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RESEARCH ARTICLE

BEHAVIORAL CRIMINOLOGY

Behavioral criminology and public policy

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Research Summary: Public policy, including crime policy, is heavily shaped by economic theory. Recently, refinements based on the application of behavioral insights into the study of public policy applications have become en vogue. Although criminologists have made some inroads into incorporating behavioral principals into the study of crime and offender decision-making, these contributions have mainly been limited to the area of risk. In this article, I offer a more widespread description of how behavioral economics (BE) can be applied to the study of offender decision-making and crime policy. Specifically, I focus on several main areas that move beyond the traditional foci on perceptions of risk: intertemporal choice, criminal labor supply, mental accounting and consumption, and social preferences. For each topical area, I first identify a presumable, normative model that could reasonably be drawn from traditional rational choice theory. I then describe ways, based on existing contributions from BE, that scholars have sought to make the assumptions (and anomalies) of this model more realistic.

Policy Implications: The primary aim of this article is to highlight implications to theory and policy that increase the utilization of BE by criminologists.

KEYWORDS
behavioral economics, offender decision-making, rational choice

More than ever criminologists are interested in more than just 'rational choice' theory, but a theory of offender decision-making. *What would a theory of offender decision-making*

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look like? What would its assumptions be, what would its main theoretical constructs be, and what would its hypotheses consist of? Finally, what empirical support is there for a theory of offender decision making and do you think such a theory would be a substantively important contribution to the field?

—Recent University of Maryland comprehensive exam question, submitted by Ray Paternoster

Public policy, whether we criminologists choose to admit it or not, is heavily shaped by economic theory or, more specifically, by predictions about how individuals will make choices in response to various (dis)incentives. For instance, we routinely enact and debate policies based on theoretically derived expectations regarding how individual actors will make choices about things ranging from saving for retirement to selecting health-care plans to choosing to which schools to send their children based on economic theory. As Cook, Machin, and Mastrobuoni (2015) pointed out, crime policy—particularly in the United States—is no exception to this general rule. For instance, Durlauf and Nagin (2011) noted that the tremendous rise in U.S. incarceration rates over the past 40+ years is congruent with a theoretical framework outlined early on by Becker (1968). Even critics who have called attention to the ineffectiveness of policies such as mass incarceration and zero tolerance in reducing crime still tend to emphasize the role of other types of incentives in alternative crime control strategies such as increased certainty, swiftness, and fairness (Kennedy, 2009; Kleiman, 2009; Durlauf & Nagin, 2011; Nagin, Solow, & Lum, 2015).

That said, there is a limit to the effectiveness of designing policies strictly around the assumptions that human actors always make choices that in are in their best interests, an assumption often criticized on the basis of the limits of human rationality (Simon, 1955, 1978). For example, Thaler and Sunstein (2003, p. 176) offered that, "Research by psychologists and economists over the past three decades has raised questions about the rationality of the judgments and decisions that individuals make." As a result, a growing movement to incorporate insights from behavioral economics (BE) to generate refinements into the study of public policy applications has become *en vogue* worldwide (Madrian, 2014). Akerlof, Oliver, and Sunstein (2017, p. 1, emphasis added) described this emergent ideological shift as follows: "There are many indications of the growth in what may be broadly classified as *behavioural public policy*."[1] This new increased emphasis on incorporating behavioral science principles into public policy has been widely embraced by many areas, including health policy (Hallsworth, 2016), environmental policy (Carlsson & Johansson-Stenman, 2012; Venkatachalam, 2008), accounting and financial regulation (Hirshleifer, Huang, & Teoh, 2017), and the study of substance use disorders (Bickel et al., 2014).

It is only natural then that this domain of thinking should also move into the study of crime policy. Yet to date, with some notable exceptions (Pickett, 2018; Pogarsky & Loughran, 2016; Pogarsky, Roche, & Pickett, 2018), there remain few active advancements as to how behavioral economics can more fully inform the study of crime and policies aimed at crime prevention. Darley and Alter (2013, p. 181) argued that, "[C]onventional approaches to dealing with crime, punishment, and deterrence in the legislative policy arenas deviate from what research on behavioral decision making has recently discovered about how people actually think and behave." There are several reasons why this might be the case. First, many criminologists have either a limited or a lack of exposure to BE, including generally lacking understanding of its careful genesis and development through the documenting of observed anomalies from standard economic models. Second, we as criminologists rely on a rudimentary conceptualization of theoretical models of how offenders make choices, stemming from a static conceptualization of rational choice theory. To embrace BE more fully, we must first expand our

standard theories of offender decision-making to apply behavioral modifications as to how potential offenders might deviate from these predictions. We can do this by drawing more liberally from existing research outside of criminology. Third, the combination of these two factors has led to the extant research on BE and crime to be restricted to limited areas, generally perceptions of risk. As I argue, although this is valuable, it is wholly incomplete.

In this article, I lay out a broader framework for thinking about BE and crime research, including how BE can be applied to the study of offender decision-making and crime policy. I argue that the study of crime, punishment, and incentives can include multiple areas of BE rich for research in theory and policy by expanding extant criminological rational choice into a more comprehensive theory of offender decision-making. Specifically, I focus on several main areas to move beyond the traditional focus on perceptions of risk: intertemporal choice, mental accounting and consumption, criminal labor supply, and social preferences. For each topical area, I first identify a presumable, normative model that could reasonably be predicted through use of traditional rational choice. I then describe ways, based on existing contributions from BE, in which scholars have sought to make the assumptions (and anomalies) of this model more realistic. In outlining an agenda for future policy research, my approach is heavily influenced by the perspective recently suggested by Chetty (2015), who proposed researchers pivot away from the simplistic (and ultimately uninteresting) question of "are offenders rational?" and instead ask more pragmatic questions that comprise more comprehensive theories of offender decision-making, which can then be used to inform public policy. Lastly, I draw out implications to theory and policy.

1 | BEHAVIORAL SCIENCE, BEHAVIORAL ECONOMICS, AND PUBLIC POLICY

Perhaps the most popularly known behavioral public policy is the popular concept of nudging or the use of practical "choice architecture" proposed by Thaler and Sunstein (2009). Based on what the authors described as philosophy of "libertarian paternalism," a nudge can be thought of as a way to enact a policy that might influence an actor to make a choice that is ultimately good for him or her ("paternalism") while preserving the individual's ability to make a different choice ("libertarian"). For instance, setting a higher option of contribution as a default—thereby requiring employees to select out of, rather than into—tends to result in individuals enrolling in helpful retirement plans and saving more (Choi, Laibson, Madrian, & Metrick, 2004). Sampson and Laub (2016, p. 330), although they did not offer an outright embrace of nudge to have large effects on offender behavior, admitted that, "[G]ood news for policy is that we can act on this insight by changing the choice architecture and 'nudging' offenders to make better decisions." For instance, they went on to describe certain ways in which probation and parole officers might become more "desistance focused." Moreover, nudges have been lauded from a cost–benefit perspective as they typically require minimal investments on the front end (Kahneman, 2013).

Nudging has begun to encroach on various crime policies. Some have speculated that that a nudge can be used for policing and deterrence, the latter based primarily on the concept of "design against crime," which is being applied in the United Kingdom (Sharma & Scott, 2015).[2] Similarly, Pickett (2018) presented results from a hypothetical drunk-driving experiment in which subjects were provided with additional information about various detection strategies that affected their intentions. Evidence from New York City revealed that nudges to remind defendants to appear in court for certain low-level offenses reduced failures to appear by as much as 32% (Cooke et al., 2018). Laub (2014) proposes an idea to incentivize schools to attend to problem students better,

rather than expelling them, by mandating expulsion be counted as zeros when computing average test scores.[3]

Nudges have generated massive public and popular attention, and many have been shown to support positive outcomes.[4] As Kahneman (2013) pointed out, however, the idea that all policy problems can be addressed merely by better or more clever design is both incorrect and potentially limiting. Loewenstein and Chater (2017, p. 27) "worr[ied] that the popularity of nudges has had unintended consequences that need to be recognised and responded to. Behavioural economics has diverse implications for public policy – of which the application of nudges is just one." Thus, although just one type of option to consider, nudges are merely scratching the surface of what BE can offer and are not always even viable (or desirable) for more complex types of policy issues. Consider, for instance, the 2016 report from the White House National Economic Council about the implications of raising the minimum wage to $12/hour and the associated claim that such a change would result in a 3% to 5% reduction on the crime rate (Executive Office of the President, 2016). Besides not only being uneasily amenable to more thoughtful design (i.e., not a nudge; on the contrary, raising the minimum wage would require making substantial investments), such a claim requires a formal prediction about how potential offenders might respond to incentives in the form of a change in wages.

There are a host of other policies including sanctioning, employment reentry programs (Bushway & Apel, 2012; Cook et al., 2015; Crutchfield, 2014; Sherman et al., 1997; Visher, Winterfield, & Coggeshall, 2005), social support programs (Harding, Wyse, Dobson, & Morenoff, 2014), and income maintenance (Mallar & Thornton, 1978; Zweig, Yahner, & Redcross, 2011) that are both (a) considerably costlier than the "nano-size investments" typically required for nudging and (b) require more and better understanding of how potential offenders might respond to clear changes in incentives. In other words, more elaborate solutions are required. Fortunately, in this regard, Bhargava and Loewenstein (2015, p. 396) argued that, "BE can and should now aspire to influence the design of policies aimed at the deeper causes of policy problems … we seek to leverage the teachings of BE more fully to deliver policy solutions whose scope is commensurable with the magnitude of contemporary challenges."

To be clear, behavioral economics is not entirely new to criminologists. Recently, Pogarsky et al. (2018) provided a robust overview and reviewed recent insights on behavioral economics and the study of crime. Many of the studies reviewed by the authors I will not cover here. Instead, the ideas presented in the current article are thus intended to be used to build on the work of these scholars and their contributions. More specifically, I draw on theoretical empirical literature from outside criminology and argue that this can be effectivity imported into expanding the study of BE and crime.

2 | BEHAVIORAL ECONOMICS: RATIONAL CHOICE AS A STARTING POINT

As a point of departure, it is perhaps helpful to deconstruct the term "behavioral economics" into its constituent parts: (a) the straightforward term "economics," which for our purposes can be defined as "the study of making choices under uncertainty," and (b) the more nebulous term "behavioral," which can be thought of as "suboptimal use of full and/or limited information" (i.e., as opposed to "rational"). Consider Thaler's (1987, p. 169) elegantly simply definition: "Economics can be distinguished from other social sciences by the belief that most (all?) behavior can be explained by assuming that agents have stable, well-defined preferences and make choices consistent with those preferences." In other words, unlike criminology or sociology, which have multiple, and sometimes competing, theories, economists tend to favor a singular, unifying theory of rational choice. This theory's foundation is a set of axioms in which it is explained that individuals have *preferences* that are well defined (i.e., ordered

in terms of how much *utility* the choice will produce), complete (i.e., either A is preferred to B, B to A, or neither), and transitive (if A is preferred to B and B to C, then A will be preferred to C). Individual behavior is then the product of *maximizing* utility; that is, individuals will choose the option that they most prefer based on preferences and constraints to their choice set.[5]

Criticisms of the assumption of perfect or hyper-rationality are legion and will not be disputed in this article.[6] Perhaps the most pertinent critique was offered by Nobel laureate Herbert Simon (1955, p. 99), who noted that, "Recent developments … raised great doubts as to whether this schematized model … provides a suitable foundation on which to erect a theory—whether it be a theory of how [individuals] do behave, or of how they 'should' rationally behave." In outlining his concept of bounded rationality, Simon argued that humans are often typically constrained by limited computational and cognitive capacity, may not have access to full information, and thus rely on certain shortcuts or *heuristics*. The concept of bounded rationality is implicated in derivative versions of Becker's theory of rational choice (Cornish & Clarke, 1985; Lattimore & Witte, 1986). More recently, heuristic biases have been more judiciously imported into the study of offender decision-making by Pogarsky, Roche, and Pickett (2017, 2018; see also Pickett, 2018).

Diverse human behaviors, however, are difficult to reconcile with rational choice by simply invoking that actors use mental shortcuts or have imperfect information. In trying to sort through classes of psychological biases, Congdon, Kling, and Mullainathan (2009) delineated between imperfect optimization, which can result in the use of decision-making heuristics, and *nonstandard preferences*, which can among other things include sensitivity to framing (see also DellaVigna, 2009, who made a similar distinction, referring to the former as "non-standard decision-making").[7] For instance, Camerer and Loewenstein (2003) cited empirical findings showing that (among other things) people routinely give to charity, smoke cigarettes that they know are bad for them, and invest their money in bonds (with comparatively lower long-run returns) when they should be investing in stocks (with comparatively higher long-run returns). These types of non–utility-maximizing behaviors generally not explainable by traditional models of rational choice are referred to as *anomalies*. Thaler (1987, p. 169) explained that "an empirical result qualifies as an anomaly if it is difficult to 'rationalize,' or if implausible assumptions are necessary to explain it within the paradigm."

Anomalies are fruitful within empirical economic research.[8] For example, Kahneman, Knetsch, and Thaler (1991) described a phenomenon in which sellers of a certain good often demand a much higher price than buyers of the same good are willing to pay, known as the *endowment effect* (see the review by Marzilli Ericson & Fuster, 2014). Thaler, Tversky, Kahneman, and Schwartz (1997) described how investors may overreact to short-term losses in their investments, which hinders long-term returns or what they term *myopic loss aversion*. Often, such as in these cases, these deviations from "rational" behavior in fact occur in predictable ways, a point emphasized in the review by Pogarsky et al. (2018). Behavioral economics research, then, is primarily focused on developing more realistic models to explain such systematic departures from rationality.[9]

In this fashion, Camerer and Loewenstein (2003, p. 7) outlined a "recipe" for research in behavioral economics:

> *First, identify normative assumptions or models that are ubiquitously used by economists, such as Bayesian updating, expected utility and discounted utility. Second, identify anomalies—i.e., demonstrate clear violations of the assumption or model, and painstakingly rule out alternative explanations (such as subjects' confusion or transactions costs). And third, use the anomalies as inspiration to create alternative theories that generalize existing models. A fourth step is to construct economic models of behavior using the behavioral assumptions from the third step, derive fresh implications, and test them.*

This strategy was also used by Kahneman and Tversky (1979) to develop prospect theory (PT), which is increasingly being used in criminological applications (Loughran, Pogarsky, Piquero & Paternoster, 2012). Kahneman and Tversky began with the standard model of expected utility (EU) theory, formalized by von Neumann and Morgenstern (1953), and then presented issues with traditional EU theory or, as they described it, "several classes of choice problems in which preferences systematically violate the axioms of EU theory" (p. 263). They then went back, revised the original model, and proposed a new theory in which certain systematic departures from rationality are predicted, such as loss aversion and nonlinear probability weighting.[10] PT has been subsequently tested in many different applications (e.g., Barberis, 2013; Camerer & Loewenstein, 2003) including crime (Loughran et al., 2012; Pickett, 2018).[11]

Importantly, this strategy implicates several essential constituent pieces. First, the establishment of a normative model in which it is outlined that how rational offenders "should" act is a *necessary condition* required prior to quantifying any systematic departures from it. This means that rational choice theories should be extended and developed further into a more well-rounded theory of offender decision-making rather than be abandoned. As developed in this article, unfortunately existing models of criminological rational choice are simple and therefore allow for us only to test limited departures from rational behavior, which then prevents us from thinking more creatively about systematic ways offenders might deviate. Second, and more relevant for purposes of policy, not only does using this strategy not preclude the role of (dis)incentives in shaping behavior, it necessarily implicates them (Kamenica, 2012). As Thaler (2017, para. 5; emphasis added) explained: "Good behavioral economics includes both structural (and other economic) factors as well as psychological phenomena. … *This is what distinguishes the field of behavioral economics from psychology: market forces are front and center*."[12] In other words, a useful theory must include how potential offenders will respond to both disincentives (i.e., sanctions) and incentives from crime.

In the remainder of this article, I offer several ideas on how the rudimentary model of rational choice used by criminologists might be extended to encompass a more complete theory of offender decision-making envisioned by Paternoster (2010). I then draw on the findings from the existing research from behavioral economics that has shed light on anomalies present in (analog) standard models, and how such refinements might serve both theory and policy. Importantly, although not explored in this article, this same, general framework of incorporating behavioral decision-making concepts to standard rational choice models can be applied to other actors in the criminal justice system, including judges, trial defendants, police, victims, and juries (see, e.g., Jolls, Sunstein, & Thaler, 1998; McAdams & Ulen, 2008; Wilson, 2019, pp. 785–805).

3 | STATE OF CRIMINOLOGICAL RATIONAL CHOICE THEORY

A common feature of each of the identified "anomalies" that breathed life into the fruitful area of BE research is that in each a starting model is required so that unambiguous predictions are made from which systematic departures can be detected. Therefore, now consider criminological rational choice theory, which is straightforward dating back to Becker (1968).[13] In Becker's model, crime is "rational" if the marginal benefits exceed the marginal costs and as the risks or costs of crime increase costs, crime will go down. Herein, risk and cost can be thought of as a "price." Most economic interpretations of crime comprise this basic framework of Becker that, although elaborated on, in spirit has not changed considerably since its introduction 50 years ago.

In my view, there are two primary limitations to how rational choice theory is treated in criminology that prevent a more behavioral perspective from taking shape: (a) Our (criminologists') models are too rudimentary in that potentially useful parameters are omitted, and (b) the state of testing is dated and highly stalled. I briefly consider each of these limits in more depth.

3.1 | Criminological models of rational choice are too rudimentary

In a typical criminological model, crime is presented as a rational choice if

$$U\,(\text{Benefits}) > p\,U\,(\text{Legal Costs} + \text{Extralegal Costs})$$

where p denotes the risk of detection and $U(\bullet)$ denotes the utility from potential benefits and costs. Many of the notable theoretical advancements in rational choice theory since have been focused on layering onto existing components of Becker's (1968) original model as opposed to expanding it by incorporating elements such as adding informal costs (Nagin & Paternoster, 1991; Paternoster & Simpson, 1996) and fear (Pickett, Roche, & Pogarsky, 2018) or amending parameters like risk to allow for perceptual rather than for objective valuation (Waldo & Chiricos, 1972). The benefit side has received comparatively less attention, although it has been expanded theoretically to include both social/personal rewards in addition to monetary returns (Loughran, Paternoster, Chalfin, & Wilson, 2016; Nguyen & Loughran, 2017; Piliavin, Gartner, Thornton, & Matsueda, 1986). There is only one easily operationalized parameter in this specification, the probability of detection or risk, and unsurprisingly, most of the extant research on BE and crime has been focused on this (Loughran et al., 2012; Pickett, 2018; Pogarsky & Loughran, 2016; Pogarsky et al., 2017; Thomas, Hamilton, & Loughran, 2018).

Importantly, several critical concepts are conspicuously absent in this basic specification that would be interesting in both a theoretical and a policy sense. For instance, missing are parameters in which basic extensions of rational decision-making are described, including time preferences, consumption, trade-offs between incentives from crime and legal incentives (such as legitimate income), and social interaction and dynamics. For example, as developed later in this article, if offenders treat illegal income differently than legal income, then this might have important implications for policies aimed at aiding ex-prisoners financially in their transition away from crime. As such, studying these concepts from a behavioral perspective would require considerably more informative normative models.

3.2 | The state of testing is stalled

A typical test of rational choice and/or deterrence theory is often posed as regressing some measure of (potential) offending on some measure of (sometimes lagged) risk or cost, whereby any rejection of the null hypothesis of no association between offending and cost/risk is taken as "evidence" in support of deterrence.[14] Tests like these, which correspond to an ostensible research question of "are offenders rational?", have several shortcomings. First, as Tyler (2018) pointed out, this is both an exceptionally weak and a mostly uninformative test.[15] Second, it tends to produce an erroneous conflation between rational choice theory and deterrence, the latter of which is merely a subset of the former, a point emphasized by Paternoster (2010). This lack of distinction is potentially limiting as it tends to narrow our focus to considering behavioral responses to policies only in terms of punishment and risks. Third, tests like these tell us nothing about how offenders are making choices and trade-offs *on the margin* (i.e., describing the *next* individual who moves from nonoffending to offending), where policy shifts are presumably being the most effective. Tonry (2008, p. 280) neatly summed up the problem by noting

that, "Useful research on deterrence will have to have to become much more nuanced than it has been so far."

This assertion parallels the evolution of BE and traditional economics, in both of which for a long time the discussion was about finding anomalies to challenge the assumptions of rationality. Research questions tended to be posed as "are individuals rational?" (i.e., "do they make optimal choices") or as "are they not rational and uncovering if certain anomalies exist?" Recently, however, there has been a movement beyond these sweeping questions into more pressing and useful questions about how the tools of BE can be more helpful with public policy. Most notable in this regard is Chetty (2015) who advocated specifically to recalibrate the framing of our research questions. He noted that, "[T]he pragmatic approach starts from a policy question—for example, 'how can we increase savings rates?'—and incorporates behavioral factors to the extent that they improve empirical predictions and policy decisions" (p. 1). Chetty went on to discuss three specific ways BE can be useful in this regard: Namely, it can be used to 1) offer new policy tools, 2) help yield better predictions about existing policies, and 3) engender new welfare implications. In this way, Chetty talked about BE as a "progression" of economics rather than as a challenge to it. For instance, rather than merely testing whether a certain sanction "works," we can reframe research questions to think about how behavioral departures from a traditional framework can be applied to increase compliance. Such a strategy can be adopted by criminal justice policy scholars, who might be convinced to move beyond asking (important) questions such as "does an intervention work?" to more nuanced ones such as "how can we make this intervention beneficial for more individuals?". The latter question necessarily requires more acute understanding of how precisely individuals might respond to various incentives laid out in the intervention.

In sum, if criminologists wish to incorporate more and richer concepts from BE into our research, we need to move away from an overly mundane conceptualization of rational choice toward a more elaborate theory of offender decision-making, heeding Paternoster's (2010) prescription to be consistent with Thaler's (2017) argument about the retaining the role of incentives (Nagin, 2007). Such an approach would yield more elaborate standard models (and predictions) and thus be used to identify potentially useful anomalies that can be built into policy. One example is a formal, rational model of dynamic Bayesian updating of perceptions of detection risk proposed and tested by Anwar and Loughran (2011). Systematic departures from this standard model have been subsequently studied by Thomas, Loughran, and Piquero (2013) and by Pogarsky et al. (2017). Such a set of strategies will then allow for us to move away from merely testing whether potential offenders are "rational" and instead move into more policy-related concerns.

4 | DEVELOPING A THEORY OF OFFENDER DECISION-MAKING

To spur more theorizing, I now consider four ways in which more formal models can be incorporated into the study of offender decision-making. For each, I then describe documented anomalies based on existing BE research before proposing ways in which these concepts are potentially relevant to offender decision-making. This list is in no way intended to be exhaustive but illustrative of how creative scholars can move this agenda forward.

4.1 | Intertemporal choice

The concept of celerity or swiftness of punishment, one third of Beccaria's (1986 [1764]) original deterrence triad, has recently taken on new relevance in crime policy discourse (e.g., Project HOPE;

Hawken & Kleiman, 2009). Criminologists, however, have tended to reconceptualize celerity as "time to punishment" or as using a variable that is typically measured as "days until arrest/punishment," upon which some measure of recidivism is then regressed. Rejection of (or failure to reject) the null hypothesis that the coefficient on this variable is equal to zero is then taken to be evidence (or absence of) of a "celerity effect" (see Pratt & Turanovic, 2016). As explained by Paternoster (2010), however, this conceptualization is likely inconsistent with Beccaria's original interpretation of what is meant by "celerity," which was seemingly presented as more of an operant conditioning mechanism rather than as a threat that decays linearly.[16] Second, and more importantly, this conceptualization is inconsistent with the idea that decisions are made between trade-offs that are occurring *intertemporally*.

A crime choice by construction typically involves trading off costs and benefits that occur at different points in time and can be analyzed as such.[17] Therefore, a more complete and accurate depiction of offending decisions needs to be informed by the results reported in the extensive economic literature on intertemporal choice. A standard framework for analyzing intertemporal decision-making was originally proposed by Samuelson (1937), who introduced the discounted utility (DU) model, which includes a parameter for systematically devaluing outcomes that occurred in future periods known as a "discount rate." Using this framework, it is then possible to make predictions between preferences between different time periods. For a review of intertemporal choice and complexities related to time preferences, see Frederick, Loewenstein, and O'Donoghue (2002).

A normative model of offender time discounting in which a discount rate is incorporated into the standard rational choice model was proposed by Nagin and Pogarsky (2001):

$$U\,(\text{Benefits}) > \delta_t p\; U\,(\text{Legal Costs} + \text{Extralegal Costs})$$

This new parameter $\delta_t = [1/(1 + r)]^t$ is a discount factor that, as described by the authors, is an "intertemporal exchange rate."[18] Assumptions of standard theory make clear predictions about how this discount factor should operate. δ depends on both (a) an individual's *discount rate*, $r > 0$, a measure of time preference, or more exactly, the degree to which one prefers the present in favor of the future; and (b) the number of periods into the future the cost will occur, t. The unambiguous prediction of this model is that the quicker the punishment, the more deterrent effect it will have. A discount factor $\delta < 1$ implies that the magnitude by which punishment produces disutility decreases as less weight will be placed on the cost of future punishment, which is similar to the original conceptualization of Samuelson (1937). Consistent with a celerity effect, punishments will have less impact the further into the future they occur. Second, the specific formula assumed to discount the future, known as "exponential discounting," will produce preferences that are time consistent, meaning that a trade-off made between t and $t + 1$ should be the same as a trade-off between any time points one period apart, $t + k$ and $t + (k + 1)$.

There has, however, been extensive work conducted in BE in which scholars have documented the common anomalies observed, calling into question each of these assumptions (Loewenstein & Prelec, 1992).[19] For instance, Loewenstein (1987) presented one type of anomaly in which an assumption of the DU model is violated—sometimes individuals display time preferences that seem to manifest as a *negative discount rate* (i.e., it seems as if $r < 0$).[20] He proposed a way to reshape this model by rewriting the utility function to including utility from anticipation, or more appropriate for the study of punishment, disutility from dread. This point about the influence of so-called "negative time discounting" and potential implications for punishment were raised by Paternoster (2010, p. 816, emphasis added), once again displaying his ability to see around corners, who noticed that, "[I]f Loewenstein is correct, persons do not view delayed punishment more favorably but want to get their punishment over as quickly as possible … *then celerity would have an inverse weight*, such that delayed punishment is perceived

to be more costly than more immediate punishment."[21] This is all to say the standard prediction of a "celerity effect" is perhaps much more complicated than the we have thus far treated it, and it likely yields important implications for future studies of punishment.

A second type of common DU anomaly occurs when individuals have inconsistent time preferences; notably, there is a tendency for some to be more impatient in the near term but less in the future. Again, in the standard model, it is implied that a time trade-off an individual makes between period t and t + 1 is identical when faced with the same choice between t + 5 and t + 6. Laibson (1997) proposed a model in which individuals with dynamically inconsistent time preferences were allowed for, in which time is not discounted exponentially but hyperbolically. Hyperbolic time discounting then explains why an individual, for instance, prefers a delayed outcome in t + 10 over t + 9 but still prefers the smaller outcome now (in period t) over waiting for the same larger outcome in t + 1. Present orientation is obviously a major focus of criminological theory, and hyperbolic time preferences have at least been speculated about for the purposes of punishment (Jolls et al., 1998; Loughran et al., 2012; Paternoster & Bachman, 2013). The implications of time-inconsistent preferences, however, likely go well beyond just punishment but instead have implications for things like probation and program completion (where commitment in the long term is overestimated in the present). In other words, people tend to be bad at projecting how well they can act rationally in the future. This has many implications for theory and policy, especially in a reentry or probation context, in which one's projected future commitment to a service program may be overly optimistic in the present.

4.2 | Criminal labor supply

As described, in a recent White House report (Executive Office of the President, 2016), the authors suggested that increasing the minimum wage to $12/hour could reduce the crime rate by 3% to 5%. Requisite in this inquiry is a model that includes parameters for how changes in legitimate wages and related opportunities might work to offset potential gains (or costs) from crime, again something that too parsimonious a model of rational choice might neglect. One such model was proposed by Erhlich (1973) who expanded Becker's (1965) original model of time allocation to study labor supply.[22] In Becker's original model, an individual is faced with a choice between allocating time between labor (L) and leisure (l), which are constrained by the total hours in the day or week, T, such that L + l = T. The individual earns income m = wL, where w is the hourly wage yielded by the market. The individual's objective is then to maximize utility gained by consumption (which is constrained by total income) and leisure. Ehrlich's model of criminal time allocation allows for a choice to allocate between L, l, and now some illicit activity D (which takes t hours), such that L + l + tD = T. The individual can now earn income m from either legitimate labor or illegal activity, m = wL + pD, where p is the illegal return to the crime. The individual's objective again is to maximize utility from consumption and leisure, this time subject to an expected penalty for detection.[23]

The predictions from the standard model are again straightforward. Grogger (1998) used this framework in his study of market wages and youth crime in the National Longitudinal Survey of Youth 1997 (NLSY97), arguing that responsiveness to falling (legal) wages was a key factor related to rising crime rates among young adults over the 1980s and 1990s. Conversely, predictions from this model would also indicate that raising legitimate wages, either through higher minimum wages, employment training, or subsidized work programs should work to reduce the attractiveness of offending. As Cook, Kang, Braga, Ludwig, and O'Brien (2015, p. 356) argued as motivation for their study of point of employment-based reentry programs, "it is plausible to suppose that interventions that are effective in improving employment opportunities will reduce the allure of crime for some released prisoners and thus reduce the recidivism rate." For example, using a sample of federal prisoners from Maryland,

Myers (1983) observed a robust decrease on postrelease offending attributable to legal wages on subsequent crime. Yet, nonetheless, the effects of subsidized work and employment programs on reducing recidivism have been found to be generally weak (Crutchfield, 2014; Lageson & Uggen, 2013; Visher et al., 2005), which indicates incongruous findings from the clean model prediction.

To help reconcile these disparities, a wealth of anomalies is observed in traditional labor supply studies (see, e.g., Fehr, Goette, & Zehnder, 2009) that easily translate into the study of criminal labor supply. For instance, Laibson and List (2015, p. 386) described one of their six key "principles of BE" as follows: "People care (in part) about how their circumstances compare to reference points." As they went on to describe, a reference point could be the price you pay for a house or the amount of money with which a gambler enters a casino. Kőszegi and Rabin (2006) formally defined the concept of *reference-dependent preferences* in noting that one's "reference point is her rational expectations held in the recent past about outcomes."[24] In other words, income that one is "used to" perhaps serves as an arbitrary reference point.

An illustrious example of reference points in labor supply decisions was provided by Camerer, Babcock, Loewenstein, and Thaler (1997), who studied hourly rates and hours worked by cab drivers in New York City. At the risk of sounding like a broken record, the standard theory prediction is unambiguous—"rational" cab drivers should choose to work longer hours on days when wage rates are high. In other words, under the traditional assumption of an upward sloping supply curve, there should be a positive relationship between hourly rates and hours worked. In fact, the authors observed the opposite—hours were negatively related to rates. Camerer et al. posed an explanation to this anomalous finding based on *income targeting*: That is, if cab drivers desired to reach a daily income goal or target, then once it was reached called it a night, then on nights when the rates were high, the drivers would tend to work fewer hours (see also Chou, 2002; Farber, 2003). This interpretation, which is consistent with PT, indicates reference dependence; in other words, desire for additional income was dependent on a prespecified—and perhaps arbitrary—reference point, which is inconsistent with the assumption that such irrelevant information should not affect preferences.

The concept of reference-dependent preferences is perhaps particularly relevant to illegal labor supply, in which it is possible that daily (or weekly/monthly) income targets serve as a reference point for illegal income generation. If this income target were to become a reference point (such as in a PT value function), then any amounts in a period below the target would not then been seen as merely an absence in illegal income but as a shortfall that is potentially treated as a *relative loss* (Heath, Larrick, & Wu, 1999). Consistent with PT, this could then likely lead to loss aversion, which would induce more risk-seeking behavior on the part of the individual to reach the target. More specifically, this could make deterrence harder as even though some perceived level of risk p does not change, it will be acted on differently as in the domain of a loss as individuals might shift to more risk-seeking behavior. Although this concept has yet to be explored in detail among active offenders, support for the idea is offered by Engstrom, Nordblom, Ohlsson, and Persson (2015), who implicate loss aversion in tax noncompliance among those individuals who realize a loss (see also Klepper & Nagin, 1989). More generally, Goette, Huffman, and Fehr (2004) discussed loss aversion in the context of labor supply decisions, which implies offenders might be responsive to illegal income in ways that go beyond them merely gaining "additional" income from crime, but such illicit income might generate reference dependence that cannot be easily undone by legal income.

4.3 | Consumption and mental accounting

Next consider the implications of the previous model for consumption, that is, how (in this case) income is used. Despite having different premiums associated with the relative riskiness of "earning" an illegal

dollar compared with a legitimate one (Grogger, 1998), once acquired standard predictions about consumption should make no distinction between a dollar earned legally versus a dollar earned illegally. In other words, supplementing legitimate income via employment training or raising minimum wages should offset related, forgone losses of illicit income perhaps keeping the total income (approximately) fixed. It is highly conceivable, however, that money earned legally is somehow "different" than money earned illegally.[25]

Perhaps the most famous theory of consumption is known as the "life cycle hypothesis," originally proposed by Modigliani and Brumberg (1954). In this theory, lifetime consumption should be equal to lifetime income, and consumption today (i.e., how much an individual chooses to consume in the present period) should depend on current income plus future income. For our purposes, in this model, two key assumptions are made. First, individuals should have *rational expectations* (i.e., they should be aware of and able to act on model predictions) about what their future earnings will be. Second, utility is maximized by maintaining a steady level of consumption.

Shefrin and Thaler (1988) observed several key anomalies related to life-cycle consumption and offered three main modifications in proposing what they referred to as the *behavioral life cycle hypothesis*. First, the authors noted (p. 610) that a more realistic descriptive theory of consumption should "also incorporate temptation … since some situations are less conducive to savings than others." More explicitly, this emphasized the role of self-control or lack thereof. Second, the authors again implicated the role of framing, observing that "income paid in the form of a lump sum will be treated differently from regular income" (p. 610). In this way, profits from illegal activity can be thought to be more unexpected or extra income and thus be susceptible to a "house money effect" (Thaler & Johnson, 1990).[26]

Although not considering illicit income specifically, Shefrin and Thaler (1988) seemed to be raising many of the same concerns criminologists have raised about how to treat illegal earnings. For instance, Sampson and Laub (1993) described the appeal of "fast money" in driving criminal behavior. Uggen and Thompson (2003) stressed the role of drug dependency in the volume of illicit income generation. As I have argued previously (Loughran, Nguyen, Piquero, & Fagan, 2013), illegal earnings are almost surely more transitory than legal earnings, and such provisional status will undoubtedly obfuscate future expectations of illegal income (i.e., illicit proceeds do not lend themselves in any way toward predictability). All of this can introduce tremendous instability into normative decision-making models, and related predictions as to how legal and illegal earnings should offset one another.

Most relevant, however, is a third observation made by Shefrin and Thaler (1988) that different money kept in different "pots," or *mental accounts*, tends to be treated much differently by the same individual and, more immediately, violates fungibility or the idea that a dollar is a dollar. Thaler (1990, p. 194) expanded on this idea of mental accounting, noting that "consumption appears to be excessively sensitive to income" (which among other things violates the life cycle hypothesis) and, more importantly, "various forms of wealth do not appear to be as close substitutes as the theory would suggest." The evidence that individuals treat money in separate mental accounts is substantial. For example, individuals tend to be much more willing to spend a larger amount when paying with a credit card as compared with cash even though a dollar spent on a credit card might cost more than one dollar in the long run (Prelec & Simester, 2001).[27] More relevantly, Kooreman (2000) observed in a Dutch sample that the marginal propensity to consume (MPC)[28] for buying children's clothes was considerably larger for income that was provided as a "child benefit" (even though it could be used for anything else) as compared with other, regular sources of income.

Again, the implications for criminal activity are manifest. It is possible, and in fact likely, that illicit funds are tracked into a separate mental account compared with how legal funds are tracked. In other words, how individuals spend (and budget) money from criminal proceeds could be much different from how they treat legal proceeds. For instance, the latter could be budgeted for standard things like

food, rent, and so on, whereas the former might simultaneously be appropriated for nonstandard, luxury, or even illegal items. If so, this has important implications for a range of things as, for example, it implies that simply trying to offset crime with regular income is perhaps more difficult than standard theory would predict. This is because regular income and illegal income may not in fact be perfect substitutes for each other as traditional forms of income maintenance polices tend to assume implicitly when allocating resources (Harding et al., 2014).

In summary, the differential valuation of legal and illegal income yields several potential interesting avenues for future research. For instance, does all money go into the same mental account or are legal/illegal earnings budgeted differently? Is the MPC of a legally earned dollar equal to the MPC of an illegally earned dollar? Are repeat offenders loss averse, and are they income targeting? How "rational" (if at all) can we think of illegal earnings expectations? All of these questions potentially have implications for things like policies aimed at increasing legal labor market incentives and in general for how potential offenders will respond to other forms of legitimate income maintenance.

4.4 | Social preferences

Peer influence has been found to be one of the best predictors of crime (Agnew, 1991; Warr, 2002). As developed in considerably more detail by others in this issue (Hoeben & Thomas, 2019), models of peer influence, however, can undoubtedly benefit from more consideration of a decision-making perspective. One way to model a decision to offend is as a function of traditional criminological/psychological constructs like social rewards and costs that capture the role of peer influence. In this case, however, "peers" are treated as inherently exogenous; that is, the only influence of the peer is through the individual's susceptibility to him or her. In such a model, the preferences and joint decision-making influences of the peers are not directly considered.

An alternative way to think of peer decision-making is in a game theoretic context, in which two (or more) individuals are involved in a strategic interaction and attempting to respond best based not only on their preferences but also on each other's potential actions. A "rational" solution concept in a such a case is known as a "Nash equilibrium," from which no player has incentive to deviate given the other player's choices. Often, such as in the case of the well-known prisoners' dilemma, the Nash equilibrium in fact represents a nonoptimal outcome for all players. Using such an approach and modeling payoffs in terms of a typical peer influence dimension such as social rewards is potentially fruitful, although not entirely straightforward in existing models of peer influence. It is also easy to conceptualize how, given such potential reward structures, peer decision-making in this context could easily lead to suboptimal outcomes for all players (such as engagement in mutually risky/costly activity).

Laibson and List (2015, p. 387) provided yet another "principle" (#4) that has behavioral implications for a traditional rational model in this context: "Although we mostly care about our own material payoffs, we also care about the actions, intentions, and payoffs of others, even people outside our family." Charness and Rabin (2002) described such factors as *social preferences* that, while preserving the role of self-interest, also involve concerns about the payoffs of others. Despite the rosy connotation, such preferences are not always in favor of the social good.

Consider, for example, the results from a traditional game theory interaction known as the "ultimatum game." In this game, two players must agree on how to split a pot of money, say, $100. Player 1 first proposes a split (e.g., 50/50, 60/40, etc.). Player 2 can then either accept player 1's offer (in which they both get the payoff) or reject the offer (in which case both players get nothing). The Nash equilibrium for this game is for player 1 to propose a split of $99/$1 and for player 2 to accept the offer (as at this point he or she will be faced with a choice between $1 and nothing). Individuals (i.e., player 2s), however, routinely reject offers below 30% of the pot even though this means they forego a tangible

payout (List, 2007). Again, a rejection of an offer that leads to nobody getting any payout represents a socially nonoptimal outcome. In response to this, Rabin (1993) proposed a behaviorally modified version of a Nash equilibrium known as a "fairness equilibrium." The implication is that individuals are willing to make decisions that are seemingly outside of their self-interest as a means to establish fairness in group decision-making. Social preferences are consistent with much of what we know about peers and incentives, particularly in terms of social rewards and costs, which might drive cooperative behavior into mutually suboptimal decisions. By expanding on concepts built around strategic interaction, such models hold strong promise for how to conceptualize interventions aimed at curbing social influences. Although perhaps less obvious for a direct policy linage, it is at least possible interventions at the school and community levels could be leveraged to account for such interdependencies among peer incentives (Catalano, Loeber, & McKinney, 1999).

5 | DISCUSSION

Contemporary policies aimed at crime reduction, ranging from general umbrella policies like incarceration and probation, to specific ones like Project HOPE and the South Dakota 24/7 Sobriety program (Nicosia, Kilmer, & Heaton, 2016), to more conceptual prevention polices, such as hot-spots policing, focused deterrence, and situational crime prevention in cybercrime, are all based on the standard concept that individual actors will alter their behaviors in response to incentives. Moreover, policies intended to leverage incentives to achieve crime reduction are not solely related to increasing costs—in fact, reentry services aimed at increasing employment, education, and housing opportunities are intended to leverage positive incentives to promote transitions to criminal desistance. That is to say, both sides of the cost–benefit relationship can be manipulated by policy. The program logic for each of these policies is grounded—often implicitly—in rational choice theory, according to which rational actors should carefully weigh and consider such (dis)incentives in their decision-making. Yet, there is considerable evidence that certain crime reduction policies are ineffective, (e.g., manifest in the arguments that deterrence "doesn't work" or employment programs "don't work"),[29] which inevitably leads to the conclusion that rational choice, as a unifying theory of criminal behavior, is incomplete at best or fatally flawed at worst. As such, it can be tempting for scholars to tend to drift away from this paradigm as a basis for future policy design and analysis.

In this article, I have attempted to provide criminologists with more insight into how to incorporate the increasingly popular insights from BE into the study of crime and crime policy. To summarize, this process involves drawing on the rich literature on BE and on the anomalies of human behavior from outside criminology, from which we might construct useful analogs. The suggestions I cover here are merely a small subset of potential innovations. Moreover, based on the advice of Chetty (2015), we should aim to reframe our research questions to be more pragmatic (e.g., "how can we increase commitment to postrelease programs?") as opposed to merely performing tests of "acting rational." The first and foremost step in this endeavor to incorporate more BE into the study of crime, however, is to embrace Paternoster's (2010) vision directly by developing more useful and comprehensive models of offender decision-making from which systematic departures based on behavior principals can be proposed and investigated. For this reason, I argue that we will necessarily need to embrace and expand on normative models of rational choice. I have tried to argue, perhaps somewhat paradoxically, that the expansion, as opposed to the abandonment, of rational choice theory is a first-order condition of this integration of behavioral economics into the study of crime. As such, a primary conclusion of this article is that I advocate for the increased development and expansion of rational choice theories of offender decision-making before we might begin to study behavioral departures.

On this point, consider an oft-cited critique of rational choice/deterrence theory offered by Pratt, Cullen, Blevins, Daigle, and Madensen (2006, p. 5), who argued that, "The effects of the variables specified by deterrence theory on crime/deviance are, at best, weak—especially in studies that employ more rigorous research designs." Putting aside disagreements concerning the potential validity of this statement, it is remarkably similar in structure to an assessment of evidence supporting life cycle theory, offered more than 20 years prior by Courant, Gramlich, and Laitner (1986, pp. 279–280; cited by Shefrin & Thaler, 1988): "But for all its elegance and rationality, the life-cycle model has not tested out very well … Nor have efforts to test the life-cycle model with cross-sectional microdata worked out very successfully."

Thaler (1985, 1999; along with his contemporaries and those who followed) did not take from this lack of evidence that he should throw the proverbial baby out with the bathwater and scrap the entire theory in favor of alternatives. Instead, Thaler was motivated by the lack of sufficient descriptive power to take an existing normative structure and supplement it methodologically to construct more useful descriptive theories that have commanded the attention of scholars, policy makers, and popular interest alike. We criminologists can follow this lead: Retain the attractive features of incorporating (dis)incentives to crime in our models by way of rational choice theory, but supplement the unreasonably logical predictions of standard rational choice theory with the rich array of modifications from BE to produce more useful descriptions of, and predictions about, how potential offenders make decisions.

ENDNOTES

[1] As Akerlof et al. (2017) noted, multiple governments have established dedicated units charged specifically with implementing behavioral insights into public policy design, including the Behavioural Insights Team in the United Kingdom and the (now defunct) Social and Behavioral Sciences Team under President Obama.

[2] See, for example, http://www.designagainstcrime.com/outputs/publications and http://www.cpted.net/.

[3] It is unclear whether this example is technically a nudge as districts being required to (as opposed to being able to opt of) counting students as zeros would constitute a clear shift in incentives.

[4] Nudge is so popular lately that *The New York Times* has published numerous articles on this (Carroll, 2017; Thaler, 2015b).

[5] Mythical agents operating under an assumption of being perfectly rational and self-interest utility maximizers are sometimes referred to as *homo economicus*. Persky (1995) traced the use of this term and how scholars have thought about and critiqued it.

[6] The idea that economists are completely hardheaded about humans making decisions like unemotional computers is overly dramatic. Considers Arrow's (1986, pp. S385–S386) view on the matter, in which he seems to reinforce the primacy of responsiveness to incentives over computational alacrity: "It seems to be asserted that a theory of the economy must be based on rationality, as a matter of principle. … But as far as individual behavior is concerned, any coherent theory of reactions to the stimuli appropriate in an economic context (prices in the simplest case) could in principle lead to a theory of the economy." Furthermore, in his (1993) Nobel lecture, even Becker conceded he "may have assumed too much rationality."

[7] A third type of psychological bias the authors separated is bounded self-control.

[8] As described in his 2015a book, Thaler published a regular series on anomalies during his time as editor of the *Journal of Economic Perspectives*.

[9] This general approach seems footed even in sociological theory. For instance, consider how what Lindberg (1992, pp. 4-5) described as the "method of decreasing abstraction": "For more than 100 years, another possibility to integrate both desiderata has been discussed: a method whereby one would begin with a very simple model and gradually make it more realistic."

[10] The two-paragraph introduction to the 1979 paper reads almost exactly in the format Camerer and Loewenstein (2003) described.

[11] PT is in fact only one of multiple alternative descriptive theories proposed as an alternative to EU theory (see Starmer, 2000).

[12] On this point, Kahneman (2013, p. ix) was even more explicit about the differences between BE and psychology: "[T]he mislabeling of applied behavioral science as behavioral economics has consequences … behavioral economics has retained the cachet of economics, so psychologists who are considered behavioral economists gain some credibility in the policy and business worlds … [but] there is the very real possibility worry that young psychologists will be put off from doing policy-related work because they do not consider themselves economists, even with the modifier 'behavioral' as a prefix."

[13] Although the implication of Becker's model is straightforward, his explanation of how he gets there is certainly not! As Shawn Bushway has repeatedly pointed to out to me (and others), such arcane economic theory—and the complex calculus that it implicitly requires—could be a deterrent from criminologists to engage more fully with economic models, a fair point for which I currently offer no solution.

[14] Here I do not mean to point fingers as I have certainly been guilty of this as well (Loughran et al., 2016).

[15] To be clear, research in which linking whether perceptions of risk are related to offending is intended to test a key assumption of rational choice theory and, thus, has a useful purpose.

[16] According to Beccaria's (1986 [1764], p. 56) characterization of celerity, "the crime and the punishment be intimately linked to together … the seductive picture of a particularly advantageous crime should immediately call up the associated idea of punishment."

[17] Usually rewards occur prior to costs, although not always (see, e.g., crime school hypotheses; Bayer, Hjalmarsson, & Pozen, 2009; Nguyen, Loughran, Paternoster, Fagan, & Piquero, 2017).

[18] Nagin and Pogarsky (2001) were clear that the parameter they attempted to incorporate into their model was time, not necessarily celerity.

[19] The DU model has been criticized long before this, for instance, see Strotz (1955).

[20] For instance, Loewenstein (1987) elicited subjects' willingness to pay for a pleasant outcome (i.e., a kiss from your favorite movie star) and an unpleasant outcome (i.e., an electric shock), which occurred at various points in the future (e.g., immediately, one day from now, three days from now, etc.). Subjects were willing to pay more to delay the pleasant outcome and get the unpleasant outcome over with (both up to a point in time).

[21] It is also likely that discount rates could be thought of as an individual difference and there could be population heterogeneity whereby some individuals are more affected by this.

[22] "Labor supply" is a fancy term for describing how many hours an individual chooses to work, that is, supplies to the labor market.

[23] For a more comprehensive explanation of these models, see Schmidt and Witte (1984) and Eide (2000).

[24] Related to the idea that BE and contributions must be understood in the context of it being a reaction to formal models of rationality, this sentence is an exemplar of that point. The term "rational expectations" has formal meaning in economics, yet criminology has no such equivalences for good or bad, a comment raised by Dan Nagin when reading this article.

[25] This is also consistent with qualitative descriptions of the sociology of money among low-income individuals (Zelizer, 1997).

[26] Consider, for instance, that $100 won playing blackjack is perhaps thought of much differently than noticing one's stock portfolio increased by $100 while reading a current statement. Standard life cycle theory would indicate these two changes are treated identically.

[27] Rick, Cryder, and Loewenstein (2008) described the phenomenon by which people are less willing to spend using cash, which is concrete, than with credit cards, which the costs are deferred, as the "pain of paying."

[28] The marginal propensity to consume can be thought of as how much of an additional dollar will be spent, ranging from 0 (none of it will be spent) to 1 (all of it will be spent).

[29] As I have tried to stress throughout, studying if an intervention 'works' is not an unimportant task.

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