

Unintended Consequences of Tuition Price Regulation: Caste, Gender, and College Outcomes

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Abstract

The objective of this paper is to empirically examine the consequences of tuition price regulation on access, equity, and education quality in centralized higher education systems. I study a 2012-13 tuition price reform that affected the engineering college market in the Indian state of Andhra Pradesh. The policy led the government to abolish previously uniform prices across all colleges and instead fix individual, cost-based, sticker prices for each college. Leveraging variation in prices created by the policy using a difference-in-differences framework, I quantify changes in enrollment, student cohort composition, and college quality measured by graduation rates. I find that despite parallel pre-trends in these outcomes before the policy, colleges that received higher sticker prices as a result of the policy, have less female and affirmative action students. These colleges also experienced gains in graduation rates, suggesting that improvements in academic performance may have been driven by a recomposition in the student body rather than institutional quality upgrades. These findings underscore the distributional trade-offs inherent in tuition regulation. While cost-based pricing may improve internal efficiency and transparency, it can reduce equity by eroding access for students with lower ability to pay. The paper contributes to broader debates on how pricing and voucher policies interact with affirmative action and centralized admissions to shape access and quality in higher education markets.

Keywords: higher education, price regulation, centralized admission, vouchers, affirmative action, caste, gender, inequality, college quality, All India Survey of Higher Education (AISHE)

JEL Classification Codes: I22, I23, I24, I28, O12, L51

1. INTRODUCTION

Understanding how government regulation affects access to higher education is critical in the context of developing countries, where affordability, affirmative action, and institutional quality intersect in complex ways. Developing countries are often resource strapped and look to private providers to meet the growing demand for higher education (Kapoor and Mehta, 2017; Muralidharan, 2019). Tuition price regulation is often implemented with the intention of promoting access and affordability for poor students, yet its consequences for equity and student outcomes remain understudied. In centralized college admissions systems, where students are matched to programs based on rank-ordered preferences and entrance exam scores, changes in sticker prices can reshape not only which colleges students attend, but also who gains access to the most selective institutions. When regulation simultaneously alters tuition costs and the structure of public subsidies, as is the case with voucher-linked affirmative action schemes, the effects can be substantial, uneven, and difficult to anticipate. This paper examines such a setting in Andhra Pradesh (AP), India, where a 2012 tuition price reform dismantled a uniform pricing structure, scaled back vouchers for marginalized student groups, and inadvertently reconfigured who could afford access to quality college programs.

The AP state government has actively regulated prices since at least 1998 (Kapoor and Mehta, 2007), but the policy of interest here, enacted in the academic year 2012-2013, was the most significant change in the structure of price regulations and has remained largely unchanged since. Before the policy, all private engineering colleges in AP charged a uniform sticker price. Starting in 2012, colleges were required to submit their financial information to the Andhra Pradesh Fee Regulation Commission (AFRC) and would receive an individual sticker price, that was expected to correspond to their marginal cost per student. Although this was not explicitly part of the policy, in the post-policy period, we observe that on average, older colleges received a higher sticker price and newer colleges received a lower sticker price. On the student side, the majority of seats at colleges became more expensive for all students (i.e. students who are and are not targeted by affirmative action (AA) policies, hereafter known as reserved and general category respectively). In particular, the price reform policy effectively changed the voucher policy for AA students. As prices were increased the maximum voucher amount stayed unchanged meaning that qualified AA students who could earlier attend older, legacy colleges for free, had to pay non-zero tuition out of pocket in the post reform period. Additionally the majority of admissions in AP's engineering college market occur through a centralized admissions system, that follows a deferred acceptance mechanism, resulting in optimal and stable matches. This eliminates the need to explicitly model the selection criteria or admission process at different colleges (Otero et al., 2021).

To understand the effects of this price reform on the engineering college market in AP, I use three categories of outcomes, namely *overall enrollment*, *enrollment composition*, and *college quality*. The first category uses measures like total class size, total number of female (male) students, and total number of reserved (general) students. These outcomes illustrate trends in total enrollment. The second category of outcomes measures student body or class composition. I use variables like percent of females in a class and percent reserved students in a class to examine trends in the

percentages of gender and AA groups and how these change with respect to the policy. The third category of outcomes uses the graduation rates of students who appear for their final year exams as a proxy for college quality, e.g. percent of students who pass relative to those who take the exam. Using an event study difference in difference design (Finkelstein, 2007), I find that after the policy came into place, cohorts at older, more expensive colleges became less female and less reserved and graduate a higher percentage of their seniors relative to new colleges. Relative to the pre-policy period, we see that there are approximately 6 more male students and 5 more general category students in an average class at older, more expensive colleges (relative to new colleges). Accompanied by decreased or unchanging patterns in the number of females and reserved students, the change in total enrollment results in a change in the composition of the student cohort. There is approximately a 3 p.p. decrease in females and 5 p.p. decrease in reserved category students (relative to new colleges) as a portion of the total class size at older, more expensive colleges. Finally, after the price reform, older colleges graduate approximately 4 p.p. more of their senior classes (relative to new colleges). The effects are generally significant at either the 1% or 5% level of significance which leads us to believe that there were implications of the price reform policy on enrollment decisions of students, the caste and gender composition of a typical class, and students' graduation outcomes. The policy had different implications for students by AA status and therefore I focus on these effects individually for reserved and general students. Moreover as seat prices changed, it is unclear how a typical household might react to these prices based on the gender of the potential student. Gender inequality is highly prevalent in developing countries, especially with regard to household resource allocation for education and health (Jayachandran, 2015).¹ Together, these factors motivate the examination of heterogeneous policy impacts for reserved (general) students and female (male) students.

This paper aims to contribute to the literature in the following ways. First, to my knowledge, this is the only direct empirical investigation of the effects of a tuition price regulation on a tertiary education market with centralized admissions, particularly in the Indian context. Second, this paper is among the first to use the micro-data from the All India Survey of Higher Education (AISHE) within the economics literature, and links the AISHE data with manually collected individual college level sticker prices obtained from the gazettes of Andhra Pradesh and various government orders creating a novel dataset. Third, this paper sets the foundation for future work examining the impact of the current and counterfactual regulatory frameworks in a centralized admissions system with affirmative action and voucher policies. Neilson (2013) has demonstrated that targeted vouchers can have a positive impact on the affordability and quality of schools, but all schools (within some geographical boundaries) are accessible to all students, and therefore part of their feasible choice set. This is not the case in the AP engineering college market. Otero et al. (2021) studied affirmative action in a centralized admissions mechanism in Brazil, but the colleges in that setting were free, elite federal institutions. I will focus on non-elite private colleges which charge students for tuition. This project aims to build on and possibly connect those two strands of literature by documenting

¹See Jayachandran (2015) for a comprehensive overview of gender inequalities and their consequences for economic development.

the role of price regulations, affirmative action, and vouchers on student enrollment and education quality.

The rest of the paper is organized as follows; Section 2 provides institutional background on Andhra Pradesh’s engineering college market, centralized admissions, and the describes the tuition price reform policy of interest. Section 3 discusses the sources of data, defines the outcomes of interest, and presents a descriptive summary of the outcomes. Section 4 presents the empirical specification, identification assumptions, and main findings of the study. Section 5 provides a discussion of the potential mechanisms that could explain the results we observe along with limitations of the current approach and data. Section 6 summarizes and concludes.

2. INSTITUTIONAL CONTEXT AND TUITION PRICE REFORM

2.1. Engineering College Admission in Andhra Pradesh

Andhra Pradesh (AP) was the largest engineering college market in India as measured by the total number of colleges over the period 2009 - 2014, with over 600 colleges.² AP’s engineering college market includes both public and private colleges, with the latter accounting for about 85% of the supply and around 80% of the enrollment. The state government regulates virtually every facet of engineering college decision making, including but not limited to, tuition prices, college entry and exit, program capacity, admission processes, curriculum, faculty hiring, promotion, and pay (Kapur and Mehta, 2017). This paper focuses on tuition price regulation for private colleges. Public colleges in this market are generally the most competitive in terms of admissions, and although their price is regulated, tuition is very cheap or even free at these colleges.

Engineering programs³ are sanctioned a certain number of seats based on state government regulations and the program capacity is fixed in an academic year. Colleges do not have the authority to unilaterally change their program capacity. There are two types of seats in a program, namely *merit* and *non-merit* seats which account for 70% and 30% of program capacity respectively. Merit seats are filled through a centralized admission mechanism based on a common state level entrance exam, namely the EAMCET. All affirmative action rules and tuition subsidies apply only to merit seats. Non-merit seats are filled on a first-come first-served basis at individual colleges’ discretion. Typically most engineering college aspirants living in AP will take the EAMCET and receive a unique rank based on their score. Thereafter, students submit an unrestricted length rank-ordered list (ROL) of *program* (college + major) preferences on an online portal. A Deferred Acceptance (DA) algorithm with serial dictatorship matches students to their most preferred, feasible, program.

There are several layers of affirmative action (AA) policies that apply to merit seats in the centralized admissions mechanism. I focus on the most important type of AA policy in this paper, namely, caste-based affirmative action. 50% of merit seats at a program are reserved for students

²The state of AP was divided into Andhra Pradesh and Telangana in 2014. The time period under consideration in this paper is for student cohorts enrolling in 2009-10 - 2015-16.

³The term *program* refers to a college + major combination. For example, Computer Science Engineering at college X is a program, and Electrical Engineering at college X is a different program.

belonging to Backward Caste or Scheduled Caste/Scheduled Tribe (SC/ST) communities. These seats are called *reserved* category seats. The remainder of seats can be accessed by all students (including BC and SC/ST students) and are called *general* category or open competition seats. When students receive their *optimal* matched program based on the DA mechanism, this incorporates their AA status. Students can either accept their match and enroll, apply for a non-merit seat at any engineering program, or reject their matched program and leave the state engineering college system.⁴ It is important to note that there are no AA policies or tuition subsidies for students who opt to enroll in non-merit seats or leave their home state’s engineering college market.

2.2. Tuition Price Regulation and Out-of-pocket Expense

The distinction between merit and non-merit seats discussed in Section 2.1 is closely related to the tuition price regulation policy at the heart of this paper. In 2008, the AP state government sought to promote engineering college demand among historically marginalized and poor students, namely the BC and SC/ST communities by introducing the *Fee Reimbursement Scheme* (FRS) (Government of Andhra Pradesh, 2008). The policy eliminated tuition fees for reserved category students who were admitted to merit seats through the EAMCET exam.⁵ As there has always been excess capacity of merit seats in AP’s engineering college market as a whole, this virtually guarantees that every reserved category student who attempts the EAMCET exam will be allotted a merit seat.

However at the start of the 2012-13 academic year, the state government introduced a tuition price regulation policy targeting private engineering colleges, that simultaneously altered tuition prices and out-of-pocket expenditure (OOP) for the entire student body.

Table 1 summarizes the policy impact on tuition price and OOP. Relative to the introduction of the policy in academic year 2012-13, I define the three years between 2009-10 and 2011-12 as the pre-period and the four years between 2012-13 and 2015-16 as the post-period. In the pre-period, merit seats at all engineering colleges were priced at ₹30.2k and non-merit seats were priced at ₹92k. Reserved category students admitted to merit seats were able to attend college for free as beneficiaries of the FRS and general category students paid full price. AA policies do not apply to non-merit seats so all students pay the full price of ₹92k for admission to these seats. In 2012, the Andhra Pradesh Fee Regulation Committee (AFRC) invited colleges to submit their financial information and fixed individual sticker prices for all colleges that was aimed at compensating them for their marginal cost per student. Each college j was given a price P_j that was uniform

⁴The EAMCET mechanism fulfills the criterion for strategy proofness (Gale and Shapley 1962; Abdulkadiroğlu and Sönmez 2003; Baswana et al. 2019) and applicants are incentivized to truthfully reveal their preferences over programs. AA policies are implemented within the DA mechanism. For additional details on how these policies are typically incorporated into centralized mechanisms for college admissions, particularly in India, see Baswana et al. 2019.

⁵The FRS scheme does not require students to pay tuition fees out-of-pocket before being reimbursed. The AP state government directly pays colleges the tuition price for all beneficiaries of the FRS scheme. Colleges do not receive any additional payment for admitting reserved category students, over and above the tuition fee, unlike some voucher programs in other countries (see Neilson (2013) for example).

Table 1: **Policy impact on tuition price and out-of-pocket expense.**

		<u>Pre-period</u>	<u>Post-period</u>
		2009-10 to 2011-12	2012-13 to 2015-16
Seat Type	AA Status	oop_j	oop_j
Merit (70%)	General	Rs. 30.2k	Rs. P_j
	Reserved	0	Rs. $P_j - 35k$
Non-merit (30%)	Not applicable	Rs. 92k	Rs. P_j

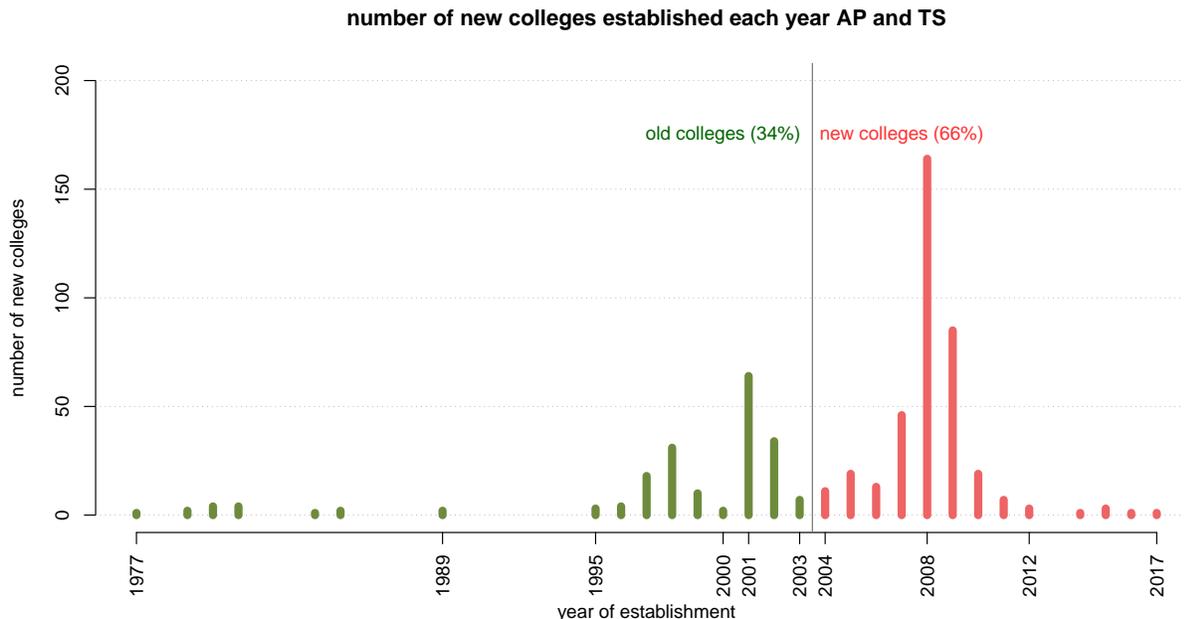
Note: Merit seats are accessible only through the centralized admissions mechanism and non-merit seats are filled at the individual colleges' discretion. Merit and non-merit seats account for 70% and 30% of sanctioned program capacity respectively. Affirmative Action (AA) status refers to whether students are in the reserved (targeted by AA) or general (not targeted by AA) category. P_j is the individual sticker price that was given to a college by the AFRC in the post period.

across merit and non-merit seats. The FRS policy was modified to reimburse students a maximum of ₹35k. This implies that reserved category students, who could previously attend engineering college for free, had to pay ₹ $P_j - 35k$ out-of-pocket. Simultaneously, non-merit or *buy your way in* seats became cheaper on average. Relative to the pre-period, the fee regulation policy made merit seats at least weakly more expensive and non-merit seats much cheaper on average as well as effectively placed a cap on the voucher amount that AA students can avail, it becomes important to understand how this changed enrollment patterns, cohort composition and education quality.

2.3. Expansion in Private Engineering College Supply

In the years preceding 2008, the AP government undertook several measures to promote engineering college education in the state. The Fee Reimbursement Scheme (FRS) discussed in Section 2.2 represents the most important demand side intervention in this regard. However the state government also played a pivotal role in expanding the supply of private engineering colleges in AP. On the supply side, starting in the year 2004, the state government strongly encouraged the entry of private colleges into the market. Figure 1, shows the number of new colleges formed each year in AP. The primary takeaway is that the majority of colleges (66%) enter after 2004 with over 150 colleges entering the market in 2008 alone.

Figure 1: **Entry of private engineering colleges in Andhra Pradesh.**



Note: The horizontal axis shows the year of establishment and the vertical axis shows the number of new institutions established in a year. The green and red vertical bars correspond to old and new colleges (i.e. established before and after 2004) respectively.

I refer to private engineering colleges formed before 2004 as *old* colleges and those that enter after 2004 as a result of concerted efforts by the AP state government and privately owned educational trusts as *new* colleges. This distinction represents an important axis along which to examine heterogeneity in the impact of the 2012 tuition price reform on private college tuition prices. Therefore it forms the basis for the empirical strategy adopted in this paper, explained in Section 4.1. Table 2 and Figure 2 jointly explain the policy impact on merit and non-merit seats on old and new colleges.

Table 2 presents summary statistics of the prices P_j for old and new colleges, as fixed by the AFRC in 2012. We see that on average older colleges received a higher sticker price P_j and in fact based on the third quartile and standard deviations we can infer that the old college price distribution is positively skewed with long right hand tails. In the pre-period colleges earn a marginal revenue of ₹30.2k and ₹92k for each merit and non-merit seat occupied respectively. In the post-period, colleges earn a marginal revenue of P_j per seat, regardless of seat type. Figure 2 demonstrates that in the pre-period, merit and non-merit seat prices were fixed at Rs. 30.2k and 92k respectively. In the post period, merit and non-merit seats are no longer priced differently within a college, and each college j receives a unique sticker price, P_j from the government, that was fixed till the end of the academic year 2015-2016.

Table 2: **Summary statistics of the individual college sticker prices in the post period.**

	N	Min	Q1	Mean	Median	Q3	Max	SD
P_j^{old}	187	35,000	35,000	47,210	39,100	56,850	113,300	15,766
P_j^{new}	354	35,000	35,000	37,221	35,000	35,000	67,500	5,650

Note: Sticker prices P_j are fixed by the AFRC at the start of the academic year 2012-13. Colleges are categorized as old and new based on their year of entry. Colleges established before 2004 are old and those established during or after 2004 are new.

Figure 2: **Tuition price before and after the Andhra Pradesh price reform.**



Note: The horizontal and vertical axes show the year of enrollment and tuition fee in 1000s of rupees respectively. The points represent the mean sticker price P_j given to a college of each type (old or new) in a year and the bars represent the 2.5 and 97.5 percentile of the distribution.

The primary takeaway is that as a direct consequence of the 2012 tuition price reform, merit seats at old colleges in the post-period are, on average, more expensive for both general and reserved category students. In particular, qualified reserved category students who could earlier attend old or new colleges for free must on average pay a non-zero out of pocket fee to attend an old college in the post-period. While the FRS covers up to ₹35k in reimbursement for reserved category students, this is typically sufficient to offset tuition expenses only at new colleges. Changes in the relative price of old and new colleges can cause significant changes in the enrollment patterns for students as they could have different price sensitivities. This can lead to changes in not only absolute enrollment numbers, but also cohort composition based on caste and gender. The tuition prices also create variation in colleges' ability to invest in quality enhancement as old colleges have a larger marginal revenue per student and can therefore commit to a larger marginal cost of education quality per student. Examining changes in enrollment, cohort composition, and education quality as a result

of the tuition price reform becomes an important tool to understand the consequences of tuition price regulation as a policy lever.

3. DATA AND OUTCOMES

3.1. Sources of Data

The primary source of data for enrollment and graduation outcomes is the All India Survey of Higher Education (AISHE). The AISHE dataset is a market level panel dataset that contains information about the sanctioned capacity for each major (e.g. Bachelors in Computer Engineering or Bachelors in Mechanical Engineering), for each college that responds to the survey, in each year (i.e. in a four year program), and the realized total enrollment. Enrollment is broken down by gender (male/female) and further by caste category. The dataset also contains information at the program level for the number of seniors who appear for the final graduation exam and the number of students who pass this exam, disaggregated by gender. Therefore, for the cohort that enrolls in 2015, we can recover their graduation outcomes from the 2019 dataset.

Data on individual college sticker prices is obtained from various government orders issued by the Andhra Pradesh state government and publicly available on the AP gazette website. I have collected the individual sticker prices for approximately 540 private engineering colleges (around 95% of the entire private market) and successfully matched these to the AISHE dataset using a unique college identifier. Combining the AISHE and fee datasets I create an unbalanced panel⁶ tracking approximately 540 colleges for the academic years 2009-10 to 2015-16. The fee regulation policy was enacted in the year 2012-13, yielding three academic years before and four academic years after policy implementation.

3.2. Outcomes

3.2.1. Enrollment

I examine changes in the overall enrollment and enrollment composition in a program (college + major) as a result of the tuition price reform. Program enrollment refers to the students matriculating in a given major m (e.g. computer science engineering or electrical engineering) in a given college j in a time period t . I consider two AA groups, namely reserved and general category students. I denote these by the set $K = \{r, g\}$. I consider two gender groups namely female and male students and denote these by the set $L = \{f, m\}$. Combining these two sets I get four mutually exclusive subgroups which a student can belong to $K \times L = \{rf, gf, rm, gm\}$. Using this notation I define two categories of enrollment outcomes, namely, *overall enrollment* and *enrollment composition*.

⁶The panel is unbalanced because the survey is voluntary and was not heavily promoted by the central government until 2014. However close to 75% of the colleges appear in all time periods and another 12% appear in all but one time period.

Overall Enrollment

I define nine overall enrollment outcomes in this section. Summary statistics for these overall enrollment outcomes can be found in panel A of Table 3. Let the number of students belonging to a subgroup be denoted by t^z . By computing the total enrollment for each $z \in K$, $z \in L$, and $z \in K \times L$, I get eight total enrollment outcomes corresponding to subgroups. The ninth overall enrollment outcome is simply the grand total in a major, in a college, in a year, defined as

$$t = \sum_{z \in K \times L} t^z$$

Therefore the overall enrollment outcomes are $(t, t^f, t^m, t^r, t^g, t^{rf}, t^{gf}, t^{rm}, t^{gm})$.

Enrollment Composition

I define eight enrollment composition outcomes in this section using previously defined notation. The outcomes in this section are all computed as percentages. Summary statistics for these enrollment composition outcomes can be found in panel B of table 3. Six outcomes are defined as a ratio of the total enrollment in a major, in a college, in a year. If t^z is the numerator of interest and $t = \sum_{z \in K \times L} t^z$ is the fixed denominator, then the outcomes are calculated for each $z \in K - \{g\} \cup L - \{m\} \cup K \times L$. The six outcomes therefore are { % female, % reserved, % reserved female, % reserved male, % general female, % general male } relative to total enrollment t . The last two enrollment composition outcomes are calculated within gender groups to see what percentage of the female and male student body comes from the reserved category, these are t^{rf}/t^f and t^{rm}/t^m respectively. The two outcomes are % reserved female as a percent of the female student cohort and the corresponding outcome for males.

3.2.2. Education Quality: Graduation Rates

I use *graduation rates* of the cohorts matriculating between academic years 2009-10 and 2015-16 as a proxy for education quality. This data is available in terms of the number of students who actually appeared for the exam and the number of students who pass their exams, broken down by gender. Summary statistics for these education quality outcomes can be found in panel C of Table 3. I define five examination outcomes, all of them as percentages. Three of these are relative to the total number of exam takers. These three are % pass, % female pass, and % male pass of all exam takers. The last two are defined within gender groups, i.e. % female pass out of female exam takers and the corresponding outcome for males.

Graduation rates based on final semester examinations are a useful measure of education quality in this setting because all colleges in this setting are mandated by the state government to set either the same, or very similar examinations. This is an artifact of the state university system in Andhra Pradesh and is common in all Indian states. An engineering college in this setting cannot award a degree, this authority rests only with the university that a college is affiliated to. Almost all the private engineering colleges in this study (nearly 93%) are affiliated to three universities, namely Jawaharlal Nehru Technological University (JNTU) in Hyderabad (JNTUH), Anantapur (JNTUA),

and Kakinada (JNTUK). The results of this study hold up even when the remaining 7% of colleges are dropped. Examinations papers are set at the university level, administered by colleges, and graded at the university level before final grades are released. Therefore the quality of this senior year graduation exam which leads to the awarding of the Bachelors in Engineering (B.Tech) degree is expected to be uniform at the university level.

3.3. Descriptive Statistics

Table 3 provides a summary of the outcomes and how they differ between old and new colleges in the pre and post periods separately. The columns labeled *New* correspond to new colleges show the mean of the outcome. The columns labeled *Old* show the difference from the mean at new colleges and the statistical significance of the difference. The main takeaway from Table 3 is that some outcomes are different in levels between old and new colleges and some are not. Where there are level differences we are able to observe the magnitude and significance of these differences. For instance in panel B we see that females always constitute a significantly smaller portion of the class at old colleges relative to new, while reserved males are balanced across old and new colleges. The full event study DiD, explained in Section 4, will inform us of the changes at old colleges relative to new as a result of the fee regulation policy.

4. Impact of the Tuition Price Reform Policy

4.1. Empirical Strategy

In this section I explain the empirical approach and identification strategy used to examine the impact of the tuition price reform policy on the outcomes of interest. Changes in tuition prices affect only incoming student cohorts and are held constant within a cohort, i.e. students are grandfathered into the tuition price and reimbursement scheme they face. I compare the difference between outcomes in the post-period and the pre-period for old colleges relative to new colleges using an event study difference in differences design (Finkelstein, 2007). The primary regression specification is given by Equation 1.

$$y_{mjt} = \alpha_m^M + \alpha_j^J + \alpha_t^T + \sum_{k=2009; k \neq 2011}^{2015} \beta_k \{Treat_j \times \mathbb{1}[k = t]\} + \gamma X_{mjt} + \epsilon_{mjt} \quad (1)$$

y_{mjt} is outcome under consideration in program m , college j , time t . $Treat_j = 1$ for an old college and 0 otherwise. X_{mjt} is a vector of relevant controls like program capacity. The α coefficients represent fixed effects of majors, colleges, and time. The primary coefficient of interest is β which measures the relative difference in y_{mjt} between old and new colleges interpreted relative to $\beta_{2011} = 0$. Standard errors are clustered at the level of treatment, i.e. the college level. ϵ_{mjt} is the i.i.d error term. The key identifying assumption is, in the absence of the fee regulation policy, enrollment and examination outcomes at old and new colleges would have progressed along parallel trends. In other words, if this untestable assumption holds, any differences in outcomes we

Table 3: **Summary statistics of the enrollment and college quality outcomes.**

	<u>Pre-period</u>		<u>Post-period</u>	
	2009-10 to 2011-12		2012-13 to 2015-16	
	New	Old	New	Old
<i>Panel A: Overall Enrollment</i>				
total class size	59.35	26.38***	62.24	36.95***
total females	23.11	7.06***	24.28	8.64***
total males	36.25	19.32***	37.96	28.32***
reserved class size	31.13	14.09***	34.91	18.73***
general class size	28.41	12.20***	27.38	18.32***
reserved females	11.23	4.36***	12.25	4.17***
general females	11.99	2.69***	12.05	4.54***
reserved males	19.90	9.73***	22.67	14.57***
general males	16.42	9.50***	15.33	13.78***
<i>Panel B: Enrollment Composition</i>				
% female in a class	36.56	-2.94***	36.73	-4.71***
% reserved in a class	52.32	-0.21	57.64	-3.17***
% reserved female in a class	17.58	-0.40	19.31	-3.23***
% reserved male in a class	34.74	0.19	38.33	0.05
% general female in a class	19.09	-2.56***	17.40	-1.42***
% general male in a class	28.60	2.77***	24.96	4.59***
% of females who are reserved	48.46	3.65***	55.69	-3.15***
% of males who are reserved	54.44	-0.52	59.30	-3.01***
<i>Panel C: College Quality</i>				
% pass of exam takers	74.29	4.19***	63.23	8.72***
% female pass of exam takers	30.70	-1.25**	27.76	-0.92*
% male pass of exam takers	43.59	5.45***	35.48	9.64***
% female pass of female exam takers	83.53	3.55***	74.83	8.11***
% male pass of male exam takers	69.38	4.76***	57.26	10.19***

Note: Panel A shows the outcomes related to overall enrollment. Panel B shows the outcomes related to the enrollment composition within programs. Panel C shows the examination outcomes that proxy for college quality measures. Signif. Codes: ***: 0.01, **: 0.05, *: 0.1.

see in the post period can be attributed to the fee regulation policy. In this case, the regression estimator can be interpreted as converging asymptotically to the average treatment effect on the

treated (ATT).

4.2. Results

I present the parallel trends figures based on the raw data and the associated regression coefficient graphs here. The detailed regression tables are in the Appendix. Figure 3 and Table 4 show the parallel trends plots from the raw data, the DiD coefficient plots, and the estimated effects of the fee regulation policy on overall enrollment patterns, initially summarized in panel A of Table 3. We don't see any glaring violations of the parallel pre-trends assumption here which is encouraging for the validity of the identification strategy. There are two main takeaways for the overall enrollment outcomes.

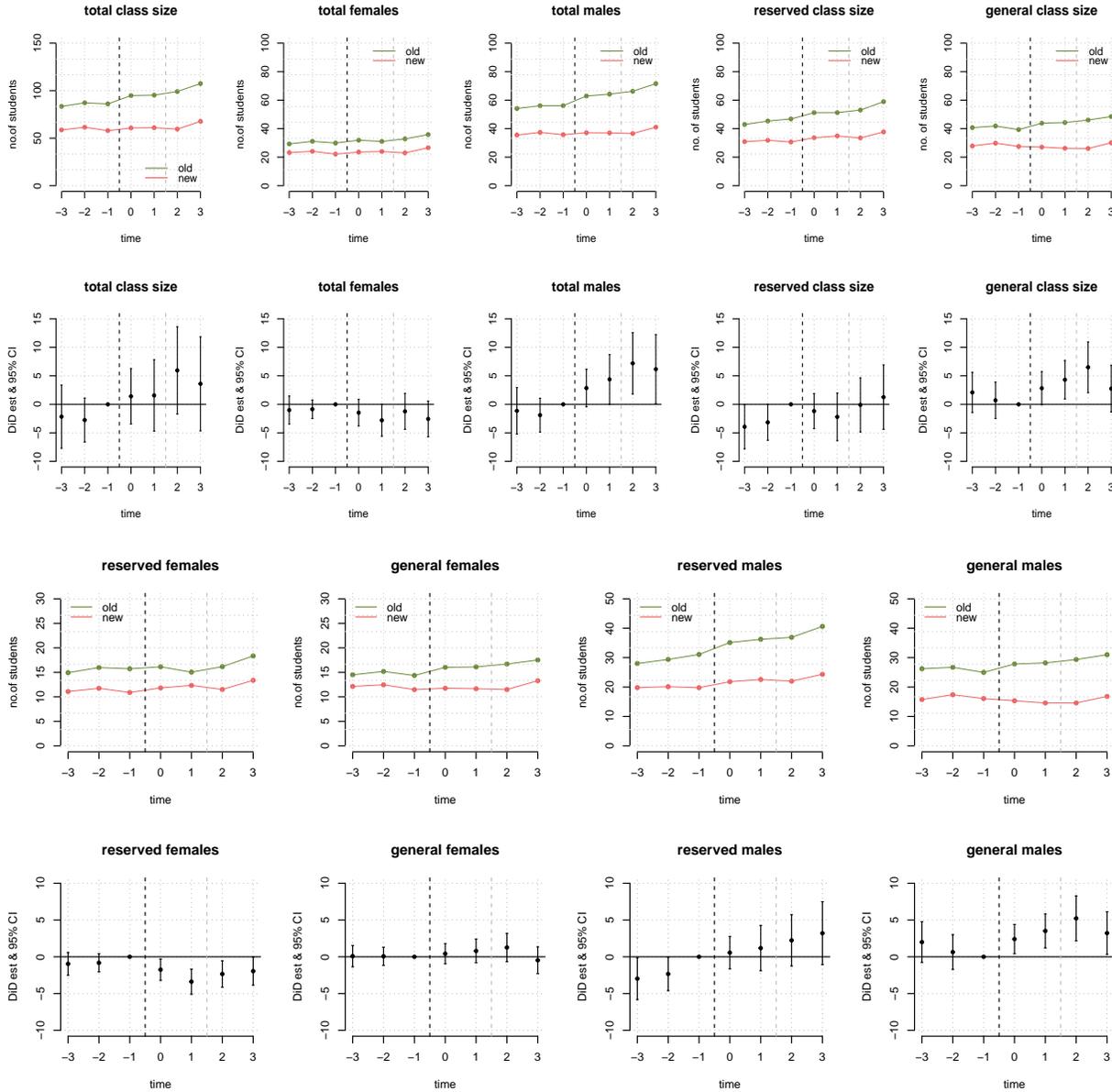
First, programs at old colleges have more male students (t^m) on average than new colleges in the post-period. We confirm this pattern in row 2 \times column 5 of figure 3. The corresponding regression coefficient is significant and meaningful based on column 3 of Table 4. In the year 2014 for instance, we observe that the price reform policy led to a little over 7 more males in a typical class (i.e. major like electrical engineering) at old colleges relative to new colleges. Upon breaking up the males into reserved males (t^{rm}) and general males (t^{gm}), we see that this pattern of increased males is driven by general males disproportionately enrolling at old colleges. The policy induces no significant changes in t^{rm} , but based on the parallel trends plot in row 3 \times column 3 of figure 3, we can see that in the post policy period reserved males enroll at both old and new colleges.

Second, we see that the female students t^f enroll at similar rates pre and post policy, and the trends are roughly parallel. There is some evidence of recomposition as there are less reserved females (t^{rf}) in an old college class in the post-period (e.g. over 3 less reserved female students in 2013), and around 1 more general female student (t^{gf}), however this estimate is imprecise. We infer that programs at old and new colleges are growing in size and general males are largely driving any differential trend in total enrollment between old and new colleges after the price reform.

Figure 4 and Table 5 show the parallel trends plots from the raw data, the DiD coefficient plots, and the estimated effects of the fee regulation policy on enrollment composition, initially summarized in panel B of table 3. Recall that based on the patterns in overall enrollment, we know that programs are bigger at both old and new colleges and this uptick in class size is driven by males. There are three main takeaways. First, in row 2 \times column 1 of figure 4 (see column 1 of Table 5) we see that the fee regulation policy led to a decrease in females as a portion of the total class (t^f/t). For instance immediately after the price reform we see almost a 2 percentage point (p.p.) decrease in t^f/t and this difference is exacerbated in the following years, hovering around 3.5 p.p. for two more years. Breaking this information down into females of each AA status in row 2 \times column 3 and row 4 \times column 1, we see that reserved females (t^{rf}) are forming a smaller percentage of the class (see column 2 of Table 5), while general females (t^{gf}) occupy a roughly steady percentage of the class. t^{rf}/t is around 4 p.p. less at old colleges for most of the post-period.

Second, in row 2 \times column 2 of figure 4 (see column 2 of Table 5) we see that the fee regulation

Figure 3: Parallel trends and DiD estimates for overall enrollment outcomes.



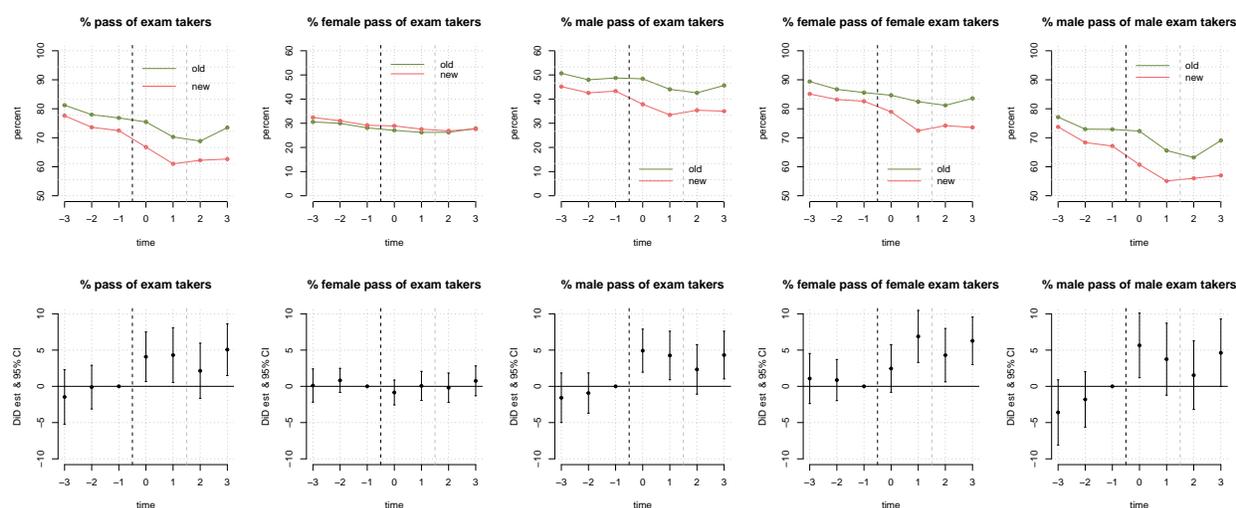
Note: The horizontal axes of all plots represent the time relative to the implementation of the fee regulation policy, implemented at $t = 0$. The black vertical dashed line between $t = -1$ and $t = 0$ represents the pre and post period relative to the fee regulation policy. Rows one and three show the raw data means for each outcome in each year (measured in thousands of students). Rows two and four show the estimates of β_{2009} to β_{2015} for the variables corresponding to rows one and three respectively. The error bars represent the 95% confidence interval of the estimate.

policy led to a decrease in reserved category students as a portion of the total class (t^r/t). After the price reform we see an initial 2 p.p. decrease in t^r/t that grows over time reaching almost 6 p.p. by 2015. Based on the estimates in column 4 and 5 of Table 5, we can see that reserved males not

unlike general females occupy a similar percentage of the class throughout. General males however, based on column 6 in Table 5 occupy around 4 p.p. more of programs at old colleges as a result of the price reform.

Third, within gender groups in row 4 \times columns 3 and 4 of figure 4 (see columns 7 and 8 of Table 5) we see that reserved students occupy a significantly smaller percentage of the class and the magnitude of this difference is larger for reserved females. Reserved females occupy upto over 8 p.p. less of the class at old colleges and reserved males occupy almost 6 p.p. less (in 2015) in the post-period. We can infer that the enrollment composition at old colleges significantly favors general students (driven by males) and is lesser for reserved students (driven by females).

Figure 5: Parallel trends and DiD estimates for college quality outcomes.

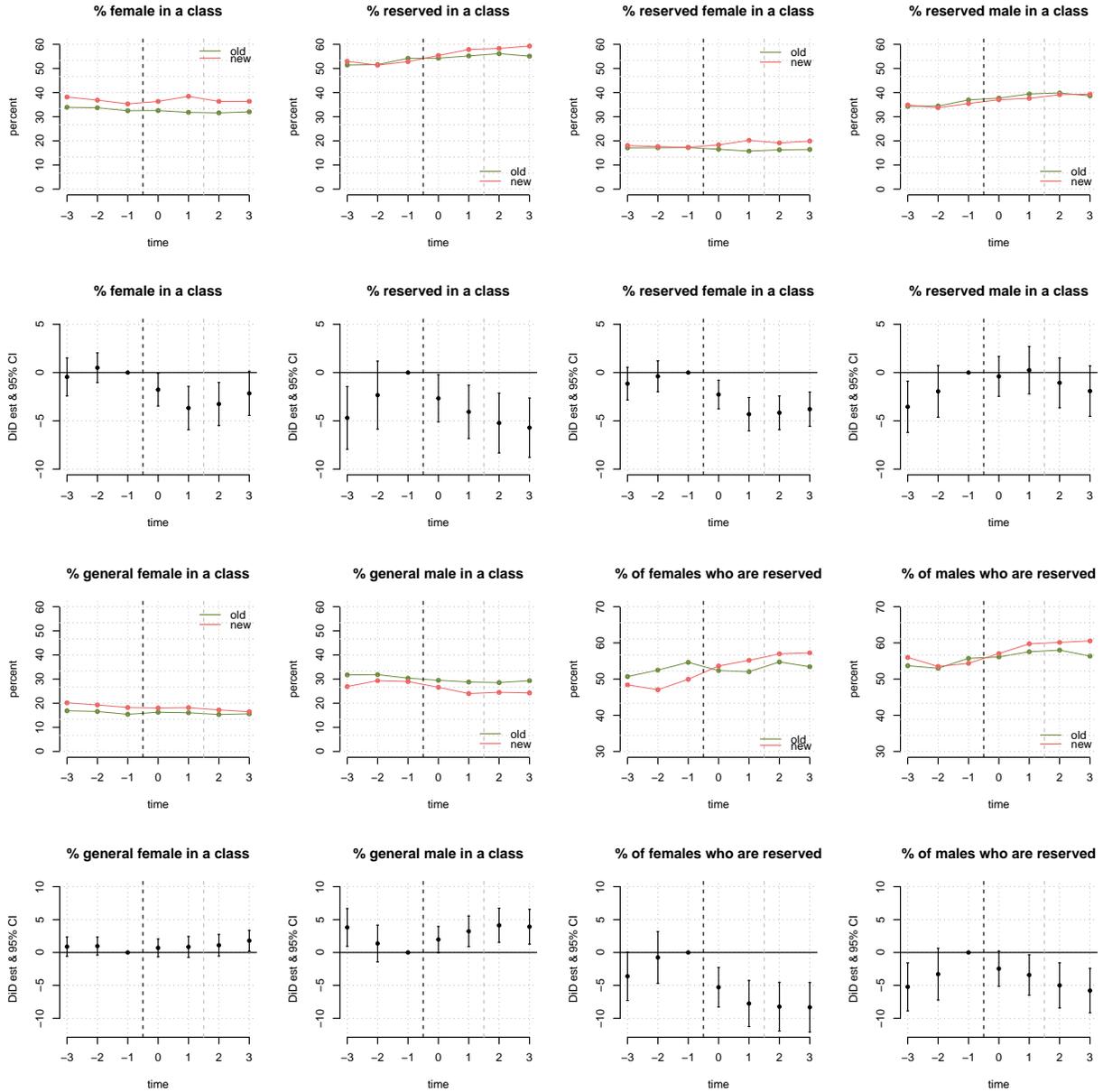


Note: The horizontal axes of all plots represent the time relative to the implementation of the fee regulation policy, implemented at $t = 0$. The black vertical dashed line between $t = -1$ and $t = 0$ represents the pre and post period relative to the fee regulation policy. The top row shows the raw data means for each outcome in each year (measured as a percentage). The bottom row shows the estimates of β_{2009} to β_{2015} . The error bars represent the 95% confidence interval of the estimate.

Figure 5 and Table 6 show the parallel trends plots from the raw data, the DiD coefficient plots, and the estimated effects of the fee regulation policy on examination outcomes that proxy college quality. These were initially summarized in panel C of table 3. Again we see that the parallel pre-trends assumption is not violated. The main takeaway here is that the price reform led to nearly a 4 p.p. increase in graduation rates for old colleges relative, as shown in row 1 \times column 2 of figure 5 (see column 2 in Table 6). This increase is driven by males as evidence by the estimates in column 3 in Table 6. Within gender groups of exam takers, we see that graduation rates at old colleges are significantly higher at old colleges for females and males based on the estimates in column 4 and 5 in Table 6. Among female exam takers, the price reform led to an increase in graduation rates as high as 6 p.p., while among male exam takers this number is as high as 5 p.p.

I discuss the results, possible mechanisms and potential implications of these patterns in Section

Figure 4: Parallel trends and DiD estimates for enrollment composition outcomes.



Note: The horizontal axes of all plots represent the time relative to the implementation of the fee regulation policy, implemented at $t = 0$. The black vertical dashed line between $t = -1$ and $t = 0$ represents the pre and post period relative to the fee regulation policy. Rows one and three show the raw data means for each outcome in each year (measured as a percentage). Rows two and four show the estimates of β_{2009} to β_{2015} for the variables corresponding to rows one and three respectively. The error bars represent the 95% confidence interval of the estimate.

5. I also explain the limitations to the conclusions that we can draw from the current dataset and empirical framework.

5. Discussion

Based on the evidence from the event study DiD estimates we can draw the following conclusions. Overall enrollment patterns show an increase in average class size at both old and new colleges. This increase is driven by male students of both AA statuses. However while reserved males enroll in larger numbers at both old and new colleges, general males enroll disproportionately at old colleges only. Consider that the number of students appearing for the EAMCET exam (i.e. competing for merit seats) and the overall ability of the student population is constant for the time-period under consideration. I venture two possible mechanisms by which we might see this change in overall enrollment and therefore total class size. First, since total enrollment for all groups is weakly increasing, we could infer that enrollment increases are caused by male students at the extensive margin (general category males in particular). Since we know that non-merit seats are now relatively cheaper and in fact general category students with higher willingness to pay are less incentivized to give the EAMCET exam and compete for a merit seat when they could simply buy their way into older more expensive colleges at the same price. In the absence of student enrollment numbers by merit and non-merit seats, we cannot definitively test this mechanism explaining increasing class size, but given that we see an increase in demand for engineering college seats as a whole, we could attribute this to the newly cheaper non-merit seats (recall Figure 2). Second, it is possible that there is a change in underlying preferences of certain groups of students. If we had access to students' rank-ordered lists for programs, we could see if there is a significant change in their program choice in the post-period. Suppose there are more lower ability high willingness to pay students than high ability low willingness to pay students. If the former group change their preferences to rank older more expensive colleges further up on their list and the latter group rank older colleges lower because merit seats are relatively more expensive for everyone all else equal then we would expect to see overall enrollment at old colleges grow faster than that at new colleges. Without additional student preference and merit vs. non merit enrollment data we cannot conclusively test either mechanism.

Given the changes in overall enrollment, we also see the composition of the student body shift in a typical classroom. Old college classrooms are increasingly male and, in particular have a larger share of general male, relative to new colleges. Reserved females as a percentage of the class were similar at old and new colleges before the price reform, but are a significantly smaller percentage of the class and the female student body, at old colleges relative to new ones, in the post-period. Differential trends by AA status for old and new colleges appear to be driven by general students either keeping their enrollment steady or in the case of males, even trading off new colleges for a seat at old colleges.

Finally for examination outcomes, we see that graduation rates in both old and new colleges decrease but this decrease is more drastic in new colleges. If students ability distributions are constant pre and post policy, and we believe that on the extensive margin male students are more likely to respond to the decrease in non-merit seat prices, then we could attribute the overall decrease in graduation rates to these non-merit seat engineers. Moreover we see some evidence for

recomposition within the female students with more reserved females now choosing cheaper new colleges and general females taking their place at old colleges. A potential reason for differential trends in graduation between old and new colleges in the post-policy period is that perhaps general students have higher ability than reserved students (for both merit and non-merit categories). Also, if we believe that willingness/ability to pay for a non-merit seat is correlated with ability of the student then lower ability students should buy their way into new colleges. Factoring in that old colleges have always been better than new colleges at graduating their students in levels, increased general percentages at old colleges and better quality students from the extensive margin should jointly contribute to old colleges graduating a larger percentage of their exam takers relative to new colleges in the post-period.

It is difficult to precisely estimate welfare implications of the tuition price reform policy without additional data, however we can illustrate some pathways along which the policy might change overall welfare. First, we see that there is an overall increase in the number of engineers, attributable to the demand side intervention (the Fee Reimbursement Scheme) and the newly cheaper non-merit seats. If this leads to an excess supply of engineers in the market, this can lower the average wage. Second, we see that on the whole, graduation rates for private unaided engineering colleges decline. If we believe the reason for this is that many more low ability students are buying their way into private colleges, we might expect an overall decline in the quality or skills of the average engineer. This is especially true because private engineering colleges account for approximately 75% of engineering enrollment in the state of Andhra Pradesh. Although an engineering student cannot practice as an engineer on the labor market without a degree, they can appear for their final exams multiple times and if they pass would eventually be certified as engineers. If employers in the labor market believe that the signal of an engineering degree is now attenuated because the market is flooded with low quality engineers, we might see demand for engineers contract and substitution away from engineers to students who major in science or earn technical diplomas who can be hired and trained for cheaper. This hypothesis could be tested with additional labor market data for cohorts of engineers before and after the fee regulation policy.

In order to understand net welfare effects, we need to consider the increased supply of engineers and the overall lowered quality of engineers. If the newer, larger cohorts of engineers are comprised mainly of students who are earning more than their outside option despite the lowered average wage, we could see net welfare gains. If on the other hand, the wage for engineers has been lowered to the point where the total value added is less than the pre-policy period, we should see net welfare losses. Some symptoms that one might expect in the latter scenario are high unemployment and low skills among engineers (Aggarwal et al., 2019), substitution to other majors or expensive private universities, and eventually an overall decline in total engineering enrollment (Ministry of Education, 2020). Currently all three of these patterns are observable in the Indian tertiary education and labor markets.

6. Conclusion

This paper studies the unintended distributional consequences of a tuition price regulation policy implemented in Andhra Pradesh’s private engineering college market. Using administrative data linked to detailed college-level fee schedules, I exploit plausibly exogenous variation in tuition prices coming from a tuition price reform policy enacted by the AP state government in 2012-13. The policy eliminated cross-subsidization between merit and non-merit seats and substantially altered the affordability of selective colleges for reserved category students. Leveraging a difference-in-differences framework that compares older, higher-priced colleges to newer ones, I document how a policy designed to rationalize pricing and control excess supply had regressive effects on student composition.

We find that while total enrollment rose across the board, the increase was concentrated among male students—particularly general category males—at older, more selective colleges. In contrast, the share of reserved category students, especially reserved category females, declined sharply at these institutions. The shift in student composition suggests that the policy disproportionately favored those with a higher willingness (and ability) to pay, effectively pricing out more vulnerable students from access to high-quality programs. At the same time, graduation rates improved at older colleges relative to newer ones, suggesting that the compositional shift may have led to academic gains at the margin, albeit at a cost to inclusion.

The findings highlight a key policy tension: price regulation designed to move from a system of common prices across colleges to individual sticker prices compensating colleges for their marginal cost per student can inadvertently diminish access for disadvantaged groups. While academic outcomes at newly more expensive colleges improve, it is unclear whether this is due to an improvement in college quality or simply a recomposition in the student body with richer, higher ability students sorting into more expensive colleges at the expense of marginalized student groups. The analysis underscores the importance of designing tuition price regulations that account for heterogeneity in student preferences, price sensitivity, and college quality.

Future work should explore the long-term welfare consequences of this reform, including its effects on labor market outcomes and student welfare. Richer individual-level data on program rankings, entrance scores, and post-college earnings would help clarify whether observed shifts in enrollment reflect changes in preferences or constrained access. Understanding these dynamics is critical for crafting pricing and subsidy policies that can promote both efficiency and equity in higher education markets.

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Appendix

Table 4: Event study DiD estimates for overall enrollment outcomes

<i>Dependent Variable: Overall Enrollment</i>									
	t	t^f	t^m	t^r	t^g	t^{rf}	t^{gf}	t^{rm}	t^{gm}
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
β_{2009}	-2.16 (2.82)	-1.01 (1.26)	-1.15 (2.08)	-3.93** (1.97)	2.08 (1.79)	-0.96 (0.79)	0.08 (0.74)	-2.98** (1.45)	2.00 (1.41)
β_{2010}	-2.76 (1.96)	-0.86 (0.82)	-1.90 (1.51)	-3.16** (1.59)	0.70 (1.62)	-0.82 (0.63)	0.06 (0.63)	-2.33** (1.15)	0.64 (1.20)
β_{2012}	1.40 (2.47)	-1.46 (1.19)	2.86* (1.68)	-1.19 (1.57)	2.82* (1.49)	-1.75** (0.74)	0.42 (0.70)	0.56 (1.12)	2.41** (1.02)
β_{2013}	1.57 (3.19)	-2.80** (1.42)	4.37* (2.23)	-2.20 (2.12)	4.31** (1.71)	-3.39*** (0.87)	0.79 (0.82)	1.18 (1.56)	3.52*** (1.18)
β_{2014}	5.95 (3.90)	-1.24 (1.60)	7.19*** (2.75)	-0.10 (2.41)	6.49*** (2.26)	-2.34** (0.91)	1.27 (0.98)	2.24 (1.78)	5.23*** (1.56)
β_{2015}	3.60 (4.20)	-2.56 (1.60)	6.16** (3.09)	1.26 (2.87)	2.75 (2.08)	-1.95** (0.97)	-0.47 (0.93)	3.21 (2.18)	3.22** (1.48)
<i>capacity</i>	0.38*** (0.03)	0.18*** (0.02)	0.20*** (0.02)	0.19*** (0.02)	0.19*** (0.02)	0.09*** (0.01)	0.09*** (0.01)	0.10*** (0.01)	0.10*** (0.01)
N	13301	13301	13301	13212	13212	13212	13212	13212	13212
R^2	0.607	0.566	0.543	0.564	0.598	0.550	0.527	0.491	0.575

Note: The numbers in each row show the coefficient estimate and the corresponding numbers in parentheses show the standard errors. All columns correspond to specifications with college and year fixed effects. Standard errors are clustered at the college level. *Signif. Codes:* ***: 0.01, **: 0.05, *: 0.1

Table 5: Event study DiD estimates for enrollment composition outcomes

	<i>Dependent Variable: Enrollment Composition</i>							
	t^f/t	t^r/t	t^{rf}/t	t^{rm}/t	t^{gf}/t	t^{gm}/t	t^{rf}/t^f	t^{rm}/t^m
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
β_{2009}	-0.45 (1.00)	-4.69*** (1.66)	-1.15 (0.86)	-3.55*** (1.35)	0.89 (0.74)	3.81*** (1.46)	-3.61* (1.88)	-5.23*** (1.86)
β_{2010}	0.50 (0.78)	-2.33 (1.80)	-0.39 (0.82)	-1.95 (1.36)	0.97 (0.70)	1.37 (1.43)	-0.76 (2.00)	-3.29 (2.01)
β_{2012}	-1.77** (0.87)	-2.67** (1.25)	-2.27*** (0.75)	-0.40 (1.05)	0.70 (0.69)	1.97* (1.01)	-5.29*** (1.53)	-2.46* (1.37)
β_{2013}	-3.67*** (1.14)	-4.07*** (1.41)	-4.31*** (0.88)	0.24 (1.25)	0.85 (0.81)	3.22*** (1.19)	-7.76*** (1.79)	-3.42** (1.57)
β_{2014}	-3.26*** (1.14)	-5.22*** (1.58)	-4.16*** (0.89)	-1.06 (1.32)	1.10 (0.84)	4.12*** (1.33)	-8.24*** (1.89)	-5.00*** (1.75)
β_{2015}	-2.15* (1.17)	-5.71*** (1.57)	-3.79*** (0.91)	-1.92 (1.33)	1.79** (0.80)	3.91*** (1.35)	-8.32*** (1.93)	-5.80*** (1.72)
<i>capacity</i>	0.04*** (0.01)	-0.01*** (0.00)	0.02*** (0.00)	-0.03*** (0.00)	0.02*** (0.00)	-0.01** (0.00)	-0.01*** (0.00)	-0.02*** (0.00)
N	13301	13212	13212	13212	13212	13212	12031	12269
R^2	0.546	0.532	0.511	0.474	0.485	0.565	0.395	0.488

Note: The numbers in each row show the coefficient estimate and the corresponding numbers in parentheses show the standard errors. All columns correspond to specifications with college and year fixed effects. Standard errors are clustered at the college level. *Signif. Codes:* ***: 0.01, **: 0.05, *: 0.1

Table 6: Event study DiD estimates for college quality outcomes

	<i>Dependent Variable: College Quality</i>				
	p/a (1)	p^f/a (2)	p^m/a (3)	p^f/a^f (4)	p^m/a^m (5)
β_{2009}	-1.30 (1.95)	0.29 (1.12)	-1.58 (1.79)	1.28 (1.78)	-3.59 (2.36)
β_{2010}	0.31 (1.55)	0.89 (0.83)	-0.57 (1.42)	1.20 (1.47)	-1.37 (1.95)
β_{2012}	3.78** (1.77)	-0.96 (0.87)	4.74*** (1.53)	2.44 (1.68)	5.31** (2.29)
β_{2013}	3.98** (1.96)	-0.01 (1.04)	3.99** (1.73)	6.72*** (1.86)	3.49 (2.56)
β_{2014}	1.86 (1.97)	-0.22 (1.04)	2.08 (1.77)	4.35** (1.91)	1.04 (2.44)
β_{2015}	4.77** (1.85)	0.77 (1.03)	4.00** (1.70)	6.22*** (1.70)	4.20* (2.41)
<i>capacity</i>	0.02*** (0.00)	0.03*** (0.01)	-0.02*** (0.00)	0.00 (0.00)	0.02*** (0.01)
N	13301	13301	13301	12102	12366
R^2	0.430	0.543	0.447	0.275	0.331

Note: The numbers in each row show the coefficient estimate and the corresponding numbers in parentheses show the standard errors. All columns correspond to specifications with college and year fixed effects. Standard errors are clustered at the college level. *Signif. Codes:* ***: 0.01, **: 0.05, *: 0.1