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Fantastic Giffen goods and where to find them

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Abstract

Giffen goods regularly feature in undergraduate and graduate level microeconomics courses. Nevertheless, they have taken on a somewhat fantastical status - misunderstood curios, whose existence in the real world is disputed. Explanations of their limited identification often rest on claimed properties, which have come to be understood as necessary for Giffen behavior. Using a dual constraint maximization construct, based on Marshall's original example, this paper demonstrates that Giffen goods need not have these claimed properties. Further, it suggests that real-world examples may be more common than has been generally thought, where they might be found, but also why identification has been limited. The analysis leads to the speculation that wider use of a more intuitive framework in the teaching of Giffen goods may have positive effects in areas such as financial regulation.

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1 Introduction

Giffen goods are inferior goods where an increase (decrease) in price causes an increase (decrease) in the quantity demanded. They are a staple of intermediate microeconomics courses. Typically, they are explained as goods where the income effect is larger than the substitution effect, but frequently they are introduced without explicit worked examples, which can make them difficult for learners to grasp. Often they are presented as theoretical economic curiosities that very rarely or never occur in the real world.

Explanations for this lack of real-world examples are often based on claimed properties of Giffen goods. For example, Varian and Melitz (2024, p.138) states "...the income effect not only has to be of the "wrong" sign, it has to be large enough to outweigh the "right" sign of the substitution effect. This is why Giffen goods are so rarely observed in real life: they would not only have to be inferior goods, they would have to be *very* inferior."; Frank (2021, p.95) states: "...it would not only have to be inferior, but would also have to occupy a large share of the consumer's budget."; Pindyck and Rubinfeld (2018, p.122) states "Though intriguing, the Giffen good is rarely of practical interest because it requires a large negative income effect."

One readily interpretible framing of Giffen behavior is in the context of a maximization of an appropriate simple utility function subject to two linear constraints (Creedy, 1990; Gilley and Karels, 1991). In this construct, one of these constraints is a maximum, such that the positively weighted sum of the number of goods is less than or equal to some value; typically this is a budget constraint. The other constraint is a minimum constraint, such that the positively weighted sum of the number of goods is greater than or equal to some value.

In Section 2, building on Marshall's eponymous explanation of Giffen goods, we provide examples that demonstrate that the income effect can be arbitrarily small, that the Giffen good can constitute an arbitrarily small percentage of the consumer's budget and that it can be arbitrarily closely substitutable. Further, we claim that the dual constraint maximization construct better enables the identification of situations likely to lead to Giffen behavior in the real world. To demonstrate this, sketches of three novel real-world examples are given in Section 3. Section 4 leans on what goes before to address the question of why more real-world examples of Giffen behavior have not been identified by economists. Section 5 provides some concluding remarks.

2 Dual-constraint maximization

2.1 Canonical example

Giffen goods were first presented in the third (1895) edition of Alfred Marshall's *Principles of Economics* (Creedy, 1990). It states (Marshall, 2013, p.109-110):

> "...as Sir R. Giffen has pointed out, a rise in the price of bread makes so large a drain on the resources of the poorer labouring families and raises so much the marginal utility of money to them, that they are forced to curtail their consumption of meat and the more expensive farinaceous foods: and, bread being

still the cheapest food which they can get and will take, they consume more, and not less of it."

Implicit in this explanation is that there is some constraint, presumably caloric intake or similar, that means the families do not simply reduce their intake of bread. Thus, we may understand this set-up as one where a family seeks to maximze their utility (gastronomic satisfaction), subject to a maximum budget constraint and a minimum calorie constraint.

To make this more concrete, suppose we consider that a loaf of bread and a piece of meat have these properties:

	Price	Calories	Utility
Bread	\$1	200	25
Meat	\$1	100	35

Now suppose we have a budget of \$6, and a minimum caloric intake requirement of 900. We maximize utility by buying as many pieces of meat as our caloric intake will allow. The optimal solution is to buy three pieces of meat and three loaves of bread. Note that if our budget increased to \$9, then the family would maximize utility by buying nine pieces of meat and no loaves of bread, so the loaf of bread is an inferior good. With the budget at \$6, if the cost of bread rises to \$1.25, then the optimal solution is to buy four loaves of bread and one piece of meat. Thus, the bread is a Giffen good.

It is instructive to examine the example from the conventional perspective of substitution and income effects. In order to be able to afford the same number of pieces of bread and meat given the price rise, we would require a budget of \$6.75. With the price of a loaf of bread set at \$1.25 and a budget of \$6.75, it can be seen that the optimal solution remains as three loaves of bread and three pieces of meat. Thus, the substitution effect is zero, and the income effect is one. This zero substitution effect is a result of the minimum constraint; if there is any of the inferior good being consumed, then an increase in price of the inferior good and a commensurate increase in budget will require that the same amount of the two types of goods be consumed in order to satisfy the minimum constraint. It seems not unreasonable that a student may interpret the "very inferior" of Varian and Melitz (2024) as synonymous with the "large negative income effect" referred to by Pindyck and Rubinfeld (2018). Since the substitution effect in this set-up is zero, the income effect may be arbitrarily small and still induce Giffen behavior. Textbooks rarely seem to consider the possibility of a zero substitution effect when discussing Giffen goods, despite it being a feature of the canonical example.

Examples of dual constraint maximization Giffen behavior are relatively easy to devise. Gilley and Karels (1991) provides an analysis of such examples, including the boundary constraints under which they will exist. Other food-based examples include those of Pareto (1896); Wicksell (1934) and Dooley (1988). In a letter to Edgeworth, dated 22 May 1909, Marshall provides an especially lucid example involving Dutch railways and canal boats (Creedy, 1990), where the minimum constraint is distance and the maximum constraint is budget. Holmgren (2024) provides an example applicable to students, where the maximum constraint is time and the minimum constraint is grade ambition. This example is perhaps noteworthy for having a non-financial maximum constraint. Haagsma (2012) discusses the

dual constraint conceptualisation and suggests, drawing on Davies (1994), that the minimum constraint should be understood as the lowest possible indifference curve. While there are theoretical examples of Giffen goods where the substitution effect is non-zero, it would be wrong to view the dual constraint framing as some specialised form given its appearance in the canonical examples in the literature. As Haagsma (2012) notes, examples where the minimum constraint is subjective, such as caloric intake requirements or grade ambition, are of a different nature to objective ones, such as distance in Marshall's travel example. In our next example, the constraints are objective.

2.2 Dice game

Here we take an example in the form of a game. Suits (2014) famously described games as "the voluntary attempt to overcome unnecessary obstacles." If we understand obstacles to be constraints, then games become a potentially natural source of Giffen goods. As we will see, this example is especially useful in offering extensions that can aid further understanding.

In each round of this game you can choose to play either Type 1 or Type 2. In Type 1, you roll a fair six-sided die and score whatever it shows. In Type 2, you roll two six-sided dice and score the worst of the two. You pay \$1 to play each round whether you choose to play Type 1 or Type 2. However, there is a second constraint that you must roll a minimum number of dice during your gaming session (i.e. if you choose to play Type 1, then you achieve one roll; if you play Type 2, then you achieve two rolls). The object of the game is to maximize your score.

The expected score from playing Type 1 is 3.5, and of playing Type 2 is 91/36. Let B be our budget, R the rolls target and S the score, with x_1 and x_2 the number of rounds that we play Type 1 and Type 2 respectively, then we are seeking to maximze the score S, where

$$\mathbb{E}[S] = 3.5x_1 + \frac{91}{36}x_2,$$

subject to the dual constraints,

$$x_1 + x_2 \leq B \quad \text{and} \quad x_1 + 2x_2 \geq R.$$

As in the previous example, we can note that Type 2 is an inferior good.

Suppose we have a budget $B = \$10$ and a minimum rolls requirement $R = 15$. We maximize our score per \$ by playing Type 1, and so we are incentivized to play as much of this as possible. However, given the constraint that we must achieve 15 rolls then we must have some proportion of Type 2. It is easy to see that the solution is five of Type 1 and five of Type 2. If the cost of Type 2 increases to \$1.20, then the solution is now that we play one Type 1 game and seven Type 2 games i.e. consumption of Type 2 has increased due to the increase in its price and it is therefore Giffen.

With the price of Type 2 reset to \$1, suppose now that we have a budget $B = \$100$ and a minimum rolls requirement $R = 101$. It is clear that the solution is 99 Type 1 and one Type 2. If the price of Type 2 rises to \$1.01, then the optimal solution will become 97 Type 1 and two Type 2. The example works for any k where budget $B = \$k$ and $R = k + 1$. The optimal solution is to select $k - 1$ of Type 1 and one of Type 2 when they each cost

$1, but if the price of Type 2 increases by a cent, then the minimum rolls constraint cannot be met within the budget and the quantity of Type 2 must increase. Since we can select k to be arbitrarily large, the Giffen good will constitute an arbitrarily small percentage of the buyer's income. This repudiates the claim made by Frank (2021) that the inferior good must constitute a large proportion of the consumer's budget. Heijman and von Mouche (2012) reports that Doi et al. (2009) were first to propose a utility function with this feature, but the utility function used in that work lacks the accessibility of this example.

Generalising the example further, define the game such that in Type 1 and Type 2 games the contestant can choose to roll k and $k+1$ dice respectively and receives the minimum score in each case. The expected value for the minimum when rolling k dice is

$$\mathbb{E}(\min) = \sum_{n=1}^{6} \left(\frac{7-n}{6}\right)^k.$$

As k increases, the difference between this expectation for k and $k+1$ becomes arbitrarily small. For a budget $B = \$x$ and a minimum roll constraint of $R = kx + 1$, the optimal solution will be to select x of Type 1 and one of Type 2. If the cost of Type 2 goes up by any amount, however small, then the new optimal solution will require more than one of Type 2, making it Giffen. Given that the difference in utility can be made arbitrarily small by increasing k and the price difference may be arbitrarily small also, then, in this example, Type 1 and Type 2 are arbitrarily closely substitutable, refuting assertions that there needs to be a lack of a close substitutable good for there to be Giffen behavior.

3 Real-world examples

We have already discussed in Section 1 some readily conceivable real-world examples, involving food, transport and student behavior. Here we aim to show that by identifying situations where there is a natural maximisation subject to multiple constraints, we can identify plausible scenarios where Giffen behavior may be observed.

3.1 Call center

Business operations naturally have a maximization in the form of profits, and frequently have maximum constraints in the form of staffing, time or budgets on the one hand and minimum targets aimed at ensuring that longer term benefits are not sacrificed for short-term revenue goals on the other. The example here is based on a call center. Suppose a call center operative makes two types of call, a sales call and a follow-up call. The purpose of the follow-up call is to collect feedback on the customer experience. The operative can make a small commission on any sales they make on the sales call. The commission amount is equivalent to significantly less than their hourly wage but is considered by operatives as better than nothing. There is no direct reward to the operative for making the follow-up calls. The operative is required to make at least 18 calls during a four hour shift. A sales call is expected to take 20 minutes; a follow-up call is expected to take 10 minutes. The operative seeks to maximize their commission while staying employed by meeting the minimum call

requirement. They achieve this by doing twelve follow-up calls and six sales calls. Central office then decide that they are not getting enough information from the follow-up calls and choose to add some extra parts to the script, making them 12 minutes long. The operative now finds they have to do 15 follow-up calls and only three sales calls. The follow-up call is thus a Giffen good with respect to time.

3.2 NFL players

Sport is another environment conducive to the creation of Giffen behavior scenarios. There are natural maximizations in the shape of score or talent maximization, and constraints in the form of rules. The example here stems from the desire of a team to assemble the best possible roster. In the NFL, there is a salary cap, providing a limit to the total amount a team can pay in wages and acting as a maximum constraint. The playing squad is limited to 53 players. While this is not a minimum constraint, the norm to fill rosters is so strong it acts as an equality constraint, and so can play the role of the minimum constraint. There are also minimum wage conditions. In order to keep within the salary cap, teams will have a mix of minimum wage players and others. The minimum wage players are inferior goods. If the salary cap were suddenly lifted without the minimum wage rising, then we would expect fewer minimum wage players to be employed across the league. There is a natural experiment here as the minimum wage rises on an annual basis independent of the salary cap. As the minimum wage rises, if the salary cap rises at a slower rate, we would expect more of the salary cap to be used by minimum wage players, creating an income effect that can force teams to employ more minimum wage players. In practice, the various salary cap exemptions and machinations and the way that teams flex the cap between years would likely make this example very hard to evidence, but intuitively it seems plausible that minimum wage NFL players are Giffen goods.

3.3 Financial regulation

Financial organizations seek to maximize financial returns on their investments. Regulators seek to ensure the organizations are able to meet future obligations by placing limits on them. For organizations like banks and pension funds, these limits are often in the form of risk limits, such that they may not carry more than a certain amount of risk. These can act as a maximum constraint. Simultaneously there is a natural instantaneous budget equality constraint i.e. that any alternative portfolio must have the same value as the current portfolio, ignoring transaction costs. This can perform the same role as the minimum constraint in the dual constraint setup. An inferior good with respect to risk would be an asset where if risk limits are eased, fewer units of the asset would be held in the portfolio. If the inferior good, with respect to risk, becomes riskier, a portfolio manager may be forced to buy more of the asset in order to maximize returns while staying within their risk budget. On a market-wide level, one might argue that this is what was observed in the downgrade of US government debt by the credit rating agency S&P on August 6th 2011. Despite the downgrade, US treasuries actually rose in price, indicating greater demand. This is highly speculative given the backdrop of the Euro debt crisis and the implications for the perception of risk on other assets caused by the downgrade; the mechanism may have been

more interconnected than in the other examples discussed here. But it seems not outlandish to claim that the initiating event was the downgrade and the consequent increase in the marginal perception of risk of US treasuries within a constrained risk environment. This ultimately led to an increase in the demand for US treasuries, and so meets the criteria of a Giffen good.

4 Limited identification

The elaboration presented here naturally leads to the question as to why more real-world examples of Giffen behavior have not appeared in the literature. The properties claimed by Varian and Melitz (2024), Frank (2021) and Pindyck and Rubinfeld (2018) are not required for Giffen behavior, so their infrequency is not a sufficient explanation for the paucity of examples. There would certainly seem to be motivation for finding examples. Stigler (1987) claimed that if an economist were to evidence a Giffen good "he would be assured of immortality, professionally speaking, and rapid promotion while still alive." In a similar vein, Steven Levitt described Robert Jensen as the 'Indiana Jones of Economics' largely for his discovery of a real-world example of a Giffen good (Levitt, 2008).

A central contention of this paper is that dual constraint maximization is a more intuitive framework for the understanding of Giffen goods. By extension, as we sought to demonstrate in the last section, it is easier to identify scenarios of appropriate utility functions subject to simultaneous maximum and minimum constraints than of upward-sloping demand curves directly. Thus, we suggest that one reason that more examples have not appeared in the literature is that economists have not been trained to identify situations that are most likely to lead to them. Relatedly, the Call Center and US Treasury examples both had Giffen behavior in dimensions other than financial price; time cost and risk respectively. Textbook examples tend to focus solely on financial price. However, the issue is likely not solely with the propensity to identify relevant situations, and the examples of the last section may suggest other reasons.

As we observed in the NFL player and US Treasury examples, the data in real-world environments may be challenging, with multiple goods, evolved complexities to the constraints, and multiple actors. First, the noise in such a system makes it more difficult to evidence causal relationships. Indeed, in practice, it may be the case that at least some of the claimed properties would be required for the effects to be large enough to be statistically evidenceable. Second, the constraints may not be totally inelastic. As Frank (2021) goes on to say in the quote from Section 1, "Otherwise, an increase in its price will not create a significant reduction in real purchasing power." A consumer may be able to flex their budget or hunger levels by small amounts to accommodate price changes. Third, as Battalio et al. (1991) notes, often we only observe data at a market level. So, while a good may be Giffen with respect to an individual actor, for others it may not even be inferior, and the effect cannot be observed at the market level at which data are available. Fourth, the Giffen scenario may exist, but without the increase (decrease) in price of the inferior good, it could not be demonstrated. Typically in markets, price and demand changes are strongly connected, making the evidencing of causal effects difficult. It is notable that the 'real-world' example of Giffen behavior to have received most widespread acceptance, Jensen and Miller (2007),

was not observed as occurring naturally in the world, but was induced by voucher-toting economists.

Fifth, while it is relatively easy to conceive of situations leading to Giffen behavior, examples such as the call center are likely to exist for only a short period of time. If the set-up produces sufficiently obvious Giffen effects to be detectable, businesses are likely to react to change the situation. In the call center example, this might consist of increasing the budget constraint or replacing the total-call with a specific follow-up call requirement. Similarly, in the sports environment, norms and rules are generally an equilibria developed over time between the stakeholders — participants, spectators and administrators. They too are likely to react negatively to these sort of situations, so that were they to be sufficiently obvious and impactful, they likely would have been addressed in the derived rules and norms we observe now. So, in both these cases, it seems highly plausible that Giffen-inducing constructs may be created, but that they would be addressed rapidly were they to come close to being evidenceable. In this telling, it is the Giffen good's paradoxical nature itself that reduces its frequency, through being deliberately selected out. The final example of financial market regulation may offer more hope for detection in this regard. Here, there is more of an antagonism between those who experience the perverse incentives — the investment organizations — and those who induce them — the regulators, such that concerns expressed by the investment organizations may be interpreted as attempts to water down regulation, and thus the conditions may persist for longer.

5 Concluding remarks

The examples presented here provide a more intuitive understanding of the mechanism behind the appearance of Giffen goods and can help to clarify their properties. Centring dual constraint maximization in the explanation of Giffen behavior is likely to provide a construct more readily identifiable in the real world than an upward-sloping demand curve, helping more real-world examples to appear in future literature. As well as the traditional food-based examples in both human and animal societies, business environments with multiple targets acting as constraints, and sports and games scenarios may all provide the sort of dual constraint maximization situations leading to Giffen behavior.

Thus, we would suggest that better wider understanding of Giffen goods is not solely of academic interest. In the financial regulation example, the investor bought more of the inferior good asset in order to stay within their risk budget, potentially creating a Pareto inferior outcome. It is questionable whether this is a desirable situation to have induced. We might similarly question the incentives created in the call center, even if they were to be, as we speculate, limited in duration. Thus, a more widespread ability to identify the propensity of constraints to create upward-sloping demand curves through a better understanding of Giffen behavior may have wider positive impacts in improving business practices or regulatory frameworks.

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