

**On the Rationalizability of Observed Consumers' Choices**  
**When Preferences Depend on Budget Sets: Comment**

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**Abstract** In a recent article, Bilancini (2011) demonstrates that assuming either price-dependent preferences or preferences that depend on the choices of other individuals can render the theory of revealed preference effectively unusable. Some readers might be tempted to infer that economists had better avoid such assumptions. In this note, we argue against that conclusion in favor of a less categorical and more pragmatic approach. In several domains, we identify fundamental weaknesses in revealed preference theory and argue that in those domains, nontraditional assumptions about preferences significantly enhance our ability to explain and predict behavior.

**Keywords** Revealed preference theory, Interdependent preferences, Relative position, Price-dependent preferences

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## Introduction

In a recent article in this journal, Bilancini (2011) demonstrates under reasonably general conditions that certain non-traditional assumptions about preferences can render the theory of revealed preference effectively unusable. The principal focus of his analysis is the assumption of price-dependent preferences or, more generally, that preferences depend on budget sets. But he makes a similar point regarding the interdependent preference assumption, which holds that the utility an individual receives from a given consumption bundle often depends on the consumption bundles chosen by others.

Bilancini's finding leads him to declare that "assuming that preferences depend on budget sets is *illegitimate* under the scientific commitments of revealed preference theory" (p. 275, emphasis added) and that interdependent preferences "may not be safe from a methodological standpoint" (p. 277). Some readers might be tempted to infer from these statements that if something must be abandoned, it is not the theory of revealed preference, but the new assumptions about preferences.

First introduced by Samuelson (1938, 1948), and later extended by Houthakker (1950) and Afriat (1967), the theory of revealed preference provides testable implications for rational consumption behavior given observed sets of budget and choice observations.<sup>1</sup> Perhaps the core application of the theory is the ability to infer that anything a person does, given the situation (e.g., the relevant values of prices and income), maximizes his utility. Thus one consumption bundle leads to higher welfare than another if the first bundle is chosen under circumstances in which the second bundle was also affordable. Varian (1982, 2012) has classified and demonstrated a number of

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<sup>1</sup> For an extensive recent summary of the foundations for revealed preference theory, see Vermeulen (2012).

other practical applications of the theory, including the prediction of demand under new budget configurations, the measurement of auction values, and measurement of the welfare effects of price discrimination.

The recent and ongoing revolution in behavioral economics has resulted in a number of modifications of the standard model of decision-making behavior that raise questions about the normative implications of revealed preferences. People may change their choices based on criteria that seem manifestly irrelevant to welfare, such as the way options are framed or the time at which the choice is presented. To cope with these issues, modified versions of revealed preference theory have been introduced that allow its limited application or that simply acknowledge its irrelevance under certain circumstances (Koszegi and Rabin 2008, Bernheim and Rangel 2009).

Bilancini's reflection on price-dependent and interdependent preferences is not the first such examination of these particular issues. Pollak (1977) draws a distinction between "normal" and "market" prices which, coupled with his relative price hypothesis, provides a basis for accounting for price-dependent preferences in a way that is consistent with revealed preference theory, albeit with some potential complications for actual application.<sup>2</sup> His separate discussion of endogenous tastes is relevant to the more general issue of reconciling both price-dependent and interdependent preferences with traditional demand and welfare analysis (Pollak 1978). More recently Balasko (2003) has shown that most properties of the standard equilibrium model can be extended to the model where preferences depend upon prices. What all these approaches have in common is that they find that some modification of revealed preference theory, or some re-framing of

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<sup>2</sup> For example, whereas Pollak argues that preferences depend on "normal" (i.e., typical) prices rather than actual market prices, it may be tricky as a practical matter to credibly frame a hypothetical price change as a change in the market price and not a change in the "normal" price.

what the non-traditional preferences in question imply, is needed to allow one to fit the other.

In this note we do not challenge Bilancini's claim that non-traditional preference assumptions may be inconsistent with revealed preference theory. Rather we argue that the most sensible response to that observation cannot be simply to abandon all non-traditional assumptions about preferences. As scientists, our goal must be to understand the economic choices of actual people. It is necessary to weigh revealed preference theory's ability to help us do that against the corresponding contribution of assuming non-traditional preferences – something Bilancini has not done. We argue that the case for acknowledging fundamental weaknesses in revealed preference theory is in fact far stronger than the case for abandoning the non-traditional assumptions that Bilancini characterizes as illegitimate and unsafe.

### **An Important Defect in Revealed Preference Theory**

As the anthropologist Margaret Mead once said, “What people say, what people do, and what they say they do are entirely different things.” Like most economists, we believe that it is often possible to learn more about people's preferences by observing what they do than by listening to what they say. In some surveys, for example, people report that they prefer dry wines to sweet ones, but their actual purchases suggest the opposite ordering. Observations like these help justify the profession's deep affection for revealed preference theory.<sup>3</sup>

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<sup>3</sup> See Bernheim (2009a, b) for a recent discussion of the justifications for relying on observed choice in welfare analysis.

But the theory must not be asked to deliver too much. If someone chooses A when his budget would have enabled him to purchase B, it is often reasonable to conclude that he prefers A to B. But there are important exceptions. Behavioral economics, as noted, has identified some of these. Others arise when the utility of a given purchase depends strongly on the choices made by others. In these cases, the problem is not that non-traditional assumptions about preferences render the theory of rational choice limited or unhelpful. On the contrary, the problem is that revealed preference theory itself can be dramatically misleading.

Tom Schelling's (1978) well-known hockey-helmet example illustrates the point. Schelling observed that when hockey players at any level are permitted to choose individually, they invariably skate without helmets. Yet those same players often vote unanimously in favor of rules requiring helmets. If helmets are so desirable, Schelling asked, why don't players just wear them? Why do they need a rule?

The answer, he suggested, is that skating without a helmet confers a competitive edge—perhaps by enabling players to see or hear a little better. For competitive athletes, gaining an edge has enormous value. No one wants to get hurt, of course, but the competitive advantage from skating without a helmet comes right away, whereas the potential costs occur only with uncertainty and delay. But when the members of one team gain an edge by skating without helmets, the opposing team's best response is to restore the balance by skating without helmets themselves. The rub, of course, is that all are then at greater risk of serious injury, and yet neither team enjoys the edge it sought—hence the attraction of helmet rules.

Any claim that revealed preference theory should command the unalloyed allegiance of economists collapses completely under the weight of this simple example. When hockey players are free to choose individually, they skate without helmets even though they had the option of wearing them. Revealed preference theory thus identifies skating without helmets as the better outcome. But as player support for helmet rules indicates, *they* – the players themselves – think it is preferable to skate with helmets. Clearly, individuals' observed choices have little or no normative content in cases such as these, just as Koszegi and Rabin (2008) recognized in situations where framing effects dominate. The trouble with revealed preference is that it imposes *ceteris paribus* conditions – it tells us what a player's best option is if he takes other players' choices as given. A proper welfare analysis, in contrast, involves an *unconditional* preference ordering – it tells us whether the individual is better off accounting for what everyone else is doing (Pollak 1978).

As the example demonstrates, preferences that depend on other people's consumption choices don't require us to abandon the theory of rational choice; nor do they make that theory unverifiable. The example also highlights the importance of adopting more descriptive assumptions about the goals agents are trying to pursue. But again, the most important point illustrated by the helmet example is one that runs directly counter to revealed preference theory with non-interdependent preferences—namely, that merely observing people choose A when they could have chosen B simply does not imply that they prefer a world in which all choose A to one in which all choose B.

## **Resolving Methodological Conflicts**

In view of Bilancini's branding of the interdependent preference assumption as "unsafe" under revealed preference theory, we might well conclude that we must either reject revealed preference theory unconditionally or else reject interdependent preferences. But those are not our only options. Revealed preference theory is often extremely useful in settings in which the utility someone derives from a good is independent of others' consumption of it. In such cases, why abandon the theory?

In other cases, however, the theory generates erroneous conclusions. The only sensible strategy, we argue, is a purely pragmatic one: rely on revealed preference theory in domains where it functions well, and abandon or modify it when it functions poorly.

We have argued by example that revealed preference theory does not always yield plausible conclusions. But the mere fact that the theory might fail in the context of a specific example does not tell us much about the extent of its shortcomings. Are they widespread, or are they isolated exceptions that can be safely ignored?

As Schelling's example illustrates, individual and collective rankings of consumption choices tend to differ whenever the utility of someone's consumption choices depends on how they compare with the corresponding choices of others. There are compelling theoretical and empirical reasons for believing that such cases are widespread.

Darwin's theory of evolution by natural selection is the only theoretical framework for thinking about preferences that commands widespread scientific respect. According to Darwin, the motivation systems of the human brain were forged over the millennia to induce individuals to take actions that best promote the transmission of their

genetic material into future generations. That perspective generates predictions about what preferences ought to look like.

Darwin's central insight was that reproductive fitness depends mainly on relative resource holdings. To different degrees across different domains, he recognized, life is graded on the curve. Despite the frequent famines of early human history, for example, there was always some food available, and the question of who got fed was settled then, as now, by relative resource holdings. Similarly, in most early human societies men took more than one wife if they could, and there, too, success depended heavily on relative wealth.

Imagine two rival genetic alleles that code for circuits in the brain that "care" to different degrees about relative wealth: one helps mold a brain that cares intensely about it, while the other molds one that cares much less intensely. Because bearers of the first allele will devote more time, effort, and other resources to the quest for high relative position, they are expected to be more likely to attain it. Accordingly, they should be more likely to survive famines and marry successfully.

In short, the only scientific theory that generates *a priori* predictions about what human preferences should look like tells us that people should care a lot about relative resource holdings. Traditional economic models assume, with no similar theoretical support, that people care only about absolute resource holdings. Surely that contrast merits at least some weight in a discussion of how to resolve Bilancini's methodological conflict about interdependent preferences.

Irrespective of the origins of concerns about relative position, there is compelling empirical evidence that most people around the world share them. Early work on the

nature of concerns about relative income actually suggested that, beyond some point, people do not care about absolute income at all (Easterlin 1995). That claim appears shaky in the light of more recent evidence (Stevenson and Wolfers 2008). But there can be no doubt that people do care about relative position, and so the methodological challenges posed by this “inconvenient truth” must ultimately be addressed.

### **Why Concerns about Relative Position Matter**

Concerns about relative position create serious difficulties for revealed preference theory. Those difficulties spring from the fact that relative position matters more in some domains than others. Two simple thought experiments illustrate the nature of the difficulty. In each, you face a choice between two worlds that are, and will remain, identical in all respects except for the one difference explicitly described. The first experiment explores the importance of relative position, or context, for evaluations of housing: Which world would you choose? World A, in which you live in a neighborhood with 6,000-square-foot houses, others in neighborhoods with 8,000-square-foot houses; or World B, in which you live in a neighborhood with 4,000-square-foot houses, others in neighborhoods with 3,000-square-foot houses?

Under the preferences assumed in traditional economic models, only absolute house size matters, so A would be the obvious choice. Yet when actual people are asked to consider this choice, most pick B.

The second thought experiment has exactly the same structure. In World A, your probability of dying on the job is 2 in 10,000 each year, and others' is 1 in 10,000; in

World B, your probability of dying on the job is 4 in 10,000 each year, and others' is 8 in 10,000. Which would you choose?

Like the first experiment, this one involves a choice between absolute and relative advantage. In A, your absolute probability of dying on the job each year will be only half as great as in B. On the other hand, your job in A would be the more dangerous one there (i.e., worse in relative terms), whereas your job in B would be the safer one in that world. Yet this time almost everyone chooses A, revealing a preference for absolute advantage over relative advantage.

Following terminology coined by the late Fred Hirsch (1976), the modal choices in these thought experiments identify housing as a "positional good" and workplace safety as a "nonpositional good." Positional goods are ones whose evaluations are particularly sensitive to context. Since evidence suggests that context matters for virtually every evaluation, a positional good is thus one whose evaluation is *relatively* heavily shaped by context. In contrast, a nonpositional good is one whose evaluation depends relatively weakly on context.

When evaluation is more heavily dependent on relative position in one domain than in another, the effect is to distort consumption decisions in favor of the more context-sensitive good (Frank 1985). That's what accounts for the apparent anomaly in Schelling's helmet example: players care about their safety primarily in absolute terms, whereas the outcome of the game is an inherently relative concern. Taking one's helmet off is attractive because the hoped for competitive edge has greater value than the corresponding reduction in safety. The problem, of course, is that the edge does not materialize when all act in tandem.

Precisely the same logic explains why military arms races are inefficient. Each side builds more bombs, hoping to gain a military advantage, but those investments prove mutually offsetting, while forcing both sides to spend less on roads, hospitals, and other goods. Note that relative magnitudes in the latter categories matter less for the outcome of international competition than relative stocks of armaments. If the context-sensitivity rankings of the two categories were reversed, there would be no military arms races. Instead, we would see expenditure battles focused on non-military goods.

### **Safety Regulation**

Revealed preference theory is often invoked by those who argue against attempts to regulate specific aspects of labor contracts. We now consider the specific case of workplace safety regulation, another example that illustrates the dangers of uncritical reliance on revealed preference theory.

Conventional arguments for safety regulation rest on claims that employers with market power might exploit workers in its absence, or that workers might not have the information necessary to weigh the relevant tradeoffs intelligently. But safety regulations act with greatest force in labor markets that are also the most highly competitive by most measures, and many of the hazards they attempt to limit are well understood by workers. Critics complain that in such cases the government makes people buy more safety than would be warranted by the value they personally assign to safety.

Let us apply this narrative to the case of a well-informed, rational worker who is weighing whether to accept a riskier job at higher pay offered by an employer in a perfectly competitive labor market. In the end, he decides to take the job, planning to use

the higher pay to buy a more expensive house. Does the government reduce his welfare if it prevents him from doing so?

If, as suggested by the two earlier thought experiments, evaluations of housing are more context-sensitive than evaluations of safety, there is no reason to expect unfettered market forces to yield a socially optimal amount of safety. Suppose, plausibly, that the worker accepted the risky job because it would enable him to meet the mortgage payments on a house in a better school district. If other parents make the same choice, the collective effect of their efforts is simply to bid up the price of houses served by good schools. No matter how energetically parents bid, fifty percent of all students still must attend schools in the bottom half of the school quality distribution. As in any arms race, individual actions are mutually offsetting.

Everyone might prefer a world in which all enjoyed greater safety, even at the expense of all having somewhat lower wages. But individual workers can control only their own choices. They cannot constrain what others do. If only a few accepted safer jobs, while others chose riskier ones, parents in the first group would be forced to send their children to inferior schools. To get the outcome they desire, they must act collectively.

An observer who rejects the assumption of interdependent preferences might invoke revealed preference theory in support of his claim that safety regulations abridge the right of workers and employers to decide individually how best to resolve the unavoidable tradeoffs between safety and wages. Such critics often ask a rhetorically powerful question: If both the employer and the worker find the terms of a proposed labor contract attractive, and both are well informed, how does the government make

either party better off by requiring greater safety than they want? The answer is that this revealed preference argument simply does not hold when preferences are interdependent in the manner described. In such cases, restricting people's ability to trade their safety for additional income can be a Pareto improvement, even in perfectly competitive markets whose participants are fully-informed. Revealed preference theory is simply misleading in this context. Even contracts that are attractive to all signatories often impose harm on third parties that it is virtually impossible for them to avoid on their own.

### **Other Problems for Revealed Preference Theory**

Revealed preference theory is also problematic for reasons related to preference interdependence but having nothing to do with positional concerns. Consider, for example, an economy in which all people smoke. This outcome might result from completely independent individual preferences for smoking. But the same outcome could also result even if each individual would have preferred that *nobody* (including himself) smoke, simply because everyone's decision to smoke might depend positively on the proportion of others who smoke. Each individual's goal might be, for example, to conform to others' behavior or to minimize the irritation experienced in the presence of others' smoking. But we cannot identify whether we are in a world of independent or interdependent smoking preferences just by observing the choices people make. An increase or decrease in the price of smoking, moreover, would affect smoking rates in similar ways, irrespective of people's reasons for smoking.

Intelligent public policy prescriptions thus require knowing *why* people smoke. In some cases, individual choices could maximize social welfare (assuming no negative

externalities associated with second-hand smoke, costs imposed on the public health system, and so forth), but in other cases, there could be collective action problems. In the latter cases, it might be individually rational for each person to smoke, given that others are doing so, even though everyone would be worse off than if no one smoked. In that case, public policies to curtail smoking would improve welfare.

In case after important case, revealed preference fails us. What we need to know is not whether individuals have made rational choices given their preferences, but whether the choices they make affect others' choices in a ways that reduce overall welfare. In such cases, discarding revealed preference theory may be an unavoidable precondition for progress.

### **Preferences that Depend on Prices**

Bilancini objects not just to interdependent preferences but also to preferences that depend on prices or, more generally, on budget sets. We share his reservations about preferences of the latter sort and applaud his obvious willingness to adopt a critical posture toward preferences generally. It would be wrong to claim that all preferences merit equal weight in policy analysis. In any large public works project, for example, some workers will inevitably be injured or killed, and in a cost-benefit analysis of the project, no rational policy maker would assign positive weight to the pleasure a sadist takes in that knowledge.

Psychologists have documented the existence of a host of bizarre and dysfunctional preferences. Those who have them often wish they did not, and policy

makers will often have good reasons for ignoring or discounting such preferences, or even for attempting to change them.

From a methodological perspective, however, it is important to distinguish between normative and descriptive analysis. If a researcher's aim is merely to predict what people will do under given circumstances, it will often be important to take even objectionable preferences into account.

Consider the idea that preferences might depend on prices, which is often associated with Thorstein Veblen's (1899) observation that many derive satisfaction from the conspicuous consumption of high-priced luxury goods. In some cases, a person's aim may indeed be just to show off or make others feel bad. An apparent case in point: An iPhone app called "I Am Rich" was briefly offered in Apple's App Store at a price of \$1000. It did nothing other than display a red ruby icon onscreen, thereby announcing to the world that the phone's owner had so much money that he could afford to spend \$1000 for an app that did not do anything. Eight copies sold before Apple removed the app from the store.

But Veblen's point was not that people would prefer to pay a higher price for a given good. Rather, it was that people may sometimes derive benefit from credibly signaling their wealth or success to others (Bagwell and Bernheim 1996; Corneo and Jeanne 1997). And if we hold the price of a given luxury item fixed, most people would be more likely to buy it if also delivered something beyond mere display. Even if display were the buyer's sole aim, goods whose only purpose is display do not actually serve that purpose very well. It is hard to imagine, for instance, that anyone would think better of someone after discovering that he had bought "I Am Rich."

In practice, most people value higher quality for its own sake, quite apart from any display value it may have. And because rational consumers know that others in the market also value higher quality, and moreover that quality improvements are usually costly to achieve, they will expect higher-priced versions of a product to have higher quality (Scitovsky 1945; Rao and Monroe 1989). A similar mechanism may be at work with respect to wages or, more generally, payments made for performing an activity; that is, offering to pay an individual more to do a job or perform an activity may adversely affect his views about the intrinsic desirability of the job or activity (Deci 1971, 1972; Gneezi and Rustichini 2000). So, again in this instance, preferences could depend upon prices.

Additional evidence suggests that prices can affect preferences. In the case of wine consumption, fMRI studies suggest that pleasure centers in the brain actually display greater activation when consumers are told the wine they are drinking is expensive (Plassman et al. 2008). Econometric evidence from secondary data shows that changes in price result in significant changes in marginal rates of substitution across a range of products, which also supports the notion that utility functions may sometimes be price-dependent (Basman et al. 1988).<sup>4</sup>

Evidence of this sort obviously poses difficult methodological questions for economists. In some cases, declaring existing methodologies sacrosanct and dismissing the problematic evidence may be the right approach. But the questions themselves surely merit further thought.

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<sup>4</sup> In all the cases mentioned, consistent with the relative price hypothesis, it is relative prices, not absolute prices, that influence preferences and behavior. Thus short- and long-run demand functions are homogeneous of degree zero in current prices and expenditure, and money illusion is absent in the long run (Pollak 1977).

### **Scientific Progress Necessarily Entails Methodological Upheaval**

Methodological crises have occurred many times in the relatively short history of the economics discipline. The rational expectations revolution, for example, ushered in fundamental changes in macroeconomists' assumptions about agent behavior. Some of the assumptions that were discarded had underpinned the econometric identification of large models that had been a mainstay of macroeconomics. Models therefore had to be modified or, in some cases, abandoned.<sup>5</sup>

A similar crisis occurred in physics when Heisenberg introduced his uncertainty principle. Heisenberg recognized the impossibility of simultaneously assigning definitive values to certain pairs of physical properties of a particle, such as position and momentum, in a quantum-mechanical system. Intuitively, this problem is often explained in terms of measurement difficulties at the quantum level: to wit, the very process of measuring the position of the particle perturbs the physical system such that the momentum of the particle is changed and cannot be measured unambiguously.

Recognition of the impossibility of certainty with respect to conjugate quantum properties challenged conventional notions of physical reality and provoked resistance from scientists who did not accept its implications. Perhaps the most prominent criticism came from Albert Einstein, who contended that because definitive values could not be assigned to all physical quantities simultaneously under the formalism of quantum mechanics, the formalism was necessarily incomplete (Einstein et al. 1935).

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<sup>5</sup> See Sims (1980) for a discussion.

A consensus among physicists has since formed in favor of Heisenberg's principle and the corresponding "Copenhagen interpretation" of quantum physical reality. Before reaching that consensus, however, physicists had to accept that many of the fundamental rules that govern non-quantum relations simply fail to apply at the subatomic level.

The challenge that interdependent and price-dependent preferences now pose to revealed preference theory resembles the challenges posed in macroeconomics and physics by the innovations just discussed. If prices change the position of a consumer's indifference map—either directly, or through their influence on others' choices—then it becomes impossible to rule out as irrational (almost) any set of choices brought about by a variation in prices: any observed choices might reflect a rational response to the "new" set of preferences, which are not independently observed. One is in a position similar to that presented by the uncertainty arising in quantum physics, in that the process (under revealed preference) normally used to identify the position of the indifference map shifts the map and so alters the reality one is seeking to measure.

Seen another way, the revealed preference problem is one of model identification. The indifference map is identified through changes in price that are assumed to shift the budget constraint but not the map itself. If the indifference map is also a function of price, then it is no longer possible to identify it through variations in price. Though conceptual solutions have been posed for potentially eliminating this identification problem (see, for example, Pollak 1977), it could prove more intractable than the problem of adjusting the revealed preference relation to the "ancillary conditions" posed by other behavioral

anomalies, such as framing effects, timing effects, and the like (Bernheim and Rangel 2009).

In any event, mounting evidence suggests that preferences often do depend on others' choices and even on prices. The economics profession has responded slowly to this evidence. To date, it has shied away from making public policy recommendations grounded on it (Frank 2005). Some of this reluctance may be rooted in economists' natural reluctance to devalue their substantial human capital investments in established analytic approaches. As Tibor Scitovsky remarked about the possibility that people judge quality by price, "Economists are wont to minimize the importance of this factor, fearing the havoc it may wreak with the whole theory of choice" (1945, p. 100).

But if preferences are not as they are portrayed in traditional textbook accounts, reluctance to deal with that fact will not alter the underlying reality. The profession's response to this reality should be driven not by an uncritical allegiance to current analytic approaches, but by the desire to understand actual economic behavior and to construct more effective economic policies. In any event, it bodes well that more recently minted economics PhDs are much more likely than their older colleagues to adopt the pragmatic posture we advocate. As Max Planck once said, "Science advances one funeral at a time." It will be the same, perhaps, in economics.

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