who conducts multi-billion dollar deals remains fresh, thus after traveling in business class they would remain more fresh and better positioned to negotiate rather than one who has been cramped in an economy class. Further, it may be cheaper for firms to provide these perks as the firms have economies of scale. Thus the conjecture that the productive fringes enhances the productivity of the firm and are true business expenditure leads to a testable hypothesis. At optimal the executives of a firm should be provided more productive fringes than private fringes. The distortion effect should be prominent for private fringes than productive fringes for the executives.

The CMIE database provides detail information on the executive’s compensation of a firm and also the five digits NIC classification based on the economic activity it is engaged in. However, this information is available for mainly companies listed in Bombay Stock Exchange and National Stock Exchange as these are required to abide by Corporate Governance Act passed in 2001. As there is no uniform designation for a firm’s CEO, thus I take the average wages of all the board of directors present in a firm in that particular year. I consider only those firms who were present both pre and post 2005, resulting in 3816 unbalanced panel observations (all sectors) and in 3038 unbalanced panel observations (industrial sector). This helps to overcome the change in sample composition between pre and post tax which is a limitation in difference in differences. It also provides information on provision for pension fund of each executive, which enables to compute the effective tax rate on superannuation
fund.\footnote{It is difficult to discern the mandatory and voluntary part of pension fund. Although in reality there is a difference between pension funds and superannuation funds here we assume both are similar. The former is mandatory and is exempt from FBT, whereas the latter is voluntary. Our assumption is reasonable on the basis of the fact that the mandatory part should remain unaffected by FBT imposition but the voluntary part should change.}

Table 6 provides main results for various version of equation (3.12). There are six columns, effects of three alternative fringe tax on average wages of the executives have been provided for both all sectors of the economy and industrial sector specifically. The other factors like sales, tenure, number of regular directors on board, location of the firm that also affects the salary of executives of a firm have been controlled for all specifications. The industry linear trend at four digits NIC has been controlled.

Consistent with the hypothesis of heterogeneous effect of fringes, I find a positive and significant effect of taxation for private-fringes and negligible effect for productive-fringes on average wages of the executives. As one moves from column(1) (column(4)) to column (3) (column(6)) respectively, the effect of a tax on fringes on the average wages of the executives becomes negligible. This pattern is robust for the economy as a whole and the industrial sector individually. This indicates towards the fact that for the executives these productive fringes are true business expenditure and not just purely managerial excess. However, these executives do have incentive to allocate more on private fringes in the compensation than is optimal just to evade higher marginal taxes. Further consistent with the executive compensation literature I find an increase in the sales of a firm significantly increases the average wages of the executive.
3.6.3 Hierarchy in the Provision of Productive Fringes

In this section, I relax the assumption that the effect of taxation on productive fringes is homogenous across all managers. As the productive fringes enhance the productivity of the firm, therefore it is in the interest of the firm that their provision increases with productivity of the employee. Therefore the executives who are more productive and whose opportunity cost of time is more for the firm should be provided a higher amount of these fringes at optimal level than a lower rank manager (Rajan and Wulf, 2006). Thus the conjecture that productive fringes enhance the productivity of the firm leads to a testable hypothesis. At optimal the more productive employee should be provided with more of these fringes; the executives who are the most productive persons in the firm should be provided more of these fringes than a lower rank manager. Hence, there should be less evidence of distortion for productive fringes for executives of the firm than other lower-rank managers.

In order to test this hypothesis I make a comparison of the effect of taxation on productive fringes on the average wages between the executives of a firm and aggregate managers in the industrial sector. Comparing column (1) (column(4)) of table 5 with that of column (5) (column (6)) of table 6 respectively, it becomes evident that the effect of a tax on productive fringes is more prominent for average wages of aggregate managers\(^{41}\) than for executives of the firm. A comparison of table 5 and table 6 for similar productive fringes and positive significant effect on average wage at aggregate level but negligible effect at executive level indicates evidence of a hierarchy of provision of productive fringes, on the basis of the productivity of the employees\(^{42}\).

\(^{41}\) Aggregate managers include all ranks of managers.

\(^{42}\) I conducted a comparison between average executive wages aggregated at industry level (4 digit NIC) and aggregated manager’s average wage for the industrial sector. No change in the pattern was observed thus in the interest of space I provide firm level information.
This is logical on the basis of the fact that the executives conduct multi-billion dollar deals and providing them these perks would enhance their productivity, leading to higher marginal benefit of the firm than providing the same to a lower rank manager.

Finally, to measure the magnitude of tax I consider the cross-price elasticity of fringes on wages. Elasticity measures the extent of doubling taxes on fringe expenditure, the percentage increase in the employee’s wage. The elasticity measure is provided in Table 7. Table 7 reflects that the elasticity is same across all type of fringes and the average wage increases of the managers by 1 percentage approximately in the event of doubling of a tax on the fringes.

This is similar to the finding of Woodbury (1983, 179) where the author found a cross-price elasticity of (all) fringes on wages to be of 4 percentage (BLS employee compensation data) and 2 percentage (Census of Government School District) data for U.S. Findings of other studies which consider other measures of elasticity and much specific fringes are not ideally comparable with this study. Gruber and Porteba (1994) considered own price-elasticity of health-insurance coverage for self-employed workers and found an elasticity greater than one in absolute value. Royalty (2000) found a cross-price elasticity of tax-rate of wages on employer provided health insurance eligibility to be 1 and pension eligibility to be 1.2. Gruber and Lettau (2004), in another study of health insurance offered by employers, found an own price elasticity to be (-0.25). On the other hand, Truner(1987) found statistically significant but very small effect of taxes on health insurance provision.
3.6.4 Robustness Check: Placebo Test

A crucial assumption internal in this analysis is that the effective tax rates a firm or industry faces are exogenously determined. This assumption would be invalid in a scenario where the concession status for the fringe benefit tax is not randomly determined and is provided favorably to growing industries. This would lead to a spurious relationship of wage increase and FBT. As a possible mechanism to discern the spurious from the casual effect I create a simulated tax on fringes in the previous period FY2004 and test its effect on the average wage. Under the assumption that the increase in average wage is a causal effect of FBT and not any spurious correlation one expects to find an insignificant effect on the average wage in the previous period, before this tax was actually imposed. The results of the tests are provided in table 8 and table 9.

Table 8 provides estimates of equation 11 with the main regressor as simulated tax on fringes at the industry level. Consistent with the hypothesis of exogenous FBT we find a negligible effect of taxation on travel expenditure in the previous period on average wage of all types of employees in the pre FBT period. However, a tax on lodging expenditures is associated with a significant negative effect in the previous period. This indicates that in reality an increase in the average wage at the industry-level caused by a tax on lodging expenditure is more than a tax on travel expenditure and has been actually under-estimated here.

Table 9 provides estimates of equation 12 with various versions of simulated tax on fringes at the firm-level. A negligible effect of taxation for both productive and private fringes on average executive wages in the previous period is found, implying a casual effect.
These estimation results gives confidence to the claim that the average wage increase that is found after FBT imposition is not a spurious regression and indicates a casual effect.

3.7 Conclusion

In the empirical literature on distortion of compensation package allocation due to taxation the evidence has always been one-sided. Thus, the hypothesis is that the employees and employers weigh the tax burden on each component of compensation (fringe benefits and wages) and allocate toward the component which has a lower tax-burden. The taxes usually distort the optimal allocation of each component in the compensation package. Usually, a change in the tax-rate of wages on fringe benefits allocation has been exploited to test this hypothesis. Ideally if the hypothesis is true then one should expect also a change in tax rate on fringe-benefits to induce allocation changes in employee’s wages. However, there is no study in the literature verifying the evidence for distortion created by taxation from the other direction. This is mainly due to the absence of instances where fringe benefits have been taxed.

This study exploits the instance of a unique new tax on fringes introduced in India and extends the literature of wage-distortion caused by taxation. I extend the simple theoretical model proposed by Woodbury (1983) and introduce taxation on fringes to motivate an empirical analysis. The model yields a number of testable implications, for virtually all of which I find empirical support. In particular, using firm-level and industry-level data and utilizing a two-way fixed effect analysis, I find that highly paid employees (managers) have more incentive to allocate more fringes than optimal in their compensation basket to evade taxes than employees at a lower
pay scale. Hence, a tax on fringes affects their wage allocation but employees with a lower rate of pay remain unaffected. Consistent with the model’s prediction, I find that an increase in taxation on fringes is associated with an increase in the average wages of the employees.

Further, in this paper I relax the assumption that fringe benefits are homogenous in nature. I exploit the difference between productive fringe benefits and private fringe benefits. I find that executives are provided more productive fringe benefits than private fringe benefits, at optimal. This is a rational behavior for the firms as there is positive externality associated with productive fringe benefits which cannot be fully internalized by the employee alone. In addition, I find evidence that lends strength to the hypothesis that a hierarchy is maintained by the firm for the provision of productive fringe benefits on the basis of productivity of the employees. The executives are ideally provided more productive fringe benefits than the lower-level managers. I find that a tax on productive fringe benefits has negligible effect on the executives’ allocation of compensation but a positive effect on the average wage of all managers. This indicates that lower-level managers were provided these fringe benefits earlier due to the lower tax burden but for that executives these are true business expenditure. These findings indicate that not all fringe benefits are purely managerial excess.

The distortion in fringe benefit allocation created due to taxation reduces with an imposition of taxation on fringe benefits, compared to a counterfactual where there are no such taxes. However, for certain fringe benefits a higher allocation is actually driven purely by productivity enhancing motivation rather than just evading taxes. So a careful analysis is required before coining higher allocation of fringe benefits as
the effect of distortion caused by taxation.
### 3.8 Tables and Figures

**Figure 1** - Trends of Fringes and Wages over Time for All Industries

![Graph showing trends of fringes and wages over time for all industries.](image)

Source: Assorted Issues of Annual Survey of India.

**Figure 2** - Revenue Collection Trends of Fringe Benefit Tax in India

![Graph showing revenue collection trends of fringe benefit tax in India.](image)

Source: Assorted Issues of Union Budget, India.
Figure 3 - Trends in Average Wages (All Employees) across Concession vs Non-Concession Sectors

Source: Annual Survey of Industries
Figure 4 - Trends in Average Wages (Managers) across Concession vs Non-Concession Sectors.

Source: Annual Survey of Industries

Figure 5 - Trends in Log (Average) Executive Wages across Concession vs Non-Concession Sectors.

Source: Center for Monitoring Indian Economy
Table 1 - FBT Heads and Valuation Base Rate

<table>
<thead>
<tr>
<th>FBT Base</th>
<th>Valuation Rate (% of Expenses)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contribution to Superannuation fund (above 1 lakh per annum)</td>
<td>100</td>
</tr>
<tr>
<td>Free or Concessional ticket</td>
<td>100</td>
</tr>
<tr>
<td>Value of ESOP</td>
<td>100</td>
</tr>
<tr>
<td>Entertainment</td>
<td>20</td>
</tr>
<tr>
<td>Hospitality</td>
<td>20</td>
</tr>
<tr>
<td>Sales promotion excluding expenditure from advertisement</td>
<td>20</td>
</tr>
<tr>
<td>Employees Welfare</td>
<td>20</td>
</tr>
<tr>
<td>Conveyance</td>
<td>20</td>
</tr>
<tr>
<td>Hotel &amp; Lodging</td>
<td>20</td>
</tr>
<tr>
<td>Repair, running of motor car</td>
<td>20</td>
</tr>
<tr>
<td>Repair, running of aircraft</td>
<td>20</td>
</tr>
<tr>
<td>Use of Telephone</td>
<td>20</td>
</tr>
<tr>
<td>Maintenance of accommodation</td>
<td>20</td>
</tr>
<tr>
<td>Festival Celebration</td>
<td>50</td>
</tr>
<tr>
<td>Health Club and similar facilities</td>
<td>50</td>
</tr>
<tr>
<td>Any other Club facilities</td>
<td>50</td>
</tr>
<tr>
<td>Gifts</td>
<td>50</td>
</tr>
<tr>
<td>Scholarships</td>
<td>50</td>
</tr>
<tr>
<td>Tour and Travel including Foreign Travel</td>
<td>5</td>
</tr>
</tbody>
</table>

Source: Adopted from Kishore (2008).

Note: The travel and conveyance heads were clubbed before (with 20% valuation) and have been separated from 2006-07.
### Table 2- Effective Tax Rate of FBT

<table>
<thead>
<tr>
<th>Sector</th>
<th>Travel</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Domestic</td>
<td>Non-Domestic</td>
<td>Coop.</td>
<td>Domestic</td>
<td>Non-Domestic</td>
<td>Coop.</td>
<td>Domestic</td>
<td>Non-Domestic</td>
</tr>
<tr>
<td>Airline, Air-Cargo</td>
<td>6.8</td>
<td>6.3</td>
<td>6.2</td>
<td>1.7</td>
<td>1.6</td>
<td>1.5</td>
<td>33.99</td>
<td>31.67</td>
</tr>
<tr>
<td>Construction</td>
<td>1.7</td>
<td>1.6</td>
<td>1.5</td>
<td>6.8</td>
<td>6.3</td>
<td>6.2</td>
<td>33.99</td>
<td>31.67</td>
</tr>
<tr>
<td>Computer Software</td>
<td>1.7</td>
<td>1.6</td>
<td>1.5</td>
<td>1.7</td>
<td>1.6</td>
<td>1.5</td>
<td>33.99</td>
<td>31.67</td>
</tr>
<tr>
<td>Pharmaceuticals</td>
<td>1.7</td>
<td>1.6</td>
<td>1.5</td>
<td>1.7</td>
<td>1.6</td>
<td>1.5</td>
<td>33.99</td>
<td>31.67</td>
</tr>
<tr>
<td>Shipping</td>
<td>6.8</td>
<td>6.3</td>
<td>6.2</td>
<td>1.7</td>
<td>1.6</td>
<td>1.5</td>
<td>33.99</td>
<td>31.67</td>
</tr>
</tbody>
</table>

Note-Superannuation Fund in FY 2005 it was taxed for any positive amount, from FY 2006 it was taxed above for Rs100000. Source - Compiled from Kishore (2008) and Sections 115WB, 115WC of Income Tax Act and Assorted Budget Issues.
### Table 3 - Descriptive Statistics of Selected Variables at Industry-level (with ASI)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Obs</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Log of average wage of all persons</td>
<td>768</td>
<td>11.11</td>
<td>.54</td>
<td>9.51</td>
<td>12.70</td>
</tr>
<tr>
<td>Log of average wage of workers</td>
<td>768</td>
<td>10.82</td>
<td>.48</td>
<td>9.45</td>
<td>12.51</td>
</tr>
<tr>
<td>Log of average wage of managers</td>
<td>768</td>
<td>12.03</td>
<td>.49</td>
<td>10.13</td>
<td>13.26</td>
</tr>
<tr>
<td>Tax Travel</td>
<td>768</td>
<td>0.01</td>
<td>.03</td>
<td>0</td>
<td>.07</td>
</tr>
<tr>
<td>Tax Lodging</td>
<td>768</td>
<td>0.01</td>
<td>.03</td>
<td>0</td>
<td>.07</td>
</tr>
</tbody>
</table>

### Table 4 - Descriptive Statistics of Selected Variables at Firm-level (with CMIE)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Obs</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Log of average wage of directors</td>
<td>3861</td>
<td>13.78</td>
<td>1.20</td>
<td>2.49</td>
<td>21.74</td>
</tr>
<tr>
<td>Log of sale</td>
<td>3861</td>
<td>4.06</td>
<td>2.58</td>
<td>-2.99</td>
<td>11.68</td>
</tr>
<tr>
<td>Tenure</td>
<td>3861</td>
<td>5.77</td>
<td>4.19</td>
<td>1</td>
<td>17</td>
</tr>
<tr>
<td>Number of regular directors</td>
<td>3861</td>
<td>1.85</td>
<td>1.04</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>Tax Superannuation fund</td>
<td>3861</td>
<td>0.03</td>
<td>0.10</td>
<td>0</td>
<td>0.34</td>
</tr>
<tr>
<td>Tax Travel</td>
<td>3861</td>
<td>0.03</td>
<td>0.03</td>
<td>0</td>
<td>0.07</td>
</tr>
<tr>
<td>Tax Lodging</td>
<td>3861</td>
<td>0.03</td>
<td>0.03</td>
<td>0</td>
<td>0.07</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variables</th>
<th>Obs</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Log of average wage of directors</td>
<td>3038</td>
<td>13.83</td>
<td>1.17</td>
<td>2.49</td>
<td>18.57</td>
</tr>
<tr>
<td>Log of sale</td>
<td>3038</td>
<td>4.66</td>
<td>1.88</td>
<td>-2.99</td>
<td>11.68</td>
</tr>
<tr>
<td>Tenure</td>
<td>3038</td>
<td>5.93</td>
<td>4.31</td>
<td>1</td>
<td>17</td>
</tr>
<tr>
<td>Number of regular directors</td>
<td>3038</td>
<td>1.89</td>
<td>1.04</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>Tax Superannuation fund</td>
<td>3038</td>
<td>0.03</td>
<td>0.10</td>
<td>0</td>
<td>0.34</td>
</tr>
<tr>
<td>Tax Travel</td>
<td>3038</td>
<td>0.03</td>
<td>0.03</td>
<td>0</td>
<td>0.07</td>
</tr>
<tr>
<td>Tax Lodging</td>
<td>3038</td>
<td>0.03</td>
<td>0.03</td>
<td>0</td>
<td>0.07</td>
</tr>
</tbody>
</table>
Table 5 - Job-wise Variation in Effects of FBT on Employees’ Wages in an Industry (with ASI).

<table>
<thead>
<tr>
<th></th>
<th>LogWage Managers</th>
<th>LogWage All</th>
<th>LogWage Workers</th>
<th>LogWage Managers</th>
<th>LogWage All</th>
<th>LogWage Workers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tax Travel</td>
<td>0.91**</td>
<td>0.01</td>
<td>-0.08</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>(Productive Fringe)</td>
<td>(0.37)</td>
<td>(0.26)</td>
<td>(0.23)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Tax Lodging</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0.73**</td>
<td>0.16</td>
<td>0.10</td>
</tr>
<tr>
<td>(Productive Fringe)</td>
<td></td>
<td></td>
<td></td>
<td>(0.27)</td>
<td>(0.16)</td>
<td>(0.12)</td>
</tr>
<tr>
<td>Industry Trend</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Year Effects</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>768</td>
<td>768</td>
<td>768</td>
<td>768</td>
<td>768</td>
<td>768</td>
</tr>
</tbody>
</table>

**(5% significance level)** *(10% significance level). Standard errors are clustered at 3 digit industry level.

Employees represents all individuals engaged in an industry. Workers include both regular and contract workers. 63 Industries’ linear trend & 6 year effects have been controlled.
Table 6 - Heterogeneous Effects of Fringe Benefits on Executive Wages in a Firm (with CMIE)

<table>
<thead>
<tr>
<th></th>
<th>Log Executive Wages (in All Sector)</th>
<th>Log Executive Wages (in Industrial Sector)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>Tax Superannuation Fund</td>
<td>0.27**</td>
<td>-</td>
</tr>
<tr>
<td>(Private Fringe)</td>
<td>(0.11)</td>
<td>-</td>
</tr>
<tr>
<td>Tax Travel</td>
<td>-</td>
<td>-0.05</td>
</tr>
<tr>
<td>(Productive Fringe)</td>
<td>-</td>
<td>(0.62)</td>
</tr>
<tr>
<td>Tax Lodging</td>
<td>-</td>
<td>0.09</td>
</tr>
<tr>
<td>(Productive Fringe)</td>
<td>-</td>
<td>(0.63)</td>
</tr>
<tr>
<td>Log Sale</td>
<td>0.09</td>
<td>0.09</td>
</tr>
<tr>
<td></td>
<td>(0.06)</td>
<td>(0.06)</td>
</tr>
<tr>
<td>Number of Regular Directors</td>
<td>-0.14</td>
<td>-0.14</td>
</tr>
<tr>
<td></td>
<td>(.08)</td>
<td>(.08)</td>
</tr>
<tr>
<td>Tenure</td>
<td>-0.07</td>
<td>-0.07</td>
</tr>
<tr>
<td></td>
<td>(0.05)</td>
<td>(0.05)</td>
</tr>
<tr>
<td>Year Effects</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>State Trend</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Industry Trend</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>3861</td>
<td>3861</td>
</tr>
</tbody>
</table>

**(5% significance level)** *(10% significance level). Standard errors are clustered at 3 digit industry level. Linear Trend at 4 digit industry level has been controlled.

Table 7 - Elasticity of FBT on Employees' Wages

<table>
<thead>
<tr>
<th>Data</th>
<th>Employees</th>
<th>Tax</th>
<th>Specification</th>
<th>Coeff.</th>
<th>AvgTax</th>
<th>Elasticity</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASI</td>
<td>Managers</td>
<td>Travel</td>
<td>(1)</td>
<td>0.91</td>
<td>0.01</td>
<td>0.01</td>
</tr>
<tr>
<td>ASI</td>
<td>Managers</td>
<td>Lodging</td>
<td>(4)</td>
<td>0.73</td>
<td>0.01</td>
<td>0.01</td>
</tr>
<tr>
<td>CMIE</td>
<td>Executive</td>
<td>Superannuation Fund</td>
<td>(1)</td>
<td>0.27</td>
<td>0.03</td>
<td>0.01</td>
</tr>
<tr>
<td>CMIE</td>
<td>Executive</td>
<td>Superannuation Fund</td>
<td>(4)</td>
<td>0.25</td>
<td>0.03</td>
<td>0.01</td>
</tr>
</tbody>
</table>
Table 8 - Untangling True Effects from Spurious Correlation of FBT on Wages
(with ASI)

<table>
<thead>
<tr>
<th></th>
<th>LogWage Managers</th>
<th>LogWage All Workers</th>
<th>LogWage Managers</th>
<th>LogWage All Workers</th>
<th>LogWage Managers</th>
<th>LogWage All Workers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simulated Tax Travel</td>
<td>-0.26</td>
<td>-0.64**</td>
<td>-0.04</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>(Productive Fringe)</td>
<td>(0.30)</td>
<td>(0.23)</td>
<td>(0.25)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Simulated Tax Lodging</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-0.45**</td>
<td>-0.81**</td>
<td>-0.24**</td>
</tr>
<tr>
<td>(Productive Fringe)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>(0.15)</td>
<td>(0.09)</td>
<td>(0.09)</td>
</tr>
<tr>
<td>Industry Trend</td>
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<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Year Effects</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>768</td>
<td>768</td>
<td>768</td>
<td>768</td>
<td>768</td>
<td>768</td>
</tr>
</tbody>
</table>

**(5% significance level) *(10 % significance level). The simulation break point is FY2004. Not rejecting the null hypothesis (absence of previous trend) is ideal.
Table 9: Untangling True Effects from Spurious Correlation of FBT on Wages
(with CMIE).

<table>
<thead>
<tr>
<th></th>
<th>Log Executive Wages</th>
<th>Log Executive Wages</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(in All Sector)</td>
<td>(in Industrial Sector)</td>
</tr>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>Simulated Tax Superannuation Fund</td>
<td>0.05</td>
<td>0.04</td>
</tr>
<tr>
<td>(Private Fringe)</td>
<td>(0.10)</td>
<td>(0.10)</td>
</tr>
<tr>
<td>Simulated Tax Travel</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>(Productive Fringe)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Simulated Tax Lodging</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>(Productive Fringe)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Log Sale</td>
<td>0.09</td>
<td>0.16**</td>
</tr>
<tr>
<td>(0.06)</td>
<td>(0.06)</td>
<td>(0.05)</td>
</tr>
<tr>
<td>Number of Regular Directors</td>
<td>-1.4</td>
<td>-1.4</td>
</tr>
<tr>
<td>(0.08)</td>
<td>(0.08)</td>
<td>(0.09)</td>
</tr>
<tr>
<td>Tenure</td>
<td>-0.07</td>
<td>-0.07</td>
</tr>
<tr>
<td>(0.05)</td>
<td>(0.05)</td>
<td>(0.05)</td>
</tr>
<tr>
<td>Year Effects</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Industry Trend</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>3861</td>
<td>3038</td>
</tr>
</tbody>
</table>

**(5% significance level) *(10% significance level). Standard errors are clustered at 3 digit industry level. The simulation break point is FY2004.
4 Economic Incentives of Manipulation for Public Good: Evidence from an Unique Road Policy in India

4.1 Introduction

Access to public goods is substantially a matter of who can extract it from the political system (Banerjee, 2004). This paper argues that the demand or ability to obtain public good like road is directly correlated with the economic returns derived from it. The same public good may serve different purpose for different sections of the economy. This may happen due to two reasons. One when the public good road complements the other better public good provisions like health and agricultural facilities. The second is that when it substitutes other poor public good provisions in the localities. The economists have always been interested in studying the factors that determine the provision of public goods (Banerjee, Iyer and Somanathan, 2008; Alesina, Baqir and Easterly, 1999).

Irrespective of this considerable interest in studying the public good provision and the collective action undertaken by the community as a whole it is difficult to analyze this issue. Banerjee, Iyer and Somanathan (2008) put forth several reasons towards it. Foremost, it is difficult to find instances where one observes public action undertaken for provision of public goods. Secondly, it is difficult to disentangle factors that simultaneously affect group-size effects and cost of supplying public goods. For example, large villages are usually established near urban areas making it cheaper to provide public goods. Third, there is wide dispersion of public good quality making a wide gap between the availability of facilities and public good provisions. Lastly, the community characteristics may be determined by public good provisions indicating
inverse causality.

In this study I try to surmount the problem stated in the above studies. This study uses a new data and technique which enables to observe the public actions undertook to obtain the public good road. I exploit the provision of new all-season roads (roads that can be used in all-weather especially monsoons) as a part of a national infrastructural program which was initiated in 2001 in India. The provision of new all-season roads (roads that can be used in all-weather especially monsoons) in villages which previously only had dry-season roads (roads that are difficult to use in monsoons) were done on the basis of a population eligibility criteria. This enabled to observe the ability of the local community to procure public good from the local authority.

The policy used two population thresholds to determine the provision of new all-season roads in villages on the basis of their villages’ population as in 2001, 250 and 500. The former determined the eligibility of the road in areas dominated with schedule castes and schedule tribes43, whereas the latter determined the eligibility of the road in general caste areas. The implementation of the policy is as follows. According to the population criteria rule, there is no provision of all-season roads in villages when the population recorded is between 100 and 249 (499), but when the population recorded is more than 250 (500) then there is a sharp increase in the provision of all-season roads. In this study I find that the eligible villages in certain states try to manipulate these population thresholds in order to obtain road in their community. This study uses a novel dataset compiled from administrative reports linking proportion of population eligible for new roads to the other public.

43 Backward caste community who belongs to a lower social hierarchal scale. Schedule V areas as mentioned in the constitution.
good provisions at the district level and at the village level correspondingly.

In this paper I find that the communities ability to extract the public good provision from the political system is contingent to the local representatives incentive to be reelected. In a particular state Maharashtra, the incumbents who are highly aligned with the ruling party of the state is substituting the higher end voters for the lower end voters from backward caste areas. The potential reason is that this voters are less educated and can be easily pursued. Further, in the better off districts the demand for public good road by the local communities is generated by the complementary role between roads and other better public good provisions like agriculture and health facilities. Whereas, in the poor districts the roads are demanded in order to substitute the provision of poor public good facilities.

The contribution of this paper is manifold. This study provides new insight into the question of what determines the public actions for the provisions of public goods which has always interested economist and policy makers simultaneously. The study also contributes to a scanty body of literature on the economic motives behind manipulation in a regression discontinuity framework (Imbens and Lemieux, 2008; Lee and Lemieux, 2009). This paper overcomes limitations in the other past studies as it uses a novel dataset constructed from the administrative reports on eligible villages and their propensity to manipulate the road policy.

The remainder of the paper proceeds as follows: Section 2 lays down the details of the national infrastructure road development program introduced in India. Section 3 provides a brief economics behind manipulation of the road policy. Section 4 discusses the identification technique and the data used for the analysis has been discussed in Section 5. Section 6 explores the empirical findings. Section 7 summarizes our findings
and some limitations of the study.

4.2 Background

In India, roads form the life-line of villages as the access to schools, market and health centers is dependent on it. According to Bell (2010) the benefits of better roads in villages is manifold. First, as consumers they enjoy a reduced prices and as producers they can negotiate for higher price for their marketable surplus. Second, as students they can access schools located outside village. Finally, with a better access to medical amenities and crucial drugs not only can their health condition improve but it actually can make a difference between life and death in several scenarios. However, forty percent of all villages in 2000 were still unconnected by roads.

In 2001, a national infrastructure development program PMGSY was initiated to fulfill the gap of roads in villages. The primary objective of this policy was to provide all-season roads to hamlets that previously did not have any all-season roads within 0.5 km. A secondary objective of this scheme was to upgrade the already existing all-weather roads based on the roads’ deterioration. This gave emphasis to more populated areas, however only 20 percent of the funds were to be allocated towards this goal and the other 80 percent of the funds would be allocated towards the fulfillment of the primary objective.

The provision of new all-season roads followed an eligibility rule. The eligi-

---

44 The policy was declared on 25th December, 2000.
45 A hamlet is a cluster of population, living in an area, the location of which does not change over time.
46 The eligibility condition for new all weather roads for hilly states (North-East, Sikkim, Himachal Pradesh, Jammu & Kashmir, Uttaranchal), desert areas (districts, blocks eligible for Desert Development Projects) and Schedule 5 areas (constitution prescribed districts, block and villages with high populations of schedule castes and tribes) is that within a radius of 1.5km no all-weather roads exist and the minimum benefited populations has to be 250 at least.
bility rule for a new all-season road \( (NR) \) linking several unconnected\textsuperscript{47} hamlets \( (h_1, h_2, \ldots \ldots h_n) \) whose populations as recorded in Census 2001 \( (p_1, p_2, \ldots \ldots p_n) \) that would be considered for construction is given in equation (4.1). Equation (4.1) captures the fact that the PMGSY rule allows the unconnected hamlets with a population greater than 500 to receive new roads but hamlets eligible by virtue of distance with a population of 100-499 do not receive a new road. The discontinuity created by the 500 population threshold will be used in this study.

\[
NR = \begin{cases} 
1 & \text{if} \quad \max (p_1, p_2, \ldots \ldots p_n) \geq 500 \\
0 & \text{if} \quad \max (p_1, p_2, \ldots \ldots p_n) < 500 
\end{cases} \tag{4.1}
\]

However, there was an exception to this rule for areas with very high proportion of Scheduled Caste or Schedule Tribe dominated localities which is designated in the constitution as Schedule V areas. The population cutoff was designated as 250 as most of the cases in these localities the hamlets are dispersed. Henceforth, hamlets with a population 100-249 do not receive a new road, whereas those above the 250 threshold became eligible to obtain road.

\[
NR = \begin{cases} 
1 & \text{if} \quad \max (p_1, p_2, \ldots \ldots p_n) \geq 250 \\
0 & \text{if} \quad \max (p_1, p_2, \ldots \ldots p_n) < 250 
\end{cases} \tag{4.2}
\]

The PMGSY was a national policy with an estimated cost of $14 billion (Rs

\textsuperscript{47}The hamlet would be considered unconnected if it does not have an all-weather road within a 0.5km radius.}
600 billion) and more emphasis was given to states that had eligible unconnected hamlets. However, there is a great deal of state-wise variation in the progress of the construction and completion of new roads, depending on the local government initiative. In some states the federal grants were a part of a loan sanctioned by the World Bank (Jharkhand, Rajasthan, Uttar Pradesh, Himachal Pradesh) and Asian Development Bank (Assam, West Bengal, Orissa, Madhya Pradesh, Chhattisgarh). In return these states had to meet some conditions for safeguarding local environment and communities. However, the eligibility rule for new all-season roads did not vary between the World Bank and ADB sponsored states and other non-sponsored states.

4.3 Economics of Manipulation to obtain Road

This section presents rationale behind manipulation of the thresholds of the road policy that informs the empirical analysis.

The ability to organize leads a nation and is a property of collectivities (Basu, 2004). Since, 1971 public good provision has been a cornerstone of election campaigns and political parties are reelected on the basis of it. To what extent the political parties are sensitive to the demands of the local communities depends to the extent they can collectively articulate their demands. If the political parties feel that provision of public goods are important for reelection then they would be sensitive to the demand. The demand for public goods like roads needs public actions. To the extent the community can convince the local authority to go beyond the book or falsely report to obtain the road represents their ability or demand for the public good. This ability to obtain the public good may come from other various factors:

48 The existing standards were appraised and modified to minimize impacts on communities and environment.
like the groups who would actively benefit from it would be most articulate. Thus, if there are sections or activities which will be complemented like health, education and agricultural facilities then those communities would be most active about it. This is similar to what Foster and Rosenzweig (2000) had found for India where school investment was rampant in areas where it was most demanded.

I test this by taking these hypotheses to the data accounting for various econometric challenges outlined below.

4.4 Estimation Strategy

In this study I am interested in analyzing the various factors that allows the public to demand or obtain the public good road from the authority.

The estimating equation at the district-level is the following:

\[
(y)_{i,k,2001} = \alpha_i + \beta x_{i,2001} + \gamma p_{i,1999} + \varepsilon_{i,2001}; i = \text{district, } k = 250 \text{ or } 500 \tag{4.3}
\]

where \((y)_{i,2001}\) is district-level manipulation of the road policy at different thresholds in 2001, \((x)_{i,2001}\) is a set of other facilities available in the locality which derives positive economic returns from the road, \((p)_{i,1999}\) captures the political controls; \((\varepsilon)_{i,2001}\) is the error term.

The outcome manipulation of the road policy at thresholds 250 and 500 respectively captures the desire or the ability of the local people to obtain the public good road in their locality. In order to do the analysis I construct the manipulation index for each of the districts at the threshold 250 and 500. Foster and Rosenzweig (2000) had found that the public goods are demanded by those sections of the community
who would derive most from it. They found for India the investment in schoolings were rampant in the areas with a higher fraction of landed compared to the landless. They argued that the technological changes and rise in yields made education more valuable so the investment in public schools responded to that. Thinking along those lines I argue that the districts with facilities like market for agricultural produce, health centers and schools which derive the highest economic return from an investment in road would demand or have the ability to obtain it. For this, I consider the availability of agricultural land, health and educational facilities.

**Identification Issues** In this study I do not have a quasi-experiment and the identification depends on the exogenity of the control variables and to what extent the omitted variable problem has been resolved. Factors like population demographics that will simultaneously affect both the facilities and the threshold will invalidate this assumption. For example, if districts have high proportion of schedule caste or schedule tribe population who simultaneously would affect the threshold and actively seek or cannot seek certain facilities then this situation can develop. Under such a situation the factors would be correlated and it would be difficult to completely purge out the other factors from the facilities available.

Partly in order to overcome identification problem I do a village level analysis comparing the eligible vs the ineligible villages at the different thresholds 250 and 500 of the road policy. I make a comparison between the behaviors of the manipulated states to those of the unmanipulated states. For this I adopt a graphical analysis as there is absence of any instrumental variable. This would be similar to graphically representing the second stage least squares.
4.5 Data

The data used in this paper has been pooled from various primary and secondary sources. In this paper the unit of analysis used is the district level as the officials who are powerful enough to falsely report or manipulate the thresholds for the road policy exist at the district level. In this section I explain the various sources and justify the choice of variables used for the analysis.

4.5.1 Manipulation of Road Thresholds

Data on the manipulation or falsely reported cases has been compiled from the Pradhan Mantri Grameen Sadak Yojna administrative records and the Census Village Directory, 2001. The former provides the population of the hamlets those which were in the eligibility list of the road networks along with their population size and respective villages. The latter provides the village population information. The entire analysis is conducted for all the unconnected villages which otherwise satisfy the distance criteria and varies by their population size for the 190 districts of the nine states. Nine out of all the entire twenty eight states could only be considered for the analysis due to limitation imposed by the data.

The population threshold that entitles a village to obtain road by the policy is a common knowledge and can be manipulated or falsely reported by the administrative officers recording the data at the district level. In order to test whether manipulation of the threshold has been done a formal McCrary test (2008) can be conducted, which assumes that randomly there should be absent of positive discrete jump in the density of hamlets\textsuperscript{49} around the threshold. The states from which the sample

\textsuperscript{49}Hamlets are a cluster of population, living in an area, the location of which does not change over time. They are a smaller sub-division than the villages, with several of them or one big hamlet constructing a village.
villages are drawn can be broadly classified into two categories, ones where there was absence of jump around the threshold and others were there was presence of jump around the threshold. For three (Chhattisgarh, Gujarat, Maharashtra) out of nine states were found to have significant positive discrete jumps around the 250 threshold and respectively around the 500 threshold for five states (Chhattisgarh, Gujarat, Maharashtra, Tamil Nadu and West Bengal) discrete jump was observed (refer data appendix). This fact becomes further evident in the Figure 1 (2) where the states that did manipulate in Panel A in comparison to the states that did not manipulate in Panel B shows a discrete jump around the 250 (500) population threshold.

Now ideally one would like to conduct McCrary test individually for all the districts in the sample to obtain an index for manipulation in each district, however due to insufficient observations the formal test could not conducted for each of the 190 district. However, I tried to overcome this limitation and constructed a crude manipulation index by taking the percentage of hamlets with population 250 (500) and above out of the total sample of hamlets in the district. The intuition behind this manipulation index is that districts with unusual proportion of hamlets with 250 (500) population is manipulating the threshold or falsely reporting to obtain the road. Although, the limitation of this index is that it cannot distinguish the true cases from the false reporting due to data limitation. I try to overcome this limitation to certain extent by conducting a test to cross-check to what extent the manipulation index is a good representative of the formal McCravy test. For this purpose I consider the state of West Bengal which has sufficient observations to conduct the formal McCravy test for all its districts and then try to cross-check with the informal manipulation index. As is evident from Table 1 the informal manipulation index around threshold 500 is
overall a good representative of the formal McCrary test in comparison to 250 and the correlation between the two is 0.7.

Table 2 lists the summary statistics of the manipulation index around various thresholds for all the states and without taking the state of Maharashtra into account. The state of Maharashtra calls for a special attention as there is a spatial clustering of the manipulation index which becomes clearly evident from Figure 3 and Figure 4 unlike other states. It is clearly evident from the table that there is a wide variation of this manipulation index across different districts. In an average district of the sample has at least forty-four percentage hamlets whose population is 250 and forty percentage hamlets those with population 500, the thresholds that is required to obtain the road policy. A noteworthy point is that without taking into consideration the state of Maharashtra the manipulation index reduces in case of threshold 250, whereas in the case of threshold 500 it increases. This indicates to the fact that Maharashtra has higher manipulation index than the average districts of the sample whose population is 250 and vice-versa for the population 500 (refer appendix1).

4.5.2 Political Alignment

The extent to which the political parties’ competition affects the provision of public goods has already been studied in the literature (Banerjee and Somanathan, 2007). The authors use a measure of political fragmentation to capture this extent of competition between the political parties. In this paper I have used an alternative measure, the margin of votes by which the incumbent won in a constituency to capture the severity of political competition. As a robust measure I retained only those contestants who had a close winning margin that is when the margin of votes by
which the incumbent won is less than the median for the entire sample of incumbents.

Another measure that has been used in this study is the political alignment of the
incumbent. The proportion of incumbents $h$ in a district that are aligned with the
ruling party of the state has been exploited here with the following index,

$$
h = \frac{\sum_{i=1}^{n} d_i}{n}
$$

where $d_i$ is a dummy indicating whether the incumbent of $i^{th}$ constituency is either
politically aligned or against the ruling party of the state. For assigning the ruling
party a rule of thumb used is that the party has to win at least fifty percentage of the
total constituencies in the state. If none of the parties won by the rule of the thumb
then it is assumed that the majority parties formed a coalition. This enables to study
how an incumbent’s accountability towards the constituents varies with being a part
or acting as opposition to the ruling party.

In order to have an exogenous variation in political environment determining the
ability of the electors to extract the provision of public goods I consider general elec-
tion conducted earlier than 2001. However, in order to maintain parity between the
constituency and census district’s boundaries, the election had to be close enough to
2001. Therefore a natural choice was the general election conducted in 1999. The Sta-
tistical Report on General Elections, 1999 provides electoral data at the constituency
level. Along with the margin of votes by which the incumbent won it also provides
party affiliation of the winner and other contestants in the constituency.

As evident from Table 2 the two political indicators strengthen the fact that there
is a wide dispersion in the political capability and alignments of the incumbents,
also that India is a democratic country. The average voting margin by which the
incumbents won in a district indicates the fact that the victories ranged widely from being marginal to landslide. Also, the average political alignment of the incumbents in a district varies from being completely opposite to that of the ruling party of the state, otherwise being highly aligned with the ruling party. In India there is a spatial pattern in the political alignment. This is clearly evident from Figure 5 where it is evident that in the state of Maharashtra draws a high proportion of incumbents who are aligned with the leading party of the state.

4.5.3 Roads Complementing other Facilities in Districts

Banerjee and Somanathan (2007), Foster and Rosenzweig (2000), Banerjee (2004) shows that public good facilities that are available in a locality is contingent on the economic returns that can be drawn from it. For example, Banerjee (2004) found that elite goods like metalled roads, tapped water, colleges which are mainly enjoyed by the Brahmans has a positive correlation with the proportion of Brahmans residing in an area. New roads can improve access to facilities like market for agricultural products, health centers and schools. Therefore, the higher these facilities are complemented by the availability of a road in a locality the higher it would de demanded by the local people.

The 2001 Census Village Directory provides the population demographic information on all the villages in India collected as a part of the decennial census between 9th February, 2001 and 28th February, 2001. It also provides information on different facilities available in these villages like primary schools, middle schools, health center and agricultural land area. As a measure of availability of these facilities I consider the amount of these facilities is provided in each of the sample districts. I account
for education and health facilities available in the locality by the average number of schools and health centers available in the district. For this instead of separately taking into account different types of either educational facility like primary, middle and secondary schools or health facility like primary health centers and nursing home, I aggregate them. Although, underline assumptions in this method is that each of these facilities are substitutable and access to the facilities is synonymous to provision of the facilities. However, this is not true as one knows empty school or hospital buildings do not generate positive welfare, but these assumptions helps to simplify the analysis.

Further, in order to measure the agricultural incentive I take into account the average proportion of agricultural land available in the district. For this I aggregate the land available under irrigation with those without the irrigation facilities. This helps to overcome the problem of irrigated facilities being representative of relatively better off districts.

Table 2 summarizes the agricultural land and other facilities like the number of schools, health centers for the entire sample of districts considered in this study. As is evident from the education and health facilities represented by the number of schools and health centers in a district that there is wide dispersion of these facilities across districts, whereas some districts are well-equipped with both facility there are others where the availability of these facilities are nil. In an average district the agricultural land is 644 hectares, however there are certain districts with nil agricultural activity indicating barren or desert areas.
4.5.4 Mapping Parliamentary Constituencies into District Data

In this study as I am interested in analyzing the various incentives behind manipulation of the threshold to obtain a road and the officers who can falsely report the data exist at the district level, the natural unit of analysis should be defined by the district boundaries.

Except for the political alignment all the other variables originally existed at the village level from the Census Village Directory, 2001 and could be aggregated to the district level. This led to 190 sample districts for the analysis. For, the political factor the electorate data existed at the constituency level. In order to map the various constituencies to the district boundaries I used the Delimitation Act, 2008 which designates various constituencies to the 2001 Census districts. Now, as the electorate data used for this study belong to the parliamentary election of 1999 some of the districts had to be weighted as would be in 2001 census districts. In certain cases the unmatched constituencies had to be dropped. After undergoing through this matching procedure I was left with 161 districts which could be mapped with their parliamentary constituencies.

4.6 Incentives to Manipulate to obtain Road

4.6.1 Basic Results

This section presents results on the various motives behind manipulation or falsely reporting by the local authority for obtaining the public good road in the locality. I begin with a numerical estimate and supplement it with a graphical analysis later.
Empirical Analysis  The results from estimating (4.3) for different thresholds are reported in Tables 3-4.

Table 3 reports on the estimation with the dependent variable as manipulation index measured at the threshold 250. There are five columns, with three different specifications ones including all the nine states and the other excluding the state of Maharashtra. In Specification 1 of Table 3 except for the political alignment all the other covariates are added like health facilities, education facilities and land available for agriculture activities. In the Specification 2, in addition to the above factors the political alignment of the incumbent has been controlled for. In Specification 3, I restrain to only those situations where the election has been a close competition by retaining to cases where the incumbent’s winning margin of votes is less than median. Now, Maharashtra is a unique state which draws a high proportion of the incumbents who are extremely aligned towards the ruling party of the state, this is clearly evident from the Figure 5. However, as visible from the Figure 5 the situation is different in other states, thus it will be interesting to find out the scenario for all the other states after omitting the state of Maharashtra. In Specification 4 and Specification 5 the political alignment specifications has been repeated without the state of Maharashtra.

As one moves from left to right a robust pattern becomes clearly visible. The districts were majority of the population are getting drawn from who can satisfy the 250 threshold i.e. high proportion of schedule caste and schedule tribes have poor provision of health facilities. However, these can actively seek goods from their local representatives in political parties. It is observed that the higher is the proportion of incumbents politically aligned with the ruling party of the state, the greater is the ability of the community to obtain the road. In the state of Maharashtra especially,
the incumbents who are represented in the parliaments are sensitive to the demands of these low caste people.

This indicates clearly towards two facts. First, the community can collectively call attention of the political party possibly with the interest of reelection of incumbents from the constituency. Secondly, a substitution in the provision of public goods is occurring. Alesina, Baqir and Easterly (1999) found that substitution between public good occurs, the more fragmented cities in United States spend proportionally less on schooling, roads and trash pick up but more on health and police. In this case, the community is substituting the public good roads with poor provision of other facilities like health facility and other facilities.

Using the coefficient one can state that in a district where all the incumbents are politically aligned towards the ruling party there is 42 percentage points more ability to seek or demand road than the average district in the sample. With severity of political competition the ability to obtain road from the local authorities increases. However, it is observed that the local authorities in Maharashtra are more accountable to the people than the rest of other states.

Table 4 reports the estimation with the dependent variable as manipulation index measured at the threshold 500. The specifications are exactly similar as above. However, a robust opposite pattern is observed here. These are relatively better off districts where the health facilities are better provided. A complementary relationship between the public good health and roads are observed here. As one knows that to maintain better health standard time costs are involved. The individuals who decide to have a better health facility have to bear the time cost in the form of traveling or actively seeking medical personnel. With improvement in a health facility
the roads 7 percentage points more demanded compared to the average health facility in a district. The political parties are less sensitive to the demands of these people. Using the coefficient one can state that in a district where all the incumbents are politically aligned towards the ruling party there is 62 percentage points less ability to seek or demand road than the average district in the sample. With severity of political competition the ability to obtain road from the local authorities decreases. However, it is observed that the local authorities in Maharashtra are less accountable to the people need than the rest of other states.

**Graphical Analysis** The need to market the agricultural produce can lead the public to demand more of public good land. Although, in the districts level analysis one observe the agricultural land to be insignificant factor it may be due to the lack of variation in land facilities across districts. Therefore, a village level analysis would be more meaningful in this case. I make a comparison between the agricultural land facilities between the states that manipulated from those that did not manipulate at various thresholds.

In comparison to the eligible and ineligible villages in the states that manipulated at threshold 250 it is evident that the former had less amount of agricultural land. Now, this goes against our conventional wisdom of manipulating the road policy threshold in order to sell agricultural produce to the market. On the other hand, it drives the possibility that these habitations are drawn from villages where agriculture is not the main means of livelihood; the majority of the community is poor. Instead serving as paid labor is a greater possibility, where a better access to the market would improve their livelihood conditions. For the states that did not manipulate in Figure 6b, the eligible and ineligible villages had similar agricultural land distribution.
On the other hand at threshold 500 in Figure 7a it becomes evident that in states that manipulated the road policy threshold at 500, when compared to the ineligible villages the eligible villages had a higher proportion of agricultural land. Further, I find in the Figure 7b states that did not manipulate has similar agricultural land distribution. This is similar to the works of Foster and Rosenzweig (2000) where they found the landowners demanded the public school investment as the high agricultural yields required technological knowledge for which investment in education was beneficial.

Thus, one can conclude that the roads have been demanded by those sections of the community who gets highest economic returns from it. In certain sections of the economy the roads have been substituted against other public goods and in other sections it plays a complementary to other facilities.

4.6.2 Factors leading to be Politically Sensitive to a Particular Group

In this section I relax the assumption that the politicians are sensitive to the demand of all type of voters equally. Politicians are responsive to the demands of those constituencies from where the incumbents have higher probability of being reelected. Now, Banerjee (2004) found that compared to the schedule caste the schedule tribe voters have been less able to form their own political group successfully in the Indian scenario. They are less educated and more dispersed group in general. Thus, the politicians may find easier to earn the loyalty of this group in return of some provision of public goods.

Comparing the Table 3 and Table 4 one can conclude that in Maharashtra the political parties are substituting the higher end voters for the lower end voters or they
are more sensitive to the demand of lower caste voters than the general caste voters. A possible reason is the schedule tribe voters are less educated and more dispersed group living in the remote areas with poor public good provisions. In Maharashtra which draws a higher proportion of incumbents who are politically aligned to the ruling party of the state. The political parties in order to secure their position may find it more beneficial to actively pursue their demand than the other high caste, educated voters.

4.7 Conclusion

The public act to obtain the public good in India with various motives. More better off districts in India demand public good like roads with the viewpoint of complementing the other facilities like health and agriculture, whereas the poor districts demand the same road with a objective of substituting other poor public good provisions like health centers and agriculture. The political parties’ responsiveness to public demand is more linked with objective of being reelected in government. The politicians as a whole response to those demands which can convert into votes easily.

These results indicate towards some interesting future research questions: The effect of better access to other public good provisions and their usage. The uniqueness of the road policy is that it provides an identification strategy that can be used to study other economic benefits. It has always held interest of economists and policy makers simultaneously how a reduction of transport costs affects the agricultural prices of non-durable goods. The availability of agricultural commodities especially for the non-durable goods causes fluctuations in the market prices of these commodities. A better transport system will increase the supply of the commodities in a
timely manner and smooth the fluctuations of consumption and non-durable goods. This will benefit both the producer and consumer simultaneously. As producer the villagers can sell their goods at the highest price possible and opt for farther markets and as consumer they can purchase the good at low prices.

Beside this a reduction of transport cost would cause an improvement access of health facilities. An individual’s decision to access health facilities involves travelling. Henceforth, with a development of road will simultaneously cause a reduction of the transport costs and travel time involved. The individual’s would be induced to access better health facilities and this would cause an improvement in their health status.
4.8 Tables and Figures

Figure 1 - McCrary test for Manipulation around 250 Threshold (Panel A - Manipulated States, Panel B - Un-manipulated States)
Figure 2: McCrary test for Manipulation around 500 Threshold
(Panel A: Manipulated States, Panel B: Unmanipulated States)
Figure 3 - Spatial Pattern of Manipulation Index at Threshold 250 across Sample Districts.
Figure 4: Spatial Pattern of Manipulation Index at Threshold 500 across Sample Districts
Figure 5 - Spatial Pattern of Incumbent’s Political Alignment across Sample Districts

Proportion of Incumbents in a District with Political Alignment that of Leading Party

Legend:
- **0.00**
- **0.01 - 0.20**
- **0.21 - 0.33**
- **0.34 - 0.55**
- **0.56 - 1.00**

Scale:
- 0
- 125
- 250
- 500 Miles

Direction:
- N

Map of India illustrating the proportion of incumbents in a district with political alignment that of the leading party.
Figure 6a - Agricultural land Distribution among eligible and ineligible villages in Manipulated States at Threshold 250

Figure 6b - Agricultural land Distribution among eligible and ineligible villages in Un-Manipulated States at Threshold 250
Figure 7a - Agricultural land distribution among eligible and ineligible villages in Manipulated States at Threshold 500

Source: Author’s Calculation from Census Village Directory.

Figure 7b - Agricultural land distribution among eligible and ineligible villages in Un-Manipulated States at Threshold 500

Source: Author’s Calculation from Census Village Directory.
Table 1- Correlation between Formal McCrary Test and Informal Manipulation Index

<table>
<thead>
<tr>
<th>Districts</th>
<th>Threshold 250</th>
<th>Threshold 500</th>
</tr>
</thead>
<tbody>
<tr>
<td>Census 2001</td>
<td>McCrary Manipulation Index</td>
<td>McCrary Manipulation Index</td>
</tr>
<tr>
<td>1901</td>
<td>-0.94</td>
<td>32.22</td>
</tr>
<tr>
<td>1902</td>
<td>2.90**</td>
<td>36.55</td>
</tr>
<tr>
<td>1903</td>
<td>-2.23</td>
<td>24.31</td>
</tr>
<tr>
<td>1904</td>
<td>-0.02</td>
<td>37.51</td>
</tr>
<tr>
<td>1905</td>
<td>-0.55</td>
<td>49.26</td>
</tr>
<tr>
<td>1906</td>
<td>1.66</td>
<td>44.02</td>
</tr>
<tr>
<td>1907</td>
<td>-1.18</td>
<td>41.81</td>
</tr>
<tr>
<td>1908</td>
<td>0.50</td>
<td>45.74</td>
</tr>
<tr>
<td>1909</td>
<td>2.96**</td>
<td>42.94</td>
</tr>
<tr>
<td>1910</td>
<td>-0.80</td>
<td>33.98</td>
</tr>
<tr>
<td>1911</td>
<td>-1.55</td>
<td>20.95</td>
</tr>
<tr>
<td>1912</td>
<td>-2.71</td>
<td>40.74</td>
</tr>
<tr>
<td>1913</td>
<td>0.51</td>
<td>49.24</td>
</tr>
<tr>
<td>1914</td>
<td>-1.37</td>
<td>46.38</td>
</tr>
<tr>
<td>1915</td>
<td>-0.21</td>
<td>53.99</td>
</tr>
<tr>
<td>1916</td>
<td>-1.20</td>
<td>15.56</td>
</tr>
<tr>
<td>1918</td>
<td>0.32</td>
<td>11.27</td>
</tr>
</tbody>
</table>

**(5% significance level) Manipulation Index indicates the percentage of hamlets in the district with population 500 out of the total sample.

Corr(McCrary test, Manipulation Index) = 0.7

Table 2-Descriptive Statistics

<table>
<thead>
<tr>
<th>Variables</th>
<th>All States</th>
<th>Without Maharashtra</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Mean</td>
</tr>
<tr>
<td>Manipulation Index cutoff 250</td>
<td>190</td>
<td>44.80</td>
</tr>
<tr>
<td>Manipulation Index cutoff 500</td>
<td>190</td>
<td>40.62</td>
</tr>
<tr>
<td>Health Facilities</td>
<td>190</td>
<td>0.41</td>
</tr>
<tr>
<td>Education Facilities</td>
<td>190</td>
<td>3.57</td>
</tr>
<tr>
<td>Total Agricultural land</td>
<td>190</td>
<td>644.68</td>
</tr>
<tr>
<td>Voting Margin</td>
<td>161</td>
<td>62151.50</td>
</tr>
<tr>
<td>Incumbents’political alignment</td>
<td>161</td>
<td>0.19</td>
</tr>
</tbody>
</table>

Variable definitions are as follows: Manipulation Index=Percentage of villages with
population 500 out of total sample of villages in the district, Voting Margin= Vote Margin by which the incumbent won, Incumbents’ Political Alignment=Proportion of incumbents in the constituency of the district who are politically aligned with the ruling part of the state.
Table 3: Different Incentives to Manipulate Road at Threshold 250

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Political Alignment Political Alignment</th>
<th>Political Alignment Political Alignment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(Without) (At closer margin)</td>
<td>(Without) (At closer margin)</td>
</tr>
<tr>
<td>All States</td>
<td>41.72*</td>
<td>52.13*</td>
</tr>
<tr>
<td>Maharashtra</td>
<td>(13.13)</td>
<td>(21.83)</td>
</tr>
<tr>
<td></td>
<td>-5.52**</td>
<td>-5.78**</td>
</tr>
<tr>
<td>Health Facilities</td>
<td>-5.52**</td>
<td>-5.78**</td>
</tr>
<tr>
<td></td>
<td>(0.95)</td>
<td>(1.07)</td>
</tr>
<tr>
<td></td>
<td>0.15</td>
<td>0.10</td>
</tr>
<tr>
<td></td>
<td>(0.38)</td>
<td>(0.41)</td>
</tr>
<tr>
<td></td>
<td>-0.00</td>
<td>-0.00</td>
</tr>
<tr>
<td></td>
<td>(0.00)</td>
<td>(0.00)</td>
</tr>
<tr>
<td></td>
<td>-190</td>
<td>161</td>
</tr>
<tr>
<td></td>
<td>81</td>
<td>67</td>
</tr>
<tr>
<td>Observations</td>
<td>190</td>
<td>161</td>
</tr>
<tr>
<td></td>
<td>81</td>
<td>67</td>
</tr>
</tbody>
</table>

*(5% significance level) (10% significance level). Standard errors in parentheses and have been clustered at the state level. The unit of observation is the district. Each cell represents results for separate regression where the dependent variable is a manipulation index for road and key independent variables are health facilities and proportion of incumbents with political alignment that of the ruling party. Closer margin indicates margin of votes by which the incumbent won is at most the median for the entire sample of incumbents.
<table>
<thead>
<tr>
<th>Outcome</th>
<th>Manipulation Index for Road</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Political Alignment (With)</td>
<td>(Without)</td>
<td>(At closer margin)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>All States</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incumbents’ political alignment</td>
<td>-</td>
<td>-61.01*</td>
<td>-66.46</td>
<td>3.07</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>(28.79)</td>
<td>(37.79)</td>
<td>(23.871)</td>
</tr>
<tr>
<td>Health Facilities</td>
<td>6.48**</td>
<td>7.07**</td>
<td>7.28**</td>
<td>6.97**</td>
</tr>
<tr>
<td></td>
<td>(0.99)</td>
<td>(0.71)</td>
<td>(1.20)</td>
<td>(2.10)</td>
</tr>
<tr>
<td>Education Facilities</td>
<td>0.24</td>
<td>0.18</td>
<td>0.32</td>
<td>-0.47</td>
</tr>
<tr>
<td></td>
<td>(0.68)</td>
<td>(0.89)</td>
<td>(0.51)</td>
<td>0.64</td>
</tr>
<tr>
<td>Total Agricultural land</td>
<td>-0.00</td>
<td>-0.00</td>
<td>0.00</td>
<td>0.00</td>
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<tr>
<td></td>
<td>(0.00)</td>
<td>(0.00)</td>
<td>(0.00)</td>
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<tr>
<td>Observations</td>
<td>190</td>
<td>161</td>
<td>81</td>
<td>132</td>
</tr>
</tbody>
</table>

** (5% significance level)* (10% significance level). Standard errors in parentheses and have been clustered at the state level. The unit of observation is the district. Each cell represents results for separate regression where the dependent variable is a manipulation index for road and key independent variables are health facilities and proportion of incumbents with political alignment that of the ruling party. *Closer margin indicates margin of votes by which the incumbent won is at most the median of the entire sample of incumbents.
5 Appendix

5.1 Appendix to Section 2

5.1.1 Data Appendix

Glossary of Pradhan Mantri Grammen Sadak Yojna (PMGSY)

All-weather road: A road which is negotiable during all weathers, except at major river crossings. This implies that the road-bed is drained effectively by adequate cross-drainage structures such as culverts, minor bridges and causeways. Interruptions to traffic as per permitted frequency and duration are, however, allowed. The pavement should be negotiable during all-weather, but this does not necessarily imply that it should be paved or surfaced or black-topped.

Black-Topped Road (BTR): A road provided with bituminous surfacing.

Core Network: Network that is essential to provide basic access to each habitation. It can also be defined as the network of all the Rural Roads that provide Basic access to all the Habitations. Basic access is defined as the single all-weather road connectivity to each Habitation. As already indicated, the effort under the PMGSY is to provide single all-weather road connectivity to each Habitation by way of connecting it to another Habitation having all-weather connectivity or to an all-weather road, in such a way that there is access to, inter alia, Market Centers.

Gravel Road (GR): A road constructed using well compacted crushed rock or gravel material, which is fairly resilient and does not become slippery when wet.

Habitation: A cluster of population, living in an area, the location of which does not change over time. Desam, Dhanis, Tolas, Majras, hamlets etc. are commonly used terminology to describe the Habitations. A Revenue village/ Gram Panchayat may comprise of several Habitations.

New Connectivity: The construction of roads on the existing alignments from earth-work stage.

Paved Road (PR): A road provided with a hard pavement course, which should be at least a water-bound-macadam layer. A paved road need not necessarily be surfaced or black-topped.

Unconnected Habitation: A habitation with a population of more than 500 persons and located at a distance of at least 500 meters (0.5 km) (from an all-weather road or a connected village/habitation).

Unpaved Road (UPR): A road not having a hard pavement course (which should be at least a water-bound-macadam layer). Thus, earthen road and gravel road will be unpaved roads.

Village Roads (VR): These are roads connecting villages/Habitation or groups of Habitation with each other and to the nearest road of a higher category.
Water Bound Macadam (WBM): This is the road layer made of crushed or broken aggregate mechanically interlocked by rolling and the voids filled with screening and binding material with the assistance of water.

Primary Data Construction Process from PMGSY, Concurring to Census 2001 Village Directory and Concurring to School Report Cards

Step 1: The Core Network (CN) provides information on all eligible habitations with a population over 100 which satisfy the distance criteria. Each habitation in CN has been assigned a unique 10 digit code with first two -state, next two-district, next two-block and last four habitations by PMGSY. This provides the population information (according to 2001 Census) ,connectivity status (unconnected for new connectivity ) of these habitations and 2001 Census villages from which they were drawn.

Step 2: The Completed Road and Proposed Roads status is provided in the District Profile, which has a unique project or road code The Completed Road information does not provide any habitation information but the proposed road information does. So merging the Completed Roads with Proposed roads would provide the districts, blocks and habitations name where the roads have been completed.

Step 3: The PMGSY Block and District code has to be concord with that from the census file to obtain their respective 2001 Census codes and names.

Step 4: The proposed road whose subset has been completed should be merged with the CN for a 1:1 mapping of the habitations and their completed roads status (or new roads status). Further, this allows forming the unique 16 digit village 2001 Census codes to which this habitation belongs. This allows the use of information from the census village directory.

Step 5: The new roads dummy variable has been constructed which assigns 1 if the road construction of a habitation is completed and zero if either under construction or not proposed.

Step 6: To rectify for manipulation of the habitation population information the respective census 2001 village total population is used as upper bound.

Step 7: The School Report Cards provides the unique 9-digit code for the village of whose 4 digit are the 2001 Census state and district codes. They also come with the 2001 Census block name and village name. This has to be manually matched with the 2001 Census using the state, district, block and village names. Thereafter the 16 digit 2001 Census codes have been formed for the respective 9-digit village code of the School report card. Also, every school has a unique 11 digit code of whose first 9-digits signifies the village code, thus these helps to concord the schools to their respective 2001 Census villages.

Step 8: Finally, the two data sets have to be merged on the basis of 16 digit 2001 Census code to get a master data whose unit of observation is the village with
information on population, the new roads completion status, school enrollment and other village demographics.

### Appendix 1 - Log Discontinuity Estimates

<table>
<thead>
<tr>
<th>Outcome Discontinuity Sample-+</th>
<th>Density Estimate of Population of Villages (150)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discontinuity of Population at 500</td>
<td>-0.01</td>
</tr>
<tr>
<td>-</td>
<td>(0.13)</td>
</tr>
<tr>
<td>Observations</td>
<td>3326</td>
</tr>
</tbody>
</table>

Standard errors in parentheses.
Appendix 2-Mid-Day Meal Scheme Across Years.

- 2008 Blocks, Food grains, Class I-V.
- All Blocks, Food grains, Class I-V.
- All Schools, Food grains, Class I-V.
- Cooked meal, Class I-V.
- Cooked meal, Cooking Assistance, Class I-V.
- Cooked meal, Cooking Assistance, (2479 EDU blocks) Class I-V, Class VI-VIII.
- Cooked meal, Cooking Assistance, (All blocks) Class I-V, Class VI-VIII.

Years:
- 1995
- 1997
- 2002
- 2004
- 2006
- 2007
- 2008
Appendix 3—Comparison of Child Labour for Sample States with National Average

<table>
<thead>
<tr>
<th>States</th>
<th>(5-9)</th>
<th>(10-14)</th>
<th>(5-14)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Andhra Pradesh</td>
<td>0.56</td>
<td>12.38</td>
<td>6.61</td>
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<tr>
<td>Kerala</td>
<td>0.00</td>
<td>0.39</td>
<td>0.20</td>
</tr>
<tr>
<td>Madhya Pradesh</td>
<td>0.14</td>
<td>5.74</td>
<td>2.82</td>
</tr>
<tr>
<td>Rajasthan</td>
<td>0.41</td>
<td>9.42</td>
<td>4.86</td>
</tr>
<tr>
<td>India</td>
<td>0.26</td>
<td>6.38</td>
<td>3.33</td>
</tr>
</tbody>
</table>

Source: Derived from Unit Level Records of NSS, 2004-05.

5.2 Appendix to Section 3

5.2.1 Calculating the Effective Fringe Benefit Tax-Rate of Firms

This appendix describes the procedure for calculation of the effective tax rate a firm faces in each industry. The effective tax rate $FB_{ik}$ on each expenditure head is computed by using the following formula for the firm:

$$FB_{ik} = [TB_k \times TR_i] \; ; i = \text{firm}, k = \text{expenditure head}.$$  

where $TB_k$ is the FBT base rate for a particular expenditure i.e. percentage of the total expenditure head considered for tax calculation. $TR_i$ represents the tax rate for a particular firm respectively.
<table>
<thead>
<tr>
<th>Sector</th>
<th>FBT Base Rate(% of expense incurred)</th>
<th>Tax Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hospitality</td>
<td>Travel</td>
</tr>
<tr>
<td>Airline, Air- cargo</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>Construction</td>
<td>20</td>
<td>5</td>
</tr>
<tr>
<td>Computer Software</td>
<td>20</td>
<td>5</td>
</tr>
<tr>
<td>Hotel</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>Pharmaceuticals</td>
<td>20</td>
<td>5</td>
</tr>
<tr>
<td>Shipping</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>Motor Vehicles</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Others</td>
<td>20</td>
<td>20</td>
</tr>
</tbody>
</table>

Source - Compiled from Kishore (2008) and Sections 115WB, 115WC of Income Tax Act and Assorted Budget Issues.

The effective rate is the product of the Valuation Base Rate and the Firm’s Tax Rate. The firm’s Tax rate is the tax rate it faces according to income tax status. Foreign ownership firms are assumed to have Non-domestic Status for simplification but in reality some of them may enjoy the domestic status. ESOP and the Superannuation Fund (Ins) are clubbed together as they have the same effective tax rate. Travel and conveyance are clubbed together.
5.2.2 Data Appendix

Definition of Expenditure for consideration of Fringe Benefits Tax

Expenditure on Lodging: The fringe benefits shall be deemed to have been provided by the employer to his employees, if the employer has, in the course of his business or profession (including any activity whether or not such activity is carried on with the object of deriving income, profits or gains) incurred any expense on, or made any payment for use of hotel, boarding and lodging facilities.

Expenditure on Travel: The fringe benefits shall be deemed to have been provided by the employer to his employees, if the employer has, in the course of his business or profession (including any activity whether or not such activity is carried on with the object of deriving income, profits or gains) incurred any expense on, or made any payment for conveyance, tour and travel (including foreign travel).

Contribution to Superannuation Fund: Any contribution by the employer to an approved superannuation fund for employees.

Annual Survey of Industries (ASI)

Workers are defined to include all persons employed directly or through any agency whether for wages or not and engaged in any manufacturing process or in cleaning any part of the machinery or premises used for manufacturing process or in any other kind of work incidental to or connected with the manufacturing process or the subject of the manufacturing process. Labour engaged in the repair & maintenance, or production of fixed assets for factory’s own use, or employed for generating electricity, or producing coal, gas etc. are included.

Employees include all workers defined above and persons receiving wages and holding clerical or supervisory or managerial positions engaged in administrative office, store keeping section and welfare section, sales department as also those engaged in purchase of raw materials etc. or purchase of fixed assets for the factory as well as watch and ward staff.

Total Persons Engaged include the employees as defined above and all working proprietors and their family members who are actively engaged in the work of the factory even without any pay, and the unpaid members of the co-operative societies who worked in or for the factory in any direct and productive capacity. The number of workers or employees is an average number obtained by dividing mandays worked by the number of days the factory had worked during the reference year.

Wages and Salaries are defined to include all remuneration in monetary terms and also payable more or less regularly in each pay period to workers as compensation for work done during the accounting year. It includes (a) direct wages and salary (i.e., basic wages/salaries, payment of overtime, dearness, compensatory allowance, house rent and other allowances), (b) remuneration for the period not worked (i.e., basic
wages, salaries and allowances payable for leave period, paid holiday, lay-off payments and compensation for unemployment, if not paid from sources other than employers),

c) bonuses and ex-gratia payment paid both at regular and less frequent intervals (i.e., incentive bonuses, good attendance bonuses, productive bonuses, profit sharing bonuses, festival or year-end bonuses, etc.). It excludes lay off payments which are made from trust or other special funds set up exclusively for this purpose i.e., payments not made by the employer. It also excludes imputed value of benefits in kind, employer’s contribution to old age benefits and other social security charges, direct expenditure on maternity benefits and crèches and other group benefits. Travelling and other expenditure incurred for business purposes and reimbursed by the employer are excluded. The wages are expressed in terms of gross value i.e., before deduction for fines, damages, taxes, provident fund, employee’s state insurance contribution, etc.

**Contribution To Provident Fund And Other Funds** includes old age benefits like provident fund, pension, gratuity, etc. and employers contribution towards other social security charges such as employees state insurance, compensation for work injuries and occupational diseases, provident fund-linked insurance, retrenchment and lay-off benefits.

**Workmen and Staff Welfare Expenses** include group benefits like direct expenditure on maternity, crèches, canteen facilities, educational, cultural and recreational facilities; and grants to trade unions, co-operative stores, etc. meant for employees.

**Total Emoluments** is defined as the sum of wages and salaries, employers’ contribution as provident fund and other funds and workmen and staff welfare expenses as defined above.

**Center for Monitoring Indian Economy (CMIE)**

**Sales** refer to the sum of industrial sales and income from non-financial services. This field reflects what most non-finance companies would report as Sales or Income from its main activities. It includes the income the company earned through the sale of industrial goods and its various associated incomes such as sale of scrap or raw material or through providing job-work, utility services, trading or other services. It includes all kinds of incomes that the company may earn through the providing of all kinds of non-financial services.

**Salaries and wages** refer to the periodic payments made to the employees for the services rendered by them.

**Superannuation Fund:** Contribution to the provident fund has been considered similar as superannuation fund. The "Employees Provident Fund Act" mandates that employers are required to make a contribution, in favour of the employees, to the Provident Fund Account an amount equal to 12 per cent (earlier 10 per cent) of
the basic pay and dearness allowance. This is a statutory requirement essentially to save for the post-retirement life of employees. Any amount that is contributed by the employer during the year to this account is reported by the companies as contribution to Provident fund.

**Director’s Remuneration:** The remuneration paid to directors which is reported under this datafield includes the amount of salary paid, contribution to provident fund, value of perquisites, performance linked incentive to whole time directors and also the commission paid to them.

### 5.3 Appendix to Section 4

#### 5.3.1 Data Appendix

**Glossary of Pradhan Mantri Grammen Sadak Yojna (PMGSY)**

**All-weather road:** A road which is negotiable during all weathers, except at major river crossings. This implies that the road-bed is drained effectively by adequate cross-drainage structures such as culverts, minor bridges and causeways. Interruptions to traffic as per permitted frequency and duration are, however, allowed. The pavement should be negotiable during all-weather, but this does not necessarily imply that it should be paved or surfaced or black-topped.

**Black-Topped Road (BTR):** A road provided with bituminous surfacing.

**Core Network:** Network that is essential to provide basic access to each habitation. It can also be defined as the network of all the Rural Roads that provide Basic access to all the Habitations. Basic access is defined as the single all-weather road connectivity to each Habitation. As already indicated, the effort under the PMGSY is to provide single all-weather road connectivity to each Habitation by way of connecting it to another Habitation having all-weather connectivity or to an all-weather road, in such a way that there is access to, inter alia, Market Centers.

**Gravel Road (GR):** A road constructed using well compacted crushed rock or gravel material, which is fairly resilient and does not become slippery when wet.

**Habitation:** A cluster of population, living in an area, the location of which does not change over time. Desam, Dhanis, Tolas, Majras, hamlets etc. are commonly used terminology to describe the Habitations. A Revenue village/ Gram Panchayat may comprise of several Habitations.

**New Connectivity:** The construction of roads on the existing alignments from earth-work stage.

**Paved Road (PR):** A road provided with a hard pavement course, which should be at least a water-bound-macadam layer. A paved road need not necessarily be surfaced or black-topped.

**Unconnected Habitation:** A habitation with a population of more than 500
persons and located at a distance of at least 500 meters (0.5 km) (from an all-weather road or a connected village/habitation).

**Unpaved Road (UPR):** A road not having a hard pavement course (which should be at least a water-bound-macadam layer). Thus, earthen road and gravel road will be unpaved roads.

**Village Roads (VR):** These are roads connecting villages/Habitation or groups of Habitation with each other and to the nearest road of a higher category.

**Water Bound Macadam (WBM):** This is the road layer made of crushed or broken aggregate mechanically interlocked by rolling and the voids filled with screening and binding material with the assistance of water.


Step 1: The Core Network (CN) provides information on all eligible habitations with a population over 100 which satisfy the distance criteria. Each habitation in CN has been assigned a unique 10 digit code with first two -state, next two-district, next two-block and last four habitations by PMGSY. This provides the population information (according to 2001 Census), connectivity status (unconnected for new connectivity) of these habitations and 2001 Census villages from which they were drawn.

Step 2: The Completed Road and Proposed Roads status is provided in the District Profile, which has a unique project or road code. The Completed Road information does not provide any habitation information but the proposed road information does. So merging the Completed Roads with Proposed roads would provide the districts, blocks and habitations name where the roads have been completed.

Step 3: The PMGSY Block and District code has to be concord with that from the census file to obtain their respective 2001 Census codes and names.

Step 4: The proposed road whose subset has been completed should be merged with the CN for a 1:1 mapping of the habitations and their completed roads status (or new roads status). Further, this allows forming the unique 16 digit village 2001 Census codes to which this habitation belongs. This allows the use of information from the census village directory.

Step 5: The new roads dummy variable has been constructed which assigns 1 if the road construction of a habitation is completed and zero if either under construction or not proposed.

Step 6: To rectify for manipulation of the habitation population information the respective census 2001 village total population is used as upper bound.

Step 7: The crude manipulation index is constructed by considering the percentage of hamlets in the districts as reported in the PMGSY with population at least 500
out of total hamlets in the sample.

Step 8: The election constituencies are concorded with 4digit 2001 Census districts with the help of Delimitation Act.

Step 9: The political alignment dummy variable has been constructed which assigns 1 if the incumbent’s political alignment is same as that of the ruling party of the state considered and 0 otherwise. For assigning the ruling party a rule of thumb used is that the party has to win at least fifty percentage of the total constituencies in the state. If none of the parties won by the rule of the thumb then it is assumed that the majority parties formed a coalition.

Step 10: Finally, the two data sets have to be merged on the basis of 4 digit 2001 Census code to get a master data whose unit of observation is the district with information on crude manipulation for road policy, the average incumbents’ political alignment and the voting margin by which the candidates’ won and other district demographics.

<table>
<thead>
<tr>
<th>States</th>
<th>McCrory t Statistic</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Cutoff 250</td>
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<tr>
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<td>Rajasthan</td>
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<td>Kerala</td>
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<tr>
<td>Tamil Nadu</td>
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</tr>
<tr>
<td>Maharashtra</td>
<td>12.49      **</td>
</tr>
<tr>
<td>Chhattisgarh</td>
<td>4.82      **</td>
</tr>
<tr>
<td>Gujarat</td>
<td>6.95      **</td>
</tr>
<tr>
<td>West Bengal</td>
<td>-0.73</td>
</tr>
</tbody>
</table>

***(5% significance level)***
Distribution of Habitations for at (250,500) Thresholds for Maharashtra
6 References


2. Assorted Issues of Annual Survey of Industries, India

3. Assorted Issues of Union Budgets, India.

4. Assorted Reports of Pradhan Mantri Gram Sadak Yojana, India


28. Handa, S., 2002. Raising Primary School Enrollment in Developing Countries:


31. Income Tax on Fringe Benefits, Chapter XIIH, Section 115W, 115WA, 115WB and 115WC.


44. Mukul, Akshaya, 2009. Dalit kids cannot use school loo but have to clean them. The Times of India, June 25

46. http://pmgsy.nic.in/


53. UNICEF 2006. Social exclusion of Scheduled Caste Children from Primary Education in India, UNICEF, India.


7 Vitae

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ties and the Need for Public Health Initiatives: Some Evidence from a House-
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