

# A Fine is a Price<sup>\*</sup>

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## Abstract

The deterrence hypothesis predicts that the introduction of a penalty for a specific behavior, which leaves everything else unchanged, will *reduce* the occurrence of that behavior. We present here the result of a field study of this hypothesis, conducted in a group of day-care centers in Israel.

In these day-care centers, parents sometimes arrive late to collect their children, forcing a teacher to stay after the official closing time. We study the behavior of the parents over three periods. In the first four weeks period we simply record the number of late-coming parents. In the second period, twelve weeks long, we introduce a monetary fine for late-coming parents. As a result the number of late-coming parents *increased* significantly. In the last period of four weeks we observed the effect of cancellation of the fine. Here the result was that the number of late-coming parents remained *stable* at the level prevailing in the second period, hence higher than it was in the first period, before the introduction of the fine.

Our results are not immediately evidence against the deterrence hypothesis. Rather we argue that penalties, (just as rewards), are usually introduced into an incomplete contract, social or private. These penalties may change the information or the perception that agents have of the outcome in the states where the contract is silent, and therefore the effect on behavior may opposite than expected. If this is true, the deterrence hypothesis loses great part of its predictive strength, since the clause ``everything else is left unchanged'' might be hard to satisfy or verify.

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## **Introduction**

Suppose you are a manager of a day-care center for little children. The day-care is scheduled to operate every day until 16:00, when the parents of the children are supposed to come and collect them. However, quite frequently parents arrive late to collect their child, forcing you to stay for some extra time in the day-care after working hours. You are considering few alternatives in order to reduce the frequency of parents coming late. A natural option, which is commonly used in other situations, is to introduce a fine: every time a parent will come late, (s)he will have to pay a fine. Will that reduce the number of parents coming late?

This prediction seems extremely plausible. It is also commonly made in two distinct fields of research: the legal and criminal studies, on the one hand, and psychological studies on the other. In our field study, this prediction is violated: the observed relationship is *significant and positive*.

In particular, we study the effect of fines on the frequency with which parents arrive late to collect their child. Our data includes observations of 11 day-care centers over a period of 20 weeks. In the first 4 weeks we simply observed the number of parents that arrive late every week. At the beginning of the fifth week, a small fine was introduced in 7 out of the 11 day-care centers. In the other 4 day-care centers no fine was introduced, and they serve as a control group. The fine was imposed on parents

coming late 10 minutes or more. The result of introducing the fine was a sharp and significant increase in the number of parents coming late. This increase was more or less stable over the 12 weeks period in which the fine was imposed.

At the beginning of the 17th week, the fine was removed. For the remaining 4 weeks we observed the removal of the fine had no effect on the number of parents coming late. This number remained on the same level as it was when the fine was active and higher than in the initial 4 weeks.

We do not claim that every time a fine is introduced the effect is similar. It is easy to speculate that with a very large fine that no parent would have come late. What this field study teaches us, we believe, is that introducing fines changes the perception of people regarding the environment in which they operate. In particular we argue that, like in many real-life situations, the environment in our study is defined by an incomplete contract. In the specific situation we are considering, the exact consequence of the behavior of the parents was not specified in all detail. For instance, there was no precise set of clauses specifying what would be the consequence of one, two or several occurrences of a delay. Parents could form a belief on that, as they probably did, and act accordingly.

The introduction of the fine into this incomplete contract reshaped the perception of the parents regarding this environment. The precise form and way in which this change takes place is only beginning to be understood: this field study is a step in this direction.

## **2. Related literature**

To contrast this result with the literature we have just mentioned, we proceed first with a discussion of theories and evidence in two different fields of research: legal studies and psychology. We do this for two reasons. First, we think that the evidence we present sheds some light on the relative merits of two main competing explanations. Second, we suggest that the explanation we present for the seemingly paradoxical behavior of the parents is new.

### **2.1 Crime and punishment**

Two main theories are used in the field of legal studies to justify punishment. The first is the deterrence theory, which justifies punishment as a deterrent of future crimes, and is grounded on the assumption that a higher expected punishment produces lower criminal behavior. The second motivation for justification for punishment is retribution for the past crime. Unlike the retribution theories, the deterrence theory can be phrased as an empirical hypothesis. One can test whether the prediction that more severe, faster, and more certain punishment produces a decrease in the level of crime. The literature presenting the deterrence argument goes back at least to Beccaria, Bentham, but also Blackstone (1765-1769: see in particular volume 4, commentary 11-12). This hypothesis has received new strength from major contributions from law and economics. Some of the fundamental papers are Becker (1968), Stigler (1970), Ehrlich (1973), Harris (1970). The literature elaborating on these initial contributions is very

large: a review has been given recently by Ehrlich (1996). It is important to recall that the economic analysis of the effect of a punishment on behavior is not direct, and requires instead a complete specification of the market forces. The equilibrium level of crime is determined by the intersection of a supply and demand curve, and the effects of punishment are determined in the general equilibrium. A change in one of the parameters, like the level of punishment, changes the decision problem of the single agent (and this fact would tend to reduce his preferred level of crime). But it also changes the problem of the others, and their reactions, and therefore again the problem of the single decision-maker. The overall result might not be the reduction one might have anticipated by considering the problem of the agent in isolation. For example, this reduction might be smaller because some have withdrawn from criminal activity, and the returns of crime for you have gone up.

A similar point, in a game theoretic model, has been recently raised by Tsebelis in a sequence of papers: see Tsebelis (1989), (1990a), (1990b) and (1990c). It may be useful to recall here the main idea in a simple model. Tsebelis considers a game between the police and the public. The public may or may not violate a speed limit and the police may or may not enforce the laws against speeding. If the police do not enforce, the public will violate the speed limit. If the police do enforce, then the public will not commit violations: so the game has no pure strategy Nash equilibrium. It has mixed-strategy equilibrium. The probability that the public will commit violation is given by the condition that the police are indifferent between enforcing or not. This

condition insures that this probability only depends on the payoff of the police. In particular it will not change if, for instance by introducing punishments, the payoff of the public changes. Hence the conclusion of Tsabelis is that Penalty has no impact on

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If we turn to empirical analysis, a systematic study of the effect of punishment on crime was developed in the seventies (for a review of this earlier work see Cook (1980), Gibbs, (1975), Zimrig and Hawkins (1973)), and is still in progress. It has reached levels of passion in the debate on the effectiveness of the death penalty, as in the exchange around the 1978 report of the National Academy of Sciences: see Blumstein, A. Cohen, J. and Nagin, D. (1978), and the comments in Ehrlich and Mark (1977).

Evidence has piled up on the side of those denying and those asserting the deterrence effect. See as examples of the second Ehrlich (1973), (1975), Carr-Hill and Stern (1973), Phillips and Votey (1975), Wolpin (1978a), (1978b), Yu, J. and Liska, A., (1993), Yu (1994), Imrohorglu, Merlo and Rupert (1997). As examples of the first, see the evidence presented in Blumstein, A. Cohen, J. and Nagin, D. (1978), Avio (1979), Hoenack and Weiler (1987), as well as the evaluation in McManus (1985). A survey of this literature is given in Liska (1987). Few would claim however that deterrence has no effect, in all cases. The disagreement is on how large the effect is, and what form is more or less effective. For the purpose of the discussion of our

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<sup>1</sup> The conclusion has been analyzed and challenged in several papers: see Bianco (1990), Hirschleifer

results, it suffices to note here that none of these important refinements of the deterrence idea explains, or even considers, the possibility that a penalty might produce an increase in the behavior that is penalized.

## **2.2 Behavior and punishment**

The literature in psychology on this topic is also very large, and is textbook material (for a clear exposition, see Bandura (1969), or more recently Schwartz (1984)). The first to study systematically the connection is Thorndyke (1931), (1932). In his early work punishment represents one half of the Law of Effect: punishment decreases the likelihood of the behavior that produces it, just as a reward increases the likelihood of an action that produces it. Later Thorndyke himself put into doubt the punishment side of the Law of effect. A first test of these conflicting views was given in Estes (1944): his experiments showed that while punishment depressed behavior, it only did it in a temporary way. In addition, this depression was taking place independently of the behavior of the animal (the subjects in his experiments). A host of studies followed, and the conclusion is still controversial.<sup>2</sup>

This large body of literature agrees on few general findings. When negative consequences are imposed on a behavior, they will produce a reduction or a cessation of that particular response. When those negative consequences are removed, the

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and Rasmussen (1991), Ordeshook (1990), Rapoport (1990), Tullock (1991).

<sup>2</sup> Detailed studies of the different effect of intensity, duration, frequency and conditions of negative consequences are in Azrin (1956, 1959, 1960), Azrin and Holz (1966), Chapman (1962), Church (1963), Powell and Azrin (1968), Rotenberg (1959), Solomon (1964).

behavior that has been discontinued will tend to reappear. In some conditions, however, the modification of behavior may become permanent. The changes induced by the punishment may be enduring changes or not, according to several factors. It may change depending on the severity of the punishment, on whether it is associated with the stimulus or only with the actual behavior, and so on. A punishment is most effective in reducing a behavior when it is certain, and it follows immediately that behavior. Finally, adaptation tends to develop to the punishment itself. So if the severity and other parameters of the punishment are left unchanged, its effectiveness tends to decrease over time.

A direct comparison of the results of this evidence with our particular experiment would be misleading. That literature deals with the behavior modification following the introduction of some punishment, as a long lasting effect. In addition, the effect is rarely considered as mediated by foresight of the subject (an exception is the work of Bandura (1969) and in general the Social Learning Theorists.

Some of the experiments arising from the cognitive dissonance and in general the cognitive approach are more directly relevant. For instance the studies of Aronson and Carlsmith (1963) and Freedman (1965) try to determine the difference in the effect of punishments of different sizes. In the Aronson and Carlsmith study children were forbidden to play with a specific toy, under the threat of a mild or more severe punishment, and their liking of the toy was then tested. The hypothesis these experiments are testing, and partly support, is that a mild punishment may have longer



and more lasting effects. The reason for this: the incongruous behavior (of not playing with a toy under a mild threat) induces, to eliminate the cognitive dissonance, the children to think that the desired object is not so worthwhile after all.

Finally, the issue of the effect of punishment on motivation and behavior is of course related to the parallel one of the effect of *rewards* on motivation and performance. Suppose that in a contractual relationship you introduce a reward, which is conditional on performance. Even if the reward is small but *leaves unchanged all the remaining terms of the contract*, it should produce an increase in performance. The literature here is also very large (see Cameron and Pierce (1994), and Eisenberger and Cameron (1996) for recent review and evaluations of the experimental evidence). The conclusions in this direction are even less firm than in the case of punishments.

We may now turn to the report of our study and of the results.

### **3. Procedure**

#### **3.1 Background**

There are two types of day-care centers for children in Israel: private and public. This study was conducted in 11 private day-care centers in the city of Haifa, from January to June 1998. All centers are in the same part of town, with no distinct features that we are aware of between them. In these day-care centers the owner is also the principal. A diploma, which is achieved after two years of studies, is needed in order to be a principal. In all the day-care centers studied the manager stays in the day-

care until 13:00. After that time the assistants are in charge. During the day children are organized into groups according to the age, from one to four years old. The maximum number of children allowed in each daycare is 35, with some exceptions of additional few more children. The fee for each child in the center is NIS 1,400 per month (about \$380 at the time of the study).

In the contract signed at the beginning of the year it is written that the day-care operates between 7:30 to 16:00. There is no mentioning of what happens if parents come late. In particular, before the beginning of the study there was no fine for coming late. When parents did come late, one of the teachers had to stay and wait for them with the child(ren). Teachers would rotate on the task. The task of taking care of children when the parents were coming late to pick them up is considered part of the job of a teacher, and this fact is clearly explained to them at the moment of hiring.

### **3.2 Organization of the study**

At the beginning of the study research assistants went to the day-care centers and asked the principals to participate in an academic study about the influence of fines. It was promised to each manager that at the end of the study she<sup>3</sup> will receive coupons for buying books with a value of NIS 500. The principals were given a telephone number at the university where they could call and verify the details (none of the principals actually did that).

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<sup>3</sup> All the managers in the study (and as far as we know in Israel) are females.

The overall period of the study was 20 weeks.<sup>4</sup> In the first four weeks we simply recorded the number of parents coming late in each week. At the beginning of the fourth week, a fine was introduced in 7 out of the 11 day-care centers.<sup>5</sup> The decision in which day-care to introduce the fine was done randomly. The announcement about the fine was made with a note posted in the announcement board of the day-care center. Parents read the announcement on this board everyday, since important announcements are posted there (such as what to bring on the next morning). The announcement specified that the fine will be of NIS 10 paid for a delay of ten minutes or more. A translation from Hebrew is presented in Appendix 1A. Very rarely parents came after 16:30. The fine was per child; if for example parents had two children in the day-care, and they came late, they had to pay NIS 20. Payment was done at the end of the month, to the principal of the day-care. There are special payments made during the year, which are paid on a monthly basis to the owner, and the fines were added to these payments. The money was paid to the owner, and the teacher who was staying was not getting any additional money. The teachers were of course informed about the fine, but they were not informed about the study. Registering the names of parents coming late was anyway a common practice.

After the 16<sup>th</sup> week the fine was removed with no explanation. The cancellation was done with a note on the board with an announcement similar to the first one. If

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<sup>4</sup> actually it was 21 weeks, with a break of 1 week because of a holiday after week XX. Moreover, week number XXX included only XXX days of study, so the number in that week is calculated as 5/XXX times XXXX.

parents asked why the fines were removed, the principals were directed to reply that the fine had been a trial for a limited time, and that now the results of this trial were being evaluated.

### **3.3 Comparison with other payment and fines in Israel**

A fine of NIS 10 in Israel today is relatively small, but not insignificant. For comparison, the fine for illegal parking is NIS 75; the fine for passing with a red light is NIS 1000 plus penalties; the fine for not collecting the droppings of the dogs is NIS 360. For many of these violations the detection and enforcement rate is however small or even zero, as in the case of the last. On the specific topic of fines for failing to collect dog droppings, see the interesting paper by Webley, Siviter, Payne and Scott (1998). For a different comparison, a baby sitter earns between NIS 15 to NIS 20 per hour. The average gross salary per month in Israel at the time of the study was NIS 5,595.

## **4. Results**

We start by presenting the raw data in Table 1. The first column reports the number of the day-care center in our study, such that the first 7 are the day-care centers in which a fine was introduced and last 4 are the control group. The second column reports the total number of children in the corresponding day-care. The other

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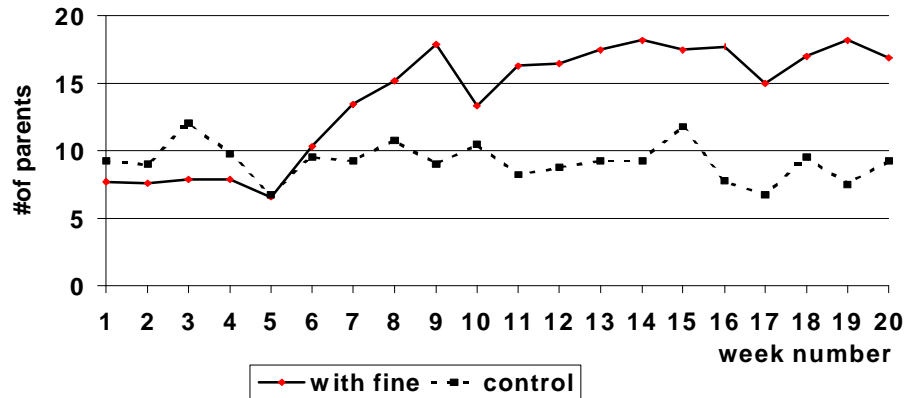
<sup>5</sup> At the beginning there were actually 12 day-care centers, but the recording from one day-care were incomplete and so after the 4<sup>th</sup> we decided not to continue the study in this day-care.

columns reports the number of times per week that parents came late (each occurrence of a delay is a separate item). For example, in week 5, in day-care number 4, we see that 7 times parents came late to collect their child.

-----Insert Table 1-----

As a first indicator for the effect of the fine, we compare in Figure 1 the average number of parents who came late per week in all 7 day-care centers in which the fine was introduced, with the corresponding average in the 4 centers of the control group. This figure seems to indicate a rather dramatic impact.

Figure 1: Comparison of the averages of the two groups



In the group with the fine the number of occurrences of a delay increased steadily in the first three-four weeks after the introduction of the fine, to finally settle at a level higher than the initial one. In the control group, on the other hand, no noticeable change takes place after week 4. The number of late arrivals seems to remain steady after the fine is removed. The rest of the discussion in this section is devoted to test this first informal impression.

Table 2 reports the average number of late-coming parents in the different day-care centers, according to 4 stages in the study (the stage with the fine, weeks 4-17 is divided into two parts).

**Table 2:** Average number of late-coming parents, according to 4 periods: Before the fine (weeks 1-4); The first four weeks with the fine (weeks 5-8); The entire period with the fine (weeks 5-16); The post fine period (weeks 17-2).

Center #	# of Children	week 1-4	week 5-8	Week 5-16	Week 17-20
1	37	7.25	9.5	12.5	15.25
2	35	5.25	9	12.2	13.25
3	35	8.5	10.25	16.8	22
4	35	6.25	5.75	6.3	5
5	34	9	15	19.1	20.25
6	33	11.75	20	24.6	29.5
7	28	6.25	10	13.1	12
8	35	8.75	8	7.2	6.75
9	34	13.25	10.5	10.9	9.25
10	34	4.75	5.5	5.5	4.75
11	32	13.25	12.25	13.1	12.25

The first statistical test we report (in Table A.1 in the Appendix) tests the hypothesis that the increase in the number of parents coming late is simply a time trend, independent of the fact that a fine was introduced. To test this we check whether a time trend exists in the control group. This might happen if, for instance, parents acquire overtime more familiarity with the teachers of the day-care and so feel more justified in stretching the rules a little. The regression shows that we can reject this hypothesis: we found no time trend in the data.

The second regression, presented in Table A.2 of the Appendix, is a linear regression of the number of late parents on the dummy variables for three possible states. The first is the state where no fine is present, the second where a fine has been introduced, and the third is the state where the fine has been introduced and later removed. As can be seen from the table, the effect of the fine is significant, that is, after the fine was introduced significantly more parents came late than before the fine was introduced. This is true also for the last period. That is, after the fine was canceled significantly more parents came late than before it was introduced. The coefficient in the state where the fine has been removed is greater than when the fine was introduced, but this difference is not significant.

A direct test of the hypotheses regarding the distribution of the random variable "number of parents coming late" is provided by the non-parametric Mann-Whitney  $U$  test. First, we find that the number of late-coming parents in the test group and in the control group, before the introduction of the fine (weeks 1-4), is not statistically different; ( $z=1.802, p<.072$ ). Now we state our two main results.

*Result 1:* The effect of introducing the fine was a significant increase in the number of late-coming parents. Two tests support this conclusion. First, the number of late-coming parents in the period of the fine (weeks 5-16) in the test group and in the control group is significantly different. In particular, more parents came late in the centers in which the fine was introduced. [This difference is statistically significant



( $z=4.460$ ,  $p<.000$ ).] Second, the number of late-coming parents before the fine is introduced (weeks 1-4) and when the fine is imposed (weeks 5-16) in the test group is significantly different ( $z=-6.086$ ,  $p<.000$ ).

*Result 2:* Removing the fine did not effect the number of late-coming parents relative to the time of the fine. In particular this number remained higher in the test group than in the control group. Two tests support this conclusion. First, the number of late-coming parents in the period when the fine is imposed (weeks 4-16) and when the fine is removed (weeks 16-20) in the test group is not significantly different ( $z=0.676$ ,  $p<.499$ ). Second, the number of late-coming parents in the period after the fine was canceled (weeks 16-20) in the test group and in the control group is significantly different. In particular, more parents came late in the centers in which the fine was introduced. [This difference is statistically significant :  $z=3.628$ ,  $p<.000$ .]

## **5. Interpretation of the results**

Any model, or explanation, of these results has to provide two specific predictions: first, the fact that the rate of delay increases after the introduction of a fine; and, second, the fact that this rate is stable after the fine is removed.

The literature we have reviewed in section 2 does not seem to provide a satisfactory explanation for both these results. In particular, the controversial issue in the literature was whether punishment induces reduction in the relevant behavior or

not. From either the theoretical or empirical point of view the possibility of an increase in the behavior which is being punished was not even considered.

The models investigated in the literature have at least three properties which are different from the environment of our study. First, the "crime" in our study is very mild, and so are the punishments.

Second, no uncertainty of punishment exist since parents are sure of being detected and fined. And the third difference is that there are no "general equilibrium effects" in our study simply because no other price changed after the introduction of the fine.

The model we suggest is different from all these models in one central assumption: we assume that the fine changes the perception of the agents about the social situation in which they are involved. We present here a few possible explanations of the data, mainly based on this assumption. Later we will discuss their relative merits.

### **5.1 The differential information-incomplete contract model**

In the initial period parents that are not facing a fine can only refer to a partially specified contract to anticipate the consequences of a delay. During the initial operating weeks of the day-care, parents probably acquire some additional information. For instance, they learn that for the mild level of occurrences of late arrivals that actually take place the penalty is not severe. This is of course not sufficient to know that the same would hold for worse behavior on their part. The implicit contract that

the day-care center is presenting to the parents might for example be perceived as follows: "We are going to take care of your children after the closing time when you come late. We are not going to put a price schedule for this extra service, which will be therefore performed for free. Of course this is supposed to be an exceptional case, and you should come late only if it is strictly necessary. If you come late too often, we might do something about it." In order to avoid this unspecified and uncertain, but possibly more serious consequence, parents refrain from too many delays.

The introduction of the fine makes the sure consequence of a delay worse (because, on top of the above, parents have to pay for each delay), but provides information. Note that none of the explicit terms of the contract has changed, neither any of the relevant laws or the widely accepted social norms. The new information is relevant if we consider the incomplete contract between the owner and the parents. The contract is incomplete since the exact terms of payment for coming late are not specified.<sup>6</sup>

The behavior in the first three-four weeks is also consistent with this explanation: parents are slowly testing the reaction of the day-care centers to higher levels of delays. As they see no reaction over and above the fine, they continue to increase their delay. In the final period, after the fine is removed, the information that

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<sup>6</sup> It is essential for this explanation that the contract will be incomplete. The alternative is that the contract was complete before and after the introduction of the fine, and simply changed from one to the other as the result of the unilateral decision of the owners of the day-care center. This argument however does not give us any way to explain why parents increase the number of delays when the price has risen.

the delay is not too bad of course persists. Parents keep coming late because they have learned this fact. If they slightly increase the number of times they come late it is because now the cost of doing so is even smaller than in the second period.

## 5.2 A simple formal model

We now outline, in an informal way, an explicit game to capture the importance of this new information. The players in the game are the day-care owner and a finite group of parents. For simplicity, the game goes on for an infinite number of periods, and players discount their utility of every period. Players play sequentially in each period. First the owner chooses an amount of fine out of a feasible set of fines. If the fine is non zero then she has to pay for the first period a fixed implementation cost. If the fine is zero she pays nothing. After that, each of the parents chooses simultaneously an amount of delay, out of a fixed interval. The payoff for the owner is the fee for that period, minus the cost, call it  $c$ , of the delay to her, all multiplied by the total delay. The payoff to each parent is the value  $v$  of the delay (getting late to the day-care center has a value for him, say because it gives him some flexibility) minus the fee, all multiplied by the amount of the delay. The maximum amount of fee that the owner may charge is randomly determined. It is chosen at the beginning of the game and communicated to the owner only. To fix the ideas, we assume that it is either a large value  $A$  with probability  $p$  or a small value  $a$ , with  $A > v > c > a > 0$ . This is the type of the owner. All the rest is known to every player.

We are going to describe an equilibrium of the game. It is convenient to begin the description from the strategy of the parents. They choose an amount of delay  $d$  which is just enough to make the owner indifferent between paying the cost of introducing the fee and charging zero fee, facing the delay  $d$  each time in the future. Parents keep doing this until some of the parents have chosen a higher delay in the past, or the owner has charged a positive fine. After that, they simply choose in each period the delay that maximizes the payoff for that period.

The owner charges zero fee in each period, until all parents have chosen the delay  $d$  in each of the previous periods, and the owner herself has chosen a zero fine. If any of the players, including her, has deviated in the previous periods, she chooses the maximum feasible fine for all the future periods, irrespective of the action of the other players, including her, in the past periods. Of course, given the strategy, the choice of fine reveals completely her type.

For some  $p$  large enough this is an equilibrium. Again let us begin from the parents. Each of them does not choose a delay larger than  $d$ , because in the event of an owner with  $A$  as a maximum fee his value in future periods will be zero. For large  $p$ , sticking to the equilibrium is better than any one-period gain. After the deviation of some player, including himself, the best one period choice is the best choice, given that he will face in any case the maximum fine according to the owner's type.

The owner is indifferent, if her type is  $A$ , between charging a fine or not (her future payoff is zero in both cases). If she is of type  $a$  she strictly prefers not to charge a fine.

This equilibrium is inefficient. Moreover, the following two facts are easy to see:

1. Suppose that, off the equilibrium path, a type  $a$  owner charges a fine  $a$ . In the equilibrium for that subgame parents now choose an amount of delay larger than  $d$ . In fact, since  $v > a$ , they choose the maximum delay possible. This is now an efficient equilibrium.
2. Suppose that, in this subgame, the owner cancels the fine. Now the parents know that the owner type is  $a$ , and they choose the maximum delay possible.

Both facts, 1 and 2 above, match our data: in the first three-four weeks after the introduction of the fine the level of delay by the parents increased, and then it stayed constant after the fine was withdrawn. It is an off-the-equilibrium path, but in our study the introduction of the fine was not decided by the owner, but by *us*.

### **5.3 Rationalizations**

A slightly different interpretation of the results may be the following. The parents may have thought that the fines were being paid, at least in part, to the teachers. This may have induced some of them to put less care in the time of arrival to

the daycare center, because what earlier was a nuisance imposed on the teachers, could now look like a service against payment, although indirect. The parents knew that the payment of the fine was due at the end of the month, to the owner. They were never told that the teachers were being paid extra, and in fact if they asked, they were told that that the teachers will not be paid more than before the fine was introduced.

In any case, this reason is not very convincing. Usually a relationship between worker and employee is a relatively formal contract, with a well specified payment schedule, that is not likely to be altered as a consequence of changes in the policy of the firm towards the customers. In addition this explanation is particularly hard to believe in light of the results in the third phase. After the fine is removed, it is hard to believe that payments were still being made to teachers

#### **5.4 The cognitive psychology explanation**

A different interpretation of the results is possible. The introduction of the fine may change the perception of coming late and of taking care of the children after closure. According to this interpretation (that we may loosely call ‘cognitive psychology’), in the first period the action of the teachers is interpreted by the parents as a generous, non-market activity. They might think as follows: ‘The contract with the day-care only covers the period until 4pm in the afternoon. After that, a teacher is just a nice person who is generous. I should therefore not abuse of his patience.’”

The introduction of the fine changes this perception into the following: The teacher is taking care of the child as much as she does earlier in the day. In fact this activity has a price (which is called *fine*). I will therefore buy of this service as much as needed.'In the third period, the reasoning just above does not change. Simply, the price of a service has gone down.

### **5.5 Comparison with the IQ experiments**

The explanation we have just suggested may seem more convincing in the light of a different but related experiment of the same authors, that we briefly describe here. The experiments reported in Gneezy and Rustichini (1998) study the effect of *rewards* on performance. In one of them for instance we asked different groups of students to solve an IQ test. To one group we promised NIS 0.1 per question they answered correctly, to a second group we promised NIS 1, and to a third group NIS 3. Finally, we did not mention money to a fourth group. The first group had the *worst* performance, even worse than the last group to which no compensation was offered.

We seem to observe the same general regularity as in the current study: a price of zero is very different from not mentioning a price. In particular, a price of zero is *not* just a very low price.

## **6. Conclusions: Incomplete contracts and incentives**



There seems to be little doubt on the fact that in our group of day-care centers the introduction of a fine *increased* the behavior that was fined, and that the behavior did *not* increase significantly when the fine was removed. These are the facts that we have to explain. These facts might be, in themselves, little more than a curious finding. It is clear first of all that a large fee would eventually reduce that behavior. For instance, in many day care centers in the USA the fee for coming late is clearly announced at the start of the year, and is linear in the time of delay. Due to this proportionality, the resulting penalty is also more severe for the average delay than the one we introduce in our experiment, even after we adjust for the difference in prices and incomes in the two countries. We have not carefully examined if the average delay is different, but this would be an interesting research.

Second, a contract where the amount paid is proportional or monotonically increasing in the amount of the delay is likely to be closer to an efficient contract than the lump sum fine we introduced in the experiment.

Finally, the method of analytical economics applied to the theory of optimal fines (as summarized in Ehrlich (1996)) reminds us that the relationship between fines and externality is not going to be a mechanical, direct implication of a smaller externality following from a higher penalty. This effect is going to be mediated by general equilibrium effects, that might weaken or even nullify the direct effect. Still we have tried to argue that the evidence we have, and in particular the paradoxical positive relationship in the second period cannot be explained in this usual way.

Fines, as well as rewards, are decided in a larger context, that we may define, for convenience, a game. Many of the games we face in real life are not completely and precisely defined. This is the case even when their description is reasonably accurate, as is, after all, a contract for child-care in a private day-care center. People facing this game do not come to it with simply their preferences and beliefs, but rather with a perception of the strategic situation they are facing. The contract that is presented to them may change this perception. The evidence we have seen suggests that introducing a fine may also change this perception of the game, and of the equilibrium. This change of perception may be a simple acquisition of information (as it is in the simple model we have proposed above), or it may be a more dramatic shift of perception, as we have tried to discuss above.

A final comment: there is no reason to believe that this effect is limited to minor faults, like a delay in the time of picking up one's child. For instance, the statement of a government that tax evasion is going to be more severely pursued may be interpreted in different ways.

## Appendix A1

# Announcement: A fine for coming late

As you all know, the official time at which the day-care ends every day is 16:00. Since some parents are coming late we (with the approval of Authority for Private Day-Care Centers in Israel) have decided to impose a fine on parents coming late.

As of Sunday (January XX), a fine of NIS 10 will be charged for every time a child will be collected after 16:10. This fine will be calculated monthly and will be paid together with the regular monthly payment.

Sincerely,

The manager of the day-care

**Table A. 1: time trends in the data.**

a) Regression with time for the control group.

Source	SS	df	MS			
Model	9.92716165	1	9.92716165	Number of obs = 80		
Residual	1376.26034	78	17.6443633	F( 1, 78) = 0.56		
Total	1386.1875	79	17.5466772	Prob > F = 0.4555		
				R-squared = 0.0072		
				Adj R-squared = -0.0056		
				Root MSE = 4.2005		

w	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
week	-.0610902	.0814446	-0.750	0.455	-.2232339	.1010535
_cons	9.828947	.9756367	10.074	0.000	7.886604	11.77129

b) Regression with time for the test group.

Source	SS	df	MS			
Model	1741.22642	1	1741.22642	Number of obs = 140		
Residual	6279.37358	138	45.5027071	F( 1, 138) = 38.27		
Total	8020.60	139	57.7021583	Prob > F = 0.0000		
				R-squared = 0.2171		
				Adj R-squared = 0.2114		
				Root MSE = 6.7456		

w	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
week	.6116004	.0988687	6.186	0.000	.416107	.8070938
_cons	7.478195	1.184363	6.314	0.000	5.136351	9.82004

**Table A.2:** Effects of the fees. The dummy variables are ``nf`` (there is no fee), ``f`` (there is a fee), ``wf`` (a fee was introduced and later removed).

reg w nf f wf

Source	SS	df	MS			
Model	2518.67159	3	839.557197	Number of obs = 220		
Residual	8018.6875	216	37.1235532	F( 3, 216) = 22.62		
Total	10537.3591	219	48.1157949	Prob > F = 0.0000		
				R-squared = 0.2390		
				Adj R-squared = 0.2285		
				Root MSE = 6.0929		

w	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
nf	-1.4375	1.337866	-1.074	0.284	-4.074444 1.199444
f	5.8125	.9518358	6.107	0.000	3.936424 7.688576
wf	7.5625	1.337866	5.653	0.000	4.925556 10.19944
_cons	9.1875	.6812081	13.487	0.000	7.844834 10.53017

**Table A.3** Effects of the fees. The dummy variables are ``nf`` (there is no fee), ``f`` (there is a fee), ``wf`` (a fee was introduced and later removed). In addition a time trend variable (``w``) is introduced.

```
. reg w nf f wf week
```

Source	SS	df	MS	Number of obs =	220
Model	2638.44973	4	659.612433	F( 4, 215) =	17.95
Residual	7898.90936	215	36.7391133	Prob > F =	0.0000
Total	10537.3591	219	48.1157949	R-squared =	0.2504
				Adj R-squared =	0.2364
				Root MSE =	6.0613

w	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
nf	-.0041041	1.549696	-0.003	0.998	-3.058646 3.050438
f	5.8125	.9468946	6.138	0.000	3.946115 7.678885
wf	6.129104	1.549696	3.955	0.000	3.074562 9.183646
week	.1791745	.099232	1.806	0.072	-.0164176 .3747666
_cons	7.306168	1.242928	5.878	0.000	4.856284 9.756052

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