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ABSTRACT

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We examine theoretically demand in a two-good economy where the demand of one good is influenced by either a spillover effect in the form of an externality from other consumers' choices and or a conformity effect representing a need for making similar choices as others. A positive spillover effect increases the demand for the good with interactions, and a conformity effect makes the demand curve pivot around the average market demand to make demand less price sensitive. The collateral implication is that spillover in consumption increases the associated derived demand for labor and conformity in consumption makes the associated derived demand for labor less elastic. Finally, we also demonstrate how the presence of a good with social interactions affects the demand for the good without social interactions and the associated demand for the labor producing the non-interactions good.

JEL Classification: D11

Keywords: consumer demand, social interactions, spillover, conformity, labor demand

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1. Introduction

Social interactions are of much policy relevance. They can alter the effects of taxation or transfer programs intended to improve the economic situation of the poor or unemployed (Grodner and Kniesner 2006). If there are significant interactions then optimal policy need consider the synergies described by so-called social multiplier effects. Where workers care about their positions in the income distribution then a beneficial regulatory policy that does not alter relative incomes receives too low a benefit in conventional cost-benefit calculations. Thus, ignoring social interactions can mis-state significantly the social welfare effects of taxes, transfers, or regulatory policy. Our contribution to an increased understanding of the role of social interactions is to flesh out succinctly the demand implications of two basic forms of interactions: spillover (externality from other consumers' behavior) and conformity (penalty for people behaving different from the norm), where social interactions are directly embedded into the utility function via social utility. Our results succinctly clarify (1) how a positive spillover generally increases product demand (and the associated derived demand for labor), (2) how conformity pivots product demand around the expected market demand to make consumers less price responsive (and the associated derived demand for labor also less elastic), and (3) how social interactions in one good indirectly influence other goods' demands and the associated derived demand for labor.

2. Organizing Model

We begin with the total utility function (Brock and Durlauf 2001)

$$V\left(x, y; \alpha, \mu_x\right) = V\left(u\left(x, y\right), S\left(x; \mu_x, \alpha\right)\right) \text{(1)}$$

st. $p_x x + p_y y = M$ (2)

where x and y are actions/choices made by an individual with the corresponding prices p_x and p_y, and $u\left(x, y\right)$ is the private utility associated with a choice bundle $\left(x, y\right)$. Here μ_x is the conditional probability measure of choices that a person places on the choices of others in the reference group, $S\left(x; \mu_x, \alpha\right)$ is social utility from the choice of the individual and his or her expectation of the choices of others, α is the parameter indicating the importance of social utility in total utility, and M is total resources.[1] Finally, we also assume a positive sign for $V_u > 0$, and that V_S has an uncertain sign depending on the form of interactions.

We consider two forms of social interactions: positive spillover and conformity. Positive spillover implies $V_S > 0$ (from social capital, neighborhood/peer, contagion, or conspicuous consumption effects). Conformity is associated with a negative contribution to utility because there is a disutility for being different, $V_S < 0$ (from class identity, social norm, relative income, or reference utility effects). Negative spillover can happen too via $V_S < 0$, or non-conformity by taking $V_S > 0$.

Because spillover is an externality relative to reference group behavior, forms like $S^{s1}\left(x;\mu_x,\alpha\right)=\alpha\mu_x x$, $S^{s2}\left(x;\mu_x,\alpha\right)=\alpha\mu_x x^2$, and $S^{s3}\left(x;\mu_x,\alpha\right)=\alpha\mu_x\sqrt{x}$ are examples of a spillover effect, where S_{xx} affects the slope of demand differently. The first spillover example above describes social capital or neighborhood effects. The second describes mathematically peer effects or contagion/herding. The third equation above represents conspicuous consumption or rat race spillover effects.

Conformity is a fundamental building block in social psychology. The idea is that individuals tend to conform to broadly defined social norms, with a magnitude depending on the cohesiveness, group size, and social support. One can model conformity as $S^{c}\left(x;\mu_x,\alpha\right)=1/\left|x-\mu_x\right|$ where someone is rewarded for behaving according to the norm. The form of social utility in S^c is difficult to work with analytically, and we need at least a restriction that $x \neq \mu_x$. Without loss of generality, we consider conformity a quadratic loss of utility such as $-S^{c1}\left(x;\mu_x,\alpha\right)=-\frac{\alpha}{2}\left(x-\mu_x\right)^2$, $-S^{c2}\left(x;\mu_x,\alpha\right)=-\frac{\alpha}{12}\left(x-\mu_x\right)^4$, or $-S^{c3}\left(x;\mu_x,\alpha\right)=-\frac{\alpha}{4}\left(x^2-\mu_x^2\right)^2$. The first representation of conformity captures social norm effects. The second is how reference income or utility effects look algebraically. The third type of conformity example above reflects threshold effects or demand maxima. Again, depending on the form of conformity via S_{xx} the effect of interactions on the demands for x and y may differ non-trivially.

3. Demand for the Good with Interactions, *x*

Interactions here are via the expectation of the demand for good x by a particular consumer, μ_x. In an ideal setting or small community an agent may observe others' demands for x and make sensible inferences concerning expected demand via the sample mean, median, or mode. In cases where the market is large the individual finds it harder to infer others' behavior and may resort to using existing norms.

To clarify the effect of interactions now we consider an exogenous change in μ_x and take the total differential of $S\left(x;\mu_x,\alpha\right)$, which is

$$dS = S_{xx}dx + S_{x\mu_x}d\mu_x + S_{x\alpha}d\alpha \; (3)$$

The difference between the non-interactions case and any case with interdependence is through S_{xx}, $S_{x\mu_x}$, and $S_{x\alpha}$.

The effects of variables influencing demand here are

$$\text{change in price}: \frac{dx}{dp_x} = \frac{\overbrace{-\lambda p_y^2}^{\text{substitution effect part}} \quad \overbrace{-x\left(p_y V_u u_{xy} + p_x V_u u_{yy}\right)}^{\text{income effect part}}}{2p_x p_y V_u u_{xy} - p_x^2 V_u u_{yy} - p_y^2 V_u u_{xx} + \left(-p_y^2 V_S S_{xx}\right)} \; (4a)$$

$$\text{change in magnitude of interactions}: \frac{dx}{d\alpha} = \frac{p_y^2 V_S S_{x\alpha}}{\det H} \; (4b)$$

$$\text{change in average market demand}: \frac{dx}{d\mu_x} = \frac{p_y^2 V_S S_{x\mu_x}}{\det H} \; (4c)$$

where the matrix H is the Hessian, and the determinant of H is

$$\det H = 2p_x p_y V_u u_{xy} - p_x^2 V_u u_{yy} - p_y^2 V_u u_{xx} + \left(-p_y^2 V_S S_{xx}\right) > 0. \; (5)$$

If the function $u(\bullet)$ is concave and $V(\bullet)$ is without interactions, the concavity of $u(\bullet)$ guarantees $\det H > 0$. However, with interactions present we still need to determine the sign of $p_y^2 V_S S_{xx}$ to decompose the effect of price on demand for x into income and substitution effects. Note that both components from the Slutsky equation are affected because interactions enter the denominator through $\left(-p_y^2 V_S S_{xx}\right)$; it is true for all further cases below.

Figure 1.1 shows how exogenous positive spillover affects the demand for good x. All forms of spillover cause demand to increase because $S_{x\alpha}, S_{x\mu_x} > 0$. As a consequence, the associated derived demand for labor also increases. However, the functional form for social interactions has a profound effect on how exactly demand shifts. For S^{s1} (social capital) the shift is parallel, for S^{s2} (contagion) the effect is larger for higher levels of x, and for S^{s3} (conspicuous consumption) the effect is smaller for higher levels of x. Not only the level of shift differs but also the slope changes non-trivially. Because $S^{s1}_{xx} = 0$, $S^{s2}_{xx} > 0$, $S^{s3}_{xx} < 0$ the first demand curve has the same slope as the no interactions case, the second demand curve is the same shape but has steeper slope, and the third demand curve has a different shape than the no-interactions case. The effect of an increase in average demand, μ_x, is qualitatively the same as a change importance of social interactions, α.

Although qualitatively all spillover effects have the same impact on demand, quantitative implications are dramatically different. Each new demand curve has a different elasticity, and potential policy implications can vary greatly. For example, when a researcher needs to calculate deadweight loss of fiscal policy such as taxation, the results differ for various demand curves. For spillover 1 the deadweight loss is the same as for the no interactions case. For spillover 2, the deadweight loss would be higher, and for spillover 3 the deadweight loss would lower than the baseline case of no interactions.

The effect of conformity in the utility function is summarized by Figure 1.2. For all forms of interactions the demand curve pivots around the point where $x = \mu_x$ because at that level of x we have $S_{x\alpha} = 0$. Although demand pivots around the average demand, μ_x, the slope of the new demand can be (1) uniformly flatter (S^{c1}), (2) become flatter as x changes (S^{c2}), or (3) the slope can change from flatter to steeper (S^{c3}). The effect of increase in average demand, μ_h, is also not uniform though all demand curves increase.

The intuition for conformity is that because there is a penalty for being different from the norm, there is a natural tendency for consumers to behave similarly. Therefore, the product demand curve is less elastic, and via Marshall's Fourth Rule so is the associated derived demand for labor less elastic. However, non-linearity of the conformity effect creates break-even points where consumers change behavior from being less responsive to the change in price to more sensitive to price changes. Some of the behavior resembles the Loss Aversion hypothesis.

The analysis not only stresses the need for modeling non-linear social interactions, but also underlines the fact that modeling interdependence by the theoretical setup in (1) and (2) is flexible and accommodates many realistic cases.

4. Demand for the Good without Interactions, *y*

We also analyze how interactions present in good x affect second good that does not have interactions, y. Comparative statics results are the derivatives:

$$\text{change in price}: \frac{dy}{dp_y} = \frac{\overbrace{-\lambda p_x^2}^{\text{substitution effect part}} \overbrace{-y\left(p_x V_u u_{xy} - p_y V_u u_{xx} + \left(-p_y V_S S_{xx}\right)\right)}^{\text{income effect part}}}{2 p_x p_y V_u u_{xy} - p_x^2 V_u u_{yy} - p_y^2 V_u u_{xx} + \left(-p_y^2 V_S S_{xx}\right)} \quad (6a)$$

$$\text{change in magnitude of interactions}: \frac{dy}{d\alpha} = \frac{-p_x p_y V_S S_{x\alpha}}{\det H} \quad (6b)$$

$$\text{change in average market demand}: \frac{dy}{d\mu_h} = \frac{-p_x p_y V_S S_{x\mu_x}}{\det H} \quad (6c)$$

Interactions affect every derivative through the denominator but interdependence also influences the income effect through $\left(-p_y V_S S_{xx}\right)$. Because the budget constraint binds, any change in good x due to a change in the price of good y changes income for good y.

With a positive spillover effect in good x the demand for good y declines for all forms of spillover. An increase in average demand increases demand for y, even though the change differs by form of spillover. The slope can only be established for S^{s1} (social capital) as it is the same as the baseline case and demand declines uniformly (because $S_{xx}^{s1} = 0$ the slope for x did not change either). The other cases of spillover for which $S_{xx} \neq 0$ have uncertain change in the slope because $\left(-p_y^2 V_S S_{xx}\right)$ in (6a) has both flattening and steepening effects.

In the case of conformity, it is unclear what happens to the demand for y because

S_{xx} affects both the nominator and denominator of (6a). Even if we focus on the simplest case, S^{c1}, $S_{x\alpha} = x - \mu_x$, and $dy / d\alpha = -p_x p_y V_S S_{x\alpha} / \det H$ is uncertain a priori. Conditional on the level of x, for individuals with $x > \mu_h$ the demand for y is higher.[3] For $x < \mu_h$ the demand for y is lower because more x is consumed, $dx / d\alpha > 0$. We still cannot determine how demand for y changes on the entire range of x because there is no reference point like μ_x in demand for the non-interactions good, y.

A graphical illustration can help. Think of an extreme case where demand for x becomes perfectly inelastic due to conformity, then demand for y becomes M_x / p_y, where $M_x = M - p_x \mu_x$ and μ_x represents a constant demand for x. Depending on whether x and y are complements or substitutes the change to the demand for y differs.

The effect of interactions in good x on the demand for good y appears in Figure 2. If without social interactions goods x and y are substitutes , $dx / dp_y > 0$, extreme conformity in x makes demand for good y is less elastic. With the presence of the substitute the demand for y was more elastic because consumers demand more of x to substitute because of the higher price of y. When the demand for x is fixed consumers cannot substitute y with x.

Alternatively, when without interdependence goods x and y are complements, $dx / dp_y < 0$, and the demand for good y with extreme conformity in x becomes more elastic relative to the case of no interactions. When there were no social interactions in x, both x and y were relatively tightly connected by being complements. When x is fixed and a certain part of income is spent on good y, the demand for y becomes more elastic.

Thus, how interactions in good x affect demand for good y and the demand for labor producing good y depends on the relationship between the two goods. In some cases we can make an inference, but the analysis becomes more involved, and the results may be less useful and intuitive. Nevertheless, we show how interactions in only one good affect the behavior of other goods as long as the goods are in the same consumer expenditure bundle.

5. Conclusion

In general, a positive spillover effect increases product (and labor) demand, and specific functional forms for social utility make the slope of demand change non-trivially. Demand can become more elastic over certain ranges of prices but less elastic over another ranges of prices. The magnitude of interactions is important because in some cases part of the population (say, low-demand consumers) may be more strongly affected by the interactions than the rest of consumers. With conformity, product demand pivots around the expected market demand, and product (and labor) demand becomes less elastic. A specific functional form can exaggerate or diminish the general changes to demand.

We also show that interactions in one good indirectly affect the demand for a good that has no direct interactions. The inter-good effect hinges on whether the two goods are complements or substitutes. We cannot analytically provide answers concerning how the non-interactions good (and associated demand for labor) is affected by an interactions type good without some prior knowledge of the relationship between the two commodities.

We acknowledge that there are other forms of interactions potentially represented by the social utility term $S(\bullet)$ besides spillover and conformity; the analytical representations may vary, and interactions may operate through different channels such as via the budget constraint. However, we believe that spillover and conformity exhaust most of the real-life interactions problems and the examples demonstrate the flexibility of our model setup. Our results are useful for policy changes and welfare analysis because the qualitative effects on demand are relatively clear; the quantitative outcomes may have profound consequences on the correct measurement of the deadweight loss or behavioral effects of taxation.

Endnotes

[1] The reference group is any set of individuals (including the entire population) to which the individual refers when making a demand decision.

[2] Suppose that $\mu_x = \frac{\sum_{i=1}^{n} x_i}{n}$. If $\forall i$ we have $\Delta x_i = \Delta_x$ and $\Delta\mu_x = \Delta_x$, then

$\frac{\partial \mu_x}{\partial x} \approx \frac{\Delta \mu_x}{\Delta x_i} = \frac{\Delta_x}{\Delta_x} = 1$.

[3] For $x > \mu_h$ we have $\frac{\partial x}{\partial \alpha} < 0$, so the individual consumes less of good x. There are more resources for good y, so the individual consumes more y because the budget constraint is binding and prices and incomes are unchanged.

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Figure 1.1. Demonstration of the effect of the spillover interactions on the demand for good x with different functional forms.

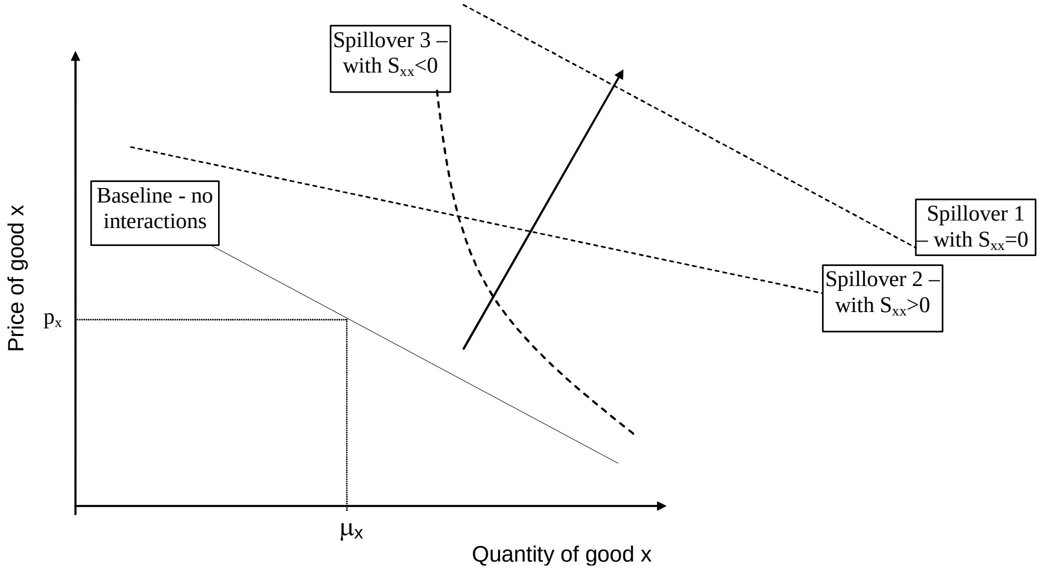

Figure 1.2. Demonstration of the effect of the conformity interactions on the demand for good x with different functional forms.

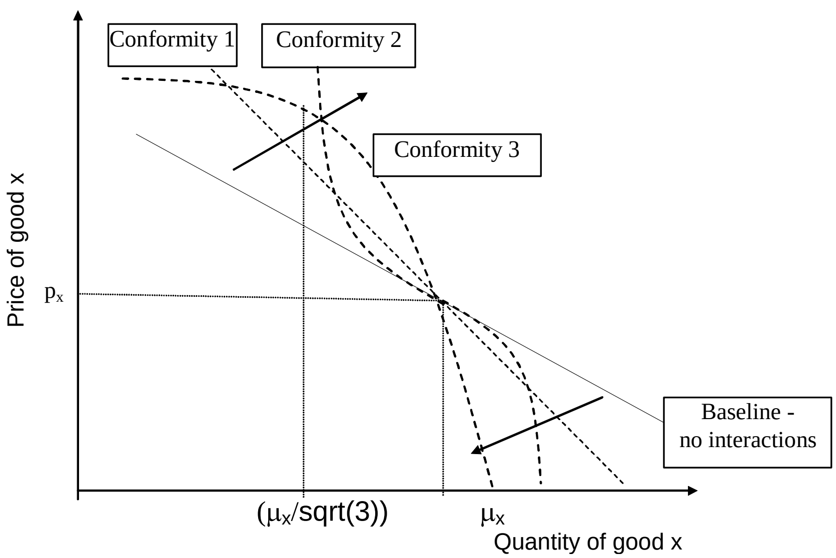

Figure 2. Demonstration of the effect of the conformity in good x on the demand for good y when there is an extreme conformity in good x (consumer consumes fixed amount of good x); graphs represent relationship between offer curves and demand curves (for good y).