



Forced private tutoring in Egypt: Moving away from a corrupt social norm[☆]

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ABSTRACT

Egypt stands as a showcase for a practice of private tutoring which severely impedes quality of education. Teachers compel students to pay for additional private tutoring, putting increased financial strain on the poorest members of society. Based on an original dataset on primary education in public schools, this paper joins empirical data and evolutionary theory to study the impact of policies to alleviate Forced Private Tutoring (FPT). Our model explains the limited impact of increases to teachers' wages in 2012. We identify alternative policies which foster a FPT-free social norm and improve the quality of education in public schools.

1. Introduction

The 2016/17 Global Competitiveness Report ranked Egypt 134 out of 144 economies with respect to its quality of primary education (World Economic Forum, 2017, p. 169). In this environment of low quality education private tutoring is widespread. The system is plagued by a decline in full-time professional teachers (Ministry of Education, 2010), an underfunded public education system, large class sizes, poor facilities and a dense curriculum which has contributed to the decline of teaching quality. Yet, the increasing use of private tutoring has effectively rendered the regular schooling system redundant and has taken it out of the hands of state control. This has allowed teachers to take advantage of the failed system and thus prevented the implementation of possible improvements (Hartmann, 2008). This suggests that private tuition is one cause, and not simply a consequence, of Egypt's low-quality public educational system.

Private after-class tutoring is common in developing countries. The reasons for private tutoring are varied: high returns (Bray, 1999); the perceived excessively competitive nature of some selective educational systems (Global Industry Analysts, Inc (GIAI), 2016); and corruption (Hallak and Poisson, 2007). It is socio-culturally insensitive to suggest all forms of tutoring amount to corruption, because each case is context and country specific (Kobakhidze, 2014). We distinguish between 'optional' private tutoring and forced private tutoring (FPT). The former represents a choice by students and/or parents, the latter arises from a teacher exploiting her position.

In Egypt, corruption is widespread across the public sector (e.g. MENA-OECD, 2009; Transparency International, 2016), encouraged by the real-term fall in public sector wages since the 1980s (Said, 2015). This tendency coincides with the establishment of the first private tutoring centers in Egypt (see Hartmann, 2008). For teachers, their income can be supplemented through after school classes. This is clearly not itself evidence of corruption. However, other features of the Egyptian education system have created a situation where teachers have the ability to successfully pressure students to participate in these classes for the teachers' own financial benefit. Teachers (1) employ means of punishment in order to force students to participate in their private classes or (2) use the deficiencies of the educational system to their advantage by deliberately reducing teaching quality and commitment (i.e., effort in class), drawing on the dense curriculum and overcrowded classrooms.

This has transferred responsibility for education from state to parents, thus putting at a disadvantage the already underprivileged poor who send their children to a public school (Tadros, 2007). A 1994 survey of 4729 households illustrated that 64 percent of primary public school children in urban areas and 52 percent in rural areas had received private tutoring (Fergany, 1994). Similar results are reported by a United Nations Development Programme survey in 1997 (Handoussa, 2010). In 2007, it was estimated that Egyptians spend \$2.2bn a year on after-class school tutoring services (Hartmann, 2007).

In many developing countries (for examples, see Bray and Lykins, 2012; Transparency International, 2016), private tutoring is now a

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norm: parents accept the need for fees, sympathize with teachers, and rationalize their own choice to buy private tutoring. In Egypt 58% of primary students received paid tutoring (Roushdy and Sieverding, 2015). A self-enforcing private tutoring mechanism is a barrier to improvement of the public education system. It encourages students to abandon the regular educational system and only attend private classes (Roushdy et al., 2010). Breaking the cycle between low quality public education and excessive private tutoring requires a change to the incentive structure of interested parties, which is ultimately self-enforcing. The government has announced new legislation to prohibit the offering of FPT (decree No. 53 of the Ministry of Education, as well as the *Egyptian Education News*, 2016 and for earlier reforms, see Sobhy, 2012). Yet, similar to previous actions by the government against FPT, this has not led to any significant effects. This is also partially due to the resistance of teachers and students to move away from their current behavior (Annan, 2016; Maghrebi and Abou-Anwar, 2016; for a list of planned reforms, refer to OECD, 2015, pp. 62–66 and also see the National Education Strategic Plan 2007–2012).

In this paper, we question the ways in which changing the incentives structure within Egypt's education system can render FPT unattractive for parents, students and teachers. We make use of an original survey dataset to estimate the motivation, perception, and extent of FPT. We then draw on evolutionary game theory to help design policies that might mitigate the perverse incentives that result in FPT. This combination constitutes the novelty of this paper, since we believe this combined approach enriches our understanding by taking into account the feedback effects between social actors. In Section 2 we provide a short review of the existing literature. In Section 3 we present the original data which illustrates the systemic reasons behind FPT and the incentive structure of teachers. In Section 4 we develop an evolutionary game theoretic model that allows us to study the conditions required for a shift to a low FPT norm. This analysis forms the support for the mechanism and policies elaborated in Section 5. Section 6 concludes.

2. Existing literature

Better education is often associated with better opportunities and higher lifetime earnings at the individual level, as well as increased growth at the macro level (Hanushek and Woessmann, 2007). Thus, understanding any corruption that occurs in the education sector is of utmost importance, especially when trying to tackle inequality. The corruption may occur at either the political, administrative (centrally or locally), or classroom level (Meier and Griffin, 2005).

Transparency International (2013) reports on corruption at the classroom level in Eastern and Southern Europe, Sub-Saharan Africa, and the Middle East - including Egypt. Teachers can either use their position to force students to pay for private tuition that should be unnecessary, or they may partake in widespread absenteeism because of parallel jobs.

In a paper which specifically considers private tutoring, Heyneman (2011) discusses its increasing use. The author starts with reasons why private tuition should, theoretically, be encouraged, but then states that any use of private tutoring goes against the principles of free education. In addition, the clear conflict of interest is highlighted in situations where the tutoring is undertaken after-hours by the original classroom teacher. The paper's conclusion is that private tutoring is a corruption of education's public purpose and should be discouraged. This was also the view of many parents in Egypt who stated that the need to purchase private lessons was undermining the universality of educational access (OECD, 2015).

Waite and Allen (2003) attempt to uncover the range of corruption that occurs in education administration. They provide examples from Mexico, China, and the USA but also note that limited data and research exists on the topic. The authors conclude that corrupt systems are especially difficult to change, since the power operating in such systems

is self-perpetuating. Heyneman (2004) distinguishes firstly between different types of corruption that can occur in the education sector (e.g. selection, accreditation, and supplies) and also between types of professional misconduct (e.g. forcing students to purchase materials, accepting payments to proceed to the next grade, and FPT). The paper considers ways to prevent the different forms of corruption. It suggests, for issues like FPT, structural reforms that separate teaching and examination, and argues that introducing "strong and professional boards with the authority to fine and dismiss" should be encouraged.

A large proportion of the literature on education corruption in developing countries focuses on the higher education sector (for an early taxonomy see Rumyantseva, 2005). Heyneman et al. (2007) and Heyneman (2015) discuss the role of cultural and social effects in determining corruption in higher education. The work points out that allowing an education system to be corrupt may be costlier than allowing corruption in other sectors because education is specifically designed to teach the young how to behave in the future. Focusing on Bosnia and Herzegovina, Sabic-El-Rayess and Mansur (2016) (and related papers, e.g. Sabic-El-Rayess, 2014) show the higher education system is corrupt by collecting survey data from students. Sabic-El-Rayess and Mansur (2016) use data to ascertain individuals' characteristics associated with different forms of corruption. In Sabic-El-Rayess (2014) the data is used to inform the creation of a framework to explain reactionary behaviours of students in corrupt higher educational systems. This might suggest that FPT is consequence of the corrupt processes orchestrated by the elites, rather than itself causing low quality education.

Recent work by Duerrenberger and Warning (2018) considers how corruption affects years of schooling, and the interaction between higher education funding and corruption. The authors use panel data comprising 88 developing countries over eight years. The authors find a negative relationship between corruption and expected years of schooling and that public higher education enrolment is positive in low-corruption countries and becomes negative in high-corruption countries. In view of this result the authors stress that a "one-size-fits-all"-policy toward higher education across developing countries does not seem to be the optimal strategy to increase years of schooling – and factors such as institutional quality must be carefully considered.

Although FPT has been studied in many developing countries (for an overview, see Bray, 1999, 2009), until now Egypt has only received limited attention. In work commissioned by the British Council Egypt, Loveluck (2012) outlines the principal problems of the educational system in Egypt. With respect to private tutoring, Loveluck suggests the problem is the negative impact of FPT on social equality and stratification as well as the disincentive for teachers to excel during their regular classes. Hartmann (2008) contains a discussion of the impact of private tutoring in Egypt on teacher-student relations and the social role of teachers. Sayed and Langsten (2014); and Assaad (2010) examine expenditure on private tuition for secondary school pupils in Egypt. In a study of two Cairo schools, Sobhy (2012) shows that the problems of FPT prevail across all social strata, although the ways in which teachers pressure students will vary. Hartmann (2013) offers evidence of the current state of Egypt's educational system and the determinants of private tutoring.

The fundamental problem with FPT is a lack of awareness that this severely impacts on the quality of teaching and the general acceptance of the current norm. In Slovakia, Kubanová (2006) shows that even teachers and pedagogy students do not perceive FPT as unethical. The informal nature of FPT means attempts to prohibit it (in countries such as the Republic of Korea, Bosnia and Herzegovina, Croatia and Poland) have met with little success (Bray, 2003).

The causal link between wages and corruption is of clear interest to policymakers from both governments and multilateral development organizations (for an overview, see Svensson, 2005). For public sector workers outside the education sector there have been numerous studies, and the evidence is ambiguous. For example, Rauch and Evans (2000)

and Treisman (2000) find no robust evidence that higher wages deter corruption, while Van Rijckeghem and Weder (2001) find that they do. In the context of education, Aslam (2011) shows that even if wage increases restoring differentials with other professions, the norm does not change because corruption remains the norm.

The paper most similar to ours uses responses from student surveys to analyze private tutoring in Hong Kong (Bray et al. (2014)). In our paper we have survey data from both parents and teachers. In addition, we employ a theoretical model to study the feedback effects of social factors within this context and based on our empirical results. Evolutionary game theory is used to study dynamic interactions which incorporate the feedback effects of individuals' decisions in larger populations. We use this framework to understand and model social processes. It has been previously used by e.g., Boyd and Richerson (1985); Durlauf and Young (2001); Gintis et al. (2005) and Sandholm (2010). The impact of social norms specifically on the prevalence of corruption has also been studied (Ostrom, 2000; Dong et al., 2009). By using an evolutionary model, we take account of the circular reinforcement mechanism that governs FPT. Individual preferences are determined by the existing norm and therefore define individual actions, which in turn affect the prevalent norm.

Evolutionary game theory assumes that certain interactions between socially conditioned individuals are persistently repeated. During random encounters with other members of society, individuals compare their success with other members and potentially decide to imitate the latter. More successful strategies are more likely to be adopted than less successful strategies. Therefore, evolutionary game theory has the advantage that choice is only based on social learning rather than the fully rational optimization process required in standard non-cooperative game theory. The replicator dynamics that we use model social pressure against behavior that is detrimental to an individual. In addition, this approach enables us to study the characteristics of the model's equilibria. In doing so, we can understand which factors increase the likelihood and stability of a given norm under decentralized decision-making. Hence, this analysis helps us to determine which policies support a transition from a socially inefficient norm to a preferred norm. For a broader overview of the evolutionary game theory approach to modelling, refer to Weibull (1995).

3. Data and empirical results

The Egyptian Center for Economic Studies, jointly with the Central Agency for Public Mobilization and Statistics (CAPMAS) conducted two surveys during late 2014 in order to gather cross-sectional data on primary education in public schools. 1504 representative Egyptian households responded to a questionnaire on their experiences in public schools and their private tuition expenditures. An equal number of representative teachers were asked questions regarding their teaching experience, income, and incentives.

According to the survey data we collected, 69.5% of all parents are dissatisfied with the educational system. Table 7 provides the reasons they provided, with private lessons and crowded classrooms topping the list. The median class size is 50 (see Table 8). Crowded classes are also cited by teachers as a reason for students dropping out (see Table 9). Poor parental education limits the ability of parents to provide tuition. 25.3% of the parents in our sample are illiterate, 18.0% can barely read and write, and 13.2% have less than an intermediate educational background.

Direct enforcement of FPT applies to 18.5% of all students. Reasons why parents choose private tuition are given in Table 6, however we argue that many of these amount to corruption. During regular classes, teachers can use overcrowded classrooms and the dense curriculum as a pretext to convey very little information to students. In addition, the structure of the curriculum causes evaluation not to be based on a fine grasp of the subject but on memorization (see also Table 7). These features create incentives for private tutoring. Exercises, model answers,

and exam preparation, are exclusive to students in private classes. During private tutoring teachers prepare summaries of what should be memorized for exams and illustrate special *tricks* for writing a specific exam answer. Crucially, for most grades, teachers set and mark the exams of the students they teach and therefore control progress of students through school.¹

Parents have little power to navigate the system without resort to private tuition, which allows them to be exploited. In theory 'parents councils' should empower parents. However, 49.6% of the parents consider the effectiveness of these to be weak or very weak. A vast majority of parents (92.5%) would prefer to send their children to a private school if it were accessible at the same cost as a public school, but distance (15.8%)² and above all credit constraints (92.9%) render private schools inaccessible³. Parents prefer to pay small amounts spread out over a long period, because of credit constraints, time preference, or because they rarely consider the total cost. In our data, 77.37% claimed to have never calculated their total tuition expenses. However, based on follow up questions, we calculated that half of the parents pay at least EGP 1000 per year and one fourth pays more than EGP 2000 per family and year (see Fig. 4).

50.3% of the parents indicate that those teachers giving private classes are the same who teach their children during regular classes. Our surveys indicate that a teacher is able to exercise additional pressure on students by offering private classes in her own home (25.4% teachers' statement vs. 47.9% parents' statement) instead of private lesson centers (10.5% teachers' statement vs. 9.7% parents' statement), the pupil's home (47.3% teachers' statement vs. 30.1% parents' statement) or at school (16.3% teachers' statement vs. 11.7% parents' statement).

Teachers may generate significant income from private tutoring (see Table 5). Although teachers of Egyptian public schools are civil servants (and therefore have job security for life), this supplementary income is important as teachers' wages have barely increased since the 1980s. Egypt showed the 9th lowest average growth rate of real wages in the educational sector from 2000 until 2008 for the 79 countries for which World Bank data is available (with an average of -3.38% compared to an average of 5.39% over all available countries). Regular salaries in the education sector had stagnated at 500 Egyptian Pound (EGP) per month over the past years and have even seen drastic slumps in several years (as illustrated in Fig. 5). Only in 2012 and again in 2014 as well as through recent public sector inflation bonuses have wages increased.

Since low wages have been identified as a cause for FPT, the Egyptian government decided in 2012 to increase teachers' wages to persuade teachers to abandon FPT. According to recent legislation, the wage for assistant teachers has been increased to at least EGP 1388 (comparable to the average wage of a low skilled worker) and EGP 3938 for master teachers (comparable to the average wage of a high skilled worker)⁴. These salary increases were intended to mitigate the practice of FPT. However, we illustrate both empirically and theoretically they did not and will not induce a behavioral change.

We find that those wage increases have had little influence on the practice of FPT, which we explain in our model (Section 4). Our data shows that teachers' wage is uncorrelated with their satisfaction levels, and only weakly correlated with the belief that the wage is 'adequate'

¹ Except for the 3rd, 6th, 9th and 12th grade –for which exams are collected and directly graded at the Ministry of Education.

² Distance (indicated by 18.8% of the parents) is also one of the principle problems for children when going to public schools. Other problems are a heavy bags (14.0%), road insecurity (13.2%), and lack of transportation (11.8%).

³ This does not indicate that FPT is exclusive to public schools. This phenomenon is also common to private religious schools and language schools, though to a lesser extent. Since in private language schools subjects are taught in foreign languages, rates for private tutoring are doubled.

⁴ According to the Presidential decree Law No. 93 for the year 2012, amending law 155 for the year 2007.

Table 1
Marginal Impact on the Likelihood of Giving Private Lessons - Probit Regression (Coefficients Show Marginal Effects).

	(1)	(2)	(3)	(4)	(5)
Age	-0.003 [*] (0.002)	-0.003 [*] (0.002)	-0.006 ^{***} (0.002)	-0.006 ^{***} (0.002)	-0.006 ^{***} (0.002)
Gender (d)	0.521 ^{***} (0.023)	0.520 ^{***} (0.023)	0.529 ^{***} (0.023)	0.529 ^{***} (0.023)	0.540 ^{***} (0.024)
Permanent Contract (d)	0.028 (0.081)	0.038 (0.080)	0.019 (0.081)	0.007 (0.090)	0.009 (0.090)
Job satisfaction:					
Somewhat dissatisfied (d)		-0.025 (0.087)	-0.008 (0.087)	-0.007 (0.087)	0.011 (0.086)
Neutral (d)		0.024 (0.100)	0.040 (0.099)	0.040 (0.099)	0.072 (0.097)
Somewhat satisfied (d)		-0.025 (0.075)	0.000 (0.075)	0.000 (0.075)	0.049 (0.076)
Completely satisfied (d)		0.055 (0.075)	0.076 (0.075)	0.076 (0.075)	0.114 (0.074)
Appropriate monthly salary			0.000 ^{**} (0.000)	0.000 ^{***} (0.000)	0.000 ^{**} (0.000)
Average class size			0.002 [*] (0.001)	0.002 [*] (0.001)	0.002 (0.001)
Received amended pay (d)				0.016 (0.060)	0.017 (0.060)
Additional income (d)					-0.074 (0.051)
Impact of income on satisfaction:					
Weak (d)					-0.176 ^{**} (0.070)
Moderate (d)					-0.166 ^{**} (0.065)
Strong (d)					-0.192 ^{***} (0.068)
Very strong (d)					-0.072 (0.063)
N	1502	1498	1498	1498	1498
Pseudo R ²	0.206	0.210	0.219	0.219	0.228
AIC	1629.086	1624.304	1610.631	1612.557	1604.069

NOTE– Marginal effects; robust standard errors in parentheses, (d) for discrete change of dummy variable from 0 to 1.

* $p < 0.10$.

** $p < 0.05$.

*** $p < 0.01$, data was tested for multicollinearity and heteroscedasticity. Reference group is defined by strong job dissatisfaction, and a very weak impact of income on satisfaction.

(see Table 3). Asked to state a ‘fair/adequate’ wage, most teachers specify a wage that far exceeds even the new higher wage implemented by the government (with a median of EGP4,000 and a mode of EGP5,000).

We run a probit regression to question what characteristics are correlated with the decision to provide private lessons (Table 1)⁵. Although gender and age are strongly correlated with the likelihood of giving private lessons, we find that type of contract, actual nominal wage, considered adequate wage, or job satisfaction have little explanatory power. We also notice that the stated amount of what the teacher considers an appropriate salary, the teacher’s age, and class size are statistically significant but insignificantly influence a teacher’s choice. Being male is the decisive variable and has a marginal effect of approximately 50%. The stated impact of income on a teacher’s satisfaction is negatively correlated with the decision to provide private tutoring, opposite to what is expected. The estimation clearly illustrates that a raise in salary will not have an impact on the decision of whether to give private tutoring classes. This confirms the results of the analytical model and proves that increasing teachers’ wages will, on its own, be an insufficient policy to discourage FPT. In addition to the variables shown here, years of teaching experience, occupational grade,

⁵ A Logit regression resulted in identical signs and values of a similar scale to those of the probit regression presented here. The Akaike Information Criterion suggests the probit is a higher quality model for our data.

satisfaction with the educational system, evaluation of whether the monthly salary is adequate for appropriate living conditions, as well as the stated effect of financial income (see Table 2) have no statistically significant impact on the decision to give private lessons. This result is supported by a UNDP report (UNDP 2010), which also suggests an increase in salaries will have very little effect on the provision of FPT. This implies the rationale for FPT provided by teachers (large classes and low pay) lacks credibility.

The discussion reveals FPT to be a product of the institutions of the Egyptian education system: a lack of checks and balances, acceptance by parents, and the difficulty of reform.

4. The model

Since FPT cannot be abolished by fiat, the focus needs to be on a shift in the behavior of all actors involved. Our game theoretic model focuses on the motivations of teachers, while studying the evolutionary dynamics of their reaction to endogenous changes in the environment in which they interact. We use this to study the long-run dynamics and conditions for a lasting shift to an equilibrium in which FPT does not occur. Our model will highlight parameters affecting either teaching quality or the likelihood of a normative shift.

In contrast to standard principal-agent models (such as Biswal, 1999, 1993; Iversen et al., 2007), shirking in our model is not a result of an information asymmetry. Hypothetically, teaching effort could be contracted and measured (e.g. through student feedback or spot

Table 2
Incentives to Give Private Lessons for Teachers - Teachers' Responses in Percent.

Positive	Nature of Effect (%)			Degree of Effect (%)				
	Positive	No effect	Negative	Very Weak	Weak	Moderate	Strong	Very Strong
Financial income	91.8	1.9	6.3	17.1	16.2	15.4	22.8	28.6
Compliance with Law	26.5	24.7	48.8	34	14.7	15.7	21.3	14.3
Financial Incentives	41.5	44.7	13.8	52.4	9.7	10.4	11.9	15.6
Good Reputation	51.1	22	26.8	29.6	12.3	15.2	17.7	25.2
Perception of Family	49.2	33.2	17.6	41.6	10.6	16.8	16.8	14.2
Perception of neighbors	21.2	39.8	39.1	50.6	5.3	19.3	16.8	8
Perception of colleagues	19.2	44.8	36	55.7	6.2	16.6	14	7.5
Perception of students	30.7	33.5	35.8	43.4	10.1	17.1	17.4	12
Perception of parents	25	29.8	45.1	39.6	5.7	18	21.9	14.8
Perception of friends	22.2	51.7	26.2	61.9	4.2	14.4	10.9	8.6

Factors Affecting the Satisfaction - Teachers' Responses in Percent

	Very Weak	Weak	Moderate	Strong	Very Strong
Income	6.7	15.2	27.1	16.7	34.3
Student love and respect	0.3	0.9	9.6	30.2	58.9
Professional ethics	0.6	0.7	3.7	27	68
Reputation	0.3	0.7	3	21	74.9

Table 3
Effect of Monthly Income on Satisfaction - Teachers' Responses in Percent.

	very weak	weak	moderate	strong	very strong	Sample size
less than 500	46.2	15.4	23.1	15.4	0	13
501 - 1200	6	16	27.7	17.9	32.4	318
1201 - 2000	7.3	14.4	26	17.7	34.7	724
2001 - 2500	5.9	15.3	28.9	14.4	35.4	353
2501 - 3000	2.5	17.5	28.8	12.5	38.8	80
3001 - 3500	0	25	12.5	12.5	50	8
3501 +	0	0	50	50	0	2

NOTE.- Correlation Coefficient: 0.034
Sig. (2-tailed / Spearman's rho): 0.192

Adequacy of A Teacher's Gross Monthly Salary to Allow for Appropriate Living

	not at all	not	somewhat	adequate	very	Sample size
less than 500	69.2	15.4	7.7	7.7	0	13
501 - 1200	31.4	46.2	18.2	4.1	0	318
1201 - 2000	28.7	44.8	23.5	3	0	724
2001 - 2500	29.7	41.1	24.4	4.2	0.6	353
2501 - 3000	17.5	47.5	27.5	6.3	1.3	80
3001 - 3500	12.5	75	0	12.5	0	8
3501 +	0	100	0	0	0	2

NOTE.- Correlation Coefficient: 0.071**
Sig. (2-tailed / Spearman's rho): 0.006

checks), but the public employee nature implies complete security of employment - even if low effort is observed.

4.1. Definitions and best responses

A teacher will receive a wage; w , for her role as a public sector employee. This wage is independent of in-class effort e . On the one hand effort is costly, but on the other hand, if observed, effort is linked to higher social reputation and status.⁶ In our model the former is given by $c(e)$ and the latter by $s(e)$.

If she partakes in FPT, she will receive additional income \bar{w}^t . This will depend on demand and wage rate (w^t). We are ignoring income from private tutoring that is not forced, i.e., not induced by a low effort level in class. Demand for FPT *increases* if a teacher exhibits *less* effort in class. Social pressure p provides an extrinsic motivation to discourage abusive teachers⁷. Assuming that this can be mitigated though

⁶ For the effect of social variables and their link to private tutoring, see Table 2 which has informed our model.

⁷ The specific types of social pressure, which can be exercised on abusive

increased effort in her public work then $p'(e) < 0$.

We can thus define a generic additive utility function for a teacher who partakes in private tutoring:⁸

$$U^{PT} = w - c(e) + s(e) + \bar{w}^t(w^t, e) - p(e) \tag{1}$$

with $e \in (0,1)$ and $\frac{\partial c}{\partial e} > 0$, $\frac{\partial^2 c}{\partial e^2} > 0$, $\frac{\partial \bar{w}^t}{\partial e} < 0$, $\frac{\partial p}{\partial e} < 0$, $\frac{\partial^2 p}{\partial e^2} \geq 0$, and $\frac{\partial s}{\partial e} > 0$.⁹

(footnote continued)

teachers, and the required conditions will be discussed in the next section.

⁸ Additive separability is frequently assumed in the literature on social utility, following Fehr and Schmidt, 1999.

⁹ See Table 2, but notice that good reputation and private tutoring are positively related, which seems contradictory to the model. The previous section illustrated that parents see private tuition as a necessity. Accordingly, a teacher who provides a good performance during her private classes and is able to blame class size and curriculum for her bad performance during regular class hours is respected by the pupils' families. For simplicity and subject to the policies elaborated in Section 5, we rely on the assumption that parents do not perceive private tuition as a necessity and do not observe the effort level during

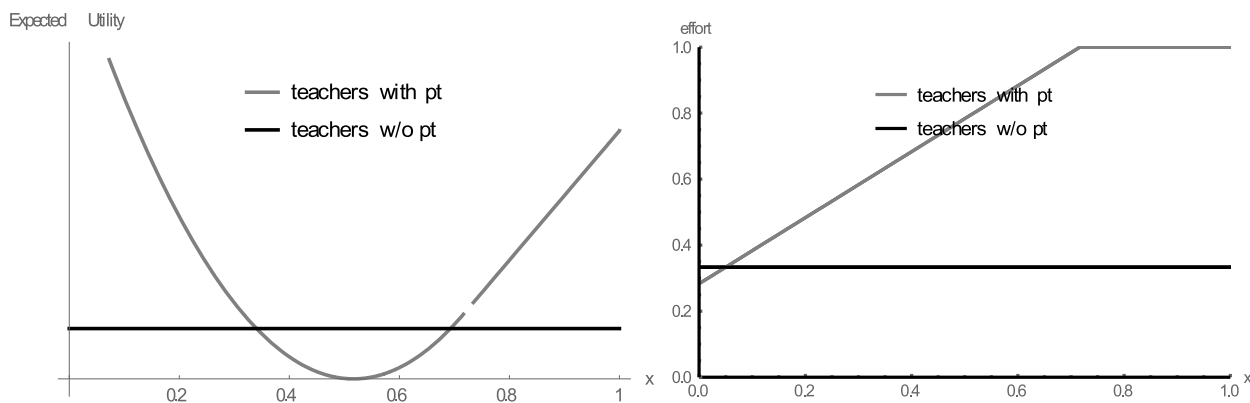


Fig. 1. Expected Utility of Teachers Following FPT vs. Teachers Without FPT, Given the Share of the Latter, and the Corresponding Effort Levels.

The first order condition of Eq. 1 determines the optimal effort level:

$$s' - p' = c' - \bar{w}' \tag{2}$$

The left-hand side defines the marginal benefits from increasing the effort level: higher status and lower social punishment. The right-hand side comprises direct disutility from effort and forgone revenues from FPT.

Assuming a more stringent functional form we are able to illustrate the dynamics and derive qualitative results of policies on teachers' behavior:

$$U^{PT} = w - \frac{ce^2}{2} + (k - \beta e)w^t - \rho x (\hat{e} - e) + \sigma e \tag{3}$$

where k and β determine the demand for FPT, with β being a weight which determines the increase in demand the teacher is able to induce through reductions in effort in class.¹⁰ For consistency, we assume $k > \beta$. Notice that an increase in k can also be interpreted as a determinant of the market power of teachers, whereas an increase in β implies that a teacher gives more weight to the social cost and less to the financial gains derived from FPT.

The effectiveness of social pressure is jointly determined by ρ and the share of teachers who do not partake in private tutoring, x . This social pressure is mitigated as effort in the public school increases towards a normative effort level as expected by society $\hat{e} \in (0,1)$. We combine here two effects. As FPT becomes less frequent, the pressure on those teachers who still rely on this practice increases. Pressure is more extensive the more a teacher's effort in class underperforms expected effort. Note that assuming $\hat{e} < 1$ can lead to a situation in which the optimal effort level of a teacher adhering to FPT exceeds \hat{e} . In this case, ρ defines social recognition for providing strong effort.

The teacher thus faces the following tradeoff: decreasing effort will increase demand for FPT and lower disutility from her day job, whereas increasing effort reduces social pressure relating to her moonlighting activities and increases reputation. Optimal effort is thus:

$$e^{PT*} = \frac{-\beta w^t + \rho x + \sigma}{c} \tag{4}$$

In accordance with our results, optimal effort is independent of income from regular teaching. It increases with social status, the effectiveness of social pressure, and the share of teachers who abandon FPT. However, it decreases in income from FPT and the effort elasticity of demand, as well as the marginal cost of effort. If the vast majority of

(footnote continued)

these hours, but will look at the actual performance of a teacher in class after proper policies have been instated.

¹⁰ Although our model assumes FPT is caused by shirking, similar results would follow if teachers were using techniques such as intimidation (which would enter the functions $s(\cdot)$, $w^t(w^t, \cdot)$, $p(\cdot)$ in the same way as effort).

teachers do not undertake FPT, those in the minority will increase their effort in the public school in order to reduce potential ostracism. Utility will then be defined by:

$$U^{PT*} = w - \rho x \hat{e} + kw^t + \frac{(\sigma - \beta w^t + \rho x)^2}{2c} \tag{5}$$

A teacher who does not undertake FPT will forgo the additional income but is not exposed to social pressure:

$$U^{NPT} = w - \frac{ce^2}{2} + \sigma e \tag{6}$$

Optimal effort level is thus:

$$e^{NPT*} = \frac{\sigma}{c} \tag{7}$$

This equation simply states that effort is increasing in reputation and decreasing in the cost of effort. If $\beta w^t > \rho x$, the effort of a teacher relying on FPT is lower than the one of a teacher abandoning the practice. Therefore, if a teacher chooses to continue FPT in the presence of a large share of the population that abandoned the practice, the teacher will only do so at a high effort level in school in order to mitigate the social stigma. Fig. 1 illustrates that whilst teachers who undertake FPT are affected by the current norm (i.e., the value of x), those who do not are unaffected.¹¹

Utility of a teacher who abandoned FPT is:

$$U^{NPT*} = w + \frac{\sigma^2}{2c} \tag{8}$$

4.2. The dynamic perspective

We use evolutionary game theory to study the system's dynamics after a change in the relevant parameters. Each teacher will occasionally compare their strategy to those of other teachers and will replicate those strategies which achieve a higher utility. The population of teachers thereby dynamically converges to the optimum level of effort over time, and each teacher acts as if she were indeed rationally maximizing utility. These dynamics are approximated by the following replicator dynamic¹²:

$$\dot{\theta}_i = \theta_i(U(\theta_i) - \bar{\theta}) \tag{9}$$

¹¹ Parameters were chosen as follows: $w = 0$, $k = 0.8$, $\beta = 0.3$, $w^t = 2.5$, $\rho = 15$, $\hat{e} = 0.8$, $\sigma = 5$, $c = 15$. These values will serve as a baseline for the following graphs.

¹² This type of replicator dynamic can also be used in the case in which teachers sometimes switch to a welfare reducing strategy (see Boyd and Richerson, 2002 for a discrete example), and further generalizes a number of other updating algorithms (see Weibull, 1995, Section 5.3).

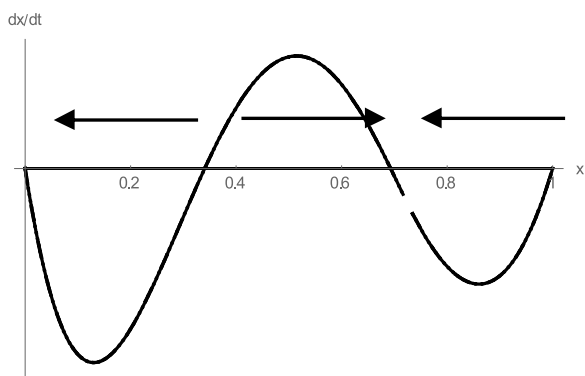


Fig. 2. The System's Dynamics.

NOTE.– A positive (negative) value indicates that the share of non-tutoring teachers will increase (decrease).

where θ_i describes the frequency of a strategy i in the population, $U(\theta_i)$ the utility granted by this strategy, and $\bar{\theta} = \sum_i U(\theta_i)\theta_i$ the average utility in the population. Simplifying Eq. 2 and using our earlier notation of x for the proportion of teachers not taking part in FPT, we obtain:

$$\dot{x} = \frac{dx}{dt} = x(1-x)(U^{NPT^*} - U^{PT^*}) \tag{10}$$

Consequently, the share of non-tutoring teachers increases (decreases) if Eq. 10 is positive (negative). The system is in equilibrium whenever a homogeneous norm exists ($x_1^* = 0$ or $x_4^* = 1$) or at an interior state $x_{2,3}^*$ at which both strategies offer an identical utility.¹³ Fig. 2 plots Eq. 10 for the parameters chosen in Fig. 1. The system has four equilibria with alternating stabilities. The one in which all teachers undertake FPT is stable, the interior equilibrium at 34 percent is unstable, the larger interior equilibrium at 70 percent is stable, and the pure equilibrium on the right, at which no teacher relies on FPT is unstable. The dynamics correspond to the utilities plotted in Fig. 1.

At a frequency slightly below (above) the left interior equilibrium it is best for a teacher to enforce (relinquish) private classes. Few idiosyncratic choices eventually lead to a displacement from one stable equilibrium to another. For this to occur in the example of Fig. 2, a minimum share of 34 percent of all teachers must choose to abandon FPT, whereupon 36 percent will follow, and the population will stabilize on the second interior equilibrium. The first interior equilibrium therefore defines a threshold of enforcing teachers that need to be incentivized by an external action to abandon FPT. Once a policy effectively encourages this percentage of teachers, other teachers will follow until the second interior equilibrium is reached.

Once a population has entered this state, no more external reinforcement is necessary. Thus, the first interior equilibrium defines the likelihood of transition between the two norms. The self-enforcing nature of a norm implies that once the threshold is crossed, no further intervention is necessary. However, if this critical number is not reached FPT will stabilize again as a prevalent norm. In the absence of a second stable interior equilibrium, only two stable norms exist: all adhere to FPT; or FPT is completely abandoned. It is important to understand in which way the parameters (and therefore policies) change the position of the interior equilibria and reduce the critical proportion of teachers necessary to induce a shift to the low FPT-norm. In addition, we are interested in the direct effect of parameter changes on teachers' effort levels.

¹³ Solving $U_i^{NPT^*} = U_i^{PT^*}$ for x provides two roots: $x_{2,3}^* = \frac{c\hat{e} - \sigma + \beta w^t \pm \gamma}{\rho}$, with $\gamma = \sqrt{(c\hat{e} - \sigma)^2 + 2c(\beta\hat{e} - k)w^t}$. If both roots are in the unit interval, one interior equilibrium will be asymptotically stable, the other unstable.

4.3. Comparative statics

Fig. 3 illustrates the effect of parameter changes on optimal effort level in class (left panel) and the interior equilibria (right panel). Proofs are given in the appendix.

The impact of a reduction in effort on demand for FPT (β) does not affect e^{NPT^*} , as can be also seen from Eq. 7, but will decrease e^{PT^*} . Raising β shifts both equilibria away from the center, and therefore will positively affect the likelihood of a transition away from the “all FPT state” and increase the share of teachers abandoning FPT at the new norm (as shown in Fig. 3). In situations with very low, only the “all FPT state” is stable, since U^{NPT^*} is always less than U^{PT^*} (also shown in Fig. 3).

An increase in the cost of effort (c) decreases the optimal effort for both types of teachers. The impact of c on the system's equilibria depends on the size of market power (k) and income from FPT (w^t). If these are sufficiently small, an increase in c shifts both interior equilibria away from the center. If, on the other hand, both are large, an increase in the costs will move both equilibria towards the center and thus, will make a transition less likely and will discourage fewer teachers to abandon FPT.

The expected effort level (\hat{e}) has no impact on the optimal effort levels, but an increase in \hat{e} diminishes the utility from FPT proportionally to ρ and shifts the interior equilibria away from the center.

An increase of social pressure (ρ) positively affects the optimal effort provided by teachers partaking in FPT. An increase in ρ shifts both interior equilibria to the left. This implies that a transition from the “all FPT state” to a mixed state becomes more likely. An increase in the likelihood of a transition through an increase in ρ comes at the cost of fewer teachers abandoning FPT at the new norm.

The effect of social status (σ) on the system's dynamics is non-linear and depends on the relative size of σ itself. When the social status benefits compensate for the cost of expected effort ($c\hat{e} < \sigma$), an increase of social status moves both equilibria away from the center. At low levels a small increase of σ has the inverse effect. A higher status generally has a positive effect on the effort level of both groups.

A higher income from private tutoring (w^t) will generally shift the left interior equilibrium to the right, thus making a transition less likely. The impact of a rise in w^t on the right interior equilibrium depends on the relative size of c and β . If both are sufficiently large, an increase of w^t shifts the right interior equilibrium further to the right. A rise in w^t will lead to lower effort levels in class of those teachers who practice FPT.

5. Discussion

We acknowledge the importance of streamlining the existing curriculum, decreasing the density of classes, guaranteeing adequate resources, and providing effective and accountable leadership (Shannon and Bylisma, 2007), but argue that policies implementing a change along these lines can only achieve their aims of improving the quality of education if the social acceptance of FPT and the incentive structure of teachers are also addressed. FPT has developed into a substitute for the regular schooling system, and therefore changes to the regular system will have limited effects if teachers and parents still perceive FPT as a viable alternative. Only if teachers, students and parents perceive FPT as socially unacceptable under a properly working education system which does not incentivize FPT (and both parents and students are empowered to benefit from these changes), can FPT be abolished.

The OECD recognizes the self-reinforcing character of established norms and structures, and the need to break them to minimize resistance to change by teachers and decision-makers (OECD, 2015). Similar to McLaughlin (1987), we argue that enduring change cannot be accomplished without changing teachers' practices and their incentive structure. Thus, in the following we exclusively focus on possible policies that can change awareness, perception, mentality and the balance

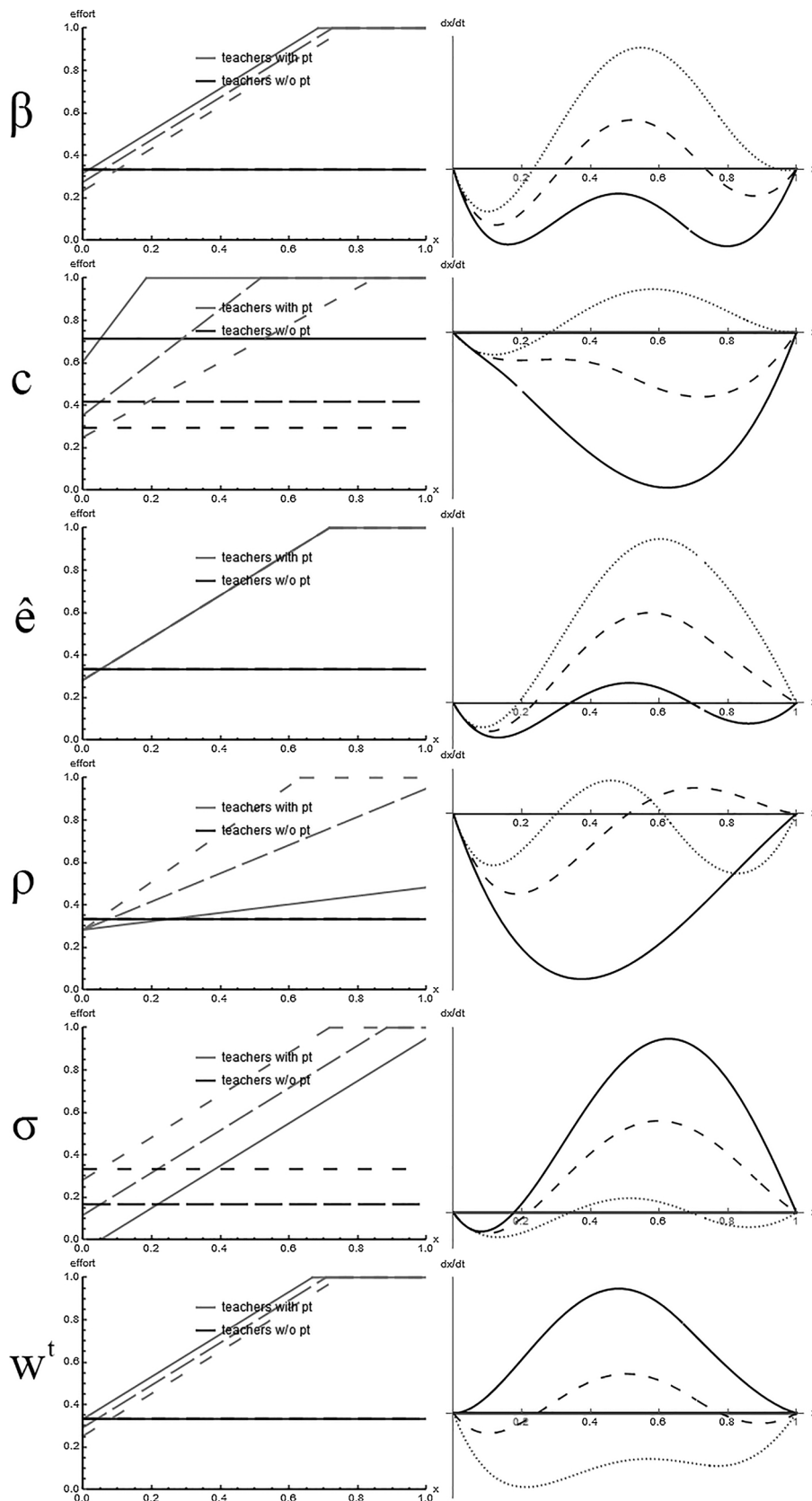


Fig. 3. Baseline as in Figs. 1 and 2: see footnote 13. Parameters are (3rd value indicates the step size): $\beta \in (0.1, 0.6; 0.25)$, $c \in (7, 17; 5)$, $\hat{e} \in (0.8, 1; 0.1)$, $\rho \in (3, 17; 7)$, $\sigma \in (0, 5; 2.5)$, $w^t \in (0, 4; 2)$. The less solid line indicates a higher parameter value.

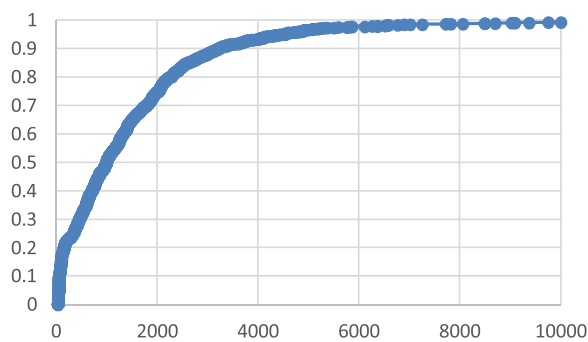


Fig. 4. Cumulative Distribution Function of Household Cost of Private Tutoring.

NOTE.— Authors’ calculations from the results in Table 4. 25% of the households pay more than EGP 2000, and 50% pay more than EGP 1000. The willingness to pay for a school that does not rely on private tutoring can be directly inferred from the graph.

of power. We stress the importance of then addressing the other issues plaguing the educational system once the former policies have been implemented.

In our model, there are multiple stable equilibria: one in which the uptake of FPT is high and another in which it is low. The parameters in our model (β , c , \hat{e} , ρ , σ , w^l), determine the fraction of students receiving FPT in each case and the unstable equilibrium’s position determines the thresholds for switching from one equilibrium to the other. In addition, most of these parameters affect the effort level of teachers. Our model points out several problems that policy-makers face while designing strategies and procedures that limit the use of FPT. First, the effectiveness of policies aiming at the disutility of teaching (c) and status effects (σ) are interdependent and vary with respect to the market power of teachers, the returns from FPT and socially expected effort levels. Second, policies can face a trade-off between short-run benefits and positive long-run effects. Policies improving the teaching condition (c) and the status of teachers (σ), and mitigating the impact of a reduction in effort (β) may encourage a short-run increase of effort at the cost of the ability to encourage a normative shift after which FPT is less socially accepted. Third and most importantly, some policies may trigger unpredicted consequences, since their impact is strongly non-linear. Effecting norm changes is thus far from straightforward and renders the development of standardized policies complicated. Well-defined approaches will require a closer look at the specific local context and the literature has shown that by working with the relevant stakeholders, progress can be made. However, in the following, we propose some general policies that should be helpful in reducing FPT by focusing on a set of strategies that increase the socially expected level of effort (\hat{e}), strengthen the ability to exercise social pressure on teachers

resorting to FPT (ρ) and reduce the potential gains from FPT (w^l).

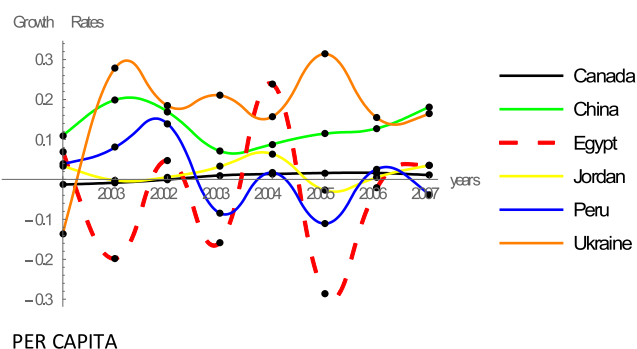
In general, reform needs to give parents and students resort to legal and administrative options that enable individuals to unilaterally reduce their demand for FPT. Strategic complementarities can ensure that a policy is especially effective if the decision by some parents to switch pushes the system past the critical level at which a norm in which FPT in unacceptable is self-reinforcing.

We believe that it should be possible to encourage the entry of private schools that offer schooling at prices close to the fees some parents are spending on FPT, thereby reducing the ability of teachers to generate profits from low in-class effort: parents are on average paying an additional EGP 2200 (see Table 4), per child, for FPT per year. We found that 92.5 percent of the parents would choose to pay an equivalent amount for a public or private primary school, if schooling was offered without the need for FPT. This solution requires that administrative hurdles for establishing new schools are eased, and that accreditation procedures are simplified. If there is robust competition between private schools, the headteachers will be incentivized to prevent FPT and this will provide a serious alternative to studying at a corrupt public school. This in turn, will also decrease the ability of teachers at public schools to resort to FPT. We acknowledge that currently, teachers at private schools also resort to FPT, some even charge higher fees. Therefore eliminating FPT requires that, as customers, parents have the necessary bargaining power to force a private school of their choosing to avoid FPT.

The system of FPT that we observe results from giving teachers control over the exam setting, and therefore progression, during early school years (except for years 3 and 6). These arrangements incentivize teachers to provide private information to students they privately tutor. The ability to reveal information on exams can be restricted by designing a set of exams independently of public teachers and exclusively based on the current syllabus, which are sent in sealed envelopes to the schools only shortly before the exam date. Examination (i.e., how points are awarded) should be rendered transparent for students and parents. Independently set exams would limit teachers’ ability to pass on exam-specific information during FPT.

Our analysis shows that FPT is partially the result of a coordination failure among parents and students. Awareness raising programs by the Egyptian government, which state parents’ and students’ rights and shapes their expectations can help to increase the normative effort level of teachers as expected by society. Awareness raising programs should also focus on school leaders who are crucial in changing the learning culture and teacher motivation (McCarthy et al., 2011). These require transparency and reward-oriented decision-making, and their successes could be leveraged through communications and engagement plans which could help build momentum on the reform efforts (OECD, 2015). Parents must be given opportunities to act collectively. The changing perspective of Egyptians towards democratization in the post-Mubarak

GROWTH RATES OF REAL WAGES IN THE EDUCATION SECTOR



INCOME IN SECTOR AS SHARE OF GDP

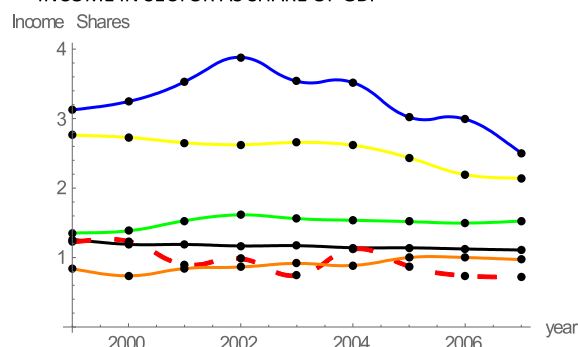


Fig. 5. Growth Rates of Real Wages in the Education Sector and Income in Sector as Share of GDP Per Capita.

NOTE. – Authors’ calculations using available World Bank Data

Table 4
Yearly Cost in EGP for Private Tutoring and School Fees: Cost Per Subject and Per Child.

	Arabic studies	English	French	German	Math
Average	323.3	316.16	595.5	1401.11	306.5
SD	310	319	568	2507	322
Median	245	240	400	480	225
Minimum	20	30	32	210	20
Maximum	8000	8000	2800	8000	8000
Number of Observations	1503	1549	44	9	1565

	Science	Social	Total Cost per Child	Total Cost per Family
Average	309.18	291.88	881.45	1479.36
SD	356	348	1416	2120
Median	240	225	605	1000.5
Minimum	20	16	35	35
Maximum	8000	8000	48700	48700
Number of Observations	908	873	2494	1486

Yearly Cost in EGP for Additional Remedial Lessons: Cost Per Subject and Per Child

	Arabic studies	English	French	German	Math
Average	146.46	140.7	199.23	36	147.75
SD	91	72	108		82
Median	120	120	200		135
Minimum	12	30	30		8
Maximum	1080	480	480		675
Number of Observations	472	400	13	1	434

	Science	Social	Total Cost per Child	Total Cost per Family
Average	157.16	155.53	491.64	698.39
SD	88	85	337	523
Median	160	160	400	560
Minimum	30	40	50	50
Maximum	675	675	2700	4000
Number of Observations	263	250	554	390

NOTE– Values are calculated from the individual responses of parents on costs per week and subjects taken.

Table 5
Growth Rates of Real Wages in the Education Sector and Income in Sector as Share of GDP Per Capita.

	Income Median	Income Mean
Average	1069.71	1480.23
SD	3332	4591
Median	337.5	466.83
Minimum	12.5	17.4
Maximum	35714.25	49200.8
Number of Observations	844	844

NOTE– Based on the calculated average and median fees, as stated by parents. The average monthly wage was EGP 435.20 in public schools between 1999–2008, based on available World Bank Data.

Table 6
Methods used by Teachers to Force Students to take Private Classes.

Mis-treatment	Expulsion from class	Arbitrary scores	Teacher does not explain	other (mention)
11.8	78	11.8	5.5	1.2

Reasons for Sending Children to Private Tutoring - Parents' Responses in Percent

Poor teaching	Crowded classrooms	Special care	difficult curriculum	desire to excel
26.4	42	10.1	48.3	49.9

era, may incentivize them to participate in the decision-making process in schools. Regular parent-teacher evenings can promote awareness and 'bottom up accountability' by facilitating communication amongst

Table 7
Reasons for Dissatisfaction and their Importance - Parents' Responses in Percent.

	not at all	not	somehow	important	very imp.
Difficult curriculum	1.8	7.6	15.6	34	40.9
Teacher relies on memorization	0.9	4.3	15.4	39	40.4
Teachers lack commitment	0.3	1.8	4.4	18.9	74.6
Private lessons	0.3	1.3	2.4	13.6	82.4
Crowded classrooms	0.6	1.7	3.6	21.3	72.7
Mistreatment by teacher	8.1	9.3	27.9	31.6	23.1
Bad student behavior	9	5.1	11.1	28.8	54

Table 8
Actual Number and Appropriate Number of Students in Class - Teachers' Statements.

	Students in Class	Appropriate number
Average	52.3	31.2
SD	12	6.5
Median	50	30
Mode	50	30
Minimum	10	15
Maximum	80	60
Number of Observations	1498	1498

parents (see [Serra et al., 2011](#)) and strengthening social pressure, reputation, and expectations. Motivation for parents to monitor teachers only works if the benefits of education for their children are well understood. The benefits of better education, especially for girls, is not

Table 9
Importance of Reasons for Students to Drop Out - Teachers' Responses in Percent.

	very weak	weak	moderate	strong	very strong
Congested classrooms	4.4	12.1	20.2	28.9	34.3
Difficult curricula	2.5	12.6	29.9	27.9	27.1
Access to school	35.3	34.4	17.9	6.4	5.9
Need for family assistance	3.9	11.4	17	29.6	38.1
Family culture	15.7	19.8	18.4	18.6	27.4
Health	31.8	30.8	19	7.1	11.3

limited to employment. It can also positively influence child mortality and fertility (see Singh and Samara, 1996). Understanding this has been shown to strengthen parental involvement (see Avisati et al., 2010 for a summary of the benefits, and OECD, 2012; Stacer and Perrucci, 2013; Domina, 2005; Driessen et al., 2005; Stevenson and Baker, 1987 for the impact of socio-economic variables on parental involvement).

For the same reasons, electronic evaluation platforms can strongly encourage teachers, but require students and parents to participate (see Avery et al., 2006; Dommeyer et al., 2004) and to have regular access to Internet. According to our data, roughly half of the households possess a computer, but only 20% have unrestricted Internet access, and computer literacy is low. 60.6% of all parents responded that their child's computer literacy is either weak or very weak. Under these conditions, public schools should offer access to the platform but exclude any possibility of manipulation by teachers or members of the school. In order to strengthen the reputation effect, outstanding teachers can be awarded prizes and receive public recognition (on awards, see Frey, 2005).

An approach that has been successful in Chile, Hong Kong, Sweden, and the US (see Shafiq, 2010, for a critical discussion) is permitting parents to co-determine the money a school receives. If parents are willing to pay a bonus to schools which receive a high evaluation by their students, headmasters and teachers may be willing to exercise peer-pressure on those teachers who harm a school's reputation. However, this approach will function only if the income from FPT is relatively low compared to the bonus payment. Requiring a large bonus, on the other hand, would disadvantage low-income households, who are unable to finance the education of their children, thereby increasing the dependence of education on income. To avoid this problem the government can fund the system through vouchers issued to each family allowing them more choice regarding the public school to which

Appendix A

Proofs
Given

$$x_2^* = \frac{c\hat{e} - \sigma + \beta w^t - \gamma}{\rho}$$

And

$$x_3^* = \frac{c\hat{e} - \sigma + \beta w^t + \gamma}{\rho}$$

$$\text{for } \gamma = \sqrt{(\sigma - c\hat{e})^2 + 2c(\beta\hat{e} - k)w^t}$$

Proof for β :

$$\frac{\partial x_3^*}{\partial \beta} = \frac{w^t + \frac{w^t c \hat{e}}{\gamma}}{\rho} > 0$$

The effect of β on the right mixed equilibrium is positive

$$\frac{\partial x_2^*}{\partial \beta} = \frac{w^t - \frac{w^t c \hat{e}}{\gamma}}{\rho} < 0$$

Only if

they can send their child, and creating financial incentives to offer a better quality of education to pupils in public schools. Again, this requires a simplification of the administrative hurdles and a reduction of the costs to establish a new private school.

6. Conclusion

This paper is one of the few attempts to shed light on the phenomenon of the excessive and forced private tutoring (FPT) in Egyptian public schools. This form of private tutoring has severely impeded the quality of the educational system, and has left Egypt as one of the lowest ranking countries with respect to educational quality, potential for growth and international competitiveness.

It allows for an informal market and corrupt system to develop that does not grade students based on their performance but on their parents' willingness and ability to pay. It has taken the responsibility to provide good public education out of the hands of the state and placed the burden on parents, thus concealing the insufficient remuneration of public school teachers, and imposing a social inequity on those most dependent on state support. This situation is found in many regions (e.g., the MENA region, South Asia, Eastern Europe), making the results of this paper attractive for scholars focusing on other developing countries.

The paper is based on a comprehensive and novel empirical data set made available to the Egyptian Center for Economic Studies. By combining both data and evolutionary theory, the paper takes the incentive structure of teachers in a social context into account. Based on our data, we define crucial monetary and social variables that determine a teacher's choice to consciously reduce teaching quality during regular hours to increase demand for private tutoring. Going beyond a purely empirical analysis while considering the reciprocal social feedback effects of the teachers' choices on their welfare enables us to study the impact of policies on two crucial factors – a teacher's effort in class, and the likelihood of a perpetual and self-reinforcing abandonment of the practice of FPT by a large number of teachers.

In this way, the paper illustrates that simply raising a teacher's income – as has been done by the Egyptian government - is an inadequate measure to increase performance, yet in conjunction with other actions, it can form a vital ingredient to improve teaching quality. Thus, the paper elaborates a set of actions that focus on social elements of individual choice and can thereby help abandoning FPT in the long-run, while encouraging higher levels of effort and better teaching quality.

$$\Rightarrow \gamma < c\hat{e}$$

Proof by contradiction: If

$$\gamma > c\hat{e}$$

and from (4) and (7)

$$0 < \frac{-\beta w^t + \rho x + \sigma}{c} < 1 \text{ and } \frac{\sigma}{c} < 1 \text{ for } x = \frac{c\hat{e} - \sigma + \beta w^t - \gamma}{\rho}$$

Implying

$$0 < \frac{c\hat{e} - \gamma}{c} < 1 \text{ and } \sigma < c$$

Which contradicts

$$\gamma > c\hat{e}$$

Therefore, $e^{PT*} = 0$ at $x_{2,3}^*$

For $e^{NPT*} = \frac{\sigma}{c}$ and setting in the corresponding U^{PT*} and U^{NPT*} in (10), we have Case1:

$$x_{2,3}^* = -\frac{\sigma^2 - 2ckw^t}{2c\hat{e}\rho}$$

Therefore

$$\frac{\partial x_{2,3}^*}{\partial \beta} = 0$$

For $e^{NPT*} = 1$ we have

Case2:

$$x_{2,3}^* = \frac{c - 2\sigma + 2kw^t}{2\hat{e}\rho}$$

Therefore

$$\frac{\partial x_{2,3}^*}{\partial \beta} = 0$$

Proof for c :

We have

$$\frac{\partial x_2^*}{\partial c} = \frac{\hat{e}(\gamma - (c\hat{e} - \sigma + \beta w^t) + kw^t)}{\gamma\rho}$$

$$\frac{\partial x_3^*}{\partial c} = \frac{\hat{e}(\gamma + (c\hat{e} - \sigma + \beta w^t) - kw^t)}{\gamma\rho}$$

For $x_2^* \in (0,1)$, we have

$$(c\hat{e} - \sigma + \beta w^t) > \gamma > 0 \tag{d1}$$

For $x_3^* \in (0,1)$, we have

$$\rho > (c\hat{e} - \sigma + \beta w^t) + \gamma > 0 \tag{d2}$$

For $kw^t \approx 0$, we have

$$\frac{\partial x_2^*}{\partial c} < 0 \text{ and } \frac{\partial x_3^*}{\partial c} > 0$$

For $kw^t \gg 0$, we have

$$\frac{\partial x_2^*}{\partial c} > 0 \text{ and } \frac{\partial x_3^*}{\partial c} < 0$$

Proof for \hat{e} :

We have

$$\frac{\partial x_2^*}{\partial \hat{e}} = \frac{c(\gamma - (c\hat{e} - \sigma + \beta w^t))}{\gamma\rho} < 0$$

$$\frac{\partial x_3^*}{\partial \hat{e}} = \frac{c(\gamma + (c\hat{e} - \sigma + \beta w^t))}{\gamma\rho} > 0$$

due to (d1) and (d2)

Proof for ρ :

We have

$$\frac{\partial x_2^*}{\partial \rho} = -\frac{c\hat{e} - \sigma + \beta w^t - \gamma}{\rho^2} = -x_2^* / \rho < 0$$

$$\frac{\partial x_3^*}{\partial \rho} = -\frac{c\hat{e} - \sigma + \beta w^t + \gamma}{\rho^2} = -x_3^* / \rho < 0$$

Proof for σ :

We have

$$\frac{\partial x_2^*}{\partial \sigma} = \frac{c\hat{e} - \sigma - \gamma}{\rho\gamma} = \left(\frac{c\hat{e} - \sigma}{\gamma} - 1 \right) / \rho$$

$$\frac{\partial x_3^*}{\partial \sigma} = -\frac{c\hat{e} - \sigma + \gamma}{\rho\gamma} = \left(-\frac{c\hat{e} - \sigma}{\gamma} - 1 \right) / \rho$$

Since $\frac{|c\hat{e} - \sigma|}{\gamma} > 1$, given that $\gamma > 0$, we have opposite signs. Thus for $c\hat{e} < \sigma$, we have

$$\frac{\partial x_2^*}{\partial \sigma} < 0 \text{ and } \frac{\partial x_3^*}{\partial \sigma} > 0$$

Proof for w^t :

We have

$$\frac{\partial x_2^*}{\partial w^t} = \frac{\beta\gamma + c(k - \beta\hat{e})}{\rho\gamma} > 0$$

$$\frac{\partial x_3^*}{\partial w^t} = \frac{\beta\gamma - c(k - \beta\hat{e})}{\rho\gamma}$$

Thus for $c \gg 0$ or large marginal benefits from decreasing e we have $\frac{\partial x_3^*}{\partial w^t} < 0$.

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