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Social Networks and Externalities from Gift Exchange: Evidence from A Field Experiment★

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Abstract

This paper asks whether gift exchange generates externalities for people outside of the bilateral relationship between the gift giver and recipient, and whether the nature of this relationship is affected by social networks. We examine this question in the context of a field experiment in urban Chinese hospital outpatient clinics. We first show that when patients give a small gift, doctors reciprocate with better service and a fewer unnecessary prescriptions of antibiotics. We then show that gift giving creates externalities for third parties. If two patients, A and B are perceived as unrelated, B receives worse care when A gives a gift. However, if A identifies B as a friend, then both A and B benefit from A's gift giving. Hence, we show that gift giving can create positive or negative externalities, depending on the giver's social distance to the third party.

1. Introduction

Gift exchange plays an important role in social interactions both in the field and in the laboratory. A classic example in the labor market involves employers paying above-market wages and workers reciprocating by devoting more effort (Akerlof, 1982; Akerlof and Yellen, 1990; Fehr et al., 1993; Fehr and Falk, 1999; Gneezy and List, 2006). A small gift has also been shown to significantly increase charitable donations (Falk, 2007).¹ Gifts are important in business contexts as well. For instance, pharmaceutical companies are

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¹There is a related experimental literature looking at gift giving behavior (e.g. charitable donation) without an opportunity for reciprocity (i.e. no gift exchange). Studies show that warm-glow (Andreoni, 1990) and concern about image (Andreoni and Bernheim, 2009) affect this altruistic giving. Interestingly, Andreoni and Rao (2011) find that asking for a gift has significant positive influence on gift giving behavior, so that potential givers try to avoid being asked (Andreoni, Rao and Trachtman, 2012). Andreoni (2007) also shows that giving to a group leads to on average lower donation per receiver compared to giving to only one individual, suggesting that altruistic giving is congestible.

estimated to spend \$19 billion per year on marketing to 650,000 prescribing US physicians in the form of free samples, sponsored dinners, and travel (Brennan et al., 2006).

This paper asks whether gift exchange generates externalities for people outside of the bilateral relationship between the gift giver and the recipient, and whether these externalities depend on social networks.² We examine this question in the context of a field experiment conducted in Chinese hospital outpatient clinics between May and August 2012. This is an interesting context for examining gift exchange because many physicians receive gifts from patients or from pharmaceutical companies, even in western countries, and the ethics of accepting gifts from patients has been discussed in the medical literature (Lyckholm, 1998; Nadelson and Notman, 2002; Spence, 2005). In our experiment, two patients visit the same physician in sequence, first patient A and then patient B. We adopt a 2×2 design that varies depending on whether patient A gives a token gift to the physician or not, and on whether patient A introduces patient B as his/her friend or not.

We find that when patient A gives a gift, he/she receives better service, and is less likely to be prescribed unnecessary antibiotics. When patient A then identifies patient B as a friend, patient B also receives better service and is less likely to be prescribed costly unnecessary drugs. Conversely, if B is not identified by A and is perceived as a stranger unrelated to A, B receives worse service when A has given a gift. Hence, whether A's gift giving generates a positive or negative externality on B depends on the social distance between A and B.

Our paper is the first to provide evidence of the existence of externalities generated by gift giving in a field setting. Moreover, we show that it is possible to generate both positive and negative externalities, depending on the social distance between the gift giver and the third party. When the recipient believes that the gift giver and the third party are unrelated, additional time spent with the gift giver is offset by spending less time with the third party stranger. However, when the gift giver and the third party are known to be friends, reciprocity towards the gift giver is also extended to the friend, generating a positive externality.

Our results have implications for welfare and for the role of social networks. Laboratory experiments have suggested that negative externalities generate efficiency losses (Abbink et al., 2002; Malmendier and Schmidt, 2011) and may exacerbate inequalities between gift givers and the unrelated third parties. Our findings regarding positive externalities suggest that the literature may have undervalued the importance of social networks. In addition to the possible information sharing and contract enforcement functions of these networks, our evidence suggests that the more people you connect to, the more benefits you may be able to collect from others' gift exchange relationships.

²We have followed the literature (discussed below) in labeling spillover effects from one patient's actions to another as externalities. However, if there is a market and care is properly priced, then arguably there is no externality if I pay more and receive more care. However, the token gift used in this experiment has little value relative to what is reciprocated, so we are picking up the effect on third parties of a non-priced exchange which perhaps more nearly merits the term "externality". If these exchanges distort the allocation of resources away from a socially efficient allocation then they could be welfare reducing. Of course it is doubtful whether the health care market in China (or elsewhere) could be said to function efficiently even in the absence of distortions caused by gift giving, given the many other distortions in health care markets.

The rest of the paper is organized as follows. Section 2 describes essential background information. Section 3 outlines the experimental design. Section 4 describes the empirical model and Section 5 presents the empirical results. Section 6 discusses the results in the context of theories of gift giving and reciprocity. Section 7 concludes the paper.

2. Background

Many lab experiments have demonstrated the existence of gift exchange relationships (e.g. Fehr et al., 1993; Fehr and Falk, 1999; Gächter and Falk, 2002). Other studies suggest that reciprocating behavior is robust to the degree of market competition (Brandts and Charness, 2004) but is affected by the perceived intentions of the gift giver (Charness, 2004). Several interesting field experiments are more related to the methods used in this paper (see DellaVigna (2009) for a nice review). Gneezy and List (2006) pay students to do fund-raising and data log work and find significant yet short-lived increases in effort in response to unexpected wage increases. Using a similar design, Kube et al. (forthcoming) report that effort falls in response to an unexpected wage decrease. Kube and Marachel (2007) find that store managers reciprocate for the receipt of small gifts from sales agents. In contrast, List (2006) finds no evidence of a gift exchange relationship in sports card trading. However, all these studies focus exclusively on the bilateral gift exchange relationship.

We know of only two lab experiments that investigate externalities from gift exchange, and as far as we know, there are no field experiments. Abbink et al. (2002) consider an experimental “bribery game”, in which two players interact repeatedly and can engage in illegal gift exchange at the expense of the general public. Malmendier and Schmidt’s (2011) laboratory experiment explores similar decision making in a one-shot environment, with the gift recipient making decisions on behalf of a client in a setting where gifts are socially acceptable. Both studies find that gift giving strongly affects the recipient’s decision in favor of the gift giver even at the expense of a third party. Malmendier and Schmidt (2011) explain their results by proposing an extension of outcome-based models of reciprocity in gift exchange. They propose a model of outcome-based social preferences with an endogenous reference group, in which gift giving increases how much the recipient cares about the giver’s welfare.

Our paper differs from these two laboratory studies of the externalities of gift exchange in three ways. First, and most obviously, it is a field experiment concerning an economically and socially important relationship—the interaction between physicians and patients in a hospital outpatient clinic. Moreover, gifts to physicians are common, and not only in China. A sizable literature examines gift giving from patients and pharmaceutical representatives to medical staffs (Levene and Sireling, 1980; Campbell et al., 2007; Spence, 2005). Wazana (2000) reviewed 16 studies published between 1982 and 1997 and found that residents accepted six gifts per year from industry representatives. In a survey of 295 British physicians from various specialties, Levene and Sireling (1980) found that 20% had received gifts such as chocolate or alcohol from patients during the previous 3 months.

Second, while the previous studies focused on how gift giving generates a negative externality, we also find evidence of positive externalities when the third party is socially

close to the gift giver. Third, in both Abbink et al.'s (2002) and Malmendier and Schmidt's (2011) setting budget constraints dictate that the third party must be hurt if the recipient wants to favor the gift giver. In our setting, a fixed time budget means that more time spent with one patient must come at the expense of less time spent with other patients. However there is no hard budget constraint dictating that if a doctor prescribes fewer unnecessary antibiotics to one patient, then he must prescribe more to another (though this kind of offset could happen). Hence our setting is somewhat more general than the laboratory experiments in that there is scope for physicians to engage in reciprocal behavior in at least one dimension that is not subject to a strict budget constraint.

There are several other important features of our setting. First, in China, most outpatient visits take place in hospitals rather than in clinics: A visit to a hospital outpatient clinic as in our experiment is often the counterpart of a visit to a physician's office in the U.S. (Hsiao and Liu, 1996; Yip et al., 1998; Hew, 2006; Eggleston et al., 2008b). Also, gift giving is an important part of Chinese culture. While it might seem odd to an American to think of giving a small gift to a doctor in an outpatient clinic, in China this is a normal behavior. To verify that this is the case, we conducted a survey of 100 physician participants in a management training program at Guanghua School of Management. Eighty-seven physicians answered yes to the question "Have you even received token non-cash gifts (such as pen, bookmark, bottle of wine, cigarettes, tea leaves) from your outpatient patients?" In answer to questions about whether such gifts were permitted at their hospital, all but 21 physicians replied that they were. However, regardless of whether they were permitted or not, no physician recalled anyone ever being punished for receiving a gift.

Second, the experiment is conducted against a background of widespread antibiotic abuse in China. In a previous audit study investigating antibiotic abuse, Currie et al. (2011) report that two thirds of patients visiting clinics with mild cold/flu symptoms received inappropriate prescriptions for antibiotics. Many received prescriptions for two or more drugs, including powerful "second-line" antibiotics that are supposed to be reserved for serious illnesses. These unnecessary prescriptions posed substantial costs to patients in terms of both monetary costs and the risk of side effects. Antibiotic abuse has additional social costs, including the rise of "superbugs" that are resistant to most or all forms of antibiotics.³

An important motive for antibiotic abuse in China is that hospitals and physicians have substantial monetary incentives to prescribe medications. While physicians are generally salaried employees, their performance bonuses often depend on the volume of revenues generated (Tang et al., 2007). Drugs are usually sold on site by hospital pharmacies, and drug sales now account for over 50% of all hospital revenues. Antibiotics account for 47% of all drug sales (Chen, 2005; Gong, 2009).⁴ Kickbacks from pharmaceutical companies can

³The Chinese have already seen increased antibiotic resistance compared to Western countries. A study of the resistance patterns of several common bacteria in China in 1999 and 2001 found that the mean prevalence of resistance among hospital acquired infections was 41% (with a range from 22% to 77%). Among community-acquired infections it was 22% (with a range of 15–39%) (Zhang et al., 2006). Moreover, the high prevalence of antibiotic resistance in China is accompanied by a rapid growth in the rate of resistance. The annual growth rate was on average 22% between 1994 and 2000 in China, while the growth rate was only 6% between 1999 and 2002 in the U.S. (Zhang et al., 2006).

provide further economic incentives for physicians to prescribe medications, with physicians receiving payments of about 20% of the value of the prescription (Yip and Hsiao, 2008).

While some have argued that physicians over-prescribe antibiotics in response to patient demand, we took steps to close down this possible channel in the experiments described below.⁵ Our patients were instructed to tell the physicians that they did not wish to take antibiotics unless they were necessary. Currie et al. (2011) found that this simple intervention reduced the prescription of antibiotics by 20% relative to a baseline where the patient made no such statement.

Thus, as we explain further below, in our experiment physicians can reciprocate to gift-giving either by providing better service, or by honoring the patient's expressed wishes by reducing costly and unnecessary antibiotic prescriptions.

3. Experimental Design

This field experiment was conducted in hospital outpatient clinics in a large Chinese city from May 2012 to August 2012, using students trained to act as patients. Two simulated patients (A and B) visited the same physician sequentially. We adopted a 2×2 design that varied with whether patient A gave a gift to the physician and whether patient A identified B as his/her friend. Figure 1 presents the physician-visiting protocol.

In Step 1 patients A and B went to the registration desk together to make appointments. Patients will often be randomly assigned to different physicians at this stage if no specific request is made. We simply took whichever physician the registration office selected for the first patient. Since it was important for patient B to visit the same physician immediately after A, patient A was instructed to tell the registration staff: "We want to leave together, please assign us to the same physician one after the other." Because the registration offices are physically separated from the physician's offices, physicians were unlikely to know that the patients had arrived together or that they had requested to be seen sequentially. When the next pair of patients arrived to see the same physician, they simply requested the physician initially seen by patient A in the first pair of patients.

Step 2 differs between the gift treatment and the no-gift control. In the gift treatment, at the beginning of the appointment patient A gives a small gift to the physician before making the chief complaint. The gift is a bookmark worth about 1.4 RMB, approximately \$0.20 U.S. (see Figure 2). This is a very small, token gift, relative to the incomes of these physicians.⁶ When giving the gift, patient A first says "I have a pretty bookmark I would like to give

⁴The central government sets hospital fees at a low level, and historically provided transfers to hospitals to cover the difference between costs and fees (Hsiao, 1996; Eggleston et al., 2008a). Starting in the early 1980s, the government began decreasing financial support to hospitals but did not allow them to increase fees (Yip and Hsiao, 2008). Instead, hospitals are allowed to set higher prices for certain technology-intensive procedures and diagnostic tests. More importantly, hospitals are allowed to add a 15% markup to drug sales (Liu et al., 2000; Eggleston and Yip, 2004; Yip and Hsiao, 2008).

⁵The argument is that patients view antibiotics as a panacea, and therefore demand them even when they are unwarranted (Cars and Hakansson, 1995; Sun et al., 2009), or alternatively that doctors believe that patients want antibiotics (Bennett et al, 2010). On the supply side, physicians may overprescribe antibiotics because they lack professional knowledge about proper antibiotic usage (Yao and Yang, 2008; Sun et al., 2009), because they want to prevent potential infections (Dar-Odeh et al., 2010). However, one would not expect over-prescription for these reasons to be sensitive to our gift treatment.

⁶The average monthly salary of physicians in our city was approximately 6200 RMB in 2010.

you.” If the gift was rejected, we asked patient A to try again saying “This is just a small token of my thanks for your work.” If the gift was rejected again, patient A took the gift back and said “That’s all right.” Patient B did not ever give a gift.

In step 3, the two patients make similar (though not identical) chief complaints. Patient A was instructed to say: “Since yesterday night, I have been experiencing slight dizziness, a sore throat, a cough and poor appetite. I think maybe I caught a cold.” Patient B’s chief complaint is: “I have a sore throat, slight dizziness, a poor appetite and some coughing. This morning, the symptoms worsened so I took my body temperature but it was in the normal range.” We purposely choose very minor symptoms so that it would be difficult for physicians to determine if the infections were viral or bacterial without further tests. Our simulated patients were told not to claim nausea, sputum, or other clinical symptoms that are not included in the chief complaint, nor were they to claim any previously related clinical history. To make sure that our simulated patients were healthy during their visits, we had a physician check on our simulated patients before the experiment. We also monitored their health and stopped them from participating during any periods of sickness.⁷

In step 4, the physician gives a physical examination, which is likely to include temperature taking, tonsil checks, auscultation, etc. According to official guidelines (Ministry of Health of the People’s Republic of China et al., 2004), antibiotics should only be prescribed when bacterial infections are confirmed by a patient’s symptoms and the results of blood or urine tests. Hence, physicians facing our simulated patients’ vague symptoms should not have prescribed antibiotics.

To exclude the possibility that physicians thought they were responding to the patient’s demand for antibiotics, in step 5 our simulated patients were instructed to express their unwillingness to take antibiotics by saying “Maybe taking antibiotics is not necessary in my case? I have heard that it is not good to take too many antibiotics” (patient A) and “I don’t like taking antibiotics. Please do not prescribe antibiotics unless they are necessary” (patient B). Given that most Chinese patients are prescribed antibiotics for minor symptoms, these statements should have made it clear to the physicians that the patient really preferred not to take them. In Step 6, the patient received any prescriptions (including non-antibiotic prescriptions, for example, Chinese traditional medicines).

Finally, in Step 7, patient A either introduces patient B to the physician (the “Friend” treatment) or does not (the “No-Friend” control). When patient A identifies patient B, he or she was instructed to say: “By the way, I came with my friend. He/she is the next patient.”

Hence, there are four regimes: Treatment 1 is the “No-Friend-Control” treatment. In this treatment patient A does not give a gift or declare any friendship. Treatment 2 is the “No-Friend-Gift” treatment. In this treatment patient A gives the gift, but does not introduce patient B. Treatment 3 is the “Friend-Control” treatment in which there is no gift, but patient B is identified by A as a friend and Treatment 4 is the “Friend-Gift” Treatment in which patient A both gives the gift and identifies patient B as a friend.

⁷In all three students had slight illnesses over the course of our experiment and were asked to suspend participation in the experiment until they were fully recovered.

We recruited 32 college students (16 males and 16 females) as our simulated patients. They were divided into 4 groups, with each group containing 8 students of the same gender. Each group was required to visit 20 hospitals. In total our sample consists of 80 hospitals (50 tertiary hospitals and 30 secondary hospitals), 160 physicians and 640 individual visits.⁸ Within each hospital, the group visited 2 physicians: Patients in the “No-Friend-Control” and “No-Friend-Gift” treatments visited one physician and patients in the “Friend-Control” and “Friend-Gift” treatments visited another physician. This within-physician design is important because we observe significant heterogeneity in prescribing behavior across physicians for the same simple symptoms. Controlling for this physician heterogeneity allows a much cleaner identification of the treatment effect.

Table 1 describes average physician and visit characteristics. Based on our post-experiment survey to simulated patients, most physicians were thought to be between 31 and 50 years old (patients reported that they were: 1=younger than 30, 2=between 31 and 40; 3=between 41 and 50; 4=older than 50). Slightly less than half (46%) were male. In most cases one other physician and one other patient were in the office during the visit and there were three patients waiting outside of the office to see the physicians. The average treatment duration for other patients was about 3.17 minutes.

We randomize some important aspects of our experiment to minimize the impact of confounding due to unobservables. Every time the group started with a new hospital, we randomly assigned the eight simulated patients to one of the eight roles listed in Step 2 of Figure 1. We also show means separately for pairs in which A identifies B as a friend, and pairs where no introduction took place. Since treatments were randomized over physicians there should be no differences in the means, and Table 1 confirms that this is the case.

Secondly, we also randomized the order of the four treatments in each hospital to ensure that our identification was not influenced by any potential order effects. To minimize the impact of other unobserved factors that might change over time, the simulated patients were required to finish the visits to a given hospital within two weeks. However, they were not allowed to carry on more than one treatment on the same day in order to avoid becoming conspicuous. Given these requirements, the eight subjects in the same group coordinated on the specific dates of the visits according to their schedules.

Table 2 gives an example of the random assignment of roles and of the order of the treatments within two hospitals by the same group of eight students. It is important to note that the same doctor saw patients in both the Gift and the No-Gift treatments, though they saw either only Friend treatments or only No-Friend treatments. Thus models with physician fixed effects (discussed below) control for unobserved heterogeneity in response to the gift treatment. It is also important to note that each physician received only one gift. Table 3 summarizes the taxonomy of treatments and observations for each type of simulated patients.

⁸According to the “hospital classification system” of the Ministry of Health of People's Republic of China, all hospitals in China are classified as primary, secondary, and tertiary hospitals based on their functions in providing medical care, medical education, and conducting medical research. We did not select primary hospitals because they are small and we felt that our simulated patients might be conspicuous.

We measure the outcome of the visits in terms of drug prescriptions and service quality. In our framework, antibiotics are unnecessary, and the patient has stated that he/she is unwilling to take them unless they are necessary. Moreover, antibiotics are quite costly relative to the average monthly income. The average baseline cost of antibiotics is about 55 RMB (approximately \$8.8 U.S.) and represents about 2% of average monthly personal income in city A.⁹ Since the main motive for prescribing antibiotics is likely to be financial, cutting back on the number and costs of antibiotics prescribed can be interpreted as a reciprocal “gift” to the patient.

If the simulated patient received a prescription, we calculated drug expenditures as follows: in many cases the total drug expenditure was listed on the prescription (79% of our visits). If not, simulated patients went to a pricing window to obtain total drug expenditures. In 14% of cases, we obtained prices using the website of the local Price Bureau.

In order to measure service quality, we ask the simulated patients to complete a survey after they finished each outpatient visit (see Appendix 1 for the complete survey). The survey covers the gender and approximate age of the physician, the environment of the visit, time spent with the physician, the questions physicians asked (e.g. whether the physician asked about symptoms such as cough, phlegm and allergies), examinations the physician performed (e.g. took temperature, checked tonsils), and the level of care provided to the patient (informed patient of drug side-effects, instructed on drug usage, suggested drinking more water, responded with polite words after being thanked). As shown below, we find statistically significant effects of our treatments on the time spent by the physician and on the probability that the physician responded politely when he/she was thanked at the end of the visit. We asked about the latter because in China it is common for physicians to treat patients in a way that lacks personal warmth and for physicians to ignore expressions of thanks, possibly due to large patient volume.

We find no significant effects of our interventions on the other measures of service quality. However, we include results for a summary measure which is the sum of all of the service measures in all our tables. The means for the individual measures and regression results for these outcomes are shown in the web supplement.

Our simulated patients underwent 5 hours of group instruction and individual practice, receiving instruction on the transcript and how to behave, dress, etc. We also instructed them to take about 15 seconds to give the chief complaint, to ensure that they did not speak too fast or too slow. The main goal was to standardize the simulated patients’ performance and appearance. To ensure that simulated patients were well trained, after the group instruction and individual practice, simulated patients tested the protocol once in their sample hospitals (not included in our regression sample) before the actual implementation of the experiment. We offered monetary compensation of 100 RMB (about \$16.00 U.S.) per visit per subject, including public transportation (about 6 RMB) and registration expenses (about 8 RMB) in the hospitals.¹⁰

⁹Average monthly income in the study city was approximately 2700 RMB in 2011.

4. Empirical Models

We first analyze the determinants of physician gift acceptance by estimating models of the following form:

$$A = \alpha_0 + \alpha_1 X + \alpha_2 E + \varepsilon \quad (1)$$

where A is a binary variable equal to one if the gift is accepted; X is a vector of patient and physician characteristics (patient's gender and age; physician's gender and a categorical variable for the physician's age, <30, 31-40, 41-50 and >51 years); and E is a vector of the environment of each visit, including whether the physician shared an office with other physicians, the number of other physicians and patients in the office during the visit, and whether other people in the room were paying attention to the gift giving. For this set of regressions we use only treatments with gift giving, i.e. the "No-Friend-Gift" treatment and "Friend-Gift" treatment.

We next estimate models of the effect of gift giving on the treatment received by patients A and B . Our experimental audit data can be analyzed by comparing means across the control and treatment groups. However, one of the main potential concerns about an audit study is that physicians might react differently to different auditors. Therefore, we also estimate models controlling for observable characteristics of auditors and of physicians, as well as for the order in which different treatments were carried out. Our models take the following form:

$$Y = \beta_0 + \beta_1 \text{Role } B + \beta_2 \text{Role } A * \text{Gift} + \beta_3 \text{Role } B * \text{Gift} + \beta_4 \text{Role } A * \text{Friend} + \beta_5 \text{Role } B * \text{Friend} + \beta_6 \text{Role } A * \text{Gift} * \text{Friend} + \beta_7 \text{Role } B * \text{Gift} * \text{Friend} + \beta_8 \text{Order} + \beta_9 X + \varepsilon \quad (2)$$

Where Y is the outcome of interest. *Role A* and *Role B* are dummy variables indicating the role of the simulated patient, *Gift* is a dummy variable equal to one if a gift was given by patient A , and *Friend* is a dummy variable equal to 1 if Patient B was identified as a friend by Patient A . The variable *Order* indicates the order in which patients visited the doctor. For instance in the example shown in Table 2, physician 2A received a visit from a pair of patients in the gift treatment first, while physician 1B received a visit from a pair of patients in the no gift treatment first. The vector X indicates observable characteristics of physicians and patients, including gender and age. We focus on models with a full set of patient fixed effects as well as physician fixed effects. All our models are estimated by Ordinary Least Squares. A table in the web supplement shows that we get similar results for binary outcome variables when we estimate logits.

The parameters of interest in these models are β_2 , β_3 and β_7 . β_2 shows the effect of gift giving on patient A relative to the control treatment. When the outcome concerns the prescription rate for antibiotics or expenditure on antibiotics, we expect β_2 to be significantly negative if

¹⁰We did not tell the students what our study was about. We did however debrief them afterwards. Since all of our students played all of the roles they were aware that we were interested in the effect of giving a gift and in whether identifying someone as a friend had an effect. Since A s and B s went together to the hospital (since they had to be seen sequentially) the B s may have known whether the A s were giving a gift or not. Given that Chinese physicians do not always close their doors (so that it is often possible to overhear what is happening in the previous visit) the B s may also have known that they were in the friend treatment. It is conceivable that this knowledge had some effect on the behavior of the patients though we trained them to behave similarly in all circumstances.

gift giving generates reciprocity. Similarly, if the outcome is a measure of service quality, such as the time the physician spends with the patient, then we expect β_2 to be significantly positive in the gift giving treatment.

β_3 measures the effect of gift giving on patient B relative to the control, while $\beta_3 + \beta_7$ measures the effect of A's gift giving on B relative to the control treatment in the Friend condition (β_7 is the difference between the effect of A's gift giving on B in the Friend and in the No-Friend conditions). If social distance matters, then the signs of β_3 and $\beta_3 + \beta_7$ will differ. If A's gift giving generates a negative externality on B, then β_3 will be positive when the outcome is pharmaceutical prescriptions and negative in the case of service quality. However, if having A identifies B as a friend neutralizes or reverses this effect, then the sign of $\beta_3 + \beta_7$ should be the reverse.

Many of the remaining coefficients in (2) should be equal to zero. For example, the introduction of Patient B as a friend occurs at the end of Patient A's interaction with the doctor, so that it is likely that $\beta_4 = 0$. In the absence of the Gift treatment, we do not expect the introduction of B to have any effect on how B is treated, which implies that $\beta_5 = 0$. And since $\beta_4 + \beta_6$ measures the marginal effect of introducing a friend on A when A has given a gift, and $\beta_4 = 0$, it is likely that $\beta_6 = 0$. Hence, we test the hypothesis that $\beta_4 = \beta_5 = \beta_6 = 0$, and estimate a model that imposes these restrictions:

$$Y = \beta_0 + \beta_1 \text{Role B} + \beta_2 \text{Role A} * \text{Gift} + \beta_3 \text{Role B} * \text{Gift} + \beta_7 \text{Role B} * \text{Gift} * \text{Friend} + \beta_8 \text{Order} + \beta_9 X + \varepsilon \quad (3)$$

Finally, we estimate the analog to model (2) separately for the "Friend" and "No-Friend" conditions because it is a little easier to compare the estimated effects in the two conditions in this framework.

5. Results

Table 4 summarizes the means of key outcomes for each group. Panel A includes variables related to drug prescription. In the "No-Friend-Control" treatment, column (1) shows that 50% of the physicians prescribed antibiotics for patient A. This rate is very high given the mild symptoms of our simulated patients and their expressed unwillingness to take antibiotics, but is in line with Currie et al. (2011) who report that 65% of similar patients were prescribed antibiotics when they did make any comment about being willing or unwilling to take them.

In contrast, column (2) shows that in the "No-Friend-Gift" treatment, only 33.8% of Role A patients were prescribed antibiotics. The second row of the table shows that the gift giving also significantly reduced A's expenditures on drugs, from 80.57RMB to 60.19RMB while the number of drugs prescribed fell from 2.35 to 1.81. As discussed above, a reduction in charges of 20 RMB represents a significant reciprocal "gift" to the patient.

Turning to service quality, Panel B shows that gift giving increase the amount of time the physician spent with Patient A, and also increased the probability that the physician would respond politely after being thanked at the end of the visit.¹¹ It is possible that the increased time that the physician spends with A is at least in part accounted for by the time necessary

to give and receive the gift. However, this type of mechanical effect cannot explain any effects on Patient B.

Columns (3) and (4) show that in the No-Friend conditions, we do not observe a significant impact of A's gift giving on patient B in terms of drug prescription. However, we observe that the physicians reduced the amount of time they spent with B. Whereas the physician spent half a minute more with Patient A after receiving a gift, he/she spent .4 minutes less on average with Patient B, a considerable reduction given that the usual visit lasts less than five minutes.

Columns (5) to (8) show the treatment effect in the Friend treatments. The effect of gift giving on A is similar to that in the No-Friend treatments. However, when A gives a gift and identifies B as a friend, B receives significantly more time from the physician and the physician is more likely to respond politely when thanked.

5.2. The Gift Acceptance Decision

Before turning to our formal analysis of the effect of gift giving and the Friend treatments, we should note that not all physicians accepted the gift, and that it is interesting to ask which factors affect physicians' decision to accept a gift or not. The question of whether doctors should accept gifts from patients has been discussed in the medical literature. For example, Spence (2005) argues that if physicians accept gifts, they may spend more time and effort on gift-giving patients and relatively less time on other patients, exactly the effect that we hypothesize that we will see here. However, Lyckholm (1998) argues that declining a gift may cause more damage to the physician-patient relationship than any potential harm done by accepting it. If a physician rejects a gift, it may be interpreted by the patient as a lack of regard for the patient's wishes, and it may hurt the patient's feelings. In the end, Western authors generally agree that whether to accept or reject gifts from patients depends on the situation (Spence, 2005; Lyckholm, 1998; Nadelson and Notman, 2002).

The existing literature often does not allow the gift recipient to make an active decision about whether to accept a gift; consequently has been little investigation of this issue. Ong (2011) assumes that gift recipients have shame aversion which makes them follow the crowd in deciding whether to accept a gift: If most people accept gifts, then the decision maker will follow without feeling any shame; but if accepting gifts is disapproved of by most people, then shame will make her reject the gift too.

Gift giving is a common aspect of Chinese culture, and in our data, most physicians accepted the small gift: In the "No-Friend-Gift" and "Friend-Gift" treatments, about 74% and 79% of the physicians accepted the gift, respectively. In order to understand factors related to rejecting the gift, we regress an indicator for gift acceptance on the physicians and patients' demographic information as well as some indicators reflecting the decision

¹¹We constructed a composite measure of service quality constructed using the surveys patients filled out after their visits. Patients were asked whether the physician asked about sputum and allergy history; whether the physician checked tonsil, body temperature and used a stethoscope; whether the physician explained any possible side effects after the prescription; and whether he/she gave other advice such as drinking more water. The mean of this composite measure was not significantly affected by any of our treatments.

environment (see Equation (1)). In this analysis we include only observations of patient A in the gift-giving treatments.

Column (1) of Table 5 shows that gift-acceptance is unrelated to the ages of physicians or patients. However, while patient gender had no significant impact, male physicians were 20 percentage points less likely to accept a gift. The office environment was also important: Column (2) shows that sharing an office with other physicians reduces the probability of accepting the gift by 30 percentage points. Similarly, when other people paid attention to the gift giving, physicians were significantly less likely to accept. But the number of other patients and physicians in the office during the visit had no significant effect on gift acceptance. Column (3) shows that these results are robust to the inclusion of the patient fixed effects. It appears that physicians may feel shame if others take particular interest in the gift giving, perhaps because this special interest implicitly signals some disapproval.

5.3. Estimated Treatment Effects

Table 6 shows estimates of equation (2). The visit order is included as a control variable in all regressions. In practice, estimates with and without fixed effects for patients and physicians were very similar, so we focus in the discussion on the estimates with fixed effects.

We first discuss how gift giving affects A's outcomes. Table 6 shows that physicians were 15% less likely to prescribe antibiotics when patient A gave a gift in the No-Friend conditions. The estimated reduction in total expenditure on drugs is about 20.02 RMB, which is quite similar to what was shown in the raw means in Table 4. Physicians also significantly decreased the number of drugs prescribed. If the figures discussed above regarding physician kickbacks are correct, they suggest that on average physicians sacrificed about 4RMB in order to reciprocate for a gift worth 1.4 RMB.¹² It is possible that this disparity reflects expectations associated with social position. As a relatively powerful and wealthy person, a physician may be expected to respond graciously to a token gift from a young student.

Turning to service quality, we find that physicians spend 0.46 more minutes on patient A in the gift-giving treatment, which is a substantial increase relative to the mean visit length. Although we do not observe significant difference on the quality of the check-up and diagnosis process (regressions not reported), physicians were also 18 percentage points more likely to respond politely when being thanked at the end of the visit (from a baseline of 50 to 60%). Hence, physicians do appear to respond positively to a token gift.

Our main focus is on the effect of A's gift giving on patient B. The estimated coefficient on "Role B*Gift" (β_3) indicates that we do not find any significant effects on the physician's prescribing behavior for patient B in the No-Friend conditions. However, summing the estimated coefficients on "Role B*Gift" and "Role B*Gift*Friend" ($\beta_3 + \beta_7$) indicates that when B is identified as a friend, doctors are 8% less likely to prescribe antibiotics to B if A

¹²This estimate is likely to be conservative. In addition to the kickbacks, hospitals are allowed to add a 15% markup to drug sales (Liu et al., 2000; Eggleston and Yip, 2004; Yip and Hsiao, 2008) and some of them use this money to pay bonuses to physicians.

gave a gift than otherwise, although the difference is not statistically significant. Total drug expenditure is reduced by 13.25 RMB, and this reduction is significant at the 5% level.

We also find a difference in service quality. Column (4) of Table 6 shows that physicians spend .43 minutes *less* with patient B in the “No-Friend-Gift” treatment than in the “No-Friend-Control” treatment. But in the “Friend-Gift” treatment, physicians spend .49 minutes ($\beta_3 + \beta_7$) *more* with gift-giver A’s friend. Similarly, column (5) shows that in the “No-Friend-Gift” treatment, the physician is 18 percentage points less likely to respond politely when thanked by patient B, whereas in the “Gift-Friend” treatment, the physician is 23 percentage points ($\beta_3 + \beta_7$) *more* likely to respond politely to B. Hence, when B is perceived as unrelated to A, A’s gift giving generates a negative externality for B. But when B is perceived as a friend of A, A’s gift giving generates positive externalities for B in terms of service quality.

As discussed above, it is reasonable to expect that $\beta_4 = \beta_5 = \beta_6 = 0$. That is, in the absence of the Gift treatment or the Friend treatment, there is no reason for B to be treated differently than A. Moreover, there is no reason for the treatment of A to be affected by the Friend treatment (since the introduction of the friend occurs at the end of the exchange). Table 6 provides support for these restrictions. Estimates of the restricted model are shown in the web supplement. The estimates are very similar to those in Table 6; once again, they show evidence that doctors reciprocate for gift-giving, that there are negative externalities of A’s gift giving on B when B is a stranger, and that there are positive externalities on B when B is identified as A’s friend.

Table 7 shows separate estimates for the “Friend” and “No-Friend” treatments. In both sets of treatments, Patient A receives better service and fewer prescriptions for unnecessary drugs in the “Gift” treatment. However, Patient B’s treatment depends on whether or not he/she is introduced as a Friend. In the “Friend” treatments, the estimates suggest that Patient B is also less likely to be prescribed prescription drugs and has lower drug expenditures, as well as receiving more time with the physician and a higher probability of a polite response from the physician. When Patient B is not identified as a friend, Patient A’s gift generates a deterioration in service quality for B. The table shows a formal test of the hypothesis that B is treated differently in the regime with a gift compared to the regime with no gift in the friend vs. no-friend treatments. The differences in treatment duration are statistically significant as is the difference in polite thanks in the friend treatment.

We also estimated models in which variables were interacted with the number of patients waiting. Doctors who are pressured for time may have less patience with the ritual of gift giving, and therefore be less likely to reciprocate positively. The results are shown in the web supplement. They provide some support for this hypothesis: When doctors receive a gift from A, the extent to which they reduce prescription of unnecessary antibiotics is reduced when there are more patients waiting. Patient B is also more likely to receive a prescription for unnecessary antibiotics when more than four patients are waiting. However, there are no interactive effects on treatment duration or the other outcomes.

Table 8 shows results separately for physicians who accepted the gift (76% of physicians) and those who did not. The estimates suggest that physicians who accepted the gift were generally more likely to respond favorably to gift givers, and also more likely to treat B better in the “Friend-Gift” treatment. However, the effects for the physicians who did not accept the gifts generally go in the same direction, and in some cases they are virtually identical to those of the gift-accepters, but less precisely estimated. For example, gift rejecters were also less likely to prescribe antibiotics and prescribed fewer drugs to Patient A in the gift-giving treatment.

We have also done some exploration of heterogeneity in physician responses to our treatments. The two characteristics that we observe about physicians are their gender and their approximate age. In Appendix Tables 1 and 2, we have estimated the models separately by these two characteristics. There are a few interesting differences. Males and females respond similarly to the gift giver across all of our measures, except that female doctors also significantly improve the other measures of service quality (beyond simply being more likely to respond politely). More strikingly, we find that only female doctors spend significantly more time and are more polite to Patient B in the “Friend-Gift” treatment. However, the point estimates are similar enough that we cannot reject the null hypothesis that male and female doctors are the same. When we look by age, there are also some differences in the “responds politely” responses. Older physicians seem more likely to respond politely to Patient A, but less likely to treat Patient B differently in the “Friend-Gift” treatment. Again, given our standard errors, we cannot reject the null hypothesis that old and young physicians behave similarly however.

6. Discussion

Gift exchange in economics is often treated as a cooperation-sustaining equilibrium in a repeated prisoner’s dilemma (Greif, 1994; Kranton, 1996a). Alternatively, welfare-reducing gifts at the beginning of the relationship are modeled as a way to increase the cost of establishing a new relationship and hence effectively prevent defection (Kranton, 1996b; Carmichael and MacLeod, 1997; Leeson, 2008). These explanations assume standard preferences and require repeated interactions.

The physician-patient interaction in our setting can be reasonably regarded as a one-shot game. Since there is no primary care system in China, most physicians don’t have regular patients, especially for common conditions like a cold or flu. Most patients expect to see random physicians when they go to hospital clinics. More fundamentally, there is a severe shortage of primary care doctors in city A so that there is no incentive for clinical physicians to compete for patients.

This section therefore provides a brief overview of models of gift exchange in one shot games similar to the interaction between our physicians and patients. We focus on the question of whether the models predict the existence of both positive and negative externalities from gift giving. It is relatively straightforward to explain a negative externality: If there is a resource constraint, then giving more to A will necessitate giving

less to B. It is more difficult to explain positive externalities from A's gift giving, though the models discussed can generally be extended to incorporate this type of behavior.

Models of outcome-based social preferences assume that decision makers care about others' payoffs though different models have different specifications of these altruistic preferences. For instance, Fehr and Schmidt (1999) and Bolton and Ockenfels (2000) model social preferences in terms of inequality aversion, Charness and Rabin (2002) argue that decision makers are strongly motivated by social welfare maximization, and Andreoni and Miller (2002) use a revealed preference approach to measure how others' payoffs enter into the decision maker's utility function.

In these models, gift giving is clearly welfare-reducing for the giver. Since the recipient is altruistic, she would like to compensate the giver, Patient A, by reciprocating. But there is no reason for B to be treated differently in the "Friend-Gift" treatment: Patient B did not give any gift and did not suffer a welfare loss, so there is no reason for the recipient to want to compensate B.

Malmendier and Schmidt (2011) address this problem by proposing a model of outcome-based social preferences with endogenous reference groups. Decision makers care about others' utility, but the weights attached to others' welfare are endogenous to people's actions. If their actions are "nicer" than expected, then the weights attached to their welfare are higher. Giving a gift is better than expected, hence the decision maker cares more about the gift giver's utility. This model can be extended to explain a positive externality by making the welfare weight depend not only on gift giving but on social distance to the gift giver.¹³ An attractive feature of this "social distance" hypothesis is that it provides a natural explanation for the diminution of the effects of gift giving when moving from A to B. If the physician feels socially closer to A as a result of gift giving, and A is socially close to B, then the physician also feels socially closer to B but the effect is not as great as it is for A.

Models of intention-based reciprocity have been proposed by Rabin (1993) and further developed by Dufwenberg and Kirchsteiger (2004). In these models, players care not only about the actions but also about the intentions of other players. They reciprocate positively or negatively according to the perceived intention. In our setting, intention-based reciprocity can explain the gift exchange relationship between the physician and patient A. However, since patient B did not give any gift, his/her actions are less likely than patient A's to demonstrate good intentions unless the physician updates his/her belief about B's intentions as a result of A's introduction.

In models of type-based reciprocity (Levine, 1998; Strassmair, 2009; Gul and Pesendorfer, 2010), how much the decision maker cares about others' welfare depends on their type. In particular, people can be either selfish or altruistic. In this model, giving a gift serves as a signal of one's altruistic type. Once again, in order for this model to explain positive externalities of gift giving, it would have to be the case that the introduction of B by A

¹³There are many laboratory experiments showing that social distance affects levels of altruism, trust and reciprocity (e.g. Hoffman et al., 1996; Bohneta and Frey, 1999; Bernhard et al., 2006; Buchan et al., 2006; Charness et al., 2007; Charness and Gneezy, 2008).

signals that B is of the same type as A, so that both are treated as altruistic types in the “Friend-Gift” treatment.

Charness and Dufwenberg (2006) have developed an explanation of reciprocal behavior based on guilt aversion. They assume that if the gift recipient does not live up to the gift giver’s (selfish or not) expectations, then there is a strong negative feeling of guilt. This assumption makes gift exchange a social norm in which a gift has to be repaid, regardless of the intentions, types, or payoffs of the gift givers. Guilt aversion can explain the physicians’ reciprocating behavior. If physicians viewed the introduction of patient B as a way to express patient A’s expectation that patient B will be treated nicely, then guilt aversion can also explain the positive externality found in the “Friend-Gift” treatment.

We have seen that there are several models of reciprocity in gift giving that may be consistent with the existence of positive externalities. The main feature of a model with positive externalities is that the recipient infers something about B’s social distance, intentions, type, or expectations from A’s introduction.¹⁴ One remarkable feature of our results is that the value of the initial gift was small relative to the reduction in antibiotic costs that the physicians gave in return. This suggests that the monetary value of the gift may not be important. A small gift may be enough to signal a type, indicate intentions, induce guilt, or to reduce the social distance between the giver and the recipient. An interesting question for future work is whether positive externalities could be generated in other ways, such as engaging in personal conversation, sharing the same hometown, etc..¹⁵

7. Conclusions

This paper provides the first field experiment investigating whether gift exchange has externalities on third parties. Our setting is outpatient clinics in the hospitals of a large Chinese city. Pairs of healthy simulated patients visit the same physician in sequence claiming mild flu-like symptoms. We show first, that if patient A gives a small gift to the physician, the physician reciprocates by reducing the prescription of unnecessary antibiotics, spending more time with the patient, and responding more politely.

Our most novel findings concern the externalities generated by patient A’s gift giving on patient B. When the physician does not perceive a connection between A and B, he/she compensates for spending more time with A by spending less time with B. This response is consistent with what has been observed in the lab (Abbink et al. 2002; Malmendier and Schmidt, 2011). However, when B is identified as A’s friend, A’s gift giving generates a positive externality for B: The physician spends more time with B, is less likely to prescribe costly antibiotics, and responds more politely to B when A has given a gift. Hence, the direction of the externality depends on whether A claims B as a friend or not.

¹⁴More generally, any model of social preferences that contains a) a budget constraint and b) correlated treatment between A & B if they are friends would be able to explain our findings.

¹⁵Dur (2009) hypothesizes that giving attention to employees can be as effective as monetary rewards. Kube et al. (2012) show in a field experiment that a real gift (a thermos) is more effective than a cash payment of equal value in inducing workers’ to put in more effort, possibly because a real gift is perceived to be more personal than cash.

Most models of reciprocity in gift giving are consistent with the existence of negative externalities when there are budget constraints. In order to explain the existence of positive externalities, it is necessary to extend existing models by allowing gift recipients to infer something about the type, intentions, or social distance of between the gift recipient and patient B from A's introduction. Alternatively, the guilt-aversion model suggests that A's introduction of B serves to create an expectation that B should be treated well.

The fact that we can generate positive externalities in our field setting has interesting implications for models comparing relationship-based and market-based modes of exchange (Kranton, 1996a; Dixit, 2003). Market-based exchange is by definition impersonal, and ensures equal treatment for each market participant. In contrast, personal exchange can be welfare improving within the context of a bilateral relationship, but can also create negative externalities and unequal treatment in the presence of budget constraints.

It is generally believed that transactions based on bilateral relationships can only be enforced on a small scale and that as the economy expands, market-based transactions gain an increasing advantage (Greif, 1994; Dixit, 2003). However, we observe positive externalities stemming from personal exchange coexisting with a sophisticated market. Moreover, the benefits of personal exchange extend beyond the bilateral relationship between the giver and the recipient to others in the same social network. These findings suggest that in addition to their possible information sharing and contract enforcement functions social networks confer valuable advantages by allowing members to tap into others' gift exchange relationships.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Appendix 1: Patient Survey

- 1: What was the approximate age of the physician?
(1) below 30 (2) 31–40 (3) 41–50 (4) above 50
- 2: What was the gender of the physician?
- 3: Did the physician share an office with other physicians?
- 4: How many physicians were in the office during your visit (excluding your physician)?
- 5: How many patients (excluding yourself) were in the office during your visit?
- 6: How many patients were waiting outside of the office (per physician)?
- 7: What is the average treatment duration (min) of the patients before you?
- 8: Did the physician accept your gift (if giving)?
- 9: Did other patients or physicians take notice when you gave the gift to the physician?

- 10: Did the physician ask whether or not you have sputum?
- 11: Did the physician/nurse take your temperature?
- 12: Did the physician examine your tonsils?
- 13: Did the physician use a stethoscope?
- 14: Did the physician ask you whether you have a history of allergies?
- 15: Did the physician take the initiative in telling you how to use the medicine?
- 16: Did the physician take the initiative in telling you the side effects of the medicine?
- 17: Did the physician take the initiative in offering you other advice e.g. drinking more water?
- 18: After you said “Thank you, physician,” did the physician respond to you with polite words like “You are welcome”, etc.?
- 19: How much time did the physician spend with you (min)

Appendix Table 1

Treatment Effects Separately by Doctor Gender

	Antibiotic prescription		Total drug expenditure in RMB		Number of drugs prescribed		Treatment Duration (min)		Physician responds politely after being thanked		Questions 10-18	
	Male Doctor	Female Doctor	Male Doctor	Female Doctor	Male Doctor	Female Doctor	Male Doctor	Female Doctor	Male Doctor	Female Doctor	Male Doctor	Female Doctor
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Role B	-0.05	-0.03	-5.44	1.09	-0.35*	-0.10	-0.19	0.22	-0.06	0.12	-0.43	0.89
	[0.07]	[0.07]	[7.59]	[7.64]	[0.14]	[0.16]	[0.17]	[0.17]	[0.10]	[0.09]	[0.49]	[0.48]
Role A *												
Gift	0.18**	0.14**	19.13**	-17.13**	0.67**	0.52**	0.66**	0.55**	0.27**	0.22**	0.31	0.88*
	[0.05]	[0.05]	[6.22]	[5.63]	[0.12]	[0.13]	[0.15]	[0.16]	[0.08]	[0.08]	[0.42]	[0.41]
Role B *												
Gift	-0.11	0.02	-0.96	-8.92	-0.10	-0.09	-0.23	-0.41*	-0.14	-0.16	-0.27	-0.45
	[0.06]	[0.06]	[7.09]	[8.09]	[0.15]	[0.14]	[0.19]	[0.18]	[0.11]	[0.10]	[0.59]	[0.53]
Role B *												
Gift	0.03	-0.06	-4.82	-11.86	0.03	-0.21	0.46	0.76**	0.25	0.35**	-0.06	0.47
	[0.08]	[0.08]	[9.67]	[9.37]	[0.20]	[0.19]	[0.24]	[0.24]	[0.14]	[0.13]	[0.73]	[0.63]
*Friend												
Constant	0.39	0.95**	84.41*	115.19**	2.61**	2.96**	4.16**	4.41**	0.87**	0.42	5.30**	2.28
	[0.34]	[0.25]	[37.42]	[17.39]	[0.55]	[0.73]	[0.61]	[0.38]	[0.34]	[0.36]	[1.67]	[1.58]
$\beta_3+\beta_7$	-0.08	-0.05	-5.78	-20.78**	-0.06	-0.30*	0.22	0.35	0.12	0.19*	-0.33	0.02
F Test $\beta_3+\beta_7=0$	1.59	0.48	0.49	8.88	0.14	3.87	1.45	3.43	1.30	3.87	0.38	0.00

	Antibiotic prescription		Total drug expenditure in RMB		Number of drugs prescribed		Treatment Duration (min)		Physician responds politely after being thanked		Questions 10-18	
	Male Doctor	Female Doctor	Male Doctor	Female Doctor	Male Doctor	Female Doctor	Male Doctor	Female Doctor	Male Doctor	Female Doctor	Male Doctor	Female Doctor
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
P value	0.21	0.49	0.48	0.00	0.71	0.05	0.23	0.07	0.26	0.05	0.54	0.96
Observations	292	348	292	348	292	348	292	348	292	348	292	348
R-squared	0.80	0.71	0.56	0.60	0.59	0.53	0.48	0.35	0.46	0.35	0.38	0.35
Visit Order												
Patient FE												
Physician FE												

Note: Robust standard errors are in brackets with

**, representing estimates significant at 1% and 5% level, respectively.

*, representing estimates significant at 1% and 5% level, respectively.

Appendix Table 2

Treatment Effects Separately by Doctor Age

	Antibiotic prescription		Total drug expenditure in RMB		Number of drugs prescribed		Treatment Duration (min)		Physician responds politely after being thanked		Questions 10-18	
	Doctor Young	Doctor Old	Doctor Young	Doctor Old	Doctor Young	Doctor Old	Doctor Young	Doctor Old	Doctor Young	Doctor Old	Doctor Young	Doctor Old
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Role B	0.05 [0.07]	-0.07 [0.07]	-2.46 [8.50]	-3.01 [6.62]	-0.20 [0.17]	-0.32* [0.13]	-0.16 [0.20]	-0.04 [0.15]	-0.09 [0.10]	0.01 [0.09]	-0.22 [0.56]	0.07 [0.43]
Role A * Gift	-0.10* [0.05]	0.19** [0.05]	19.97** [6.40]	18.18** [5.55]	0.50** [0.13]	0.63** [0.12]	0.47** [0.17]	0.57** [0.13]	0.10 [0.09]	0.26** [0.07]	0.62 [0.48]	0.57 [0.35]
Role B * Gift	-0.08 [0.06]	-0.02 [0.07]	-9.37 [8.68]	-2.61 [7.06]	-0.10 [0.17]	-0.04 [0.13]	-0.44* [0.21]	-0.07 [0.16]	-0.22 [0.12]	-0.04 [0.10]	-0.45 [0.65]	0.38 [0.50]
Role B * Gift * Friend	0.02 [0.07]	-0.05 [0.08]	-4.34 [10.38]	-11.28 [8.60]	-0.01 [0.22]	-0.21 [0.17]	0.79** [0.28]	0.46* [0.20]	0.44** [0.15]	0.18 [0.12]	0.61 [0.77]	-0.50 [0.60]
Constant	0.02 [0.10]	0.66* [0.26]	50.40* [20.31]	70.85** [19.44]	1.89** [0.72]	2.54** [0.48]	5.20** [0.75]	4.42** [0.64]	1.09** [0.21]	0.79* [0.33]	4.17** [1.23]	4.05* [1.78]
$\beta_3 + \beta_7$	-0.07	-0.08	-13.71	-13.88*	-0.11	-0.25	0.35	0.39*	0.21	0.14	0.16	-0.12
F Test $\beta_3 + \beta_7 = 0$	0.92	1.50	2.51	4.12	0.31	3.36	2.30	5.82	3.57	2.55	0.07	0.07
P value	0.34	0.22	0.12	0.04	0.58	0.07	0.13	0.02	0.06	0.11	0.79	0.79
Observations	244	396	244	396	244	396	244	396	244	396	244	396

	Antibiotic prescription		Total drug expenditure in RMB		Number of drugs prescribed		Treatment Duration (min)		Physician responds politely after being thanked		Questions 10-18	
	Doctor Young	Doctor Old	Doctor Young	Doctor Old	Doctor Young	Doctor Old	Doctor Young	Doctor Old	Doctor Young	Doctor Old	Doctor Young	Doctor Old
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
R-squared	0.84	0.68	0.61	0.57	0.59	0.52	0.50	0.39	0.48	0.37	0.44	0.32
Visit Order												
Patient fixed effects												
Physician fixed effects												

Note: Robust standard errors are in brackets with

**, representing estimates significant at 1% and 5% level, respectively.

*, representing estimates significant at 1% and 5% level, respectively.

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Highlights

- When patients give a small gift, doctors reciprocate with better service and a fewer unnecessary prescriptions.
- Gift giving creates positive externalities for third parties associated with the gift giver.
- Gift giving creates negative externalities for third parties not associated with the gift giver.

Figure 1.
Physician-visiting protocol

Figure 2.

Table 1

Physician Characteristics

	All	No-Friend Group	Friend Group	Equal Means Test (T Test)	Equal Means Test (Wilcoxon- Mann-Whitney test)
	Mean	Mean	Mean	P-value	P-value
Physician's Age: <=30	0.11 [0.32]	0.11 [0.32]	0.11 [0.32]	1.00	1.00
Physician's Age: 31-40	0.27 [0.44]	0.29 [0.45]	0.25 [0.43]	0.29	1.00
Physician's Age: 41-50	0.39 [0.49]	0.39 [0.49]	0.39 [0.49]	1.00	1.00
Physician's Age: >=51	0.23 [0.42]	0.21 [0.41]	0.25 [0.43]	0.26	1.00
Male physicians	0.46 [0.50]	0.45 [0.50]	0.46 [0.50]	0.75	1.00
Number of other physicians	1.22 [0.93]	1.25 [0.99]	1.19 [0.87]	0.42	0.84
Number of other patients	1.16 [0.98]	1.10 [0.98]	1.23 [0.97]	0.08	0.84
Number of patients	3.18 [1.34]	3.16 [1.32]	3.20 [1.37]	0.70	0.49
Treatment time of other patients	3.17 [1.51]	3.12 [1.39]	3.22 [1.63]	0.37	0.46

Table 2

Determining the Role and Order of Simulated Patients (An Example)

Hospital ID	Physician ID	Student ID	Visit Date	Treatment Assigned	Role Assigned
(1)	(2)	(3)	(4)	(5)	(6)
1	1A	1	15-Jun	No-Friend-Gift	A
1	1A	2	15-Jun	No-Friend-Gift	B
1	1A	3	12-Jun	No-Friend-Control	A
1	1A	4	12-Jun	No-Friend-Control	B
1	1B	5	11-Jun	Friend-Control	B
1	1B	6	11-Jun	Friend-Control	A
1	1B	7	20-Jun	Friend-Gift	A
1	1B	8	20-Jun	Friend-Gift	B
2	2A	1	3-Jul	Friend-Gift	B
2	2A	2	3-Jul	Friend-Gift	A
2	2A	3	6-Jul	Friend-Control	B
2	2A	4	6-Jul	Friend-Control	A
2	2B	5	1-Jul	No-Friend-Gift	A
2	2B	6	1-Jul	No-Friend-Gift	B
2	2B	7	10-Jul	No-Friend-Control	A
2	2B	8	10-Jul	No-Friend-Control	B

Notes: Each physician received only one gift. Each physician saw either two pairs with a “friend” introduction, or two pairs without a “friend” introduction.

Table 3

Taxonomy of Treatments

	No Friend Group			Friend Group		
	Friend Introducing	Gift Giving	# of Observations	Friend Introducing	Gift Giving	# of Observations
Control A	NO	NO	80	YES	NO	80
Control B	NO	NO	80	NO	NO	80
Gift A	NO	YES	80	YES	YES	80
Gift B	NO	NO	80	NO	NO	80

Table 4

Mean Outcomes

Sample	No-Friend Group				Friend Group			
	Control A	Gift A	Control B	Gift B	Control A	Gift A	Control B	Gift B
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A. Drug Prescription								
Prescription rate for antibiotics	0.50 [0.50]	0.34* [0.48]	0.49 [0.50]	0.47 [0.50]	0.51 [0.50]	0.34* [0.48]	0.50 [0.50]	0.43 [0.50]
Total drug expenditure in RMB	80.57 [43.85]	60.19** [45.24]	80.23 [41.01]	77.62 [38.83]	84.26 [44.91]	65.82* [45.92]	82.80 [46.03]	71.22 [43.83]
Number of drugs prescribed	2.35 [0.94]	1.81** [0.75]	2.11 [0.81]	2.10 [0.81]	2.51 [0.94]	1.90** [0.79]	2.28 [0.87]	2.09 [0.86]
Panel B. Service Quality								
Treatment Duration (min)	4.29 [0.96]	4.79** [0.91]	4.36 [0.85]	3.98** [0.71]	4.44 [0.86]	5.07** [0.93]	4.18 [0.79]	4.66** [0.85]
Physician responds politely after being thanked	0.55 [0.50]	0.73* [0.45]	0.60 [0.49]	0.45 [0.50]	0.59 [0.50]	0.82** [0.38]	0.50 [0.50]	0.71** [0.46]
Quality of the checkup and diagnosis process (sum of suvey questions Q10-Q18)	4.06 [2.69]	4.60 [2.29]	4.36 [2.36]	4.04 [2.63]	4.57 [2.59]	5.10 [2.43]	4.05 [2.37]	4.28 [2.06]

Note: an asterisk or double asterisks indicates that the figure in column (2) is significantly different from that of column (1) at either the 5% or 1% significance level. Similar inferences can be drawn for column (4) relative to column (3), column (6) relative to column (5), and column (8) relative to column (7). We use t-tests in this table, and have verified that we get same results using Wilcoxon-Mann-Whitney tests.

Table 5**Determinants of the Gift Acceptance Decision**

	Gift Acceptance	Gift Acceptance	Gift Acceptance
Physician's Age: 41-50	0.06 [0.07]	0.00 [0.07]	0.08 [0.08]
Physician's Age: >=51	0.01 [0.09]	-0.08 [0.08]	-0.06 [0.10]
Physician is Male	-0.20** [0.07]	-0.28** [0.07]	-0.32** [0.08]
Patient is Male	-0.09 [0.07]	-0.06 [0.06]	-
Patient's Age: 20	0.14 [0.08]	0.11 [0.07]	-
Patient's Age: 21	0.05 [0.09]	0.02 [0.08]	-
Share an office	-	-0.30** [0.11]	-0.34** [0.12]
Number of other physician in the office	-	0.04 [0.04]	0.07 [0.05]
Number of other patients in the office	-	-0.01 [0.04]	-0.02 [0.05]
Other people paying attention to the gift giving	-	-0.32** [0.06]	-0.29** [0.07]
Constant	0.76** [0.10]	1.23** [0.11]	1.28** [0.15]
Observations	160	160	160
R-squared	0.10	0.31	0.43
Patient fixed effects			

Note: Robust standard errors are in brackets with

**, representing estimates significant at 1% and 5% level, respectively. Only gift A simulated patients are included.

*, representing estimates significant at 1% and 5% level, respectively. Only gift A simulated patients are included.

The omitted doctor's age dummy is "Physician's Age: <=40". Robust standard errors of the regressions in columns 1 and 2 are clustered at the physician level.

Table 6

Treatment Effects on Drug Prescription and Service

	Antibiotic prescription	Total drug expenditure in RMB	Number of drugs prescribed	Treatment Duration (min)	Physician responds politely after being thanked	Questions 10-18
	(1)	(2)	(3)	(4)	(5)	(6)
Role B	-0.04 [0.06]	-3.84 [6.39]	-0.28* [0.13]	0.15 [0.15]	0.08 [0.08]	0.60 [0.44]
Role A * Gift	-0.15** [0.05]	-20.02** [5.39]	-0.54** [0.11]	0.46** [0.14]	0.18* [0.07]	0.52 [0.40]
Role B * Gift	-0.03 [0.05]	-3.91 [5.78]	-0.03 [0.10]	-0.43** [0.13]	-0.18* [0.08]	-0.46 [0.40]
Role A * Friend	-0.28 [0.37]	-9.89 [36.66]	0.27 [0.87]	0.00 [0.64]	0.21 [0.32]	0.35 [1.57]
Role B * Friend	-0.26 [0.37]	-8.99 [36.96]	0.31 [0.86]	-0.32 [0.63]	0.07 [0.31]	-0.60 [1.54]
Role A * Gift * Friend	-0.02 [0.07]	-0.63 [8.17]	-0.08 [0.17]	0.22 [0.20]	0.08 [0.10]	0.01 [0.55]
Role B * Gift * Friend	-0.05 [0.07]	-9.34 [7.91]	-0.19 [0.16]	0.92** [0.19]	0.41** [0.11]	0.77 [0.54]
Constant	0.50 [0.26]	80.50** [13.83]	2.35** [0.52]	4.29** [0.76]	0.55 [0.41]	4.08* [1.97]
$\beta_3 + \beta_7$	-0.08	-13.25*	-0.22	0.49**	0.23**	0.31
F Test $\beta_3 + \beta_7 = 0$	2.57	5.70	3.59	12.58	9.39	0.69
P-value	0.11	0.02	0.06	0.00	0.00	0.41
Observations	640	640	640	640	640	640
R-squared	0.73	0.56	0.51	0.38	0.36	0.32
Visit Order						
Patient fixed effects						
Physician fixed effects						

Note: Robust standard errors are in brackets with

**, representing estimates significant at 1% and 5% level, respectively.

* representing estimates significant at 1% and 5% level, respectively.

Table 7

Treatment Effects Separately for “Friend” and “No Friend” Treatments

	Antibiotic prescription		Total drug expenditure in RMB		Number of drugs prescribed		Treatment Duration (min)		Physician responds politely after being thanked		Questions 10-18	
	Friend	No-Friend	Friend	No-Friend	Friend	No-Friend	Friend	No-Friend	Friend	No-Friend	Friend	No-Friend
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Role B	0.07 [0.07]	-0.07 [0.06]	-0.92 [8.13]	-2.01 [7.16]	-0.23 [0.16]	-0.25 [0.15]	-0.20 [0.17]	0.14 [0.18]	-0.10 [0.09]	0.10 [0.10]	-0.53 [0.48]	0.72 [0.51]
Role A * Gift	0.15** [0.05]	0.12* [0.05]	20.76** [6.03]	20.72** [5.70]	0.65** [0.13]	0.57** [0.11]	0.66** [0.15]	0.48** [0.15]	0.23** [0.07]	0.18* [0.08]	0.55 [0.40]	0.64 [0.41]
Role B * Gift	-0.10 [0.05]	0.00 [0.05]	-13.57* [5.83]	-3.54 [5.92]	-0.23 [0.12]	-0.03 [0.11]	0.52** [0.14]	0.42** [0.13]	0.24** [0.08]	0.18* [0.08]	0.41 [0.36]	-0.43 [0.41]
Constant	0.51 [0.32]	0.50 [0.27]	84.47* [38.60]	79.85** [22.44]	2.51** [0.52]	2.35** [0.48]	4.44** [0.72]	4.22** [0.73]	0.59 [0.37]	0.55 [0.32]	4.22* [1.86]	2.72 [1.63]
$\beta 3-\beta 1$	-0.17	0.07	-12.65	-1.53	0.00	0.22	0.72**	-0.56*	0.34*	-0.28	0.94	-1.15
F Test $\beta 3-\beta 1=0$	2.69	0.53	1.19	0.02	0.00	1.07	7.54	4.45	5.84	3.53	1.74	2.29
P-value	0.10	0.47	0.28	0.89	0.98	0.30	0.01	0.04	0.02	0.06	0.19	0.13
Observations	320	320	320	320	320	320	320	320	320	320	320	320
R-squared	0.73	0.79	0.58	0.58	0.49	0.60	0.39	0.43	0.40	0.39	0.37	0.35
Visit Order												
Patient fixed effects												
Physician fixed effects												

Note: Robust standard errors are in brackets with

**, representing estimates significant at 1% and 5% level, respectively.

representing estimates significant at 1% and 5% level, respectively.

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Table 8

Treatment Effects Separately for Physicians Who Accepted and Rejected the Gift

	Antibiotic prescription		Total drug expenditure in RMB		Number of drugs prescribed		Treatment Duration (min)		Physician responds politely after being thanked		Questions 10-18	
	Accept	Rejec t	Accept	Rejec t	Accept	Rejec t	Accept t	Rejec t	Accept t	Rejec t	Accept t	Rejec t
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Role B	-0.02 [0.06]	-0.09 [0.13]	-3.58 [5.68]	-0.90 [13.93]	-0.24* [0.12]	-0.18 [0.25]	0.05 [0.14]	-0.24 [0.26]	0.04 [0.07]	-0.18 [0.16]	0.22 [0.39]	-0.10 [0.83]
Role A * Gift	0.16*** [0.04]	-0.17 [0.10]	21.50*** [4.43]	-13.71 [11.51]	0.58*** [0.10]	0.55*** [0.20]	0.61*** [0.12]	0.29 [0.24]	0.22*** [0.06]	0.14 [0.14]	0.56 [0.32]	-0.11 [0.76]
Role B * Gift	-0.03 [0.05]	0.00 [0.11]	-6.03 [6.49]	-3.29 [12.46]	-0.03 [0.12]	-0.19 [0.24]	-0.36* [0.15]	-0.13 [0.26]	-0.13 [0.09]	-0.04 [0.16]	-0.24 [0.47]	-0.17 [0.68]
Role B * Gift * Friend	-0.04 [0.06]	-0.08 [0.16]	-10.04 [7.35]	3.49 [17.62]	-0.20 [0.16]	-0.06 [0.30]	0.75*** [0.19]	0.49 [0.31]	0.35*** [0.11]	0.11 [0.20]	0.40 [0.56]	0.13 [0.92]
Constant	0.02 [0.12]	0.52 [0.45]	50.05* [23.81]	30.67 [39.13]	1.89*** [0.58]	2.28*** [0.80]	4.17*** [0.61]	3.65*** [0.62]	0.90*** [0.17]	1.26*** [0.43]	3.38*** [0.97]	2.92 [1.92]
$\beta 3 + \beta 7$	-0.07 [0.12]	-0.08 [0.16]	16.07*** [7.35]	0.20 [17.62]	-0.23 [0.58]	-0.24 [0.80]	0.38*** [0.61]	0.36 [0.62]	0.22*** [0.17]	0.07 [0.43]	0.15 [0.97]	-0.04 [1.92]
F Test $\beta 3 + \beta 7 = 0$	1.93	0.43	8.50	0.00	3.34	0.86	6.22	2.12	8.00	0.17	0.15	0.00
P value	0.17	0.51	0.00	0.99	0.07	0.36	0.01	0.15	0.00	0.68	0.70	0.96
Observations	488	152	488	152	488	152	488	152	488	152	488	152
R-squared	0.74	0.76	0.57	0.65	0.52	0.62	0.37	0.53	0.35	0.56	0.32	0.47

Visit Order

Patient fixed effects

	Antibiotic prescription		Total drug expenditure in RMB		Number of drugs prescribed		Treatment Duration (min)		Physician responds politely after being thanked		Questions 10-18	
	Accept	Rejec t	Accept	Reject	Accept	Reject	Accept t	Reject	Accept t	Reject	Accept t	Rejec t
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Physician fixed effects												

Note: Robust standard errors are in brackets with

*** representing estimates significant at 1% and 5% level, respectively;
* representing estimates significant at 1% and 5% level, respectively.