Implications of smart decision-making and heuristics for production theory and material welfare

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Abstract

Conventional theory assumes that economic agents perform at optimal levels of efficiency by definition and this is achieved when individuals behave in a particular fashion. Moreover, neoclassical production theory masks the process by which optimal output can be achieved. I argue that economic theory should be revised to incorporate some key findings of behavioural economics, while retaining the conventional theory's normative ideal of optimum output whilst rejecting its normative procedural ideals of how to achieve optimality in production. I argue that neoclassical procedures can be expected to yield sub-optimal levels of output and therefore should not be benchmarks for procedural rationality. I present an alternative more realistic and analytically precise specification of the production function related to the fast and frugal heuristics narrative pioneered by Gigerenzer and Leibenstein's x-efficient theory. This approach incorporates an understanding of the appropriate procedures, psychological and organization variables, decision-making capabilities and end-goals required to achieve optimality in production and, thereby, grow the wealth of nations, thereby enhancing the material wellbeing of the population at large. This also provides us with the tools to better identify economic inefficiency and the conditions that contribute to it.

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1 Introduction

There is a consensus amongst behavioural economists that decision-makers often deviate from the behavioural norms identified as optimal by conventional (neo-classical) economics in both the domain of consumption and production, with a more recent focus on consumption. The focus of this article is on choice behaviour inside of the firm. Conventional economics typically maintains that decision-makers not only should but do behave in a manner consistent with the neoclassical norms for optimal behaviour. This behaviour ultimately results in economic efficiency. More specifically it is maintained that economic agents within the firm are behaving as if they are optimizing thereby maximizing profits and minimizing average production costs (Altman 1999; Friedman 1953). Any other behaviour (such as the use of heuristics—decision-making shortcuts) would see the firm decimated by market forces. Moreover, non-optimizing behaviour would not be rational (where rationality is defined as including, as a necessary condition, optimizing behaviour). And irrationality of this type is ruled out, by assumption, by the conventional wisdom.

But the facts suggest otherwise. What actually transpires in the black box of the firm often is persistent sub-optimal behaviour. The firm is not as productive as it might otherwise be given the traditional inputs into the firm's production function. Or, when firms are performing efficiently or optimally this is not necessarily consistent with firm members adhering to the optimal conventional behavioural norms of conventional economic theory, where the latter I refer to as rational or smart behaviour. What conventional economics recognizes is the type of economic inefficiency that is given 'exogenously' by market structure, referred to as allocative inefficiency. This is a function of distorted market prices relative some competitive ideal. This conventional type of inefficiency tends to be relatively trivial. But another type of inefficiency, referred to as x-inefficiency by Leibenstein, in his classic 1966 article, appears to be quite important when analysts bother to test for its substantive significance (Frantz 1997; Tong 2020). X-inefficiency is defined as not being as productive as possible given traditional factor inputs. Being as productive as possible, given these inputs is referred to as x-efficiency. Conventional economics assumes x-efficiency dominates in the long run.

X-inefficiency is assumed away by the conventional economic modeling of the firm. But x-efficiency very much depends on the choices made within the black box of the firm. Conventional economics assumes that the choices made are consistent with x-efficiency. However, this need not be the case. I argue, unlike in the conventional modeling of the firm, that there is no guarantee that x-efficient choices will be the norm. Moreover, smart or rational agents can be expected to make choices that will result in the firm being x-inefficient.

The x-inefficiency is part of the behavioural economics methodological narrative pioneered by Simon (1959, 1978, 1986, 1987). Generally speaking, behavioural economics argues for modelling assumptions that align with the facts and theoretical narratives that build upon how individuals or economic agents make decisions in the real world. It challenges the conventional economics assumption that individuals tend, even in the long run, to behave in accordance to conventional or neoclassical behavioural norms.

A critical and general methodological point raised by behavioural economists is the importance of determining benchmarks for best-practice choice behaviour of individuals in a variety of decision-making environments. Most recent attention has been directed to the choices of consumers and households and the psychological, sociological and institutional determinants of these choices; with some discussion on the neurological determinants. Little emphasis has been directed on choices made inside the firm, which has significant effects on the level of material well-being achievable in a society. The great methodological debate relates to whether general 'neoclassical' benchmarks are optimal (and assumed achievable by reality-based decision-makers) or whether alternative benchmarks make more sense. In the heuristics and biases approach to behavioural economics (Kahneman 2003; Kahneman and Tversky 1979; Thaler and Sunstein 2008; Tversky and Kahneman 1981), humans tend not to meet achievable optimal neoclassical benchmarks and therefore make suboptimal choices. This is often a product of using heuristics or decision-making shortcuts. In the alternative fast and frugal approach, alternative optimal benchmarks are and should be adopted, based on context specific heuristics. This evolutionary approach to the use of heuristics is referred to as ecological rationality (for an early rendition of this see, March 1978). This can take the form of fast and frugal heuristics (Gigerenzer 2007; Mousavi et al. 2017; Mousavi 2018). Or, more broadly, it can take the form of heuristics that are frugal but not necessarily fast (slow thinking) (Kahneman 2011).[1] This is very much in contrast to heuristics and biases approach where heuristics yield sub-optimal choices and outcomes.

Following from some of the key points articulated in x-efficiency theory, we argue that firms are efficient only if firm decision-makers choose to behave in a manner consistent with maximizing productivity given the traditional inputs at hand. However, such behaviour takes place only under a specific incentive environment and typically also requires particular preferences by firm decision-makers. It is not a matter of firms simply attempting to maximize profits as per conventional economics or adopting fast and frugal heuristics in the place of profit maximization. If profits are being maximized, it becomes a matter of how profits are being maximized. The how is not addressed in the conventional narrative and the same is the case with the fast and frugal narrative with regards to the organizational structure of the firm and the embedded incentive environment.

We argue that economic efficiency is achieved when firms adopt heuristics that are nuanced to the particular circumstances of the firm, where these may not be consistent with neoclassical behavioural norms, for example. This type of smart decision-making, more in line with 'satisficing' behaviour (which one can refer to as frugal or simple or simplified heuristics), is context dependent and contributes towards

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[1] Kahneman's (2011) now recognizes the possibility that under certain circumstances fast and frugal heuristics (fast thinking) will yield superior outcomes than proxies to conventional economic norms (slow thinking). From the perspective of this article, slow thinking can also be a non-conventional heuristic that is fit for purpose. And a slow thinking heuristic might form the basis for an informed fast and frugal heuristic. This is similar to the reality that efficient intuition (fast thinking) based decisions are drawn on prior experience (slow thinking) on oneself or others. The latter often incorporated in social norms, habits, and traditions.

achieving economic efficiency. In this context, fast and frugal heuristics, can yield higher levels of x-efficiency than following neoclassical behavioural norms. But blindly following any particular set of theoretical norms to achieve efficiency can be predicted to yield sub-optimal economic outcomes. Using heuristics as opposed to neoclassical behavioural norms is only one component of the economic efficiency narrative. Economic efficiency also critically depends on the preferences of decision-making, the firm's state of industrial relations, the organizational form of the firm, as well as market forces.

1.1 Optimal, economic efficient behaviour

Optimal behaviour is considered to be behaviour which achieves economic efficiency or x-efficiency in production. What this, in effect, means is that firm members are working as smart and as hard as they can (maximizing effort inputs), given the totality of traditional factor inputs. This 'ideal' scenario is what Leibenstein (1966) refers to as x-efficiency in production. Conventional economics assumes that firm members (economic agents) are maximizing effort inputs at all times. Market forces ensure this outcome which can be reinforced by the assumed aligned profit maximizing preferences of firm members (Altman 1999; Friedman 1953). Hence, problems with firms' performance are not scrutinized in terms of potential organizational, power, or preference related issues inside of the black box of the firm (Cyert and March 1963; Tong 2020).

   The conventional economic wisdom does not strictly specify how economic efficiency is achieved, but it does relate closely to profit maximizing behaviour and related intensive no cost or very low cost information search behaviour as well as detailed marginal calculations. And it is assumed that economic agents actually behave in this manner or it is assumed that they behave *as if* they are engaging in such profit maximizing behaviour (Berg and Gigerenzer 2010; Friedman 1953). In this modeling framework there is no analysis of how firms are actually run as functioning and successful economic entities. In reality, no successful firm's members invest their time and effort engaged in intensive marginal calculations combined with intensive information search activities. They engage in different and varied activities to make their firms successful (Cyert and March 1963; Frantz 1997; Gordon 1996; Lazonick 1991 Leibenstein 1966, 1979; Levine and Tyson 1990; Penrose 1959; Sheffrin 2008; Tong 2020).

   In the heuristics and biases approach to behavioural economics pioneered by Kahneman and Tversky the optimal normative behavioural benchmark is the one identified in conventional 'neoclassical economics'. Deviations for this decision-making behavioural norm is thought to be yield sub-optimal choices which reduce the decision-makers' welfare from what it could otherwise be. Although Kahneman and Tversky's focus was not on firm behaviour, it logically follows from their argument that such deviant sub-optimal behavioural will result in lower levels of economic welfare (lower levels of GDP per person, for example). Critical to this approach is the assumption (backed up with evidence largely from experiments on consumer behaviour) that decision-makers tend to deviate, often persistently (no or

little Bayesian updating) from neoclassical behavioural norms (Kahneman 2003, 2011; Kahneman and Tversky 1979; Thaler 2015).

Individuals tend not to behave neoclassically. This is a fundamentally important finding as it undermines the conventional economics assumption that not only should economic agents behave neoclassically, but they actually do. This point is reiterated by Smith (2003, 2006), who maintains that such deviations from neoclassical norms represent rational and optimal behaviour from the perspective of firm performance.

What are the implications of ecological rationality and fast and frugal heuristics in the context of x-efficiency theory for production theory and our understanding of material welfare? I argue that they suggest alternatives to the neoclassical production function and that the neoclassical production function per se yields a misleading benchmark of what is maximum (efficient) output. Building upon the insights from behavioural economics, I present an alternative, more realistic and analytically precise specification of the production function which I referred to as the Satisficing, Boundedly Rational and Smart Fast and Frugal, X-Efficient production function or SAXE. The latter incorporates an understanding of the appropriate procedures, organization variables and end-goals required to achieve optimality in the realm of production.

Satisficing (developed by Simon 1978, 1987) refers to doing the best one can, given one's decision-making capabilities and the decision-making environment. This is opposed to the conventional economics concept of maximizing. Bounded rationality (also developed by Simon 1978, 1987) refers to rational or smart behaviour that is fit for purpose. It is behaviour suited to one's decision-making capabilities and environment. And, bounded rationality invariably involves the development and use of heuristics or decision-making shortcuts. Fast and frugal (Gigerenzer 2007) refers to heuristics that are minimalist and quickly executed, potentially generating savings in time and money. Smart fast and frugal heuristics makes reference to such heuristics that are well thought out and fit for purpose and relates to Simon's concept of procedural rationality. This alternative specification of the production function is ecologically rational in that it evolves based on decision-makers' capabilities and their decision-making environment (related to bounded rationality). But this does not entirely dismiss neoclassical specifications, specifically that efficiency requires that output is maximized given traditional factor inputs. Rather, it places the neoclassical specification of efficiency in the context of bounded rationality. Conventional theory simply assumes that the rational firm (its agents) will make decisions abiding by conventional behavioural norms (or behaving as if they do) to achieve economic efficiency, de facto x-efficiency. The SAXE specification, makes no such assumption. Conventional norms are not assumed to be ideal or even achievable. Although output maximization is required to achieve x-efficiency, it is understood that the means to do so are complex and context dependent. X-efficiency is not guaranteed by assumption. It is achieved only when appropriate context dependent behavioural norms are developed and adhered to within a facilitating institutional environment.

The neoclassical assumption of the necessary conditions (such as effort 'maximization') that need be met for economic efficiency to be realized is an important

one. But the neoclassical necessary conditions are often mis-specified or not specified; they are implicitly assumed. A critical contribution of neoclassical methodology is to underline that there are objectively determinable standards for production efficiency to be achieved and for individual utility to be maximized. Not all behaviours can be deemed efficient or utility enhancing. However, I also argue that the neoclassical normative argument that individuals behave in a manner consistent with economic efficiency is highly misleading.

I also make the case that rational choice behaviour can deviate significantly from benchmark efficient behaviour. Individual or group (firm) based rational choice behaviour can result in rational inefficiency in the domain of production. Inefficient choice is not equivalent to lacking in intelligence (Altman 2017). Rationality is consistent with both efficiency and inefficiency in production. I argue that "ecological rationality" need not be economically efficient (can be x-inefficient). An important component of my discourse is the argument that production efficiency is not always consistent with neoclassical norms. Moreover, production efficiency is critically dependent upon the incentive cum institutional environment faced by economic agents within the firm. This takes us beyond a discourse on heuristics and decision-making. Economic efficiency requires the realization of specific institutional norms (related to firm governance). The 'right' institutional framework need not be in place, yielding rational production inefficiencies.

1.2 Neoclassical norms, heuristics and economic efficiency

Conventional theory assumes that rational agents produce efficiently by minimizing costs and maximizing profits. It is further implicitly assumed that economic agents behave in a manner consistent with effort maximization. Economic agents of the firm behave as if they are all characterized by such behavioural arguments. Such efficiency enhancing behaviour is enforced through the survival principle. Inefficient firms are eliminated in the long run by the competitive process (Friedman 1953).

Consistent with x-efficiency theory and the related evidence, I argue that conventional economics incorrectly assumes that all agents maximize effort inputs, which is fundamental to generate production efficiency (Frantz 1997; Leibenstein 1966; Tong 2020). This incorrect behavioural assumption is reinforced by the incorrect institutional assumption of perfect or highly competitive product markets. But if one assumes that neoclassical behavioural assumptions prevail, one assumes that firms are always operating along their respective optimal production possibility frontiers (PPFs) whereas they might very well be operating in the interior of their PPFs.

Following the findings of fast and frugal heuristics research, I also argue that economic agents using clearly non neoclassical methods (fast and frugal heuristics) *can* yield superior results. Hence, such heuristic behaviour facilitates achieving higher levels of effort input required to realize production efficiency. But note that heuristics need not always be 'fast'; they can involve slow thinking (Kahneman 2011). Given that effort is a scarce resource, what one can argue from the fast and frugal approach is that adopting a heuristics approach to decision-making saves this scarce effort resource as compared to what would transpire if neoclassical behavioural
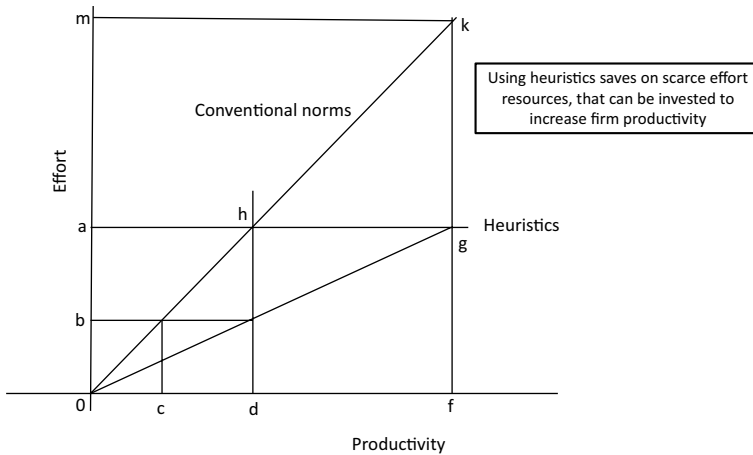
Fig. 1 Effort, decision-making norms and labour productivity

norms are adopted. The accumulated effort savings could then, potentially, be used to invest in increasing firm productivity thereby increasing its level of x-efficiency. Moreover, adopting fast and frugal heuristics need not sacrifice on the overall efficiency of choice outcomes with regards, for example, the operation of the shop floor or investment decisions.[2]

This point is illustrated in Fig. 1, where effort input is on the vertical axis and productivity is on the horizontal. Line 0 k represents conventional behavioural norms, whilst 0 g represents heuristics based behavioural norms incorporating fast and frugal heuristics. 0 g yields higher levels of productivity than does 0 k—0f productivity compared to 0d. 0 g (heuristics) represents a more efficient use of effort. Looked at from an effort-use perspective, heuristics requires less effort (0b) to yield a given level of productivity (0d) than conventional behavioural norms (0a). In this scenario, maximum effort is given by 0 m, where conventional norms yield a much lower level of productivity (0f) than what could be generated using heuristics in the decision-making process. This level of productivity requires a much lower level of effort (0 m). The surplus effort could be invested in generating a higher level of productivity. But the savings in effort need not be invested to increase productivity or the level of x-efficiency. Much depends on the preferences of firm members, how the firm is organized, and market forces.

Therefore, unlike with the heuristics and biases approach to behavioural economics neoclassical behavioural norms should not be the benchmark by which to measure optimal behaviour. One cannot assume a priori that efforts to maximize profits or minimize costs will yield economic efficiency irrespective of the processes adopted to realize this end. But this does not vitiate the critical point made in conventional

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[2] Gigerenzer's (2007) point of focus is the realm of consumer related decision making, but this can be extended to the realm of production and the theory of the firm.

economics that effort maximization is an essential determinant of economic or x-efficiency. The simple point made here is that neoclassical behavioural norms cannot be expected to yield economic efficiency. The type of decision-making norms one adopts critically affects the firm's level of x-efficiency by impacting on the efficiency by which scarce effort resources are employed.

This narrative yields the hypothesis that non-neoclassical (SAXE) heuristic based behavioural norms, in an appropriate institutional environment, can yield higher levels of productivity generating higher levels of x-efficiency. This hypothesis is reinforced by the experimental work of Smith (2005, 149). Smith concludes (2005, 149–150):

> It is shown that the investor who chooses to maximize expected profit (discounted total withdrawals) fails in finite time. Moreover, there exist a variety of nonprofit-maximizing behaviors that have a positive probability of never failing. In fact it is shown that firms that maximize profits are the least likely to be the market survivors. My point is simple: when experimental results are contrary to standard concepts of rationality, assume not just that people are irrational, but that you may not have the right model of rational behavior. Listen to what your subjects may be trying to tell you. Think of it this way. If you could choose your ancestors, would you want them to be survivalists or to be expected wealth maximizers?

This SAXE approach to the theory of the firm has implications for one common interpretation of bounded rationality theory, which infers that boundedly rational behaviour yields sub-optimal decisions since bounded rationality imposes a constraint on rational ('unboundedly' rational) neoclassical behaviour (Conlisk 1996). Being boundedly rational results in firms performing in the interior of their production possibility frontier. In this approach the neoclassical narrative is retained. The benchmark for optimality is the neoclassical norm. But from the SAXE approach, bounded rationality simply implies that we live in a non-neoclassical world and that this affects the decisions that rational-smart decision-makers make. And, these rational decisions, in a world of bounded rationality, can't be the same as what might transpire in a neoclassical world. Heuristics can, therefore, yield better decisions and better outcomes (higher levels of x-efficiency) that can be achieved by abiding by neoclassical behavioural norms.

This point elaborated with regards to fast and frugal heuristics specifically, by Todd and Gigerenzer (2003, 160–161):

> Studying ecological rationality enables us to go beyond the widespread fiction that basing decision making on more information and computation will always lead to more accurate inferences. There is a point at which increasing information and information processing can actually do harm…there are cases where cognitive limitations actually seem to be beneficial, enabling new functions that would be absent without them, rather than constraining the possible behaviors of the system… given that cognitive capacities are free parameters that have been adjusted in the course of evolution, the ability to use simple heuristics may have required the evolution of no more than a certain limited

amount of cognitive capacity necessary to execute those heuristics. This argument requires that simple heuristics had a selective advantage over more complex cognitive strategies (which would have required more processing power). But we have already seen that such advantages do exist, in terms of speed and robustness and enabling new functionality. Thus, the benefits of simple limited decision mechanisms may actually partly underlie the emergence of bounded rationality itself.

A key point made in this ecological rationality narrative is that given the cognitive wiring of the decision makers and information imperfections the standard for unbiased behaviour often should not be neoclassical norms. What often appears to be an error or bias using neoclassical norms may in fact be a form of optimal behaviour. Neoclassical behaviour would be irrational or biased here. And, therefore, neoclassical behavioural norms should not be used as the norm for optimal behaviour.

But the rational use of heuristics need not yield x-efficiency in production. The appropriate heuristics need be chosen to elicit economic efficiency or x-efficiency. Being fast and frugal need not translate into being x-efficient. Much critically depends upon the heuristics adopted inside of the firm and related institutional environment. An important point made by Simon (1987) and Leibenstein (1966) is that firm decision-makers attempt to maximize (or satisfice) in terms of their preferences. But satisficing behaviour, although rational and utility maximizing, need not be consistent with generating economic efficiency. And such utility maximizing behaviour can persist if relatively x-inefficient firms are somehow protected from market forces. Therefore, sub-optimal heuristics (behavioural norms) can persist given appropriate environment conditions (Altman 1999). In this case, even adopting non-neoclassical norms can result in the firm operating in the interior of its production possibility frontier. And we have here a case of rational inefficiency (Altman 2005, 2006, 2017). Ecological rationality is consistent with both rational inefficiency an x-efficiency in production.

1.3 Implications of x-efficiency theory and fast and frugal heuristics for the PPF

X-efficient production results from best practice management practices, preferences of decision-makers, the manner in which the firm is organized, and market forces. It takes a micro perspective on firm decision-making and organization and is consistent with the notion of bounded and ecological rationality as well as with smart and rational decision-making (Frantz 1997; Leibenstein 1966, 1979). When a firm is x-inefficient its production possibility frontier lies in the interior of the x-efficient PPF (Altman 2005, 2006). If x-inefficiency is assumed away, as it is in conventional or neoclassical theory, then the revealed production possibility frontier is assumed to be the optimal x-efficient PPF. Following upon a SAXE narrative, attempting to achieve x-efficiency by applying simplistic neoclassical behavioural norms to the firm embedded in the real world of bounded rationality would be one sure method of assuring firm underperformance and, therefore, x-inefficiency in production.

In the original x-inefficiency model (Leibenstein 1966), x-inefficiency results in higher unit production costs since managerial decisions in and of themselves result in lower effort inputs and, therefore, lower levels of productivity. This can be illustrated in a one factor input model of the firm, where w is unit labor costs (a proxy for all labour costs), Q is output, and L is labor input:

$$AC = \frac{w}{\left(\frac{Q}{L}\right)} \tag{1}$$

Average cost increases as labour productivity falls as a function of a reduction in effort inputs. In this case x-inefficient firms survive only if all firms are equally x-inefficient or if they are protected from competitive pressures.

If the level of x-efficiency is contingent upon the costs of labor inputs, such as incentives to labor and management, different levels of x-inefficiency can be *balanced* by countervailing differences in production costs. Relatively x-efficient firms would be characterized by the same average costs as x-inefficient firms. In this case, x-inefficient firms can survive even in the face competitive product markets. In Eq. 1, changes in w can be neutralized by changes in productivity. This is important to note since firms need not be economically efficient to survive on the market even when product markets are relatively competitive since x-inefficiency need not generate higher average costs.

From the fast and frugal narrative, one would hypothesize that neoclassical behaviour will yield a lower level of output than is feasible—one would be in the interior of the production possibility frontier. Based on our modeling above, fast and frugal heuristics, which can be removed from optimal neoclassical behaviour, should yield higher levels of productivity, higher levels of x-efficiency than neoclassical norms. The fast and frugal production possibility frontier would, therefore, lie above the neoclassical PPF.

However, there might be an array of non-neoclassical behavioural norms and parameters that yield x-efficiency in production. Specifying what they are, requires a nuanced understanding of the firm and its current institutional and market context. For example, x-efficiency in production might require frugal heuristics, efforts to minimize moral hazard, and more fairness introduced into the incentive environment of the firm. A production possibility frontier based on this more holistic approach to the firm (going beyond, but incorporating the insights from the fast and frugal narrative) could reflect an even higher level of x-efficiency and should, therefore, lie even above the fast and frugal PPF. Which decision-making norms firm members adopts, however, plays an important role in explaining a firm's level of x-efficiency.

Some of these points are illustrated in Fig. 2. If the neoclassical or conventional behavioural norms is the benchmark for achieving optimal firm performance, given by PPF CONXI (conventional norms-x-inefficiency), then the heuristics and biases narrative suggests that the human preference for heuristics yield a PPF, H&B, below CONXI reflecting a lower level of productivity and a higher level of x-inefficiency. The fast and frugal narrative suggests a superior PPF given by the Heuristics PPF. Therefore, the conventional PPF, CONXI, reflects x-inefficiency in production not
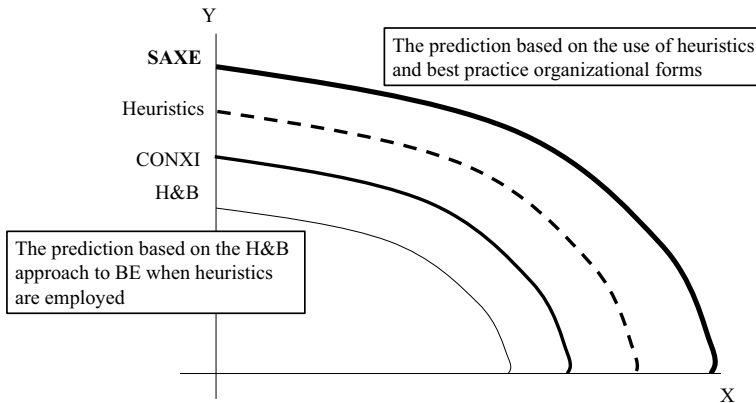
Fig. 2 The Satisficing Boundedly Rational and Smart Fast and Frugal, X-Efficient production function

economic efficiency as typically assumed. Going beyond the important heuristics narrative, adding a more appropriate decision-making environment and decision-maker preferences into the decision-making mix yields an even higher PPF given by SAXE, the Satisficing Boundedly Rational and Smart Fast and Frugal, X-Efficient production function.

Applying neoclassical behavioural norms and ignoring the intricacies of firm decision-making in the real world of bounded rationality would be expected to shift the firm's production possibility frontier inward as it engenders an inefficient use of scarce effort resources in the decision-making process, thereby reducing output per unit of factor input. This pushes the firm further from its potential of producing at economic or x-efficiency.

2 Conclusion

This article integrates the concepts of x-efficiency, bounded rationality, and fast and frugal heuristics as they relate to economic efficiency. This requires that one recognizes the importance of conventional economics' emphasis on what is technically required to achieve economic efficiency. This relates to the notion that economic efficiency requires that effort inputs (quality and quantity dimensions) are somehow maximized. But the conventional wisdom assumes that effort maximization is a given. And, it does not discuss how economic efficiency can be realized apart from assuming that it is achieved through a focus on profit maximization. But this concept is too narrow to provide any substance to an explanation of how economic efficiency can actually be achieved within the firm.

The bounded rationality approach to human behaviour maintains that in the real world, smart, intelligent, rational economic agents cannot and will not behave in accordance to conventional or neoclassical behavioural norms. The fast and frugal heuristics approach suggests that decision-making outcomes are superior when non-conventional norms are evolved and put into practice. This is in stark contrast to the

heuristics and biases approach that maintains that because economic agents don't and can't abide by conventional norms their decision-making outcomes will be sub-optimal. In this context, I argue that heuristics can generate superior productivity outcomes by saving on scarce effort resources and generating more effective and efficient outcomes, contributing to higher levels of economic or x-efficiency thereby increasing society's level of material welfare. In contrast, conventional behavioural norms waste scarce effort resources yielding lower levels of x-efficiency. Therefore, conventional or neoclassical behavioural norms should not be used as the baseline to measure optimal efficiency and bounded rationality need not yield sub-optimal economic behaviour. This is an important analytical prediction that is clearly differentiated from what flows from the conventional wisdom and from the heuristics and biases perspective in behavioural economics. It forces us to take a much more nuanced and reality-based perspective on what is required both inside the firm and with regards to institutional parameters to facilitate and incentivize the realization of x-efficiency.

However, we should not assume that economic efficiency is achieved simply as a function of economic agents adopting heuristics to engage in decision-making inside of the firm. Such an assumption would be little different from the neoclassical assumption that production efficiency is always achieved by way of the survival principle. The smart-rational choices of economic agents need not be optimal even given the fast and frugal narrative. Appropriate heuristics need be adopted depending on circumstances. The heuristics narrative requires more specificity. Moreover, the important positive heuristics narrative is only part of the economic efficiency puzzle. Achieving economic efficiency requires not only adopting appropriate context-dependent heuristics, but also adopting the appropriate organization forms and information environment that generate the incentives to facilitate x-efficiency in production. This represents a more holistic, behavioural, approach to a theory of the firm, incorporating a more prescient understanding of optimal decision-making processes and of the firm's overall decision-making environment and the overarching preferences of the firm's decision-makers.

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