

The Social Norm of Tipping: Does it Improve Social Welfare?

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Abstract

Some economists believe that social norms are created to improve welfare where the market fails. I show that tipping is such a norm, using a model in which a waiter chooses service quality and then a customer chooses the tip. The customer's utility depends on the social norm about tipping and feelings such as embarrassment and fairness. The equilibrium depends on the exact social norm: higher sensitivity of tips to service quality (according to the norm) yields higher service quality and social welfare. Surprisingly, high tips for low quality may also increase service quality and social welfare.

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1. Introduction

Some economists believe that social norms are created because they increase welfare. Arrow (1971, p. 22), for example, wrote, “*I want, however, to conclude by calling attention to a less visible form of social action: norms of social behavior, including ethical and moral codes. I suggest as one possible interpretation that they are reactions of society to compensate for market failures.*” Two paragraphs below Arrow adds, “*There is a whole set of customs and norms which might be similarly interpreted as agreements to improve the efficiency of the economic system (in the broad sense of satisfaction of individual values) by providing commodities to which the price system is inapplicable.*”

Others, however, oppose this view, and argue that social norms exist for various reasons, but not because they improve efficiency or welfare (see for example Elster 1989). My goal is to contribute to the debate by analyzing the social norm of tipping. Tipping is a social norm because one of the main reasons (sometimes even the only reason) that we tip in certain situations is that others also tip in these situations, so that tipping became the norm. Why do we conform to social norms? Psychologists suggest that we conform to social norms “so that we will be liked and accepted by other people” (Aronson, Wilson and Akert 1999, p. 294). In the case of tipping, people often also feel guilty, unfair and embarrassed if they do not tip when the norm is to tip.

This article addresses several main questions about tipping: can tipping improve welfare, and if yes, by how much?² Can tipping yield the welfare-maximizing service quality? Do the answers to these questions depend on the exact norm about tipping, and if so, in what ways? Does tipping motivate workers to provide better service? If yes, does it imply that welfare is increased too, or that service quality exceeds its optimal level?

² I use the shorter “welfare” to denote what Arrow called “*the efficiency of the economic system.*”

Tipping is an especially interesting norm to analyze from an economic perspective because it is more closely related to economics than most other social norms. Tipping is an economic transaction, in which one agent provides service and the other agent pays for it, and is related to several different areas in economics. First, it is a major part of income for millions of workers in the United States alone; for many of them (waiters, for example) it is the main source of income (see Wessels 1997). Thus, tipping is closely related to labor economics. Second, people tip in order to feel fair and avoid embarrassment and guilt; this suggests a close connection to behavioral economics. Third, tipping is a way of monitoring workers by the customers and is a form of providing incentives; it is therefore closely related to economics of information. Finally, the owner of the establishment can choose between tipping and a service charge and can decide how much direct supervision is required in addition to customer supervision (in the form of tipping), suggesting implications of tipping to management strategy and industrial organization.³

Another reason why tipping is a particularly interesting social norm is its magnitude. Tips in US restaurants alone are about \$27 billion each year (Azar 2004a), and tipping is common in other industries and additional countries, so annual worldwide tips are probably a much bigger figure. In addition, as was mentioned above, millions of workers in different occupations derive a significant portion of their income, often most of it, from tips.⁴

Finally, tips can be easily observed and measured, whereas many other social norms are not. We can say that someone tipped 13 percent of the bill, or six dollars, and that the norm is 15 percent; we cannot discuss norms of good table manners in the same way. As a result, the

³ A more detailed discussion of the implications of tipping for economics and management and research ideas that follow from these implications appear in Azar (2003).

⁴ In what follows, I use “waiters” and “restaurants” rather than the less concrete and more cumbersome “service providers” and “establishments,” but the analysis is applicable to tipping in general.

predictions of a theoretical model can be relatively easily tested in the case of tipping, but not in many other social norms.

Tipping being a social norm still does not necessarily mean that people tip only because this is the norm. People follow some norms because it is in their best interest to do so, regardless of the social norm. For instance, most people would not choose to go out naked in the winter even if this was not against the norm (and the law). Future service considerations are sometimes mentioned as a reason for tipping that is not directly related to tipping being a social norm. The argument is that by tipping more for good service, the waiter is encouraged to give the tipper good service in the future. But why do travelers tip, knowing they are never going to come back to the same place? A more plausible explanation is that people tip because this is the social norm; if they deviate from it they feel unfair and embarrassed, resulting in a disutility that exceeds the utility from the money they can save by not tipping.

Thus, tipping illustrates the importance of social norms and utility from feelings in economic models: any attempt to model tipping without considering social norms or feelings is bound to conclude that one-time customers should not tip (see Ben-Zion and Karni 1977), in contradiction to the actual behavior of customers. The importance of social norms and feelings, however, is not limited to tipping; they play a role in many areas in economics, such as consumer behavior and labor economics, and including them explicitly in models in these areas can improve the predictive power of the models.

The empirical research about tipping is abundant, and a complete discussion of it would require too much space and is of little relevance to this article.⁵ Some of this literature is

⁵ Most of this research was conducted by psychologists (in particular Michael Lynn of Cornell, who is the most-prolific author on tipping). The interested reader can find extensive reviews of this literature in Lynn and McCall (2000) and Azar (2005a). Two empirical papers that are closer to economics than to psychology include

mentioned later, where it does relate to the current article. Experimental research includes Ruffle (1998), who reports the results of experiments in which participants in dictator and ultimatum games acted in a way that resembles tipping, and historical research includes Azar (2004d) who looks at the evolution of tipping since its inception a few hundreds years ago and tries to learn from it why people tip and whether tipping improves service quality.

Very little theoretical work in economics was devoted to tipping, however. Sisk and Gallick (1985) discuss tipping and offer some interesting ideas about how to interpret the tipping transaction. They argue that tips protect the buyer from an unscrupulous seller (or his agent) when the brand-name mechanism for assuring contractual performance is insufficient. They do not provide a formal model of tipping, however. Schwartz (1997) shows that tipping may increase the firm's profits when consumer segments differ in their demand functions and their propensity to tip. Ruffle (1999) presents a theoretical model about gift giving and discusses briefly how the model can be applied to tipping as well. Azar (2004a) examines the optimal choice of monitoring intensity when workers face incentives that are not provided by the firm, such as tips. Increase in such incentives reduces optimal monitoring intensity but nevertheless increases effort and profits unambiguously. Azar (2004b) presents a model of the evolution of social norms. When a norm is costly to follow and people do not derive benefits from following it except for avoiding social disapproval, the norm erodes over time. Tip percentages, however, increased over the years, suggesting that people derive benefits from tipping, such as impressing others and improving their self-image as being generous and kind.

The main attempt at understanding why people tip using a theoretical model, however, remains the pioneering work of Ben-Zion and Karni (1977), who built a theoretical

Conlin, Lynn, and O'Donoghue (2003) who look at the efficiency of tipping, and Azar (2005b), who tries to answer why do we tip some occupations but not others.

framework for a repeated interaction between a customer and a service agent. They showed that the marginal reward for effort must be positive for the service agent to provide more than the minimal effort level. They also proved that tips tend to be smaller when turnover of customers or service staff is higher and when customers visit the establishment less frequently, and concluded that tips are consistent with self-interest seeking behavior only for the case of repeated customers.

The current article adds to Ben-Zion and Karni by introducing social norms and feelings as a source of utility (or disutility). This significant change enables to explain why one-time customers also tip (and as discussed later, the model probably explains tipping by repeated customers as well). The article presents for the first time a complete and formal model of tipping that incorporates social norms and utility from feelings to explain why people tip (even in one-shot cases), and how workers respond to tipping, taking into account that the norm may dictate tips that are a function of service quality. Moreover, the article addresses for the first time the question how different tipping norms affect welfare differently.

The results support Arrow's view that social norms can improve social welfare. How much welfare is improved, however, depends to a large extent on the sensitivity of the social norm to service quality. If the norm dictates that bad service should be punished significantly (e.g. by not tipping at all for bad service), welfare will be higher than if the norm punishes bad service only mildly (or not at all). It follows that if we want to improve welfare, we should not tip when we get bad service. On the other hand, when we get extraordinary service, we should tip even more than 15 percent (where 15 percent is the norm for good service).

The rest of the paper is organized as follows: Section 2 presents the theoretical model and describes the equilibrium. Section 3 analyzes how tipping affects social welfare, and Section 4 concludes.

2. The Model

The model consists of a single interaction between a waiter and a customer. The waiter plays first by choosing the quality of the service he provides, s . The quality is determined by how attentive and friendly the waiter is and how much effort he makes to fulfill the customer's needs. Above a certain quality level, providing better service requires the waiter to exert more effort. I normalize the quality level that minimizes the waiter's effort to be zero. We can restrict attention to non-negative quality levels, because the equilibrium never involves negative service quality.

The customer plays second by choosing the tip in percentage of the bill. The tip is denoted by t (a tip of 15 percent means $t = 0.15$, not $t = 15$), is non-negative, and is potentially chosen according to the quality of the service provided. The function that associates each quality level with a certain tip percentage is referred to as the tipping function; it is derived from the customer's utility maximization. I assume that the social norm and the customer's utility function are common knowledge, so the waiter can calculate the tipping function. The rest of this section describes the game in detail and solves it using backward induction.

2.1. The Customer

Psychologists offer several reasons why people tip (see for example Lynn and Grassman 1990). The most common reasons are embarrassment when stiffing (tipping poorly or not at all), caused by social pressure (even when dining alone – then the waiter causes the social pressure); fairness – most people feel unfair when they do not tip for good service; generosity; empathy for the waiter who works hard and earns a low wage; and future service.⁶

⁶ I thank an anonymous referee for suggesting that another potential reason for tipping (related to social pressure caused by the waiter) is guilt aversion. Consequently, psychological game models, such as Dufwenberg and

Both embarrassment and fairness motivations are caused by the social norm: people do not feel embarrassed or unfair when they do not tip workers that are not supposed to be tipped, such as flight attendants.

Future service is potentially a reason for tipping only when the customer intends to come again to the same restaurant. The model in this paper uses a one-shot game, and as such it assumes that future service is not an important reason for tipping. This is clearly the case when non-repeated customers tip. However, future service seems not to be a reason for tipping by repeated customers as well (Kahneman, Knetsch and Thaler 1986; Lynn and Grassman 1990; Azar 2004c).

The other reasons for tipping can be divided into two groups according to their effect on the optimal tip. Embarrassment when stiffing and willingness to feel fair generally encourage the customer to tip according to the social norm. Generosity and empathy for the waiter might lead the customer to tip more than the norm. Consequently, the social norm plays a major role in the customer's decision about the tip size.

Denote the tip dictated by the social norm for service quality s by $n(s)$; I sometimes refer to it as the appropriate tip, but it is a function of service quality rather than a constant. The norm is taken as exogenous in the model. This simplifies the analysis significantly, but

Kirchsteiger 2004) may be applied to the analysis of tipping, if we think that the major motivation for tipping is guilt aversion – i.e. that people tip because they think the waiter expects a certain tip and if they will not tip, they will feel guilty. While this is indeed a potential reason for tipping, the model presented in this article provides several advantages over an attempt to apply more general models to tipping. First, it allows for additional reasons for tipping and does not assume that guilt aversion is the only reason. Second, it is much simpler and therefore more traceable in various dimensions in which general games, justifiably, are more complex – for example it does not require us to assume and analyze what are the beliefs of each player about the intentions, beliefs, and kindness of the other player. Finally, the model here adds a few dimensions that are not part of general games – such as the tipping norm and how it is affected by service quality.

implies an additional assumption and raises a question. The assumption implied is that the customer does not think that he can change the social norm by changing his tip, a reasonable assumption because each customer is a negligible fraction of the population.

The question raised is what if the analysis shows that the optimal tipping function is different from the social norm? Does such result imply a problem in the model? The answer is no. First, while actual tipping does change the social norm in the long run, it takes many years for the norm to change. Therefore, at any given time, actual tipping may be different from the social norm. Second, the model deals with tipping in a specific restaurant (since the waiter and the customer can identify the specific restaurant they are in), which need not be a representative restaurant. As long as the model does not yield tips that are always lower (or always higher) than the social norm, any single restaurant may have tips that differ from the norm. The national average of tips should be equal to the norm if the norm is stable, but the tips in each restaurant need not. Finally, if we interpret the social norm as describing not only how much to tip, but also how people should feel when they disobey the norm, then the model in fact offers a characterization of a stable social norm: the optimal tipping behavior is identical to the norm, so one can think about the norm as being endogenous under this interpretation (more on this later).

The norm about tipping is that poor service deserves lower tips (Post 1997). I therefore assume that n is non-decreasing, and in addition assume that it is continuous and that $n(s) \geq 0$ for all s (there cannot be a norm to tip a negative percentage). Denote the bill size by b , and the deviation of the tip from the norm by d (notice that the deviation can be negative):

$$(1) \quad d = t - n(s).$$

The customer's utility depends on wealth, enjoyment from the dining experience, and feelings (embarrassment, fairness and so on). I assume that the utility function is separable in its three components: the utilities from wealth, dining, and feelings are added together to

compute the total utility, but otherwise they do not interact with each other. Since the cost of the meal is a small fraction of the customer's wealth, I assume that she has constant marginal utility from money in this range of wealth levels. As a result, we can ignore her initial wealth and consider only the changes in her wealth, $-b(1 + t)$. The utility from feelings, denoted by $f(d)$, depends on the social norm: embarrassment, for instance, arises only when the customer violates the norm. Moreover, the magnitude of the feelings depends on the size and direction of the deviation from the norm. The utility from the dining experience depends on service quality and on the quantity and quality of food purchased, which can be measured by the bill size, and is denoted by $G(s, b)$; G is strictly increasing in both s and b . Substituting $d = t - n(s)$, the utility function takes the following form:

$$(2) \quad u(s, t, b) = -b(1 + t) + f(t - n(s)) + G(s, b).$$

Recall that s is chosen by the waiter. The bill size is chosen by the customer, but is not the focus of this paper, and is taken as exogenous in what follows in order to simplify the analysis. Another justification for taking b as exogenous is that b is determined primarily when the customer makes the order. When she observes the service quality and has to choose the tip, the bill size is already given.

The utility from feelings, although only a function of d , consists of two different parts. The desire to conform to social norms in order to feel fair and to avoid embarrassment leads the customer to tip according to the social norm. Tipping much above the norm is considered inappropriate, and in addition may cause the customer to feel wasteful, so if fairness and embarrassment were the only motives for tipping, f would be maximized around $d = 0$. If empathy for the waiter and generosity were the only motivations for tipping, f would be increasing in d up to the point where the customer does not feel empathy or a desire to be generous anymore. In general, the marginal utility from feelings, f' , is decreasing in the tip

size; since $d = t - n(s)$, it is also decreasing in d . Assumption 1 summarizes the assumptions made so far and adds some regularity conditions:

- Assumption 1.** (i) f is twice continuously differentiable and is strictly concave in d .
(ii) $f'(d) \rightarrow \infty$ as $d \rightarrow -\infty$, and $\lim_{d \rightarrow \infty} f'(d) < 0$.
(iii) n is non-decreasing and continuous and $n(s) \geq 0$ for all s .
(iv) G is strictly increasing in s and in b .

In addition, let us define the following function:

Definition 1. $t^\wedge(s)$ is the function that satisfies $f'(t^\wedge(s) - n(s)) = b$ for all s .

As we will see in Proposition 1, $t^\wedge(s)$ is the utility-maximizing tip as a function of s , except when $t^\wedge(s)$ is negative. When the tip is $t^\wedge(s)$, the psychological marginal utility from tipping, given by $f'(t^\wedge(s) - n(s))$, is exactly equal to the marginal cost of tipping, which is b , which provides the intuition why $t^\wedge(s)$ is optimal (when the constraint that the tip cannot be negative does not bind).

The continuity of f' , Assumption 1 (ii), and $b > 0$, imply that $t^\wedge(s)$ exists for all s (notice that $t^\wedge(s)$ might be negative). Strict concavity of f implies that for every s there is a unique value $t^\wedge(s)$. It is possible, however, that $t^\wedge(s_1) = t^\wedge(s_2)$ for $s_1 \neq s_2$. Assumption 1 leads to the following results (all the proofs appear in the appendix):

Proposition 1. *The optimal tipping function is $t^*(s) = \max [t^\wedge(s), 0]$.*

Proposition 1 follows, as can be seen in more detail in the proof, from the first-order condition for utility maximization by the customer, together with the constraint that the tip cannot be negative.

Corollary 1. *For a given value of s , if $b > f'(-n(s))$, then $t^*(s) = 0$.*

Corollary 1 reflects the following idea: if even when the tip is zero, the marginal cost of tipping is still higher than the marginal benefit, we would like to tip a negative amount, but since we cannot, the best we can do is to tip zero.

Lemma 1. t^\wedge is parallel to n ; that is, $t^\wedge(s) - n(s)$ is a constant for all s .

Lemma 1 essentially says that if we could tip a negative percentage, the difference between the optimal tip and the tip dictated by the norm would not depend on s but rather it would be a constant.

Corollary 2. t^\wedge is non-decreasing and continuous.

Corollary 2 implies that better service can either increase tips or leave them unchanged, but it cannot reduce tips.

As can be seen from Proposition 1, the optimal tipping function may be kinked. The kink point is important for our purposes, so let us define the following:

Definition 2. Let s_0 be the highest value of s that satisfies $t^\wedge(s) = 0$, if such value exists.

Suppose that s_0 exists. Since t^\wedge is non-decreasing, it follows that for any $s > s_0$, we obtain $t^*(s) = t^\wedge(s) > 0$. That is, s_0 is the kink in the optimal tipping function, t^* . Since t^\wedge is parallel to n , t^* is parallel to n for all $s \geq s_0$. Because n is non-decreasing and $t^*(s) = 0$ for all $s \leq s_0$, t^* is non-decreasing. Since t^\wedge is continuous and $t^*(s) = \max [t^\wedge(s), 0]$, t^* is continuous.

Since t^\wedge is continuous, s_0 exists whenever we can find values s_1 and s_2 such that $t^\wedge(s_1) \leq 0$ and $t^\wedge(s_2) \geq 0$. That is, s_0 does not exist when t^\wedge is always strictly positive, or always strictly negative. When $t^\wedge(s) < 0$ for all s , it means that the customer never tips regardless of service quality. I assume that this does not happen; indeed, a very small fraction of the population averse tipping so strongly that they never tip.

When $t^\wedge(s) > 0$ for all s , the customer gives a strictly positive tip regardless of service quality; there is no kink in the optimal tipping function, $t^*(s) = t^\wedge(s)$ for all s , and therefore t^* is non-decreasing and is parallel to n . For the purpose of the next subsection, define s_0 to be some negative number in this case; this does not change the analysis because $s \geq 0$ in equilibrium. Notice that $t^\wedge(s) > 0$ for all s whenever t^\wedge is strictly above n , because $n(s) \geq 0$ for all s .

The analysis above shows that the optimal tipping function follows the social norm very closely. In fact, the two are parallel except for points where the customer leaves a zero tip. Whether the optimal tip is above or below the social norm depends on the exact shape of f . This result suggests the following interpretation: suppose that the optimal tipping function describes the tipping of the representative customer at a specific restaurant (a similar argument can be made if the tipping function belongs to a single customer at a specific restaurant). If in some restaurants the tips are higher than the norm while in others they are below the norm, then the social norm might be the average of the tipping behavior in different restaurants, and yet the representative customer of each restaurant tips differently from the norm. This is one explanation for why getting a tipping function that is different from the norm does not mean that the norm should change, even in the long run.

When tips are strictly positive, the slope of the social norm is equal to the slope of the tipping function, which in turn determines the incentives faced by the waiters. When the social norm is steep (differences in service quality affect the tip significantly), waiters face large incentives to provide excellent service; when it is flat, they do not. Therefore, a steep social norm may yield a high-quality equilibrium, whereas a flat norm may result in a low-quality equilibrium. Low service quality, in turn, reduces the utility from the dining experience and the willingness to pay for it, and therefore may affect social welfare. The next sections discuss these intuitions more rigorously.

2.2. *The Waiter*

The waiter's utility is a function of his wealth and his effort on the job; his effort depends on the quality and quantity of the service he provides. The quantity of the service can be approximated by the bill size. While the bill depends on the price of each item, the variation within the same restaurant in the prices of different entrees is not large. The number of diners at the table and whether they order drinks, appetizers, and desserts, cause most of the

variation in bill size at a specific restaurant. More diners or more items ordered increase both the bill and the quantity of service, and therefore the two are closely related.

Serving multiple diners exhibits increasing returns to scale: serving four diners at one table requires less than four times the effort of serving a single diner. The bill, however, is roughly proportional to the number of diners, so this observation suggests that quantity of service is concave in bill size. On the other hand, when bill size is increased because of additional items such as drinks, appetizers and desserts, the quantity of service is convex in bill size. The reason is that taking an order for a dessert and bringing it requires similar effort to that needed for an entrée order, but adds much less to the bill size. For simplicity, I assume that these opposite effects cancel out on average. As a result, the effort is proportional to the bill size and is equal to $e(s)b$.

The function $e(s)$ represents the effort required per dollar of bill size, when service quality is s . I assume that e is twice continuously differentiable. Recall that by previous normalization, $e(s)$ is minimized when $s = 0$; this implies that $e'(0) = 0$. Effort should increase in bill size for all s , therefore $e(s) > 0$ for all s . In addition, I assume that e is strictly convex: the higher is service quality, the more effort is required to improve it further. It follows from the strict convexity of e and from $e'(0) = 0$ that $e'(s) > 0$ for any positive s : better service requires more effort (above the threshold $s = 0$). The following assumption summarizes the characteristics of the effort function (most of them discussed above):

Assumption 2. *The effort function is $e(s)b$; e is strictly convex and twice continuously differentiable; $e'(0) = 0$; $e(s) > 0$ for all s ; and $e'(s) \rightarrow \infty$ as $s \rightarrow \infty$.*

I assume that the waiter's utility is separable in wealth and effort, and that each tip is a small fraction of the waiter's wealth; as a result, his marginal utility from the tip is constant. Therefore, we can ignore his initial wealth and consider only the change in his wealth, which is equal to $t(s)b$. Consequently, the waiter's utility function takes the following form:

$$(3) \quad v(s, t, b) = b(t(s) - e(s)).$$

The waiter chooses s to maximize his utility; b is exogenous and $t(s)$ is the tip chosen by the customer as was derived in the previous subsection.⁷ Including $t(s)$ rather than t in the utility function corresponds to the assumption that the waiter knows the social norm and the utility function of the customer and therefore is able to calculate $t(s)$ and predict the tip that results from each service quality. This assumption has two alternative interpretations: one is that the customer in the previous subsection is the representative customer of the restaurant. A specific customer may tip differently, but the waiter does not know the tipping function of each customer and therefore he bases his optimization on the representative customer. The second interpretation is that the customer is a specific customer and the waiter is able to predict her tipping function according to her appearance and the dining occasion (lunch or dinner, business-oriented or social event).

2.3. *Choice of Service Quality in Equilibrium*

It is possible to show that under some conditions, the waiter either chooses zero effort or chooses the service quality s^* that satisfies the first-order condition $t'(s^*) - e'(s^*) = 0$. This analysis, however, does not provide insights about the characteristics of the effort function and the social norm that affect the equilibrium service quality. Instead, I assume in what follows that the social norm, the utility from feelings and the effort function take specific functional forms; then, comparative statics on the parameters of the functions can yield some interesting insights. I assume that the social norm takes the following form:

$$(4) \quad n(s) = N_0 + N_1s, \text{ where } N_0 \geq 0 \text{ and } N_1 \geq 0.$$

⁷ In the previous subsection it was denoted as $t^*(s)$ to avoid confusion between the value t and the function t , but here I drop the asterisk to simplify notation, since using t^{**} and t^{***} is cumbersome.

A norm of tipping a fixed percentage of the bill regardless of service quality, for example, corresponds to $N_I = 0$. The linearity of the norm is not as restrictive as it might appear, since quality has no natural scale. Therefore, we can scale quality to yield the linear relationship assumed: take an arbitrary service quality above zero and denote it as $s = 1$; quality $s = 2$ is then defined as the quality that increases the tip compared to $s = 1$ by $n(1) - n(0) = N_I$, and so on.

I assume that f is given by

$$(5) \quad f(d) = F_0 + F_1d + F_2d^2,$$

where $F_2 < 0$. Notice that the customer never chooses $d > -F_1/2F_2$. Doing so reduces her utility from feelings and her wealth compared to $d = -F_1/2F_2$. Therefore, the behavior of $f(d)$ for $d > -F_1/2F_2$ does not matter as long as it is below $f(-F_1/2F_2)$. In other words, we can use $f(d)$ without loss of generality for any utility from feelings f^\wedge in the form of

$$\begin{aligned} f^\wedge(d) &= F_0 + F_1d + F_2d^2 && \text{for all } d \leq -F_1/2F_2 \\ f^\wedge(d) &\leq F_0 - F_1^2/4F_2 && \text{for all } d > -F_1/2F_2. \end{aligned}$$

Therefore, the form of $f(d)$ is less restrictive than it appears to be. In particular, the utility from feelings does not have to be symmetric in d for the analysis below to be correct.

I suggest the following interpretation for f : F_2 measures the magnitude of the reasons that cause the customer to tip close to the social norm, namely embarrassment and fairness. F_1 measures the effect of the reasons to tip even more than the social norm: generosity and empathy for the waiter, minus the opposite effect of the feeling of wastefulness that might arise when the customer tips more than is necessary.

Substituting $d = t - N_0 - N_I s$, the first-order condition of the customer's problem becomes

$$(6) \quad F_1 + 2F_2(t - N_0 - N_I s) = b.$$

Using Proposition 1, the optimal tip is

$$(7) \quad t(s) = \text{Max} [(b - F_1)/2F_2 + N_0 + N_1s, 0].$$

The last equation can be rewritten as

$$(8) \quad t(s) = \text{Max} [T_0 + T_1s, 0],$$

where $T_0 = (b - F_1)/2F_2 + N_0$ and $T_1 = N_1$.

It is easy to see that if $F_1 = b$ then the tipping function is identical to the social norm (and if F_2 is very big compared to $b - F_1$, they are almost identical). We can think about the norm that society creates as including not only how much to tip, but also how badly to feel when one disobeys the norm.⁸ Under this interpretation, we can define the equilibrium (or a stable norm) to occur when $F_1 = b$. When this happens, people tip exactly what the norm prescribes, and therefore even if in the long run their behavior affects the norm, the norm does not change.

Notice that $F_1 = b > 0$ implies that ignoring the desire to save money, the customer prefers tipping above the norm to tipping exactly the amount dictated by the norm. This can occur, for example, if the norm is that over-tippers are considered generous, therefore giving people a reason to tip above the norm. In equilibrium, however, this incentive to tip above the norm is exactly offset by the desire to have more money, and by the negative feeling of wastefulness. Moreover, if we think about b as being different in various restaurants rather than a constant, $F_1 = b$ implies that showing off generosity by over-tipping (minus the effect of feeling wasteful) is more utility enhancing in higher-priced restaurants. Indeed, this is supported by the evidence that tips in upscale restaurants tend to be higher (not only in absolute value, but also in percentage of the bill) than those in cheaper restaurants (Post

⁸ I thank Ricky Lam for this idea.

1997). For the rest of the paper, however, I consider F_1 and F_2 as depending on the customer's personality, rather than being part of the norm.

Suppose that $T_1 > 0$; restricting attention to $s \geq 0$, if $T_0 \geq 0$ then the tipping function is affine. If $T_0 < 0$, it is kinked: it is horizontal and equal to zero up to $s_0 \equiv -T_0/T_1$, and is affine with a slope of T_1 for $s > s_0$. Equation (8) shows again what was argued before in the general case: whenever the tip is positive, the tipping function is parallel to the social norm. In particular, for any $s \geq \max [s_0, 0]$, both are affine with a slope of N_1 . Since $F_2 < 0$, if $F_1 \geq b$ then $T_0 \geq N_0 \geq 0$ and the tipping function parallels the social norm for all non-negative s . Once again, the norm can be either above of below the tipping function: the tipping function exceeds the norm if $F_1 > b$, is exactly equal to the norm if $F_1 = b$, and is below the norm if $F_1 < b$. The intuition is that when evaluated at $d = 0$, the marginal cost of the tip is b and the marginal benefit is F_1 , so for deviations close to zero the customer prefers $d < 0$ (to tip below the norm) if $F_1 < b$. The strict concavity of $f(d)$ ensures that if for d -values close to zero $d < 0$ is preferred to $d = 0$, then the optimal d when allowing d to take any value is still negative. The intuition for the case $F_1 > b$ is similar.

After solving the customer's problem, we now go backwards and ask which service quality the waiter chooses given the customer's tipping behavior. I assume that the waiter's effort function (per unit of bill size) is quadratic, $e(s) = E_0 + E_1s + E_2s^2$. Since by previous assumptions $e'(0) = 0$, $e(0) > 0$ and e is strictly convex, we get $E_0 > 0$, $E_1 = 0$ and $E_2 > 0$. The waiter's utility is therefore (with some abuse of notation, keeping v as the utility function)

$$(9) \quad v(b, s) = b(\max [T_0 + T_1s, 0] - E_0 - E_2s^2),$$

where $E_0 > 0$, $E_2 > 0$, and $T_1 \geq 0$.

I assume that the waiter's utility when he chooses $s = 0$ and does not receive tip, which is equal to $-bE_0$, is greater than his utility from quitting his job and working somewhere else.⁹ The waiter chooses s to maximize his utility and takes b parametrically. Recall that the waiter never chooses negative s , as this is strictly dominated by $s = 0$. Clearly, when $T_1 = 0$, the optimal service quality is zero, as the waiter is not rewarded for extra effort. When $T_1 > 0$, it is more convenient to examine the first derivatives t' and e' rather than t and e . The waiter wants to choose s that maximizes $t(s) - e(s)$; doing so is equivalent to choosing s that maximizes the area under t' minus the area under e' , both evaluated between 0 and s . Since t' and e' are the marginal benefit and marginal cost (per dollar of bill size) for the waiter from increasing service quality, the areas under t' and e' between 0 and s are the total benefit and total cost resulting from quality s . Recall that $e'(s) = 2E_2s$, $t'(s) = T_1$ for all $s > s_0$, and $t'(s) = 0$ for all $s < s_0$, where s_0 is the kink point in the tipping function. There are two cases to consider:

(1) When $T_0 \geq 0$, the kink is irrelevant because it occurs at $s_0 \leq 0$. The slope of $t(s)$ is $T_1 > 0$ for all positive s ; since $e'(0) = 0$, we obtain $t'(s) > e'(s)$ for values of s close to zero. Therefore, the optimal quality is strictly positive.

(2) When $T_0 < 0$, $t'(s)$ is equal to zero for $s < s_0$ and to T_1 for $s > s_0$. We can then divide the analysis to two sub-cases: if $T_1 \leq e'(s_0) = -2E_2T_0/T_1$, then $t'(s)$ is below $e'(s)$ for all $s \geq 0$, implying that the optimal quality is zero. If $T_1 > e'(s_0) = -2E_2T_0/T_1$, two points might be optimal: $s = 0$ and $s = T_1/2E_2$. We have to compute the waiter's utility in both of them ascertain which one is better. These observations are summarized in the following proposition.

⁹ While this assumption simplifies the analysis, what we really need is only that the waiter receives at least his reservation utility when he provides the optimal service quality. This is likely to hold, because if it does not, all waiters quit their jobs; restaurants, then, have to increase wages until the waiters receive their reservation utility.

- Proposition 2.** (i) If $T_1 = 0$, then the waiter chooses $s = 0$.
- (ii) If $T_1 > 0$ and $T_1^2 < -4T_0E_2$, then the waiter chooses $s = 0$.
- (iii) If $T_1 > 0$ and $T_1^2 \geq -4T_0E_2$, the waiter chooses $s = T_1/2E_2$.

2.4. The Importance of the Social Norm

While the service quality in equilibrium depends on several parameters, the ones that are the focus of this paper are those of the social norm, N_0 and N_1 . By examining the effect of N_0 and N_1 on service quality we can not only infer whether the social norm of tipping can improve service quality in general, but also see how different norms result in different quality levels. Let s^* denote the service quality chosen by the waiter. The effect of N_1 on s^* is summarized in the following corollary:

- Corollary 3.** (i) When $T_0 \geq 0$, s^* is strictly increasing in N_1 .
- (ii) When $T_0 < 0$, there exists a value X such that $s^* = 0$ for $N_1 < X$ and s^* is strictly increasing in N_1 for all $N_1 \geq X$.
- (iii) For any combination of values for the parameters N_0 , F_0 , F_1 , F_2 , b , E_0 , and E_2 , we can ensure that s^* is above any arbitrary service quality s that we want by choosing N_1 large enough.

Proposition 2 and Corollary 3 suggest the importance of the slope of the social norm with respect to service quality. If the slope is zero, service quality is zero. Whenever service quality is positive, it is strictly increasing in the slope; and by choosing a high enough slope, we can ensure that the service quality exceeds any desired level. When the social norm recommends varying the tip significantly according to the service quality (high N_1), the customer does so and provides incentives for the waiter to improve the service. On the other hand, if the norm dictates roughly the same tip regardless of the service received, equilibrium service quality is very low, possibly even zero.

The importance of N_0 is suggested by the next corollary:

Corollary 4. If $T_1^2/4E_2 < (F_1 - b)/2F_2$ (notice that $F_1 < b$ is necessary for this to hold) then there exists a value $Y > 0$ such that if $N_0 < Y$ then $s^* = 0$.

The significance of N_0 is somewhat surprising. At first, it is not clear why a constant of the social norm should matter for the waiter's choice of quality. Being a constant, it does not seem to affect the incentives of the waiter to increase quality in any way; recall that the social norm does not have a kink because $N_0 \geq 0$, so N_0 is part of the appropriate tip regardless of service quality. The reason why N_0 matters is that the tipping function might be below the social norm, and might be kinked. When the tipping function is kinked (this happens when $T_0 < 0$, or equivalently $N_0 < (F_1 - b)/2F_2$), the waiter has to increase his effort without reward up to $s_0 = -T_0/T_1$; only further increase in his effort increases his tip. The lower is the value of N_0 , the lower T_0 is. If $F_1 < b$, then T_0 is negative for low values of N_0 . In this case, lower N_0 implies higher absolute value of T_0 and higher s_0 ; the waiter has to make more effort before he starts being rewarded for additional effort. Naturally, this increases the likelihood that he finds $s = 0$ to be optimal.

In some sense, we can conclude that while both N_0 and N_1 are important in affecting s^* , N_1 is more important. The reason is that N_0 has an effect only when $T_1^2/4E_2 < (F_1 - b)/2F_2$ (see Corollary 4), while N_1 affects s^* for any parameter values. Moreover, while both N_0 and N_1 can determine under certain conditions whether s^* is positive or zero, marginal changes in N_1 have an effect on s^* also when $s^* > 0$, while marginal changes in N_0 do not; to see this, recall that whenever s^* is positive, it is equal to $T_1/2E_2 = N_1/2E_2$.

2.5. *The Potential Market Failure*

Proposition 2 suggests that in certain conditions service quality in equilibrium is zero. This result represents a market failure in the market for good service. At $s = 0$, the marginal benefit of the customer from better service, which is assumed to be strictly positive, exceeds the marginal cost for the waiter of improving service, which is zero. Yet, the market outcome

is the inefficient zero service quality. In the absence of an explicit contract between the waiter and the customer, incentives are provided to the waiter by the social norm and the willingness of the customer to adhere to it. If the social norm does not provide the right incentives, the market for good service collapses.

What happens when the waiter chooses to provide zero quality in equilibrium? One possibility is that suggested by the model: customers get poor service; if $N_l > 0$, they do not leave tips (see Lemma 2 below), and if $N_l = 0$, they leave tips only if $T_0 > 0$. There is an alternative, however: if the consumer surplus from dining in a certain restaurant is generally small, then zero quality, even though it saves the customer the expense of tipping, can result in negative consumer surplus. In this case, the customer chooses to go to a different restaurant or to eat at home.

The restaurant owner, if she wants to stay in business, has to make sure service improves; to do so, she supervises the waiters directly, and provides them with incentives to excel in their job. These incentives can be higher wages, better shifts, better tables and promotion to the good waiters, and dismissal of the less competent ones. The increased service quality can even be above s_0 , resulting in positive tips that enhance the incentives faced by the waiters even further.

Since the owner spends money on direct supervision anyway, she might find it optimal to take the tips from the waiters by adding a fixed-percentage service charge (sometimes called gratuity) that replaces tipping.¹⁰ Direct supervision might be needed also when s^* is positive, but is too small and customers either avoid the restaurant or substantially reduce the price they are willing to pay for dining there. Supervision by the owner, however, is costly, whereas monitoring by the customer is not. The potential inefficiency of the social norm is

¹⁰ Such service charges are common in Europe; in the United States, they are often imposed on parties of six or more diners.

now represented by the cost of supervision rather than by low-quality equilibrium. In other words, the social norm of tipping can save the need of costly supervision of waiters, but whether or not it does so depends on the exact norm – in particular on the sensitivity of the appropriate tip to service quality (N_I in the model).

2.6. Comparative Statics

While the effect of N_0 and N_I on the equilibrium of the model was discussed above, it is interesting to know how the other parameters, namely F_0 , F_I , F_2 , b , E_0 and E_2 , affect the equilibrium. Recall that whenever $s^* > 0$, it is equal to $T_I/2E_2 = N_I/2E_2$. That is, the equilibrium quality is strictly decreasing in E_2 . This is intuitive: the more costly it is for the waiter to provide excellent service (higher E_2), the lower the service quality he chooses in equilibrium. No other parameter except N_I affects s^* conditional on s^* being positive. But several parameters affect whether s^* is positive or zero. In particular, Proposition 2 suggests that if $T_I > 0$, then $s^* = 0$ whenever $T_I^2 < -4E_2T_0$; substituting for T_I and T_0 , the inequality becomes $N_I^2 < -4E_2(N_0 + (b - F_I)/2F_2)$.

This inequality can be satisfied only if $b > F_I$ (since $F_2 < 0$). This means that higher b and lower F_I make it more likely that $s^* = 0$. The intuition about b is that the higher the bill is, the bigger is the incentive to stiff, because more money is at stake. Consequently, s_0 increases, which means that the waiter has to make more effort before he starts to be rewarded for additional effort; therefore, he is more likely to find the effort required to get positive tip too big and to choose $s^* = 0$. The intuition about F_I is that higher F_I increases the willingness of the customer to tip and reduces s_0 ; therefore, the waiter is less likely to find zero quality to be optimal.

When $b > F_I$, higher E_2 also makes it more likely that the waiter chooses $s^* = 0$. Intuitively, the more costly is effort, the more likely the waiter is to find zero quality to be optimal. With $b > F_I$, higher F_2 (closer to zero) makes it more likely that the waiter chooses

$s^* = 0$. F_2 closer to zero means that the social norm is less important to the customer, stiffing is more likely, s_0 increases and the waiter is more likely to save his effort. F_0 and E_0 do not affect s^* ; this is intuitive, as they enter as constants in the utility functions of the customer and the waiter.

3. Social Welfare

To examine how efficient is tipping in ensuring good service, the natural thing to do is to compare the equilibrium service quality to the welfare maximizing quality. The results do not depend on the functional forms of f and e that were used to analyze the equilibrium, so I allow for flexible forms of f and e , where f is strictly concave and e is strictly convex. I retain $n(s) = N_0 + N_1s$ as the social norm, however, to enable meaningful discussion about the parameters of the social norm.

I assume that the utility from the dining experience is proportional to the bill size. This assumption implies that the utility from dining, $G(s, b)$, can be written as $g(s)b$. Notice that $g'(s)b$ is the marginal utility from an increase in service quality, while N_1b is the associated increase in tip (according to the social norm). It makes sense that the norm is such that the customer and the waiter split (not necessarily equally) the gains from improved service quality. If the norm gives the customer a strictly positive share of the gains at any s , then $N_1 < g'(s)$ for all s . Notice that if $N_1 > g'(s)$ for some s , it implies that the norm gives the waiter rewards for increased quality beyond the additional utility that the customer derives from this better quality. The customer, whose optimal tipping function is parallel to the norm whenever the tip is strictly positive, is actually made worse off by the increased quality, because of the higher tip she is expected to give. In such a case, there is no reason why the norm, and the customer, should encourage higher service quality by such a high slope (N_1). Therefore, I assume that $g'(s) \geq N_1$ for all s (in Proposition 3 below I make the stronger assumption $g'(s) > N_1$). The customer's utility function is given by:

$$(10) \quad u(s, t, b) = b(g(s) - 1 - t) + f(t - N_0 - N_1 s).$$

Recall that the general form of the waiter's utility function is $v(s, t, b) = b(t(s) - e(s))$.

The welfare function, $w(s, t, b)$ is defined as the sum of the non-monetary utilities of the waiter and the customer:

$$(11) \quad w(s, t, b) = f(t - N_0 - N_1 s) + b(g(s) - e(s)).$$

In addition to the assumptions in the previous section, I assume the following:

Assumption 3. *$g - e$ is strictly concave (notice that concavity of g is sufficient for this to hold given strict convexity of e), g is twice continuously differentiable, $N_1 > 0$, and $g'(s) \geq N_1$ for all s .*

Assumption 3 leads to the next two results:

Lemma 2. *When $N_1 > 0$, there is no equilibrium (of the two-stage game described in the previous section) in which service quality is zero and the tip is strictly positive.*

Proposition 3. *Assume that $N_1 < g'(s)$ for all s . Then,*

(i) *The welfare-maximizing service quality is strictly higher than that obtained in equilibrium.*

(ii) *The welfare-maximizing tip is weakly higher than that obtained in equilibrium.*

Proposition 3 suggests that although the social norm enables an equilibrium with positive service quality, as long as $N_1 < g'(s)$ for all s , the equilibrium involves a service quality smaller than optimal. This result may have implications for restaurant owners. If they can increase service quality, they may be able to raise prices more than they have to compensate the waiters for the additional effort. To see this, suppose that they increase service quality by one unit compared to the equilibrium. The customer's utility from dining increases by $bg'(s^*)$, but he also tips bN_1 more, so the owner may be able to raise prices by up to $b(g'(s^*) - N_1)$. He has to compensate the waiter for the increased effort, net of the increased tips received by the waiter: $b(e'(s^*) - N_1)$. The owner's profit from increasing the service quality

may therefore be up to the difference, $b(g'(s^*) - e'(s^*))$. Is this difference positive? As long as $s^* < s^w$, the answer is yes. Since $g - e$ is strictly concave, $g' - e'$ is strictly decreasing. By definition, $g'(s^w) - e'(s^w) = 0$, so $g'(s^*) - e'(s^*) > 0$ for all $s^* < s^w$.

Improving service quality, however, entails not only additional compensation to the waiter, but also costly monitoring. When the owner relies on tipping to give the waiter incentives to provide good service (as is often the case in practice), she does not have to incur costly monitoring. When the owner wants to increase service quality beyond the equilibrium level, she has to employ workers that supervise the waiter's work, and maybe even to invest in training of the waiter. These additional costs may outweigh the potential benefits from increased quality, resulting in no action being taken by the owner to increase service quality.

So far we have seen that under several assumptions the equilibrium service quality is below the optimal level. It is interesting to explore further the connection between the norm and the resulting equilibrium: what conditions about the social norm affect how close is the equilibrium to social optimum? What is the optimal social norm? How does the social norm affect social welfare? The following corollary addresses these questions:

- Corollary 5.** (i) For all $N_l < g'(s^w)$ and $s^* > 0$, $|s^w - s^*|$ is strictly decreasing in N_l .
- (ii) The optimal affine social norm has $N_l = g'(s^w)$; N_0 does not affect social welfare, as long as N_0 is above some threshold.
- (iii) Social welfare is strictly increasing in N_l for all $N_l < g'(s^w)$.

Corollary 5 demonstrates the importance of the slope of the social norm, N_l . Up to $g'(s^w)$, higher slope (N_l) yields higher welfare. It is easy to see the intuition behind the optimal norm condition, $N_l = g'(s^w)$, if we assume that g is affine: $g(s) = G_0 + G_l s$. Then, the optimal norm has $N_l = g'(s^w) = G_l$. When the waiter increases service quality by one unit, he gets $bN_l = bG_l$ more in tips. That is, he gets all the fruits of the increased quality; the customer pays every increase in her utility back to the waiter in the form of tips. The waiter

in this case chooses to increase service quality as long as its effort cost, $e'(s)b$, is less than the utility it brings to the customer, bG_I ; that is exactly what a social planner would like to do as well, and the resulting service quality with such norm is the quality that a social planner would like to implement.

Although tipping is not likely to yield the welfare-maximizing service quality, it has the potential to increase welfare compared to the no-tipping equilibrium. Notice, however, that when tipping does not exist, the customer has no utility from feelings. Therefore, in addition to the effect of tipping on service quality, tipping may affect social welfare directly through the utility or disutility that people experience when they tip. If people find tipping extremely annoying because it requires them to compute the tip and look for the correct change, tipping can be welfare reducing even if it increases service quality significantly. On the other hand, if people like tipping because it gives them power and allows them to reward a good waiter and punish a bad waiter, tipping may be welfare-enhancing even if it has no effect on service quality. Several experimental studies, for example, found that people are often willing to incur costs to punish others who were hostile to them or to reward others who were friendly (see Fehr and Falk 2002). Without substituting numbers for the parameters of the model, however, we do not know whether the utility from feelings is negative or positive. I will therefore choose a conservative approach and compare welfare with and without tipping by looking only at welfare from service quality; that is, f does not enter the welfare function, implying $W(s, b) = b(g(s) - e(s))$.

Proposition 4. *Whenever the equilibrium service quality is strictly positive, the existence of tipping increases welfare as defined by $W(s, b)$.*

This result shows that tipping is a social norm that has the potential, under some reasonable conditions, to increase welfare by increasing service quality.

4. Conclusion

The article presents for the first time a complete and formal model that incorporates social norms and utility from feelings to explain why people tip, how workers respond to tips, and how the exact norm about tipping affects social welfare. The analysis shows that tipping increases welfare under several conditions; as such, tipping is an example that supports Arrow's (1971) interpretation of social norms, "*agreements to improve the efficiency of the economic system.*"

The customer and the waiter could benefit from a contract that prescribes the service quality and its price. While the restaurant can make a standard contract for all its employees and customers, however, the enforcement of the contract would be problematic: if the customer refuses to tip, the waiter will probably find it too costly to enforce the contract. The subjectivity of service quality makes enforcement even more difficult. Without tipping, the lack of an enforceable contract leads to minimal service quality, which is inefficient, because the customer's utility from additional quality exceeds its cost to the waiter. The social norm of tipping remedies this potential market failure by providing an implicit standard contract. The embarrassment and unfairness that people feel when they violate the norm serve as an enforcement mechanism. As a result, the social norm of tipping can increase welfare by improving service quality. This suggests that economics and social norms share double-sided causality: economic reasons may create and support social norms, and social norms affect economic behavior.

The welfare-enhancing role of tipping implies that the British customers in coffee shops who invented tipping in the 16th century (Schein, Jablonski and Wohlfahrt 1984), as well as the Americans who brought the custom to the United States in the late 19th century (Segrave 1998) improved social welfare. It is not clear why in Europe, where tipping began, many establishments decided to replace tipping by service charges. The analysis suggests that doing

so might be welfare reducing, and understanding why this happens is an interesting question for future research.

The model suggests that although tipping can increase welfare, service quality and social welfare are likely to be below their optimal values. The exact shape of the social norm is crucial: higher sensitivity of the norm to service quality (i.e. the appropriate tip is a steep function of service quality) results in better service and higher social welfare. Low sensitivity of the norm to service quality may lead to zero quality in equilibrium. Surprisingly, if the norm dictates tips that are very low for poor service, this can also result in zero-quality equilibrium.

While in Europe the replacement of tips with service charges takes away the advantages of tipping, in the United States the behavior of people may undermine the role of tips. Many people report feeling pressured to tip even for bad service. In a poll conducted at the website www.tipping.org, the question “Do you feel pressured to tip at a restaurant even if you feel you received bad service?” was posted. By April 13, 2003, out of 6069 voters, 66 percent answered “Yes.” Presumably, people feel pressured to tip for bad service because they are afraid to be viewed as “cheap” if they do not tip. In addition, they may feel uncomfortable stiffing the waiter whose income depends on tips. But if this pressure continues, tipping is likely to stop being welfare enhancing. If people tip similarly for bad and good service, waiters no longer have an incentive to provide excellent service. We should retain tipping as a mechanism of consumer monitoring by encouraging people to tip according to service quality. Bad service should be punished by a low tip (or no tip at all), and excellent service should be rewarded by more than 15 percent. Customers who refuse to tip when they receive bad service should be viewed not as “cheap” but rather as brave and as promoting welfare by disciplining the waiters.

A common criticism against economic models that incorporate utility from conforming to social norms or from feelings is that every phenomenon can be easily explained if we allow the agent to care about things beyond his material well-being. While there is a lot of experimental evidence suggesting that people care about social norms, reciprocity, and other psychological motivations¹¹, many economists are still reluctant to accept the importance of psychological motivations and to incorporate those in economic models. One reason for this is that they question the external validity of these experiments: they argue that such behavior in experiments does not imply that in real-life economic situations we will observe the same behavior.

Tipping is an excellent example for two things. First, tipping shows that such psychologically-motivated behavior happens in real-life situations involving dozens of billions of dollars, thus illustrating the external validity of these experiments. Second, tipping shows that insisting on models without social norms and feelings might yield false predictions about phenomena where norms and feelings play an important role. As Ben-Zion and Karni (1977) show, traditional economic analysis suggests that non-repeated customers should not tip. Yet, this prediction is obviously violated in practice, since most people tip even when they do not intend to return to the same establishment. This suggests that feelings and social norms are important not only in psychology and sociology, but also in economics. This lesson should be applied to other economic areas as well: models that incorporate feelings or social norms should not be discarded when they explain phenomena in which feelings or social norms are in fact important.

Appendix: Proofs

Proof of Proposition 1

¹¹ For good reviews of some of this literature see Fehr and Gächter (2000) and Fehr and Falk (2002).

The customer chooses t to maximize the following utility function: $u(s, t, b) = -b(1 + t) + f(t - n(s)) + G(s, b)$, subject to the constraint $t \geq 0$. Let us proceed by solving the unconstrained problem and examining whether the potentially optimal value of t is positive. For every value of s , the first-order condition with respect to t is $-b + f'(t - n(s)) = 0$. Notice that the value of t that solves the first-order condition is $t^*(s)$. The second-order sufficient condition is a strict concavity of f , which is satisfied by Assumption 1. If $t^*(s) \geq 0$ then the constraint $t \geq 0$ is satisfied, and since the utility function is strictly concave in t , the unique global maximizer of $u(s, t, b)$ is $t = t^*(s)$. If $t^*(s) < 0$, then for all non-negative values of t , $0 = -b + f'(t^*(s) - n(s)) > -b + f'(t - n(s)) = du/dt|_t$. The inequality follows from the strict concavity of f . Since du/dt is negative for all non-negative values of t , it is clear that the optimal value of t that satisfies the constraint $t \geq 0$ is zero. Therefore, the optimal tip is the maximum between $t^*(s)$ and zero. Q.E.D.

Proof of Corollary 1

By the strict concavity of f , if $b > f'(-n(s))$ then $t^*(s) < 0$. Using Proposition 1, this implies $t^*(s) = 0$. Q.E.D.

Proof of Lemma 1

Since f is strictly concave, f' is strictly decreasing and therefore it has an inverse function, $[f']^{-1}$. Using Definition 1, $t^*(s) - n(s) = [f']^{-1}(b)$, a constant; that is, t^* and n are parallel functions. Q.E.D.

Proof of Corollary 2

This follows directly from Lemma 1 and the assumption that n is non-decreasing and continuous. Q.E.D.

Proof of Proposition 2

(i) If $T_1 = 0$ then the first-order condition of the waiter's utility with respect to s is $-2E_2s = 0$, the second-order sufficient condition is satisfied ($-2E_2 < 0$) and the optimal service quality is 0.

(ii) and (iii) When $T_1 > 0$, the most convenient way to proceed is by dividing the analysis to two cases: $T_0 \geq 0$ and $T_0 < 0$.

Case 1: $T_0 \geq 0$. Notice that $T_1^2 \geq -4T_0E_2$, because $E_2 > 0$, so we want to show that $s = T_1/2E_2$.

Indeed, when $T_0 \geq 0$, $\max [T_0 + T_1s, 0] = T_0 + T_1s$ for all non-negative s . The first-order condition of the waiter's maximization problem becomes $T_1 - 2E_2s = 0$ and the second-order sufficient condition is satisfied ($-2E_2 < 0$), so the waiter chooses $s = T_1/2E_2$.

Case 2: $T_0 < 0$. Since $T_0 < 0$, the tipping function has a kink. Recall that $s_0 = -T_0/T_1 > 0$ is where the kink occurs. There are two sub-cases to consider:

(a) If $T_1 \leq e'(s_0) = 2E_2s_0 = -2E_2T_0/T_1$, then s_0 yields higher utility than any $s > s_0$; the marginal cost of increasing s is $2E_2s$ and it lies above the marginal benefit, T_1 , for $s > s_0$, because $T_1 \leq 2E_2s_0$ and $E_2 > 0$. Notice, however, that $s = 0$ is strictly preferred to s_0 : both yield a zero tip, but $s = 0$ entails strictly less effort. Rearranging the inequality we get that whenever $T_1^2 \leq -2E_2T_0$, the optimal service quality is zero. Notice that the last inequality can be satisfied only when $T_0 < 0$; if $T_0 \geq 0$ then the right-hand side is non-positive, while $T_1^2 > 0$. Therefore, we can say that whenever $T_1^2 \leq -2E_2T_0$, the optimal service quality is zero; we do not need to add the condition that $T_0 < 0$ which we started from.

(b) If $T_1 > e'(s_0)$, or equivalently $T_1^2 > -2E_2T_0$, then values of s that are close to s_0 from the right are preferred to s_0 . For all $s \geq s_0$, we get $v(b, s) = b(T_0 + T_1s - E_0 - E_2s^2)$, so if the waiter must choose $s \geq s_0$, his optimal s is obtained by the first-order condition: $T_1 - 2E_2s = 0$, or $s = T_1/2E_2$ (the second order sufficient condition is satisfied: $-2E_2 < 0$). If the waiter must choose $s \leq s_0$, his optimal choice is $s = 0$, since it minimizes effort and the tip is zero for all $s \leq s_0$.

We therefore have two candidates to be optimal in this case, and we have to compare the utility from them: $v(b, 0) = -E_0$, and $v(b, T_1/2E_2) = T_0 + T_1(T_1/2E_2) - E_0 - E_2(T_1/2E_2)^2 = T_0 - E_0 + T_1^2/4E_2$. As a result, $s = 0$ is optimal in this case if and only if $T_0 + T_1^2/4E_2 < 0$, or $T_1^2 < -4E_2T_0$ (assume that when he is indifferent, the waiter chooses the higher service quality). Similarly to (a), this condition implies that $T_0 < 0$ is satisfied. Combining this with the assumption we started from for this case, $T_1^2 > -2E_2T_0$, we obtain that $s = 0$ whenever $-4E_2T_0 > T_1^2 > -2E_2T_0$. Add the result in (a), to get that $s = 0$ whenever $T_1^2 < -4E_2T_0$, and $s = T_1/2E_2$ whenever $T_1^2 \geq -4E_2T_0$. Q.E.D.

Proof of Corollary 3

(i) By Proposition 2, when $T_0 \geq 0$, $s^* = T_1/2E_2 = N_1/2E_2$. Since $E_2 > 0$, s^* is strictly increasing in N_1 .

(ii) By Proposition 2, when $T_0 < 0$, if $T_1^2 < -4E_2T_0$ then $s^* = 0$ and if $T_1^2 \geq -4E_2T_0 > 0$ then $s^* = T_1/2E_2 = N_1/2E_2$. Substitute $N_1 = T_1$ in the inequalities and rearrange to find that $X = (-4E_2T_0)^{1/2}$ satisfies part (ii) of Corollary 3.

(iii) If $T_0 \geq 0$, choose any $N_1 \geq 2E_2s$. If $T_0 < 0$, choose $N_1 \geq \max [2E_2s, (-4E_2T_0)^{1/2}]$. Notice that N_0, F_1, F_2 and b , although they do not appear explicitly, affect the required level of N_1 through their effect on T_0, F_0 and E_0 do not affect N_1 in any way. Q.E.D.

Proof of Corollary 4

By Proposition 2, whenever $T_0 < -T_1^2/4E_2$, service quality is zero. Substitute $T_0 = N_0 + (b - F_1)/2F_2$ in the condition and rearrange to get $N_0 < -(b - F_1)/2F_2 - T_1^2/4E_2$; that is, $Y = -T_1^2/4E_2 - (b - F_1)/2F_2$ satisfies the condition in Corollary 4. Since N_0 is assumed to be non-negative, we should verify that $Y > 0$; this is the reason for the condition $T_1^2/4E_2 < (F_1 - b)/2F_2$. Q.E.D.

Proof of Lemma 2

When the tip is strictly positive, the optimal tipping function is parallel to the social norm and therefore has a slope of $N_I > 0$. If service quality is zero and the tip is strictly positive, it implies that $t(s) = T_0 > 0$. But then the waiter is better off choosing s slightly above zero rather than zero, since $T_I > 0 = e'(0)$, so this cannot be an equilibrium. Q.E.D.

Proof of Proposition 3

The first-order conditions of $w(s, t, b)$ with respect to t and s are:

$$(12) \quad \partial w / \partial t = f'(t - N_0 - N_I s) = 0, \text{ and}$$

$$(13) \quad \partial w / \partial s = -N_I f'(t - N_0 - N_I s) + b(g'(s) - e'(s)) = 0.$$

The second-order sufficient conditions for a maximum are:

$$(14) \quad \partial^2 w / \partial t^2 = f''(t - N_0 - N_I s) < 0,$$

$$(15) \quad \partial^2 w / \partial s^2 = N_I^2 f''(t - N_0 - N_I s) + b(g''(s) - e''(s)) < 0, \text{ and}$$

$$(16) \quad (\partial^2 w / \partial t^2)(\partial^2 w / \partial s^2) - (\partial^2 w / \partial t \partial s)^2 = f''(t - N_0 - N_I s)(N_I^2 f''(t - N_0 - N_I s) + b(g''(s) - e''(s))) - (N_I f''(t - N_0 - N_I s))^2 = b f''(t - N_0 - N_I s)(g''(s) - e''(s)) > 0.$$

The inequality in (14) holds since f is strictly concave. The inequalities in (15) and (16) hold because f is strictly concave and $g - e$ is strictly concave by Assumption 3.

Substituting (12) into (13) and assuming $b > 0$, we get $g'(s) - e'(s) = 0$. This equation defines the welfare-maximizing value of s ; by the strict concavity of $g - e$, this value is unique, and using Assumption 2 and $g'(s) > 0$, such value exists. Substituting this value into (12) then gives the welfare-maximizing value of t . Assumption 1 ensures that this value of t exists and is unique. To proceed, let us define the following:

(i) Let s^w be the unique value of s that solves the equation $g'(s) - e'(s) = 0$, and let t^w be the unique value of t that solves the equation $f'(t - N_0 - N_I s^w) = 0$ (the superscript w stands for “welfare-maximizing”). Notice that t^w might be negative.

(ii) Let $t^w \equiv \max [t^w, 0]$.

(iii) Let s^* and $t^*(s^*)$ be the service quality and tip in equilibrium.

Since $g'(s) > 0$ for all s , $e'(0) = 0$ and e is strictly convex, we know that $s^w > 0$. If $t^w \geq 0$, then t^w is the global maximizer of w and therefore it is also the global maximizer subject to the constraint $t \geq 0$. When $t^w < 0$, then since t enters w only through f and f is strictly concave, the welfare-maximizing value of t subject to $t \geq 0$ is 0 . Therefore, t^w is value of t that maximizes welfare subject to $t \geq 0$.

If $s^* = 0$, then by Lemma 2 we get $t^*(s^*) = 0$, implying that $s^w > s^*$ and $t^w \geq t^*(s^*)$, and Proposition 3 holds. For the rest of the proof, assume that $s^* > 0$. This implies $t^*(s^*) > 0$, because if the tip in equilibrium is zero, the waiter cannot find it optimal to provide strictly positive service quality. The tipping function has a slope N_I for all $s > s_0$ (recall that s_0 is the kink point of the tipping function; it may be negative, and then the tipping function is affine for all $s \in [0, \infty)$, which is the range of interest). Since $t^*(s^*) > 0$, we know that $s^* > s_0$ and the slope of the tipping function at s^* is $N_I > 0$. The first-order condition of the waiter's problem implies that whenever $s^* > 0$, $e'(s^*) = N_I$. Since $e'(s^w) = g'(s^w) > N_I = e'(s^*)$, it follows by strict convexity of e that $s^w > s^*$. This completes part (i) of Proposition 3.

Because $t^*(s^*) > 0$, the first-order condition of the customer's problem has to be satisfied: $f'(t^*(s^*) - N_0 - N_I s^*) = b$ (this condition might be violated only in the corner solution, $t^*(s^*) = 0$). The strict concavity of f implies that the value of t that satisfies $f'(t - N_0 - N_I s^w) = b$ must satisfy:

$$(17) \quad t - N_0 - N_I s^w = t^*(s^*) - N_0 - N_I s^*.$$

It follows that $t = t^*(s^*) + N_I(s^w - s^*) > t^*(s^*) > 0$. Strict concavity of f implies that $t^w > t > t^*(s^*)$ for all $b > 0$. This completes the proof of part (ii) of Proposition 3. Q.E.D.

Proof of Corollary 5

(i) The proof of Proposition 3 shows that if $s^* > 0$, then $e'(s^w) = g'(s^w)$ and $e'(s^*) = N_I$. Since e' is strictly increasing, s^* is strictly increasing in N_I . Because s^w is the unique solution to

$g'(s^w) - e'(s^w) = 0$ and g and e do not depend on N_I , s^w is not a function of N_I . Since $s^w > s^*$, it follows that $|s^w - s^*| = s^w - s^*$ is strictly decreasing in N_I .

(ii) The optimal social norm is the one that induces the equilibrium with the highest welfare. Since service quality and tip in equilibrium are lower than their optimal values, it is clear that a norm that results in $s^* = 0$ (which implies $t^*(s^*) = 0$) is not optimal. The first-order condition of the customer's problem is $f'(t^*(s) - N_0 - N_I s) = b$, where $t^*(s)$ might be negative. Since f is strictly concave, this implies that $t^*(s) - N_0 - N_I s = [f']^{-1}(b)$, where $[f']^{-1}$ denotes the inverse function of f' . For all $N_0 > -[f']^{-1}(b)$ and all $s \geq 0$ we get $t^*(s) = [f']^{-1}(b) + N_0 + N_I s \geq [f']^{-1}(b) + N_0 > 0$. Therefore, if $N_0 > -[f']^{-1}(b)$, tips are always positive; according to Lemma 2, this implies $s^* > 0$. In the rest of the proof I therefore limit attention to $s^* > 0$.

Recall from (11) that $w(s, t, b) = f(t - N_0 - N_I s) + b(g(s) - e(s))$. Whenever $t > 0$, $t - N_0 - N_I s = [f']^{-1}(b)$, a constant. Therefore, conditional on the tip being strictly positive, the norm cannot affect $f(t - N_0 - N_I s)$. The optimal norm is the one that maximizes $b(g(s) - e(s))$. Since b is exogenous and $g - e$ is strictly concave, the best a norm can do is to induce s^* that satisfies the first-order condition $g'(s^*) - e'(s^*) = 0$. By definition, the unique s^* that satisfies this equation is s^w . Since $e'(s^*) = N_I$ in equilibrium, if $N_I = g'(s^w)$ then $s^* = s^w$; to see this, notice that in this case we have $e'(s^w) = g'(s^w) = N_I = e'(s^*)$. Strict convexity of e then implies $s^w = s^*$. That is, the optimal affine norm has $N_I = g'(s^w)$. Notice that since we can do no better than implement s^w , N_0 has no effect on social welfare once it is high enough to ensure that $s^* > 0$.

(iii) Since $g - e$ is strictly concave and is maximized at s^w , $g(s) - e(s)$ is strictly increasing in s for all $s < s^w$. The norm affects social welfare only through $g(s) - e(s)$. In addition, for all $N_I < g'(s^w)$, s^* is strictly increasing in N_I and $s^* < s^w$. It follows that social welfare is strictly increasing in N_I for all $N_I < g'(s^w)$. Q.E.D.

Proof of Proposition 4

In the absence of tipping, the waiter minimizes his effort by choosing to provide zero service quality. Since $W(s, b)$ is strictly concave and is maximized at $s^w > s^*$, it is higher for $s^* > 0$ than for $s = 0$. Q.E.D.

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