Economic Complexity and Evolution

Andreas Chai
Chad M. Baum *Editors*

Demand, Complexity, and Long-Run Economic Evolution

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Introduction: Demand, Complexity, and Long-Run Economic Evolution

Chad M. Baum and Andreas Chai

1 The Long-Run Growth of Demand

In July 1959, then-Vice President Richard Nixon travelled to Moscow to open an exhibition showcasing America's technological and material achievements. The highlight was a full-scale replica of the home of an average American worker. It was equipped with fitted carpets, a television in the living room, central heating and a kitchen with a washing machine, a tumble-dryer, and a refrigerator. The Soviet press cast doubt on whether the ordinary American lived in such luxury and mockingly baptized it the 'Taj Mahal'. Upon viewing it, Khrushchev spotted an electric lemon squeezer and remarked that no one in their right mind would want to acquire such a 'silly gadget'. Later, Nixon was invited to make some remarks on Soviet television and used the occasion to expound on the advantages of American life. He explained that Western economies had, through enterprise and industry, managed to overcome poverty and famine in just a few hundred years. Modern Americans owned 56 million television sets and 143 million radios, he informed his Soviet audience, many of whom lacked access to their own bathroom or kettle. Some 31 million families in the United States moreover owned their own homes, and the average American family could buy 9 dresses and/or suits and 14 pairs of shoes each year. In the USA, it was further claimed one could get a house in a thousand different architectural styles. An infuriated Khrushchev, seated at Nixon's side, clenched his fists and mouthed to the camera 'Nyet!' (de Botton 2004, p. 33).

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But Nixon was not lying. Starting from the mid-eighteenth century, Western economies had undergone the most radical transformation in living standards ever known in human history. Over its course, consumption patterns of ordinary workers had been transformed beyond recognition, finally encompassing an immense variety of new goods and services (Lebergott 1993; Bianchi 2002). This stood in stark contrast to what the vast majority of earlier generations could possess: For example, a survey of the household inventories of tradesmen in the late-seventeenth century found that only 27% possessed books, 11% owned knives and forks, 33% had pictures, and 28% owned window curtains (Weatherill 1988, p. 184). What is more, despite the persistent increases in real-income levels that have characterized Western economic development, growth in real-consumption expenditures shows no signs of abating today.

As a result of this expansion, the industrial and sectoral composition of modern economies has changed significantly. Entire industries exist today that were unheard of less than 50 years ago (Scranton 1994). A good example is the tourism industry, one of the fastest-growing industries of the twentieth century). It has been estimated to contribute US$7.6 trillion (10%) to global GDP while employing around 292 million workers worldwide (equal to 10% of all jobs), according to the WTTC (2017). As a recreational activity, it also represents the principal migratory movement in modern societies, having involved as many as 700 million international travellers in 2001 (Sinclair and Stabler 1997). Given the overall scale of this activity, as well as its labour-intensive nature and positive impact on the international balance of payments (from incoming tourists), it is no surprise that governments frequently look to inbound tourism as a viable way of realizing economic growth and full employment. In fact, by the 1990s more than 125 nations considered tourism as not only a major industry but also a primary generator of employment and foreign exchange reserves (Richter 1989).

In addition to the emergence of new industries, more traditional sectors have also undergone significant transformation. In the case of agriculture and food production, for instance, such activities now contribute a meager 0.7% of GDP in the United States, along with less than 2% of overall employment (Dimitri et al. 2005). This notably contrasts with the situation at the turn of the twentieth century, at which point 60% of the population lived in rural areas and more than one-third of labour and GDP were tied up in this sector (Council of Economic Advisors 2006). Indeed, driven by the electrification of production and processing, diffusion of large-scale machinery, and greater use of chemical fertilizers and pesticides (Clarke 1994; Gardner 2002, p. 28–45), it is now possible for just 322,000 farm operators (or 0.001% of total population) to produce 90% of the food consumed annually in the United States (Conkin 2008, p. 164).

As first argued by Engel (1857), there is the prevailing belief that one of the hallmarks of higher living standards is how rising per-capita income allows consumers to diversify their spending away from essentials, notably food. Accordingly, spending less on food is itself taken as evidence of a nation's current level of development. Looking at the United States, it can thus be observed that the level of household income devoted to food consumption has declined from 42.5% to 9.6%

since the beginning of the twentieth century (US Department of Labor 2006; Clauson 2014). With so many conceivable choices appealing to one's hard-earned income, the seemingly settled, unfashionable—and rural—nature of food production frustrates any attempt to convince urban consumers to pay more than necessary, or more than they are accustomed. Inscribed at the heart of consumer theory is thus the view that wider choice and a more diversified consumption basket are material signs of a better life.

2 Rethinking the Economic Problem

The purpose of this volume is to examine the long-run structural shifts in consumption patterns, and specifically how these are driven, *inter alia*, by increasing levels of household income. According to the US Department of Labor (2006), in 1901, average total household expenditures on all items were US$769. By 2003, this had risen to $40,748—or a more than 52-fold increase in overall expenditures in just over 100 years (*ibid*.). This begs the question of why consumption patterns have continued to evolve and expand over time, even in spite of the immense increase in the real wealth of households and their overall living standards (Witt 2001).

Indeed, in 1930, John Maynard Keynes predicted in "*The Economic Possibilities of our Grandchildren*" (Keynes 1930) that "the economics problem" would be solved within a few generations, such that consumer needs would not only be met but that the broad incentives for workers to work more would decline. As a result, workers would become more likely to reduce their working hours, exchanging these for greater leisure time (Pecchi and Piga 2008; Skidelsky and Skidelsky 2012). In this regard, Keynes underscored the following fundamental point: the extent to which economic growth translates into better living conditions for the general populace strongly depends on the manner in which consumption patterns evolve as households become more affluent.

Clearly we have not reached such a "satiation point" where the overall level of demand would cease to rise. Instead, what seems to have transpired, and to continue to transpire, is that the composition of consumption patterns has fundamentally changed, e.g. with greater emphasis on more "relative" considerations such as status. Today more than ever, consumption spending in advanced economies is far less focused on satisfying the basic needs of households as a result (Chai and Moneta 2012). Of course, this finding seems quite intuitive, especially given increasing household expenditures on things like entertainment, travel, or even relative 'luxuries' such as fancy coffee or organic food. From Keynes' perspective, however, this represents a problem, as it suggests that the economic problem is not just tied to our ability to satiate our more absolute needs. Accordingly, it is not only Keynes, but also the conventional utility-based approach to consumer behaviour, as devised by William Stanley Jevons, that comes under scrutiny. Here, it is crucial to note that this approach was primarily designed to examine and explain those acts motivated by the "lowest rank of feelings", such as basic hunger and thirst (Warke 2000, p. 17).

Hence, within textbook microeconomics, one founding axiom of neoclassical analysis is that consumption is 'insatiable', i.e. consumers will always prefer more of something to less. The dominant neoclassical approach for studying consumption therefore tends to focus on how constraints such as the household budget impact consumption behaviour (Deaton and Muellbauer 1980). Meanwhile, much less is said about the underlying needs that actually motivate the behaviour that seeks to work within such constraints. However, it is precisely the motivations of consumers, not to mention the tendency of such motivations to evolve over time, which comes into focus when we consider how consumption patterns have managed to expand at such a staggering rate over the past century.

For this reason, It is necessary to go beyond the standard reliance on arbitrary, *a priori* assumptions about, e.g., consumer-utility functions, and to instead begin with questions such as how consumers learn about new goods and how such goods come to be associated with and assigned a given utility (Menger 2007; Ruprecht 2002). To do so, we must take a closer look at the processes of consumer learning, given that it is their interactions with suppliers and supply-side innovations which enable goods and services to mutate in a functionally and economically significant fashion. Understanding the processes by which consumers discover the usefulness of things can therefore shed light on the key features of consumption growth across modern societies. This deeper level of analysis moreover helps us to offer answers to some of the most important and enduring questions involving the overall growth and structural change of modern economies: Why do levels of per-capita consumption continue to grow more than two centuries after the industrial revolution? Can we identify any regularities for such processes, and what are the implications for the (industrial) organization of economic activities? What explains the uneven nature of growth, and to what degree can we expect such growth to continue into the future?

3 Bounded Rationality and the Emergent Complexity of Consumer Behaviour

The overall purpose of this book is to consider the long-run evolution of global consumption patterns and, in so doing, to understand potential implications for modern economies. In developing countries, there is little doubt that the current resource-intensive consumption patterns, first writ large in the West, have set a concerning precedent for the increasing number of affluent consumers around the world. Given that around 3.1 billion people are projected to enter the middle class by 2030 (OECD 2010), this raises questions about the overall sustainability of these broad shifts in global consumption patterns. For instance, if we set this in terms of how much discretionary income is expected to become available worldwide, though mostly in emerging economies, this represents an increase on the magnitude of $23 trillion between 2015 and 2030 alone (Dobbs et al. 2016). Beyond the changes occurring in developing economies, consumption patterns across the West are also

being reshaped in fundamental ways. Thanks to decades of rising real-income levels, entrepreneurial effort, and technological progress, consumers now devote ever smaller attention to satisfying their basic needs, often shifting instead to other consumption domains that are not necessarily any more sustainable. Rather, the general focus of priorities seems to be shifting to more non-material considerations such as the quality of social interactions, allocating time to other pursuits, and the avoidance of boredom. Grasping what this may imply for the pursuit of sustainability, among other considerations, thus requires that we understand the broader consequences of the changing composition of consumption, that is, at the level of both individuals and societies.

Beyond changes in the range and type of needs that consumers aim to satisfy, i.e. "what" is being consumed, a second important theme is related to the "how" of consumption, i.e. how consumers learn to satisfy their needs and wants. Thus, not only does technological progress yield increasingly complex goods and services, but the shifting foundations of market competition also tends to generate fast-paced change in the type and variety of goods from which consumers can choose. On the one hand, given that search costs have radically declined thanks to the information revolution, this would seem to augur a more simple and straightforward choice for consumers. No longer is it necessary, for instance, to 'shop around' at a range of department stores for the best price, nor even to leave one's house at all. Rather, the greater convenience afforded by platforms such as Amazon and eBay enables one to access a wealth of price details and product information with a few mouse clicks.

And yet, while searching has indeed been made easier, consumers still face fundamental challenges, for instance, if more technologically advanced goods are accompanied by increasingly complex contracts and/or require one to choose between a constantly evolving array of pricing structures. On the first point, a good is example is mobile phone contracts, where studies have demonstrated the broad difficulty of choosing between contracts as the tariff structure becomes more complex (Friesen and Earl 2015). In order to actually enjoy the benefits of owning such a device, individuals are thus required to invest in attaining knowledge that is more specialized and sophisticated. Nonetheless, while the search for such information is made substantially easier by recent ICT innovations, this greater ease of search still cannot ensure that the information one receives is accurate or indeed likely to be helpful. For instance, surveys reveal that consumers generally worry about the quality of the services they receive (e.g. Dulleck and Kerschbamer 2006). As a result, there is a growing literature on the attributes and implications of those 'credence goods' where the quality of the good is difficult to assess by consumers, especially if they lack the necessary education or expertise (Darby and Karni 1973; Dulleck et al. 2011). Underscoring the increasing importance of trust, consumers are thus forced to evaluate the quality of a product in relation to the perceived credibility of the sellers involved—that is, inferring a product characteristic from a trait of the seller (Cuthbertson and Marks 2008; Moser et al. 2011). In fact, the growing need for quality information, and not just for more information in general, also explains the proliferation of labels and certification schemes within modern economies.

Furthermore, another potential benefit from being able to rely on others, e.g. as stand-ins for product quality, is how this can optimize on our limited attentional resources. That is, given that we as humans are subject to not only limitations on our time and money but also on our cognitive effort and the ability to process complex information, it is quite helpful to be able to 'outsource' some of this processing elsewhere, maybe even to those who can more efficiently and effectively do so. Using the language of behavioural economics, it is therefore argued that the concept of bounded rationality can also offer insight into how individuals manage an environment that is increasingly complex—and indeed why it is crucial to do so (Simon 1956; Earl 1986; Aversi et al. 1999; Nelson and Consoli 2010). Notably, one crucial implication of the existence of bounded rationality is that the 'perfectly optimization of' decisions is logically impossible, in view of the unreasonable expectations on available time and energy. That is, as agents only have limited reasoning power and the taking of any decision is necessarily costly (Loasby 1998, p. 22), decision-makers can, at best, approximate the ideal of rational behaviour set forward by neoclassical economics.

Moreover, in response to the inexorable constraints of bounded rationality and the potential for information overload, individual decision-makers ultimately require something in the form of institutional aids to approximate 'rational' behaviour. For example, in order to reduce the uncertainty of increasingly diverse and knowledge-intensive markets, expert advice has assumed greater importance as a key input to purchasing decisions. According to Earl and Potts (2004, p. 629), expert advice is most needed in cases where consumers lack the specialized knowledge required in a specific consumption domain. Given that such knowledge proves necessary to enable them to satisfy their needs, it is logical that consumers would seek to fill in the gaps in their knowledge by, *inter alia*, consulting magazines, inquiring with public authorities, or inviting word-of-mouth recommendations from fellow consumers, retailers, or from the producers themselves. For this reason, numerous economic studies have investigated how and under which circumstances consumers are more likely to rely on significant others in order to obtain further information about goods and services (Nelson 1970; Rosen 1981; Bikhchandani et al. 1992). In this way, we can observe how institutional and contextual determinants shape consumption, and indeed how the interplay among these factors can often lead to unexpected outcomes for individual behaviour (Baum and Gross 2017).

However, what has so far been given less attention is the other side of the equation, that is, how social and economic institutions have evolved to accommodate the emergent complexity of consumer behaviour and the growing demands placed on individual decision-makers. If we wish to understand the twists and turns of global consumption patterns, more consideration must therefore be given to the evolving institutional structure of modern economies and, specifically, its impact on the "how" of consumption. Only on the basis of such research can we offer preliminary insights into the potential for modern economies to finally attain the sufficient resolution of the "economic problem" highlighted by Keynes nearly a century ago.

4 Overview of Contributions

The time is definitely ripe to consider the implications of these various global trends, which is why a re-evaluation is now underway in the contemporary study of demand and consumer behaviour. Within microeconomics, the relative nature of consumption and the role of the social environment have both become prominent issues in the literature (i.e. Hopkins and Kornienko 2004; Arrow and Dasgupta 2009). In addition, there is also a shift towards considering how biological evolution shapes consumption patterns (Witt 2001; Robson and Kaplan 2003; Rayo and Becker 2007). Within macroeconomics, moreover, we find growing awareness of the role of income inequality in shaping consumer demand (Bertola et al. 2014). Even while such topics may appear new to the canon, however, it bears underscoring that economists have long examined such topics (e.g. Veblen 1994). For this reason, it is perhaps better to think of this as a renaissance whereby the field of economics connects more deeply with the variety and complexity of its foundations. Finally, from the point of view of welfare economics, these trends beg us to consider whether increases in per-capita consumption expenditure can always be presumed to deliver higher living standards. In other words, as economic systems continue to evolve towards greater complexity, what does this engender for our general understanding of consumer behaviour?

In sum, this movement has created the impetus to re-examine and deeply explore some longstanding questions in micro- and macroeconomics that have been hitherto inadequately answered. For example, do consumers have an insatiable appetite for novel goods and services and, if so, to what extent might it be said that the insatiable nature of consumer demand is co-determined by the sway of social institutions? Apart from Engel's law, what other empirical regularities may be identified to explain the way in which consumption patterns evolve as societies become more affluent? Furthermore, how do these affect the industrial composition of evolving economies, especially in light of the overall tendency towards complexity? Finally, in view of the established need for more sustainable societies what might this suggest about the likelihood for the widespread adoption of sustainable consumption practices? In other words, if the evolution of demand is endogenously influenced by not only economic, social, and institutional factors, how might this change our understanding of the necessary requirements for learning to consume more sustainably? Given the novel blend of challenges that confront modern societies (climate change, resource depletion, safe and secure access to food and water, etc.), finding answers to these questions is perhaps more important now than ever before.

This collection of essays features contributions that bring to bear novel insights and approaches in order to move us closer in the direction of the answers we require. In this regard, the first two contributions analyse Keynes' sketch of long-run economic evolution by focusing on the role of institutions in mediating the relationship between economic growth and the realization of higher living standards. Friedman (2019) notes that technological advances contribute towards higher income inequality and a growing share of income earned by capital-owners. In so

doing, he highlights two reasons why rising labour productivity need not automatically translate into higher living standards. By way of a solution to these twin issues, he thus advocates renewed investment in those types of public goods that stand to benefit everyone, and could thereby help to blunt the aggregate and distributional effects of technological progress on the economy. Next, Potts (2019) picks up this thread by arguing that the fundamental missing feature of Keynes' sketch of long-run growth is a failure to recognize that the conditions for both supply and demand in the economy are critically influenced by socio-economic conditions. As such, institutional evolution shapes not only how a given set of resources can be used to solve the aforementioned economic problem but also fundamentally shapes our understanding of the economic problem itself. Given a change in institutional configuration, for instance, we can expect the composition of demand to also 'co-evolve' with the supply side. That is, because institutions do not evolve in a cumulative fashion but rather on the basis of creative destruction, it is easy to envision a situation where both the existing structure and assortment of demand will be, just as novel production technologies must ultimately replacing those which are older. Indeed, given the general reliance of consumers on supply-side aspects and institutional features to make decisions, e.g., about credence goods, any changes in the nature of the goods and attributes are likely to beget changes elsewhere in the economy as well.

Shifting attention towards the underlying drivers of long-run economic evolution, the other two contributions in this part explore some of the notable consequences of the global trends that have already been mentioned. In this regard, both can be seen as attempts to learn from history, specifically that of Keynes' predictions, by identifying potential issues that are either likely to emerge or unlikely to be resolved from having a higher standard of living. Recall that the principal prediction by Keynes (1930) was that the increasing opportunity for discretionary purchasing would enable (more) individuals to trade-off work-hours for greater leisure. Ultimately, this did not end up occurring because of how the socio-economic context surrounding also evolved over time, thereby inducing decisions different from what we might expect. In this regard, Earl (2019) advises caution in light of the expectations that the robotic revolution and other productivity-enhancing innovations will solve the economic problem and herald in a Golden Age of economic growth. Not only do such proclamations seem to unintentionally echo those of Keynes, they also forestall informed discussion about the opportunities and challenges that are brought about by increasing affluence. To highlight what the microeconomics of future consumption could entail, Earl therefore examines drivers of aggregate consumption in increasingly affluent countries and, on this basis, explains how higher discretionary spending is only likely to be available to certain types of people, e.g. those who are relatively older and/or have the requisite skills to thrive in the new global economy. Otherwise, and in keeping with Friedman's emphasis on distributional outcomes, we can expect gains of increasing affluence to be shared unequally across nations and income classes.

If this is the case, we can expect the ability to absorb the resulting quantity of excess labour to be one of the strongest conditions for successfully navigating the

potential consequences of technological progress and economic growth. But what about those sectors where technical change at a fundamental level is either infeasible or perhaps undesirable? In order to explore this question, Cedrini and Guerzoni (2019) take aim at the century-long shift from craft- to mass-production in the cultural industries. Specifically motivated by Baumol and Bowen's (1965) assertion that these industries cannot enjoy the productivity gains available to other sectors, the authors endeavour to excavate some of the more beneficent aspects of this situation. Notably, drawing on Scitovsky's (1992) notion of creative consumption, the example of this industry is utilized to provide suggestions for rethinking, and even reversing, the unsustainable path of economic development that has emerged in an era of more affluent societies.

In Part 2, the essays contribute towards building a behavioural account of the way in which consumption patterns expand and adapt to rising levels of household income and evolving institutional conditions. In order to establish new perspectives on the long-run evolution of demand, Chai (2019) reviews a number of historical case studies and empirical investigations conducted over the last 15 years, all of which have employed Witt's (2001) "Learning to Consume". This article specifically reveals how this burgeoning body of literature has delivered insights into the precise manner that the character of demand is endogenously influenced by economic institutions, as well as the implications for achieving more sustainable levels of consumption. Witt (2019) then expands on this in order to tackle the important relationship between consumer welfare and levels of consumption. In doing so, he joins a growing chorus of scholars who have issued a fundamental challenge to the orthodox view currently underpinning pro-growth policies, i.e. that more consumption is a reflection of higher living standards. In its place, Witt proposes a more motivation-centric perspective on individual welfare, whereby increases (or decreases) in welfare are evaluated not in relation to the greater ability to spend but rather the extent to which such spending actually provides satisfaction for the suite of needs and wants motivating behaviour. According to Witt, the pursuit of societies that are more satisfying (and sustainable) then begins with a revaluation of the relationship between welfare and consumption.

Amidst all of these conceptual and practical insights, what is still somewhat absent is the methodological basis to explore these issues more deeply. In order to render the insights more actionable, the remaining two contributions therefore develop potential modelling approaches vis-à-vis the relationship between consumption behaviour and the broad socio-institutional environment. First, Baum and Weigelt (2019) focus on the relationship between retail formats and consumer behaviour. Highlighting both the variable pace of behavioural change in the emerging market of sustainable food consumption and the emergence of novel types of retail formats, the authors utilize a discrete choice experiment to explore the significance of retail formats for purchasing choices. As a result, they find that type of retail format is a significant determinant of consumption behavior, both on its own and through its interactions with other quality attributes. Contrary to the idea that retail formats become irrelevant once the product assortment is taken into account, this chapter demonstrates how the format plays the crucial role of offering credible

information about product quality. In this manner, the authors invite further consideration of how broader systems evolve to give individuals the information that is required to make more autonomous and informed decisions.

Last but not least, introducing a bit more formal rigor to this discussion, Almudi and Fatas-Villafranca (2019) elaborate a modelling approach that is able to integrate the uneven growth in productivity across sectors—in other words, structural change. Moreover, one of the key upshots of their so-called "multisectoral growth model" is that a number of demand-side elements turn out to be crucial, notably the income elasticities for the respective sectors. Through this model, the authors can therefore represent economic growth as not only a long-run property endogenously emerging from the uneven sectoral patterns of productivity growth that are observed in modern economies. More crucially, since it is the growth in per-capita income that specifically propels the uneven expansion of different sectors, the model illuminates the difficulty of explaining sectoral change, and ultimately economic evolution, without integrating how consumption behaviour evolves over time. The authors therefore conclude that, when formulating industrial policy, the effect of demand-driven structural change and its influence on the composition of the economy must be taken into account.

Taken together, the contributions in this collection highlight two broad and important trends in contemporary economic thought. First, a growing number of scholars interested in accounting for long-run economic growth are coming to accept that consumer preferences cannot be assumed to be exogenous and stable, even in the long run. As a result, the typically strict separation between the considerations of demand and supply is becoming increasingly blurred as scholars seek to identify the social and institutional determinants that are most conducive for growth (Mokyr 2002; de Vries 2008; McCloskey 2010). Rather than something that is seen to be "beyond dispute", consumer preferences are thus increasingly seen to be shaped in particular ways by, *inter alia*, levels of affluence and the socio-economic context. Secondly, the insights into the endogenous nature of preferences have instituted a more coherent basis for examining the relationship between consumption and welfare and, indeed, whether growing income will continue to deliver higher living standards. Notably, and as has been demonstrated from a range of perspectives in the various chapters, the persistence and stability of this relationship depends on the motivations that underlie human behaviour, providing it with both its operative force and orientation. In order to understand what the future holds, for ourselves and our grandchildren, we must look more closely to insights from relevant disciplines such as psychology and biology, all the while crafting the frameworks and tools that are needed to get to the core of the "economic problem."

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Part I
Re-thinking the Economic Possibilities of Our Grandchildren

Work and Consumption in an Era of Unbalanced Technological Advance

Benjamin M. Friedman

Abstract Keynes's "Grandchildren" essay famously predicted both a rapid increase in productivity and a sharp shrinkage of the workweek – to 15 h – over the century from 1930. Keynes was right (so far) about output per capita, but wrong about the workweek. The key reason is that he failed to allow for changing distribution. With widening inequality, median income (and therefore the income of most families) has risen, and is now rising, much more slowly than he anticipated. The failure of the workweek to shrink as he predicted follows. Other factors, including habit formation, socially induced consumption preferences, and network effects are part of the story too. Combining the analysis of Keynes, Meade and Galbraith suggests a way forward for economic policy under the prevailing circumstances.

Keywords Productivity · Income · Consumption · Leisure · Technological unemployment

1 Introduction

Most of John Maynard Keynes's economic writings addressed phenomena that worked themselves out (or not, in the case of a depressed economy's ability to regain full employment without fiscal stimulus) over limited time spans. As Keynes famously remarked, "in the long run we are all dead." It is ironic, then, that what has today become his most widely discussed individual essay – his "Economic

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Possibilities for our Grandchildren" – focused on a distinctly longer horizon: 100 years.[1] In this paper Keynes laid out his expectations for how consumption and work would evolve over the coming century, and he went on to speculate on the social and moral consequences that would ensue. What he predicted has, in part, turned out to be remarkably accurate so far. In other respects his image of the future was far wide of the mark. The contrast, together with the reasons for it, is highly relevant to our own prospects today.

What Keynes got right was the continuing advance of economic productivity, in the standard sense of the economy's ability to generate ever more output from any given amount of labor and capital and other resources, and therefore the continuing increase in the quantity of goods and services produced per person in the population. Although today most citizens of the Western world probably think of unending economic growth resulting from technical progress as simply a matter of course, not long before Keynes's day this was not thought to be so. Judged by the available historical record, there was little improvement in average Western living standards over the two thousand or so years prior to the onset of the Industrial Revolution. Adam Smith, who died in 1790, still thought that increased productivity came only from increased specialization in production, not from technological advance (and Smith wrote at some length about what society should therefore do to offset what saw as the deleterious effect of ever greater "division of labor"). As late as the first quarter of the nineteenth century, prominent political economists like Malthus and Ricardo failed to grasp the implications of ongoing technological change. Not until the 1830s was it clear that the improvement in living standards increasingly evident in Britain and America, and some other countries too, was more than just the upswing of the latest "long wave."[2]

But by 1930, when Keynes published his "Grandchildren" essay, the ongoing technologically driven advance of productivity, and with it the ongoing improvement in general living standards, was widely understood. Even so, projecting its continuation for another hundred years was bold. "I would predict," Keynes wrote, "that the standard of life in progressive countries one hundred years hence will be between four and eight times as high as it is today" (pp. 325–326).[3] For the United States – see Fig. 1 – his prediction was perhaps even not optimistic enough.[4] Until the 2007–9 financial crisis, U.S. per capita output was on a trajectory to reach a level in 2029 more than nine times as high as in 1929 (the last data point Keynes would have had). Even after the downturn triggered by the crisis, the U.S. economy is today right on track to reach Keynes's eight-fold multiple.

By contrast, Keynes badly misconstrued how citizens of these "progressive countries" would choose to enjoy the fruits of their economies' ever-increasing

[1] Keynes (1930). Keynes apparently wrote the paper two years earlier, before the onset of what became the Great Depression.

[2] The first systematic recognition and treatment in the United States appears to have been Wayland's (1837) political economy text.

[3] Page references for Keynes's essay are from Keynes (1972).

[4] Data on per capita gross domestic product are from the Bureau of Economic Analysis.

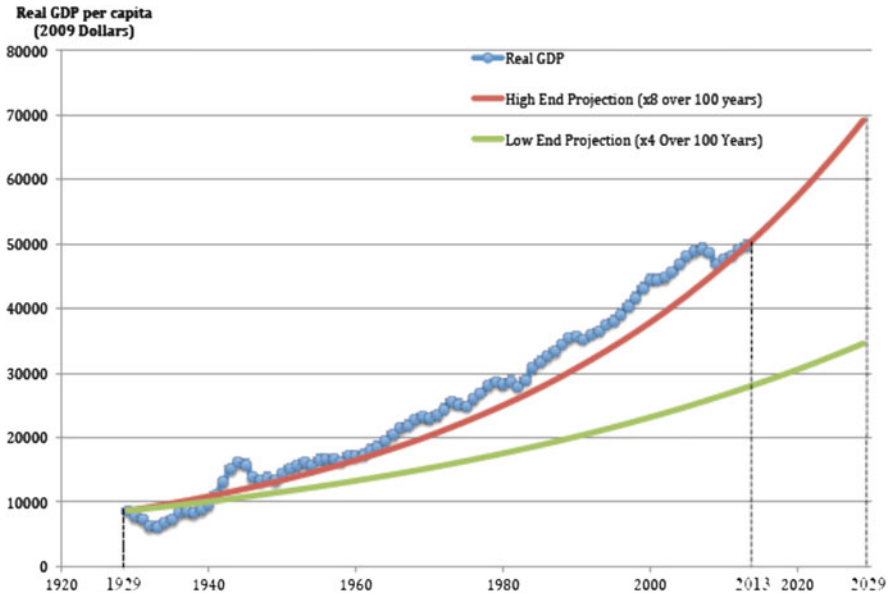

Fig. 1 Real GDP per capital, projected and actual, 1929–2029

productivity. With greater productivity, people on average can consume more than before without needing to work more, or they can work less than before without having to consume any less. Or they can do some of both: consuming more while working less. When Keynes wrote, the historical record since the Industrial Revolution was strongly consistent with "some of both," and that is what he predicted would follow. He was even quite specific on the matter, concluding that "a quarter of the human effort to which we have become accustomed" would suffice, and envisioning "3-hour shifts or a 15-hour week" (p. 325, 329).

Although perhaps overly ebullient, Keynes's prediction for the path of per-person labor input between 1929 and 2029 was roughly consistent with the pattern of the prior hundred years. From 69 h in 1830, the average workweek for Americans doing what was considered "full time" work had fallen to 47 h by 1930 – see Fig. 2 – even as U.S. per capita production, and therefore living standards, rose dramatically.[5] And, in the first four decades after Keynes wrote, the workweek indeed continued to shrink at nearly the same rate. By 1970, Americans on average were working not quite 39 h per week.

So confident was Keynes about the matter that the principal thrust of his "Grandchildren" argument concerned not *whether* the workweek would continue to decline, but what the human consequences would be. He found them serious and

[5]Data on the average workweek are from Vandenbroucke (2009) for 1830–1890, from the *Historical Statistics of the United States* for 1900–1970, and from the Bureau of Labor Statistics for 1980–2012.

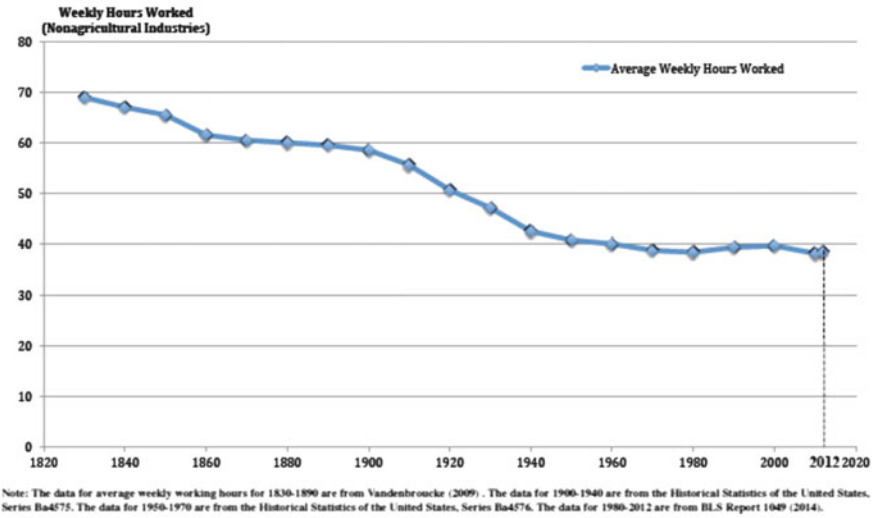

Fig. 2 Weekly hours worked, 1830–2012

challenging. Keynes wrote that he thought "with dread of the readjustment of the habits and instincts of the ordinary man, bred into him for countless generations, which he may be asked to discard within a few decades" (p. 327). The central challenge to be presented by ever greater productivity was the need "to devote our further energies to non-economic purposes" (p. 326). Man's "real, his permanent problem" would be "how to occupy the leisure, which science and compound interest [Keynes's way of thinking about ongoing productivity improvement] will have won for him." It would be, he concluded, "a fearful problem for the ordinary person" (p. 328).

That part of Keynes's prediction has turned out to be wrong; or at least it is on hold, and it seems highly unlikely to come true by 2029. After adjustment for the ups and downs of the business cycle, the American workweek has now remained approximately unchanged for more than four decades. In 2007, just before the onset of the recession triggered by the financial crisis, the average American worker put in 39.2 h on the job, slightly up from a then-recessionary low of 38.0 h in 1982. During the post-crisis recession, as involuntary part-time work became more prevalent, the average workweek fell to an all-time low of 37.9 h. By 2012 it had recovered to 38.5 h, identical to what it was in 1980.

Section 2 examines more closely why, and when, the evolution of work departed from Keynes's expectation. As Section 3 goes on to argue, the explanation is that Keynes has actually turned out to be wrong about living standards too – at least the aspect of living standards that matter for the ideas about work and consumption that he advanced in his "Grandchildren" essay. Section 4 discusses a further dimension of the interaction between work and consumption that Keynes certainly did take into account: the role of habit and social relations in determining preferences. Section 5

looks forward, focusing on the prospect of what Keynes called "technological unemployment" (p. 325), albeit now in a different context from what he anticipated. Section 6 suggests a potential solution, though to be sure only a partial one, for this problem in the form of increased production of public goods. Section 7 concludes.

2 Why was Keynes wrong about work?

Where did Keynes's thinking go wrong? How could he be strikingly right in one dimension of economic activity – output consumed – but so wrong about another – labor input – when standard economic theory relates the two in such a straightforward way? Further, why did economic behavior in the first of these dimensions continue along the path it had followed since the Industrial Revolution, while in the second it did so until the 1970s but then marked a distinct departure?

Several potential explanations suggest themselves. To begin, as Keynes recognized, conventions of human behavior, and the social and political institutions to which they give rise, change slowly. Part of the problem he foresaw in the "Grandchildren" essay was precisely the need to redirect human values away from the emphasis on achieving economic ends, as these became easier to fulfill and hence demanded less effort and therefore became less worthy of attention. But this argument is, at best, far from sufficient. Why would society's presumptions and arrangements surrounding work have exhibited enough flexibility to accommodate a decline in the workweek from nearly 70 h to little more than half that, but then no farther? Or, to put the matter in terms of the calendar, why would these institutions have suddenly become inflexible only in the 1970s? As is often the case, pointing to social conventions is rarely an answer to any substantive question; at most, it helps organize ways of reaching toward an answer.

A second potential explanation, to be taken more seriously, is that the character of work changed. Economists' standard model posits that consumption provides positive utility (perhaps diminishing at the margin, but still with positive sign), while working generates disutility (perhaps increasing at the margin). But the assumed disutility of labor surely depends on the conditions under which people work, and these have changed enormously over time.[6] In 1870 a quarter of American workers were farmers and another fifth were non-owner farm laborers. Today both together represent barely 1% of the U.S. labor force. The change matters because farm work is physically arduous and accident-prone, is typically performed in isolated settings providing little social engagement, and is subject to the extremes of weather. Blue-collar laborers (as distinct from craftsmen) have likewise diminished from nearly a tenth of the labor force in 1870 (and about the same percentage as recently as 1940) to barely 1% today. Maids, laundresses and other domestic servants have diminished

[6]See Gordon (forthcoming), Ch. 8, for a detailed discussion of the changes over time in the United States.

from 8% of the labor force to less than 1% over the same period. Fully three-fifths of the work force, for whom the assumed disutility of labor once required no further explanation, is now doing something else.[7]

What, then, are all the workers doing? More than a third of all American workers are now either professionals or managers, in contrast to less than 5% in 1870 (and still only 11% in 1940). And more than two-fifths work in service-sector jobs other than domestic service – clerical workers, salesmen and -women, and other service jobs – also compared to less than 5% in 1970. To be sure, not all clerical or sales jobs are enjoyable; nor, for that matter, is all professional and managerial work. More than 50 years ago Sloan Wilson's best-selling novel (and then the film featuring Gregory Peck) portrayed the frustrations of the "man in the gray flannel suit." Today's newspapers are filled with stories of "the ennui of the cubical" and the hardships of life on the front lines of a Walmart or a Starbucks. But compared to the back-breaking physical labor of plowing and digging and hefting equipment, and the risk of losing an arm or becoming crippled in some industrial accident, these unpleasantnesses appear mild. And even for work that has continued to be done in factories and slaughterhouses and steel mills, over time successive waves of occupational safety legislation have reduced the risks and ameliorated the noxious environment. Even something as simple as the reduced need to clean up ubiquitous manure, once cars and trucks and buses replaced horse-drawn transportation, surely reduced the disutility of work for a substantial segment of the workforce.

Here too, however, the abruptness of the halt in the century-plus shortening of the workweek calls for more explanation than these influences are able to provide without significant further elaboration. The movement of the American labor force from farms and messy and dangerous factory floors to offices and cubicles was well in progress long before the 1970s.

A further possible explanation is that, in an era of ever fewer settings that provide effective opportunities for personal connections and relationships – a phenomenon famously documented for the United States by Robert Putnam (2000) – the workplace may have, by default, assumed greater importance in ways not immediately suggested by the concept of "labor." Many Americans now derive much of their sense of self, not to mention their identity as seen by others, from their work rather than their church or club or pastime. Many define their social circles by who sits in the next office, not in the next pew. But the evidence on Americans' transference of their social connections to the workplace remains uneven at best,[8] and without more chronologically detailed evidence its bearing on the abrupt change in trend in the U.S. workweek in the 1970s is far from established.

[7]Data on occupations are from the *Historical Statistics of the United States*.

[8]See, for example, Putnam (2000), Ch. 5.

3 Was Keynes wrong about living standards Too?

A very different explanation arises from the fact that, on closer inspection, the first part of Keynes's prediction was perhaps not as accurate as it may seem after all. To recall, Keynes predicted a four- to eight-fold increase over the coming hundred years, for countries like America and Britain, in what he called "the standard of life" (p. 325), and when he went on to discuss the implications he foresaw he assumed an eight-fold multiple. But he did not specify what "the standard of life" meant. Per capita output – see again Fig. 1 – has indeed grown at that pace, on average, since he wrote. As the recent public discussion has increasingly emphasized, however, for some time now most Americans' incomes, and therefore what most Americans consume, have not increased as rapidly as U.S. per capita output.

One reason is simply that larger shares of output are going to uses that do not visibly contribute to living standards. At the most basic level, as the U.S. economy has become more capital intensive, and as the composition of its capital has progressively shifted away from long-lived plant toward shorter-lived equipment, the share of total output required merely to replace what is either wearing out or becoming obsolete – in other words, the difference between gross product and net product – has increased. In 1929 depreciation of all kinds of capital, whether owned by businesses or households or government at all levels, amounted to slightly less than 10% of U.S. gross domestic product. In 2013 it was just under 16%. Compared with when Keynes wrote, therefore, an additional six percent of the economy's output (whether measured in total or per capita) is not available for either current consumption or net increases in capital stock to raise the future trajectory of consumption.

Another four percent has gone into defense spending. In 1929 the federal government's purchases of goods and services for the military totaled just under one percent of total output. Defense spending is now somewhat under five percent of output (and, at some points in between – especially the 1960s and 1970s – it was much higher than that). To be sure, national security is a crucial underpinning of any country's "standard of life." But the output devoted to making weapons and tanks and airplanes for the military is not part of the population's living standard construed in the usual way, nor are the services provided by uniformed soldiers and seamen and airmen.

The quantitatively most important reason most Americans' incomes and consumption have increased far more slowly than U.S. output per capita is that, ever since the 1960s, individuals' personal shares of the nationwide aggregate have become less equal. The phenomenon is not limited to the United States; income inequality has widened in practically all of what Keynes considered the "progressive countries." When inequality becomes greater, the median of a rising distribution increases less rapidly than the mean, so that even if the fraction of aggregate income devoted to consumption remains unchanged, more than half of the population experiences a slower growth in living standard than what the growth of per capita output implies.

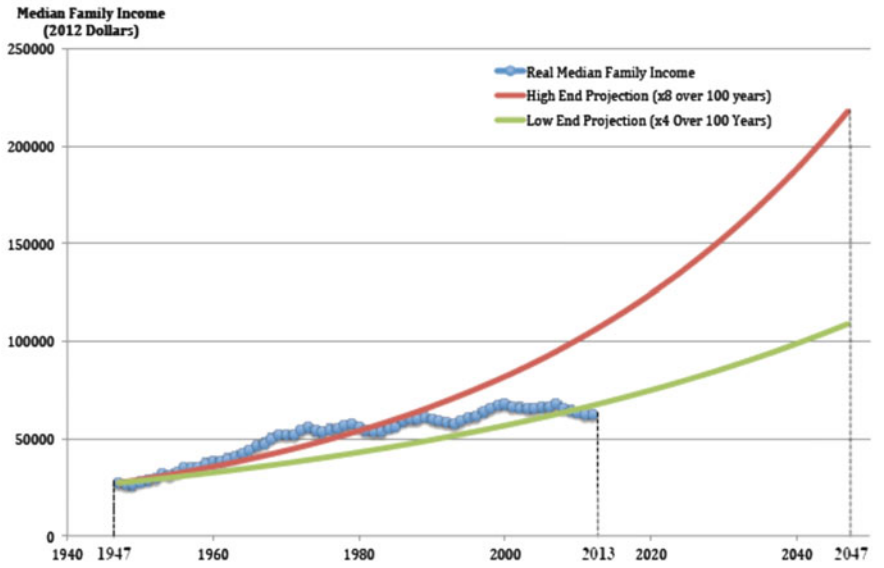

Fig. 3 Real median family income, projected and actual, 1947–2047

In the United States the difference has been substantial. U.S. data on median incomes are not available prior to 1947, and so it is impossible (without inferring the median from other data, which would expose the exercise to methodological questions of a different kind) to evaluate Keynes's prediction over the first 18 years of his intended hundred-year horizon. But for the 65-year span from 1947 to 2012 (the most recent available data) – see Fig. 3 – it is clear that Keynes was *over*-optimistic if one construes "the standard of life" as the median rather than the mean.[9] Extrapolated to a hundred years, the realized growth rate of the U.S. median family income over 1947–2012 would produce a multiple of just over 3 ½, modestly below the low end of Keynes's projected increase (and well below the trajectory of per capita output).[10]

Moreover, the growth of U.S. median income exhibits a distinct slowing in the early 1970s, roughly coincident with the leveling off of the average workweek. From the beginning of the series in 1947 (the local peak preceding the 1948–9 "inventory recession") to 1973 (the local peak preceding the "OPEC recession"), the median

[9]Data on median family income are from the Bureau of the Census.

[10]Some part of the difference between the growth of output per capita and of median family income reflects the fact that family size has shrunk over this period, and therefore does not properly bear on the argument here. But the difference is not great in this context. Between 1947 and 2012 the average number of persons per family in the United States fell from 3.67 to 3.13 (data are from the Current Population Survey). With adjustment for family size, the growth of real median family income over this period would produce a multiple of 4.6 over a hundred years – more than for the raw data, but still well below the trajectory of real output per capita.

family's income grew in real terms at 2.8% per annum – far in excess of the rate needed to deliver an eight-fold multiple over a hundred years. By contrast, from 1973 to the present real median income has grown by just 0.3% per annum, not even enough for a doubling in a hundred years (the projected 100-year multiple at that rate is merely 1.3).[11]

The origins of this slowing of family income growth are clear enough: the dramatic reversal in the trajectory of real wages for the majority of American workers. Between 1947 and 1973 the average hourly wage for nonsupervisory workers in private industries other than agriculture (restated in 2013 dollars) nearly doubled, from $12.27 to $21.23 – an average growth rate of 2.1% per annum. But by 2013 the average hourly wage was only $20.13 – a 5% *fall* from the 1973 level. Despite an increase in two-earner families, therefore, the median family income *declined*.[12]

This sharp difference between the pre- and post-1973 growth rates – for either family incomes or wages – is not merely an artifact of the 2007–9 financial crisis. During the post-crisis recession the median family's income did fall more in percentage terms than per capita output, and as late as 2012 there was still no sign of recovery; median income in 2012 stood more than 8% below the 2007 peak. But even without the post-crisis decline, the slowdown compared to 1947–73 was major. In contrast to 2.8% per annum growth from 1947 to 1973, the growth from 1973 to 2007 (not just a local peak but, as of the time of writing, the record high) was just 0.6% per annum – again implying not even a doubling (a multiple of 1.8) if extrapolated for a hundred years.

The reasons for widening inequality are many and varied, and the empirical research needed to assign weights to the different factors involved (most of the posited explanations are not mutually exclusive) remains unfinished. Most economists have placed greatest emphasis on the changing technology of production, which attaches increased value in the labor market to some sets of skills and reduced value to others.[13] Another explanation that has received widespread attention, more in the popular press than among economists, is the ongoing internationalization of markets for not only goods but, increasingly, services too (itself a consequence of advancing technology) – so that an ever larger fraction of workers in the highly developed economies face competition from those in countries where wages are low

[11]In 1973 the average number of persons per family was 3.48. With adjustment for the smaller size of families, the realized growth between 1973 and 2012 would produce a multiple of 1.5 over one hundred years – somewhat larger than without the family size adjustment, but still far from even doubling.

[12]In 1973 female participation in the labor force was 44.7%; by 2012 it was 57.7%. (The peak, in 1999, was 60.0%.) Much of this increase, however, was offset by declining male labor force participation: from 78.8% in 1973 to 70.2% in 2012. As Fig. 2 shows, there was also some modest further decline in average hours worked per week. But the main reason for the slower rise of real family incomes was the decline in real hourly wages. Data on real hourly wages are from the Bureau of Labor Statistics, adjusted (slightly) to correct for a series break at 1966.

[13]See especially Goldin and Katz (2008).

compared to their own. Some further suggested causes of widening inequality are more specific to the United States: the skill-biased composition of U.S. immigration, which exposes low-wage workers to even more competition; the declining real value of the federally mandated minimum wage; and declining American union membership. Because inequality is increasing in all of the major industrialized economies, however, and in much of the developing world as well, the common working presumption among most economists is that country-specific institutional features are unlikely to bulk large in the overall story.

Finally, in addition to widening wage inequality, with its array of potential explanations, within the past two decades the functional composition of income has been shifting. In most of the advanced economies, income earned from providing labor has been shrinking as a share of all income earned, while income earned from owning capital has correspondingly increased.[14] Given the highly unequal ownership of capital, this shift in functional shares results in an increasingly unequal distribution of incomes overall. (This phenomenon, which stands quite apart from wider wage inequality, is at the heart of Thomas Piketty's (2014) argument that has received so much public attention).

Widening inequality of incomes, of course, need not imply widening inequality of consumption. Most obviously, as Keynes himself later emphasized (in a quite different context) in the *General Theory*, those with higher incomes normally save more. The bearing of this distinction on Keynes's argument in the "Grandchildren" essay is not straight forward, however. Especially in an economy like that of the United States, where the great majority of the population significantly under-saves for retirement,[15] people's inability to provide adequately for their future consumption surely matters for their current sense of material well-being – which is what Keynes thought would lead to dramatically reduced work effort. Consumption inequality plausibly has increased less than income inequality also because of reliance on publicly provided in-kind goods and services like food or shelter or medical care.[16] But even on its own terms, the difference between the trends in inequality of income and of consumption turns out to be less important than one might think. Although some work on this question using direct expenditure data has emphasized the difference – a greater increase in inequality of income than of consumption[17] – more recent research for the United States by Attanasio et al.

[14]See Elsby et al. (2013) on the United States and Karabarbounis and Neiman (2014) on the decline of the labor share as a global phenomenon. A large literature has developed suggesting explanations for this development.

[15]See Munnell et al. (2014) for a review of the most recent evidence.

[16]In the United States the number of people participating in the Supplemental Nutritional Assistance Program ("food stamps") was roughly stable at 20–25 million until the 2007–9 financial crisis, but since then it has nearly doubled. By contrast, publicly provided housing has shrunk relative to the growing population. Medicaid (the main medical care program for the indigent) has increased enormously in cost, but it is not obvious that recipients feel better off because their medical care costs more.

[17]See, for example, Krueger and Perri (2006) and Meyer and Sullivan (2013).

(2012) and Aguiar and Bils (2013) concludes that "consumption inequality has tracked income inequality much more closely than estimated by direct responses on expenditures."[18]

It is also possible to argue that consumption today is not directly comparable to consumption in prior years, especially in light of the far greater variety of choice confronting today's consumers.[19] (A familiar classroom exercise is to show students the 1902 Sears Roebuck catalog, which is available in an inexpensive reprint, and ask them to choose between a specified amount of money that they could spend only on selections from the catalog and some lesser amount, adjusted for inflation since 1902, that they could spend on whatever they choose from what is available today.[20]) Presumably variety and choice do matter. But for increasing variety and choice to negate the effect of the much slower growth of income and consumption for purposes of Keynes's incorrectly thinking that work effort would continue to decrease, it would have to be the case that the increase in variety and choice has accelerated in recent years, just as the growth of incomes and consumption for the majority of families has slowed. No one has made this case.

In sum, with widening income inequality in recent decades the failure of either the incomes or the consumption of most American families to keep up with the growth of U.S. output per capita bears directly on the initial accuracy but subsequent failure of Keynes's prediction for work. Until the 1970s, Keynes was right on both fronts: per capita output grew at the upper end of the range he predicted, most families' incomes grew even faster (inequality was mostly narrowing during that period), and the workweek continued to decline. But with widening inequality from the early 1970s on, the growth of most families' incomes became far slower than he had predicted, and the workweek stopped declining. The latter combination has persisted ever since.

4 The role of "non-standard" preferences

From the perspective of the standard economic model, with positive utility from consumption and disutility of labor, one might still expect that the workweek might have continued to decline after 1970, just not as rapidly. After all, despite the adverse shift in distribution, up to 2007 the median family income (and therefore the incomes of the majority of families) did continue to experience some modest increase. Under the standard substitutability and convexity assumptions, the typical individual would have chosen to apply at least some part of that increase toward eliminating the disutility of work. (Moreover, as women's participation in the paid labor force

[18] Aguiar and Bils (2013), p. 1.

[19] Lebergott (1993), for example, has made this argument.

[20] *The 1902 Edition of the Sears, Roebuck Catalogue* (New York: Gramercy Books, 1993).

increased, the average workweek overall might have shortened on yet other grounds.)

As Keynes was well aware, however, influences not encompassed within the standard utility model readily account for why people with only modestly growing incomes would choose to consume more and also work more. Economists since Adam Smith have well understood the role of habit formation in shaping consumption preferences. Given any existing level of economy-wide consumption, a modestly higher level does generate increased utility – for a while. But in time the novelty erodes (one can think of the novelty either in terms of total consumption or as utility from new goods), and to achieve again the higher level of utility associated with the earlier increase, yet a further increase is required. Keynes of course knew the thinking along these lines by Smith, Mill, Marshall and others. Further work since his time has formalized the character of the preferences involved, and produced extensive empirical verification, but the basic idea remains the same.[21]

Keynes was also well aware of the role of socially determined consumption preferences. This insight had likewise been explicit in Smith's writings, and within Keynes's lifetime Veblen had popularized the idea. In his "Grandchildren" essay, Keynes similarly distinguished "those needs which are absolute in the sense that we feel them whatever the situation of our fellow human beings may be" from "those which are relative in the sense that we feel them only if their satisfaction lifts us above, makes us feel superior to, our fellows." He even anticipated the class of wants that later thinkers like Fred Hirsch (1976) formalized as "positional goods," going on to argue that "needs of the second class, those which satisfy the desire for superiority, may be insatiable" (p. 326).

A further spur to consumption demand (at the expense of leisure) that seems especially relevant over a century-long time horizon, but that Keynes may not have taken into account, is the role of network effects in creating new preferences. As he not only anticipated but emphasized, the technology of everyday life has changed dramatically since 1930. People are free to take advantage of many of those changes, or not, as they choose. Whether to own a dishwasher in one's house or apartment, for example, is a matter of individual choice. Other technological changes, however, create networks that most people bear significant cost to refrain from joining. When Keynes was born, there were no telephones. By 1930, nearly half of U.S. households had them. Today in the United Sates residential or cellular telephone ownership is nearly universal.[22] Not to have one means cutting oneself off from the society's commonly accepted communication system. Because of network effects, a good that was a luxury when first introduced has become a necessity. Today the transition to a computer-based communication network is likewise already well in place. Nor is communication the only area in which such network effects regularly occur. In Keynes's youth, owning an automobile was a luxury, and in some countries it still

[21]The modern literature on the role of habit formation in consumption preferences is large. For two early contributions, see Constantinides (1990) and Campbell and Cochrane (1999).

[22]Data on telephone penetration are from the *Historical Statistics of the United States*.

is. But in countries like America and Britain, once cities grew up along configurations based on the assumption of readily available transport by car, for people living in those cities owning one became a necessity.

Especially with the addition of influences on consumption preferences due to habit formation, social comparison, and network effects, the sharp slowing in the median family's income beginning in the 1970s seems persuasive as an explanation for the simultaneous reversal of what had been, for at least a century and a half, a declining workweek. As standard theory suggests, consumption and labor input are indeed related. Keynes's error in predicting the path of labor input looks to be largely a reflection of what, on closer inspection, turns out to have been his error in predicting the path of income and therefore consumption.

5 Technological unemployment

Keynes's predictions for the workweek, and for the living standard of the median family (if that is what the "standard of life" was supposed to mean) have not been realized. But there is a different rendering of what he foresaw in his "Grandchildren" essay that looks more likely to come about, perhaps even by 2029.

Keynes wrote in his essay of "technological unemployment," which he defined as "unemployment due to our discovery of means of economizing the use of labor outrunning the pace at which we can find new uses for labor" (p. 325). He went on, as we have seen, to picture the form this phenomenon would take as fewer hours on the job for the typical worker: "3-hour shifts or a 15-hour week." That is not what has happened. But an alternative construction of what technological unemployment might mean is no job at all – or at least no worthwhile job – for an increasing number of able-bodied and -minded citizens, while others continue to work, with ample pay, for whatever the society construes as the normal number of hours.

Replacing human work with that of machines has been a continual theme in Western economic thinking – and in Western culture more broadly, sometimes as a concern and sometimes as an aspiration – at least since the Industrial Revolution. So far, the resulting fears of widespread labor idleness, however, have not been realized. Technological advances have reduced the need for some forms of labor input, thereby freeing up the economy's human resources for other applications, often including new applications likewise opened up by new technology. On net, labor input per person has gone down (as it did until the 1970s) or remained steady (as it approximately has since then), while consumption has increased. Implicit in the standard account of this process is that new applications for labor emerge, at least on a pace with the technologically induced elimination of demand for labor in others. The invention of the automobile mostly eliminated the jobs of saddlers and stable boys, but it created new jobs for auto workers, mechanics and gas station attendants.

Keynes predicted that the race between technology freeing labor and new applications (themselves perhaps technologically based) emerging would become lop-sided, with resulting further decrease in labor input per person. But here too,

his argument neglected distributional considerations. Just as he implicitly assumed that the increase he foresaw in per capita output would carry over to the living standard of the typical family, he assumed (in this case more explicitly) that the reduction in labor input per person would be somewhat evenly spread throughout the workforce – hence the 3-hour shifts and 15-hour weeks.

By contrast, other observers of the economy's ongoing technological advance have suspected that the workforce would experience shrunken labor demand in a lumpier way. James Meade (1965), writing a third of a century later, envisioned a world in which "the proportion of the working population [importantly, the proportion of the population, *not* the proportion of the typical worker's time] required to man the extremely profitable automated industries would be small" (p. 33). And what would the rest of the working-age population do? With adequately high wage rates, each individual would be able to work only a limited number of hours per week – as Keynes had predicted – so that the reduced labor demand would, in effect, be shared across the population. Keynes clearly thought wages would be high enough that putting in fewer hours would still give workers an adequate income to support an ample living standard. But with labor demand so far reduced, what would keep wages high?

Meade instead thought "wages would thus be depressed" (p. 33), as ever less labor was necessary for production. Correspondingly, an ever greater share of total income would go to the owners of the machines. In the absence of government-provided welfare on a massive scale, therefore, most of the workforce would be compelled to take whatever low-paying jobs they could get, presumably in the service of the machine-owners but not working with the machines. In Meade's vision, "we would be back in a super-world of an immiserized proletariat of butlers, footmen, kitchen maids, and other hangers-on" (p. 33). In today's American context a half-century later, one might substitute gardeners, swimming pool attendants, personal trainers and home nurses.

Two further influences at work today, foreseen by neither Keynes nor Meade (at least not in making this argument), threaten to make the situation even worse in countries like the United States. First, advances in communication technology are opening an ever wider array of not just goods but also services to international trade. The mere displacement of workers from goods-producing industries does not, per se, necessarily cause a reduction in overall labor input. The result, historically, has been the movement of employment into the service sector. But today the "off-shoring" of jobs from high-wage economies like that of the United States is no longer a matter of goods-producing industries only. Nor are the only service jobs to be off-shored low-wage activities like staffing call centers. Computer programming, reading X-rays, preparing tax returns, carrying out legal research – all are traditionally higher-wage professions, and today each can be, and increasingly is, performed for U.S.-resident customers outside the United States.

And second, even for many of the lower-wage jobs that must be done on site – again, the gardeners and swimming pool attendants – a steady flow of (mostly illegal) immigrants is available to do such work at wages that most Americans would find unacceptable. Wholly apart from the question of whether these jobs

would offer significantly higher wages if immigrant workers were not there to take them, the point is that even the production that must be carried out in the United States if it is to be consumed by Americans nonetheless often does not present employment opportunities for American workers.

What remains in the "protected" sphere, therefore, are service-sector jobs that not only must be performed on site but require sufficient training and qualification (and are subject to sufficient monitoring from government or self-regulatory industry groups) to be resistant to potential labor supply from large-scale immigration, including in particular illegal immigrants lacking the requisite qualifications. Jobs requiring face-to-face client contact in sophisticated contexts are the obvious example.[23] But with ongoing advances in communications technology the meaning of "face-to-face" is changing, and even such sophisticated services as medical evaluations are already beginning to be delivered remotely. Apart from resistance by industry groups and licensing authorities, there is no economic reason why the medical examination conducted via Skype between a U.S. patient in a rural area and a doctor at a U.S. urban medical center could not instead be done a doctor at some hospital abroad.

Many economists today expect the pace of technological advance – and with it, implicitly, what both Keynes and Meade called "technological unemployment" – to accelerate over coming decades. Mostly prominently, Erik Brynjolfsson and Andrew McAfie (2011, 2014) have argued that new digital technologies like driverless trucks and voice recognition systems will significantly enhance the rate of productivity growth in the United States and similar economies. But they acknowledge that these technologies will sharply reduce the demand for labor,[24] and they offer little answer to the question of what new applications of labor will emerge to take the place of the positions thereby eliminated; the technologies they see at the forefront of the new, faster productivity trend are overwhelmingly labor-saving. Even those like Robert Gordon (2012) who expect future productivity growth to be disappointing (mostly on the grounds that nothing on the horizon looks capable of matching the impact of world-changing advances of the past like steam power, railroads, electrification, the internal combustion engine and powered flight) nonetheless do not foresee substantial new demands for labor in medium- to high-wage jobs.

As a result, it increasingly looks as if Keynes's benign vision of "technological unemployment," in which the "fearful problem for the ordinary person" will be "how to occupy the leisure" (p. 328), is less likely than what Meade regarded as the "hideous outlook" of "an immizerized proletariat" (p. 33) desperately seeking whatever low-wage work it can get.

[23]Frey and Osborne (2013), for example, emphasize this aspect of the shift to service-sector employment.

[24]See especially Brynjolfsson and Andrew (2014).

6 A potential solution: Keynes meets Galbraith

The difference between Keynes's optimism and Meade's pessimism is, as we have seen, in large part a matter of disaggregation and distribution. Aggregate output has grown along the robust path foreseen by Keynes. But as Meade presciently foresaw, not everyone has shared equally in the fruits of this increase. Moreover, the widening inequality has not been random. The same force that was at the heart of both Keynes's and Meade's analyses – technological advance – has been central to the increasingly unequal distribution.

Writing after Keynes but before Meade, John Kenneth Galbraith (1958) spotlighted a quite different problem he saw emerging in post-war Western society – but, interestingly, likewise an issue apparent only from looking beneath economy-wide aggregates. While Meade's insight came from focusing on the distribution across individuals within the total of personal income, Galbraith examined the distribution between private consumption and public within the total of goods and services consumed. Writing fully a decade before the current trend of ever-widening income inequality began, Galbraith described what he saw as the abundant consumption of goods and services produced by private firms. In contrast, he thought consumption of those goods and services that only government or other public institutions could provide was inadequate and would become more so.

The difference between the two kinds of goods (and services too) is not entirely arbitrary. Many goods can be produced either privately or publicly, and under normal circumstances both efficiency grounds and other criteria that loom large in traditional Western thinking mostly warrant relying on the private sector for this purpose. But others – called "public goods" for just this reason – are inherently unsuitable for the private market, usually on grounds of non-excludability. National defense, public security and roads are all classic examples. Galbraith pointed in particular to schools, police, parks, playgrounds, streets, sanitation, transportation, air quality, and parking. A key decision for any society, one that it cannot simply leave to the market (again, because of non-excludability, for example), is therefore how to divide its production, and its consumption, between privately and publicly produced goods. As Galbraith saw it, Western society in the post World War II era was characterized by "public poverty" together with "ever-increasing opulence in privately produced goods" (p. 199) – or, more concisely, "private opulence and public squalor" (p. 203).

The origins of the problem, he argued, were twofold. First, as in much of his other work, Galbraith assumed that advertising was highly effective in shaping consumer demands – not just on matters of which brand to buy in preference to some other, but more importantly increasing demand for the advertised products and even creating whole new demands for products that otherwise would not have been bought. The difference between the private and public sectors, in this context, was that the private sector had a profit-based incentive to engage in advertising, and therefore did so heavily, while the public sector did not. The result was to skew the composition of demand, bolstering the demand for privately produced goods, both individually and

in the aggregate, at the expense of demand for public goods. Whether advertising is as effective as Galbraith assumed is a subject economists have long debated, and the question is far from settled. Moreover, today, when many states aggressively market their lotteries, and new government initiatives like expanded health care regularly rely on advertising to persuade the target public to take advantage of the services provided, the distinction between a private sector that advertises and a public sector that does not seems less clear-cut than it may once have been.

By contrast, the second argument Galbraith made for the skewing of demand toward private and away from public goods seems, if anything, more persuasive today, at least in the United States. Demand for public goods by definition expresses itself through the society's public institutions, government foremost among them. Funding to pay for them is likewise a matter of public decision-making. The effectiveness of that demand, and of the funding for it, is therefore only as great as the effectiveness of the society's public institutions allows it to be. In today's era of paralyzed and otherwise dysfunctional government, in America especially at the federal level but in many states as well, the inability of the relevant participants to reach political agreement in effect blocks the demand for public goods from realization. When the economy is not fully employed, as in the wake of the recent financial crisis, the result is an absence of needed stimulus to aggregate demand. Under conditions of full employment, the outcome is exactly the skewing of overall demand, away from public goods toward (by default) privately produced goods, that Galbraith had in mind.

The relevance of Galbraith's argument to the current Keynes-Meade trap in which many of the advanced western economies now find themselves is that increased provision of public goods, whether produced by private firms or directly by government, offers the prospect of partly blunting both the aggregate and the distributional effects of ongoing technological advance about which Keynes and Meade wrote.[25] As Galbraith predicted, by now much of America's essential physical infrastructure suffers from depreciation or obsolescence or both. Modernizing and replacing it is a large task, likely to take not just years but a generation or more. Undertaking that process would increase not just aggregate demand for labor but, specifically, demand for labor not of the footman-butler-maid kind. And the nation would benefit not just from the making of renewed infrastructure but from the having of it.

Keynes's essay was prescient in some respects, though strikingly off the mark in others. Such is the risk of hundred-year prediction. In a way that would be consistent with much of his later writing, however – especially that prompted by the depression that was just beginning when his "Grandchildren" essay was published – his error

[25]Tax payments also come from citizens' incomes, of course, and so apart from distributional consequences there would be little point, in the context of this discussion, of taxing the median earner's income in order to fund public-sector demand that creates employment for the median worker. But the tax revenues would largely come from those citizens who already have high-income jobs, while the jobs created – in rebuilding the nation's infrastructure, for example – would presumably be taken by those who don't.

suggests a way forward. It is rare for an economy's short-term cyclical objectives (spurring employment during yet another protracted "jobless recovery"), medium-run objectives (combating the perverse distributional consequences of technological unemployment) and long-run objectives (where are today's equivalents to Grand Central Station and the Triboro Bridge?) to coincide to the extent that they do today. The combined analysis of Keynes and Meade and Galbraith leads to a consistent solution, even if only a partial one, at all three horizons.

7 Summary of conclusions

Keynes's expectations for dramatically reduced work effort – and with it, the deep personal and societal challenges about which he expressed such vivid concern – have not materialized, at least not in the United States. After declining for more than a century, the average U.S. work week has now remained roughly unchanged for four decades. The primary reason is that Keynes's prediction for rising living standards has also been unfulfilled. With declining real wages (looked at another way, widening inequality), the median family income stopped rising at just about the same time that the work week stopped getting shorter. The continuing strong increase in per capita output that Keynes correctly predicted did not translate into rising living standards for the majority of families. What at first impression looks like a puzzling contrast between Keynes's strikingly accurate prediction about productivity and his wide-of-the-mark prediction about work turns out not to be a puzzle after all.

One way for society to address not only the ongoing problem of stagnant incomes for the majority of families but also the looming threat of what both Keynes called "technological unemployment" (compounded in the United States and similar economies by the ongoing shift of new categories of both goods and services from the nontradable to the tradable sector, and in the United States by immigration patterns as well), is to take up the challenge of rebuilding the nation's deteriorating infrastructure. Doing so would simultaneously help ameliorate the problems he raised in his "Grandchildren" essay, and that James Meade foresaw in a different way, but also address the imbalance that John Kenneth Galbraith identified between private and social consumption – an imbalance that, at least in the United States, has worsened in the half-century since Galbraith wrote.

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Institutions Hold Consumption on a Leash: An Evolutionary Economic Approach to the Future of Consumption

Jason Potts

Abstract As first suggested by Keynes (1930), much thinking about the future of consumption starts with claims about future income, technology or demographics, perhaps concocted in a growth model, and then considers what consumption will look like, as a separate question, given those priors. A different approach starts one step further back with inquiry into the type of institutions that would produce such evolutionary growth. You then ask how those same institutions would shape consumption. I argue that the future of consumption depends on income and innovation, which themselves depend on the evolution of institutions. I suggest that this is an evolutionary economic approach to the future of consumption.

Keywords Consumption · Innovation · Institutions · Keynes

1 Introduction

This paper approaches the question of the future of consumption by revisiting a particularly insightful essay by John Maynard Keynes' (1930) on 'The economic possibilities of our grandchildren'. Keynes peered far into the future, to a time that would correspond to about now, to ask what patterns of consumption might look like. I will argue that in a kind of back-of-the-envelope invention of modern growth theory (still several decades in the future) Keynes basically forecasted the doubling and doubling-again of modern income and production. But where his prediction went wrong was in the composition of consumption, which he thought would

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become utterly dominated by leisure. He got this wrong, I suggest, because the institutions necessary for production growth to occur would also be institutions that would induce the economic problem itself to continue to evolve, shifting into ever new spaces of consumption possibility. To understand the future of consumption you need to understand the future of production, which was Keynes' point. But my additional point is that to understand the future of production you need to understand the future of institutions, which in turn also shape the evolution of consumption.

Any rational and systematic model of thinking about the future of consumption will at some point invoke a budgeting model that asks—what income will we have?—and with that entry in the ledger, then turns to the question of—how will we spend it? This will take what we know about existing consumption patterns, and recalculate with a larger numerator. (Or it traces consumption into a realm of preferences that are still mostly latent and considers what will happen when they become widespread.) Another (more speculative) approach relies on picking a particular line of industrial or technological development Z—where Z is say the internet, robots, CO2 production, or stem cells (Franklin and Andrews 2012)—and extrapolates that through an economic model to arrive at pattern predictions of representative consumption in this world where Z is, say, much cheaper or more abundant. This can also be done with demographic projections on Y, where we ask what would happen if there were to be, say, many more 'Y people'—where Y might be 'young', 'old', 'genetically enhanced', 'Swedish', 'zero marginal product workers', and so on.

In both approaches first you figure out what is happening on the supply side (what capital will exist, what income will be produced, the state of technologies, populations) and once that is modeled, you then read off the implications on the demand side. Keynes's 'Economic possibilities of our grandchildren' (*en passant*, observe that Keynes didn't have any) is the canonical form of this approach, in which the question of 'the future of consumption' was yoked to the question of what life will be like when 'the economic problem' is solved. On the supply side, Keynes started by solving the economic problem (by invoking the 'magic of science' and the 'miracle of compound interest'), and then turned to infer the consumption settings that solution implied in the form of an inquiry into preferences for leisure, or demand for status, or the allocation of the surplus from technological change and capital accumulation (Stiglitz 2008; Pecchi and Piga 2008).

My approach does not reject this basic 'Classical' premise—namely that to understand (the future of) consumption you first need a reading on (the future of) production—or simply that what is consumed must first be produced (note this is not a claim about Say's law, which is a separate point about coordination in a monetary economy). I simply take this one step further back, such that changes in production or supply conditions are a function of the evolution of institutions, a claim that is broadly supported in the development and comparative institutions literature (Hall and Jones 1999; Acemoglu et al. 2001; Gwartney et al 2006). The economic possibilities, including the consumption possibilities of anyone's grandchildren, thus depend to a considerable degree on the institutions that their grandparents choose, and the processes of economic evolution in the interim.

Now, this is certainly not the only way that *evolutionary economics* can address the question of 'the future of consumption'. In prime instance, an obvious claim to direct relevance is through the study of the evolution of preferences and preference endogeneity (Witt 2001; Nelson and Consoli 2010). This can be augmented by studies of human behavioural evolution (Miller 2000; Bostrom 2004). Another evolutionary economic approach is through forecasting based on historical analysis of structural change in aggregate expenditure patterns of household consumption (Chai and Moneta 2010, 2013). Analysis of conspicuous consumption and status competition, since Veblen's 'Theory of the Leisure Class' has long been part of evolutionary economics (Frank 2011). But my claim here is that an evolutionary economic account of the future of consumption should be firstly approached as a story about *institutions and institutional evolution*, and only subsequently as an account of endogenous change in preferences, technology and income dynamics associated with those institutions. Put simply, in order to project understanding of the future of consumption, we need to start with a model of the evolution of economic institutions, for these shape the forces that will affect future consumption.

2 What does it mean to 'solve the economic problem'?

Nevertheless, before we set off down that path, let us appreciate the genius of Keynes in putting these questions together in the first instance—namely addressing the future of consumption by analyzing the future of production by considering the economics of a world in which the economic problem is solved. While perhaps unremarkable now, he anticipated the main outlines of modern growth theory that would not arrive for another 15–25 years the subsequent Harrod-Domar and Solow-Swan growth models built on exogenous technological change and steady-state capital accumulation driving an aggregate consumption function.[1] Keynes didn't quite put it like this, instead referring to (1) the miracle of compound interest (he points out that the present value of the pirate gold that Francis Drake paid to his venture capitalist backer Queen Elizabeth I is approximately equal to the UK's contemporary foreign investments circa 1930); and (2) the 'cumulative crescendo' of 'the great age of science and technical inventions'. Later in the essay Keynes is at pains to make clear that so long as bad choices are avoided (war and civil unrest, population explosions) and that science is left alone (he seems to mean 'not persecuted' rather than 'lavishly publically funded') then 'the rate of accumulation [will be] fixed by the margin between our production and our consumption'. That is, for given technology, the savings rate determines steady-state income, which is the Solow-Swan model in a nutshell.

[1]The consumption function argument was to be part of Keynes's later *General Theory*, although the implicit form presented in Keynes (1930) is actually closer to Milton Friedman's 'permanent income' version.

Keynes's point is simply that given the trajectory of scientific and technological advance (which he makes exogenous) then a sustained positive savings rate in a peaceful economy will eventually arrive at a steady-state level of income based on accumulated capital wealth that can be taken to produce a level of consumption, even after necessary savings are put aside for maintenance investment, that would represent the economic problem as solved (*viz*. 'which science and compound interest will have won for him' (Keynes 1930)).

What Keynes is saying is that there is some level of real per capita income X*, such that if $X > X^*$ then we can consider the economic problem solved. He speculates that X* might be 4–8 times the 1930s level of real income, and furthermore that he expected this to be reached within 100 years, implying a cumulative average growth rate of only on the order of 1.4–2.1 %. This was at the time Keynes' wrote certainly at the high end of the experience of any nation at any previous point. Moreover, writing at the onset of the great depression it was seen as perhaps a wildly optimistic claim. But he actually turned out to be almost exactly on the mark, going forward. Real GDP per capita in the UK increased four-fold in the 70 years between 1930 and 2000 (an annualized growth rate of 2.3 %). It increased almost six-fold in the US. And as McCloskey (2014) notes, that's an underestimate because it doesn't factor in quality improvements and increase in variety. But Keynes wasn't even close to estimating the enormous real growth rates that Japan and Germany experienced and China continues to experience. So even Keynes' most optimistic sentiments underestimated what actually happened.

So the wealth of capital, and the income that produces, are now given at X* such that the economic problem is considered solved. It's not entirely clear what X* refers to, but Keynes does indicate a distinction between absolute needs as opposed to relative consumption (the desire for superiority, or status goods[2]) which he acknowledges are insatiable. The heuristic he invokes is when we 'prefer to devote our further energies to non-economic purposes'. This has been widely taken to mean when we start to choose leisure over work. But with aggregate income given at X* or greater, and thus with the economic problem solved, he transforms this into a new sort of problem by invoking a distributional assumption that we would subsequently come to know as 'macroeconomics' by considering the choices of a representative agent in that economy, now looking at consuming their share of that income. Specifically, Keynes thought that the income elasticity of leisure was much higher than that of consumption in the long run. He was wrong about that as it turned out,[3] a point I will return to soon (on the non-declining disutility of work, see Epstein and Kimball 2014). But he followed his line of reasoning to propose that these rational

[2]Consideration of status is not necessarily as an argument in the utility function, but as a ranking device that determines success in the non-market sector (Cole et al. 1992).

[3]In that working hours, or labour participation have not fallen systematically in the way predicted. However, we can square this prediction with observation if we will interpret leisure sufficiently broadly to include all classes of welfare (dole, disability support, pensions, parental leave, etc.), and even more-so if we will also interpret some of the growth of public sector work as a form of leisure (see Graeber, www.strikemag.org/bullshit-jobs/).

grandchildren would probably choose much higher levels of 'non-economic purposes' (they would allocate more of their temporal budget to leisure and less to work and consumption).[4] This was the launching point for Keynes to fret about what they would do with all this free time, and to suggest that we ought to start preparing for that day by developing our skills in 'the arts of life'.[5]

But certain branches of modern economics have developed a different conception of what it means to speak of a 'solution to the economic problem' that turns not on a particular output measure of consumption, income or production, but rather on arriving at a particular set of rules and recipes (i.e., institutions) that are conducive of the economic conditions for human flourishing (e.g., Acemoglu and Johnson 2005). These come more from the spontaneous order tradition (Austrian, institutional and evolutionary economics in particular, but also constitutional economics, public choice economics and new economic history) as represented by for example FA Hayek, James Buchanan, Douglass North, Elinor Ostrom, Deirdre McCloskey, Bruno Frey and Ed Phelps.

So there are two distinct conceptions of what it means to 'solve the economic problem'. In the first sense—the sense Keynes refers to, and that carries through to neoclassical growth theory and to most working conceptions of 'the escape from poverty'—the economic problem is solved for an individual, a representative individual, or a society, when real consumption passes beyond some quantitative level X*. This approach is instrumental in that we don't really care how it was achieved, but only that the outcome was achieved. This line of thinking therefore tends to be favoured by those who seek to design solutions through interventions or transfers that seek pre-defined targets associated with achieving particular levels of material consumption.

But there is a second sense in which we can speak of a 'solution to the economic problem' as arriving when the necessary conditions are in place within which an individual can achieve economic outcomes consistent with human flourishing, when that is understood to mean the result of substantial per capita income growth. The difference here is that we do not need to specify in advance what that is (it can remain subjective); only that the individual, representative individual, or society can *reasonably expect* to solve their economic problem in the course of everyday human action because of the institutional environment in which they live, which is to say without extraordinary struggle, political revolution, luck, inheritance, etc. In most instances, these two definitions will substantially overlap. But this second definition places the locus of what a solution looks like in the state of an economy acquiring a particular set of institutions, I*. Each economy j then maps to an institutional configuration I_j which is, or is not, in I*, where I* is the set of institutions that is

[4]Keynes also introduced the idea of 'a new disease, of which some readers will not have heard the name, but of which they will hear a great deal in years to come—namely *technological unemployment*'. He reassured, however, that 'that is only a temporary phase of maladjustment'.

[5]Keynes himself, we should note, reputedly possessed legendary skill in such arts, and we must assume that he only wanted that those who came after him should experience no less. He makes a point of criticizing the lifestyles of the elite rich at the time.

consistent with generating substantial per-capita income growth. With appropriate caveats on the societal distribution of this income, the economic problem is solved when I_j is in I*.[6]

We thus arrive at a conception of a solution to the economic problem not in the Keynes-Swan-Solow sense of a level of aggregate output and consumption X*, but rather in the Hayek-North-Phelps-McCloskey sense of a suite of effective institutions I* that is consistent with the flourishing of free economic agents.

It is worth noting that this institutional argument (I_j is in I*) is not unfamiliar to Keynes in his earlier writing. Indeed, Keynes (1920:18) saw a particular institutional configuration behind the high levels of investment through the 19th Century.

> Society was so framed as to throw a great part of the increased income into the control of the class least likely to consume it. The new rich of the nineteenth century were not brought up to large expenditures, and preferred the power which investment gave them to the pleasures of immediate consumption. In fact, it was precisely the inequality of the distribution of wealth which made possible those vast accumulations of fixed wealth and of capital improvements which distinguished that age from all others.

But, as Crotty (1990), points out, Keynes was emphasizing that this institutional configuration was transitory. 'I seek only to point out that the principle of accumulation based on inequality . . . depended on unstable psychological conditions, which it may be impossible to recreate' (Keynes 1920: 21). This same argument might usefully be reframed as a story about institutional evolution.

The story of long run economic growth can be told about exogenous technological change and capital accumulation, which corresponds to Keynes' (1930) appeal to the 'magic of science' and the 'miracle of compound interest'. But one can also account for long-run economic growth from the perspective of a societal struggle—and historical process of economic evolution (Dopfer and Potts 2008)—to arrive at an effective set of institutions to incentivise high levels of economic production and the growth of knowledge to occur. Again, these are not mutually exclusive or inconsistent but they do put analytic emphasis in different places.

Keynes more or less took the solution to the economic problem as given, both in the production of the aggregate wealth, and also in its distribution. He then identified the new problem as then lying with how we adapt to this, both psychologically—for he recognized that 'modern man' is not naturally well-adapted to a life of uncompetitive leisure—and also in respect of a kind of social division of labour. You can read in his essay an equivocation between whether this will imply the further refinement of a specialist 'leisure class' (contra Veblen's *fin de siècle* mockery) or whether this might unfold as a specialist uncoupling within each person (*Á la* life in Marx's communist society where one can 'hunt in the morning, fish in the afternoon, rear cattle in the evening, criticize after dinner'). Keynes implicitly argues that there is no incentive problem within this, and that production or wealth created can be distributed without consequence, writing, one must presume not with highest respect

[6]I thank an anonymous referee for clarifying this logic.

of '[t]he strenuous purposeful money-makers [who] may carry all of us along with them into the lap of economic abundance.'

Keynes' overarching point was of the need to start preparing for this leisure society that was just over the horizon, lest we make a mess of it when it comes, which he thought the idle rich of his time were doing. 'It will be those peoples who can cultivate into a fuller perfection that art of life itself who will be able to enjoy the abundance when it comes' he prophesies (Keynes 1930). The modern incantation is to prepare for a post-consumption world, and to avoid the ecological and psychological catastrophe that will imperil a world that cannot make this adaptive enlightened transition away from overconsumption and toward the arts of living well.

In the remainder of this essay I want to develop the evolved-institutions story of long run growth (rather than as a story about changing preferences, arguments about the changing content of utility functions, arguments pivoting from the introduction of new technologies, or arguments built about the dynamics of distributional shares of consumption) as an approach to inquiry into the future of consumption. The upshot is that analysis of the future of consumption is examined as the outcome of *that same institutional evolution story*—i.e., the process by which effective institution evolve (by design and by selection) is the explanatory mechanism or analytic pathway for inquiry into the future of consumption. In essence, once we have an account of the institutions that generate a solution to the economic problem (under the free human flourishing criteria, rather than a minimum consumption level criteria), and the evolutionary pathway by which they arrive and stabilize, we then ask what type and forms of consumption are consistent with *those same institutions*.

3 Institutions for growth & consumption are the same

To address consumption in the future we need to think not about the nature of income or technology associated with a society in which the economic problem is solved, but about the institutions that such a society would have. We then ask, what will consumption look like under those same institutions?

The economic problem, in this sense, is solved by the evolution of good institutions. To the extent that Keynes predictions came true, then, this can be attributed not to 'the magic of science and the miracle of compound interest' because that would require a further auxiliary hypothesis to explain why this did not happen in some other parts of the world. (Were they immune to the charms of science? Did the arithmetic behind compound interest not function there?). A consistent explanation can be offered in differing institutions, such that the parts of the world where Keynes' predictions haven't yet come true, or are not looking good for the 2030 cut off (e.g., large parts of Africa and the Middle East, mostly) the most plausible

explanation is because of 'bad institutions'. So it's not just that good institutions solve the economic problem, but that bad institutions retard its solution.[7]

So what we seek, then, is to arrive at a clear sense of the types of institutions that 'solve the economic problem' in the above sense. In the manner of Schumpeter, Hayek, North, Phelps, Acemoglu, Robinson, McCloskey et al., we can suggest that these are likely to be those of a market-based society centred about property rights, rule of law, price system, and some comprehensive of social safety net. The argument is that such a system of institutions best incentivizes entrepreneurial activity, capital investment and innovation toward the growth of knowledge (McCloskey 2014).

The solution to the economic problem involves the deep embedding of these or similar (Rodrik 2009) institutions. The future of consumption will therefore also proceed with respect to these assumptions. This means we don't have a separate story for the future of consumption as from the sources of the wealth and income that we attribute to a solution to the economic problem.

This also means that we need not necessarily worry about the nervous breakdown that Keynes' foresaw might afflict the mass of the population through such a transition, because of our competitive 'impulses and deepest instincts... bred into him through countless generations'. Institutions may adapt, so minds don't have to. Keynes pointed to the potential trauma of adaptation to a leisure society, venturing that this might take several decades for society to adapt. This is certainly in line with modern evolutionary psychology, and also the Becker-Rayo-Robson (Robson 2001; Rayo and Becker 2007) model of utility functions as evolutionary adaptations.

However, as Earl (2013) argues, evolution does not set out to optimize utility functions, or at least does not in humans, but will tend to select for mechanisms that induce effective 'search' behaviour by truncating overthinking with a preference for action and equipping the economic agent's preference set with ways of regenerating experimental variety. The point, rather, is that adaptation need not actually take place at the level of preferences and utility functions at all but can proceed as institutions adapt (on a faster scale) to these underlying drives and propensities, including Earl's group selection model of population search. Instead of preferences and utility functions needing to adapt, as Keynes worried about, our institutions instead may adapt (evolve) to channel those atavistic preferences and utility functions into a differently configured world. This can be observed in reputational economies of open science (Nielsen 2011), for example, or the innovation commons of peer production (such as in open source software).

[7]Note that by bad institutions I also take this to mean bad government policies. Keynes failed to see the distorting effect of government policies, particularly in relation to taxes on capital and on incentives to work and save (Ohanian 2008, in Pecchi and Piga 2008).

4 The shape of consumption within institutions that have solved the economic problem

We can now use this approach to think through some possibilities, both in the positive sense of things that could occur, but more importantly in the negative sense of indicating why some other things will likely not occur because they are inconsistent with a system of institutions that need to be in place if we are to consider the economic problem solved. In a famous phrase explaining why human culture was not unconstrained, the sociobiologist Wilson (1978) used the metaphor that 'genes hold culture on a leash'.[8] The same principle applies here for the same evolutionary reasons: [evolved economic] institutions hold [future] consumption on a leash.

I will consider a few aspects to illustrate this theme: first, the rise of the latest 'new economy', the so-called 'creative economy'; and second, the growth of household productivity. I want to use these two examples as illustrative of the theme of reading the future of consumption from the extrapolation of a set of institutions consistent with a solved economic problem.

4.1 The rise of the new economy, again

Evolutionary economic historians have long noted the developmental precession of types of economy (Freeman and Soete 1997; Freeman and Louca 2002): the rise of the agricultural economy; the rise of the industrial economy; the service economy; the information economy; the knowledge economy; and most recently the rise of the creative economy (Florida 2002), also known as the experience economy (Andersson and Andersson 2006). Think of this as an evolutionary developmental account of successive waves of 'new economies' where as new technologies and sectors follow a trajectory of origination, diffusion and embedding they become vastly more productive, lowering the price of their outputs, which then become inputs into the next 'new economy'. These meso-sectoral processes (Dopfer and Potts 2008) of industrial dynamics are central to the evolutionary economic account of long-run economic growth and development.

We no longer live in an agricultural economy, not because we no longer produce agricultural goods, but rather because enormous improvements in efficiency and productivity mean we only require 2–3 % of factors devoted to that production rather than 60–80 % as when we had an 'agricultural economy'. When 50 % of a workforce

[8] 'The genes hold culture on a leash. The leash is very long, but inevitably values will be constrained in accordance with their effects on the human gene pool. The brain is a product of evolution. Human behavior—like the deepest capacities for emotional response which drive and guide it—is the circuitous technique by which human genetic material has been and will be kept intact.' (Wilson 1978: 167).

is employed in manufacturing, we have a manufacturing economy, but when the same levels of output or greater are produced with only 10 % of the workforce, we no longer have a manufacturing economy. This is economic structural evolution. Most OECD nations are currently characterized as a service economy, or a knowledge economy, or a creative economy in the sense that these are the large growing sectors that draw on the largest quantity of resources. As economic evolution occurs in these sectors they will not only become more productive (more output produced with fewer inputs) but the falling real cost of production will also drive structural change in other sectors (creative destruction), creating new opportunities for entrepreneurs, workers and consumers.

What we should take from this is that the very market-capitalist institutions that underpin the growth of capital and the development of new technologies, the same forces that are claimed to solve 'the economic problem' in Keynes's telling, are from the Schumpeterian perspective the same forces that lead to continual and ongoing economic transformation from within, as a succession of 'new economies', with each one building on the surpluses and relative abundances created by the previous (Freeman and Soete 1997).

The institutions of market capitalism are such that there will continually be innovation and creative destruction, and thus new 'new economies'. Keynes's model of economic possibilities was based on a Classical notion of a steady state being reached, but with market capitalist institutions, no such thing ever happens. But the point to note is that without market capitalist institutions, the economic problem doesn't get solved either. You can't have one without the other, which is my central point regarding the implications for the future of consumption. So long as there are institutional mechanisms to incentivize the accumulation of capital and to drive technological progress in specific sectors, this will create economic opportunities for the creation of new sectors (these 'new economies'). Rather than a surplus accumulating as a societal leisure allocation, which would require very different institutional configurations, market capitalist institutions are consistent with the ongoing development of 'new economies'. These new economies will open new opportunities for entrepreneurship, for work, for consumption, and even for leisure.

We can see this in the contemporary 'creative economy' (Florida 2002; Potts 2011). Driven by rising real incomes and the development of new digital technologies and the internet, there has been an explosion of new firms, markets, jobs and consumption possibilities (e.g., social media). We observe a new digital economy, with new companies such as Google and Facebook at its frontier. The agricultural and industrial economy surpluses did not lead us to a world of leisure, with food, clothing and industrial products supplied by a day of work each week (in developed nations, agriculture and manufacturing account for less than 20 % of GDP), but rather freed up resource for the development of other parts of the economy, such as retail, health, and leisure. Leisure became a 'new economy' industry, not a consumption surplus. That development is consistent with the underlying institutional forces and we should expect that this pattern to continue.

4.2 *Evolution of household production and productivity*

Consider a further example of institutional shaping of consumption: namely, the growing productivity of households. Keynes's implicit model was one in which firms produce and households consume. But Becker (1965) proposed a different model in which households derive utility (U) from consuming services (or 'commodities', Z_i) that are produced by combining market goods and services (X) with time (*t*) and human capital (S). The household is thus modeled as a 'little factory' producing such goods as 'security', 'entertainment', 'sleep', 'children's well-being' and so on using inputs bought on the market (such as televisions, beds, books) with the time committed by those in the household, combined with *t* and S. Becker proposed to model changes in the market conditions (the 'new economies' as above) as a change in X_i, (and also on S) and to address the impact on Z_i and t.

$$U = U(Z_1, \ldots Z_m)$$
$$Z_i = f(X, t, S)$$

We can read Keynes's concerns through Becker's 'allocation of time' model of household production as recognising that the consumption problem of 'how to occupy the leisure … to live wisely and agreeably and well' (Keynes 1930: 371) is actually also able to be viewed as a household production problem (in Becker's sense) of combining the markets X's with time (*t*) and human capital (S). We can therefore reconstruct Keynes's concerns into Becker's microeconomics as being really about the allocation of *t* and investment in S to 'teach us how to pluck the hour and the day virtuously and well' (*ibid* 373). For any given set of market prices on X_i and shadow prices on Z_i, there will be an optimal allocation of *t* and investment in S that will maximize U. Keynes can be translated into Becker by considering a world with vastly lower $P(X_i)$, and a higher opportunity cost on *t*. We would expect to observe that maximizing households may actually therefore consume more market goods as inputs into household production in order to efficiently allocate time. By definition this will imply a shift in the structural composition of consumption within the household, and furthermore that the form of this shift will be impossible to predict because it will depend on the qualities created by new technologies and new goods and services.

As such an evolutionary account will focus on a different point, namely an expansion of the set X_i (and not just a fall in relative price) due to the successive waves of new economies, as above, bringing new goods that might enter into household production functions Z_i. We can further note that this will create opportunities (for the household entrepreneur) to create new possible Z_is, i.e., increases in the range of household production—producing things in the household (Z_i) that were previously only available for purchase on the market (X_i). Or it may be that increased abundance in X and increased investment in S increases the productivity with which Z_i's are produced. Income and substitution effects will shape variously the quantity

or the range of Z_i consumed. The evolution of X (market-based economic evolution) drives the evolution of Z (evolution of household production and productivity, (Brynjolfsson et al. 2003)), thus shaping the evolution of consumption along an open expanding frontier. We can read the effects on consumption from the co-evolutionary outcome of economic institutions, firm production and household production.

5 Why Keynes was wrong

Keynes's predictions on the economic possibilities of his grandchildren were spookily on the money in terms of his growth projections, but were wildly off in his conjectures about a leisure society. The technical explanation is that one of his parameters was wrong: specifically, he thought that in the long run the income elasticity of leisure was much higher than the income elasticity of consumption. This has not turned out to be the case in general. He was also wrong about the utility signs on activities such as work and leisure, which he assumed to be respectively strongly negative and positive, although he allowed that some people will probably continue to feel the need to do some work to feel contented. The work of economists such as Ed Phelps (2013) and Richard Freeman (on labour markets) point to the idea that he underestimated this one too, and that employment can be much more satisfying that Keynes imagined. Much of this has to do with the continual creative destruction of the labour market and the creation of the waves of new economy jobs.

But the main thing Keynes got wrong was that he didn't have an endogenous explanation of innovation or economic transformation (unlike Schumpeter, say). Had he done so, he would have focused far more closely on the role of institutions to continually reinvent the economy (Schumpeter's 'creative destruction'), bringing new opportunities for entrepreneurship, firm and household production. These dynamics are institutionally conditional and in this sense the future of consumption is ultimately a function of the evolution of economic institutions.

Only a certain set of institutions are compatible with a 'solved economic problem'. The endeavour to uncover the outline of these institutions, and to model not just the way those same institutions also constrain the set consumption possibilities, but the way in which they actually shape behavior is the research program that an evolutionary economic approach to consumption ought to undertake. To paraphrase E.O. Wilson, institutions hold consumption possibilities on a leash.

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The Mortgage Treadmill Versus Discretionary Spending and Enforced Leisure

Peter E. Earl

Abstract This paper undertakes a Post Keynesian/evolutionary examination of drivers of consumers' spending in economies where productivity and per-capita income are rising. It argues that housing affordability will continue to decline as banks will be willing to risk facilitating ever-higher mortgage/income ratios, and that this will limit the ability of younger generations of consumers to reduce their working hours. Rising overall affluence will bring greater discretionary spending opportunities to some consumers, but nervous consumers may not be willing to spend more and environmental concerns may pose limits for discretionary purchases. The robotic revolution will have profound distributional consequences that will, if not addressed, enhance potential for instability.

Keywords Discretionary spending · Robotics revolution · Housing affordability · Mortgage stress · Aggregate consumption

JEL Classification Codes E2 · E21 · R21

1 Introduction

In his 'Economic Possibilities for our Grandchildren', Keynes (1930, reprinted in Keynes 1963) greatly overestimated the extent to which hours of work would be reduced as productivity rose. Despite this, he made a very valuable contribution by drawing attention to how the economic problem of scarcity might be 'solved' by the combined forces of compound interest and scientific progress. He also made an important early contribution to psychological economics and happiness economics by considering the psychological issues that might arise if the masses were to find

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themselves in a situation rather like that of the 'idle rich' of his time, in that they were no longer motivated by any need to work to provide for the necessities of life. Although his forecasts about leisure and indolence proved to be exaggerated, he was pointing in the right direction: the general population today *does* have more leisure time and often uses it as 'couch potatoes', watching 'reality' TV shows and organizing much of their lives around sport, rather than in making civic contributions and engaging in the sophisticated arts that were so important in Keynes's own life.

The present paper is an attempt to add a dimension to the analysis of the future of consumption that Keynes was unable to offer in 1930 because he was still a few years away from working out what became his (1936) *General Theory of Employment, Interest and Money*. Its focus is on the future scale and variability of consumption as a component of aggregate demand. To explore these issues, it is necessary not merely to apply what Keynes wrote in the *General Theory* but also to update his analysis of consumption. Ironically, some of the forces that have become significant drivers of the growth and variability of aggregate consumption spending were starting to emerge as Keynes was working out his analysis. However, he did not take into account what was implied by, say, London's new suburban housing developments or the spread of motor cars and contemporary art-deco electrical consumer goods amongst those members of the middle class who did well during the interwar years. Rather, his focus was on why large-scale unemployment could persist. His thoughts about the future focused on the 'euthanasia of the rentier class' that his theory seemed (erroneously) to imply via its assumption of a falling marginal efficiency of capital. He seemed oblivious to:

(i) The emerging new world in which home ownership was becoming more widespread;
(ii) How the mass production of energy-hungry consumer durables such as cars and electrical appliances was changing consumer lifestyles (for the middle classes, at least);
(iii) How the uptake of such products was being aided by innovations in the provision of credit and changes in attitudes towards being in debt, brought about by the arrival of 'hire purchase' arrangements; and
(iv) The role that continual innovation and the pursuit of higher status might combine to play in ensuring that consumers would keep returning to consume-durables markets to upgrade their products, at the cost of a reduced tendency to save and reduce their working hours.

Keynes's *General Theory* and his analysis of prospects for future generations could have read rather differently had he taken careful note of what Veblen (1899) had said about the lifestyles of the growing middle classes, or if he had Schumpeter's interest in technological change.

The rest of the paper is divided up as follows. Section 2 focuses on the future of consumer indebtedness, with particular emphasis on how the behaviour of banks (which is given surprisingly little attention in Keynes's *General Theory*) affects the cost of housing. I argue that the mortgage treadmill that besets many modern consumers is set to continue and worsen, along with other modern forms of

household indebtedness, so long as per-capita incomes continue to rise. I then consider, in Sects. 3 and 4 respectively, two potentially disruptive forces, namely, the interaction between environmental concerns and discretionary consumption, and the implications of spectacular reductions in the cost of automating production processes. Section 5 is a short concluding discussion.

2 Financial Evolution and the Debt Treadmill

In his critical analysis of Keynes's 'Economic Possibilities for Our Grandchildren', Nobel Laureate Joseph Stiglitz (2008) focuses on the puzzle of why consumers have often (more so in the US than Europe) failed to increase their leisure hours as their real incomes have risen. Partly he ascribes this to the fulfilment and social interaction that many people get from being at work, the difficulties of dividing up jobs for workers to share in a seamless manner, and the difficulties of coordinating leisure time when both members of a couple have jobs. But he gives greater emphasis to the significance of status-seeking/status-maintaining consumption and to addictive taste formation, both of which are promoted by the advertising strategies of suppliers. His view of consumers as concerned with their relative standing is not only similar to recent arguments by Robert Frank (1999, 2007); it also is in line with the neglected analysis of the consumption function offered by Duesenberry (1949) and which Frank (2005) has sought to revive. Stiglitz does not refer to this literature however. Moreover, he fails to examine a major aspect of household spending that has changed considerably since Keynes's day, namely, the cost of housing relative to hourly rates of pay. This is particularly significant for the 'property-owning democracies' that have emerged since Keynes's time (for example, as promoted in the UK in the 1980s through the privatization of social housing). The modern consumer is able and willing to pay a premium for the security of home ownership and the prospects of capital gains that would not be available from renting, whereas in Keynes's time the ordinary worker would typically have lived in rented accommodation.

To appreciate how rising affluence is associated with falling housing affordability, consider the case of Australia: at the time Keynes wrote his paper, the ratio of house prices to annual household income was about 2.0; from the late 1980s through to the end of the century it was running at around 2.7–3.0, but in 2002–2003 it jumped to 4.0. Since then, it has mostly fluctuated in the 3.5–4.0 band but reached 4.3 in 2014 (see Joye 2014). If trends in housing affordability are not reversed by policy interventions, the cost of servicing mortgages may continue to impede the potential for reductions in working hours. As a result, the fruits of rising disposable incomes and falling prices of goods from sectors with high productivity growth are mostly enjoyed by older citizens who bought their homes when housing was cheaper, whereas young couples find it financially challenging to set up a home and raise children, despite rising average per-capita income levels.

The housing affordability issue is often discussed purely as a supply-side problem, in terms of the need to release more land for residential development in order to limit increases in real-estate prices. Here, however, I am going to argue that a major driver is the way that the lending strategies of banks have evolved and that it warrants the imposition of new regulations on the financial sector: housing becomes less affordable, the more willing banks are to lend money to enable their customers to buy it.

Housing costs have indeed risen relative to income, and might be expected to continue to rise, partly due to the growth of city populations, with what Hirsch (1976) called the 'positional good' nature of housing resulting in higher relative prices for real estate in desirable locations, such as in well-service suburbs that offer shorter commuting times. However, the rise in the house price/income ratio would have been far smaller were it not for the ways in which financial institutions have changed their lending rules. If lending rules had not been relaxed but the authorities had still released the same amount of land for residential property, we would have had not only the same urban sprawl but also, because of the positional-good issue, a *relative* price gradient between properties similar to what we observe, although house prices in *general* would have risen less. In addition, with less purchasing power being put into the housing market, but keeping the same pattern of construction costs, increases in land values in general would have been smaller. By implication, if in the future, banks continue to raise the mortgage/income ratio, the cost of housing will continue to escalate if the authorities constrain their releases of land in line with population growth, or, mindful of environmental pressures, are increasingly reluctant to release land for development despite population growth. Paradoxically, then, the new cohorts coming into the housing market will find housing less affordable because more money is being made available to finance housing purchases.

The process by which the evolving lending strategies of banks cause housing affordability to fall works as follows. As individual earning power and the participation rates of women in the labour force increase, the proportion of household income needed to service basic needs other than housing falls. So, to the extent that consumers are prepared to hold back on consumption of discretionary items, they can service larger mortgages relative to their incomes. The banks stand to profit from offering such mortgages and make them available. As some consumers take up such mortgages, they will be able to out-bid those who do not, forcing the latter into less acceptable properties. The latter are then likely to take up more challenging mortgages in order to maintain their competitive positions when bidding for real estate. In other words, if we apply the thinking of Veblen, Frank, Hirsch, and Duesenberry and recognize the competitive nature of housing ownership, we can see that the behaviour of the banks produces a situation rather like that at a concert, in which everyone ends up standing up to get a better view but no one, aside from the first-movers in the front rows, actually gets a better view than if they all were to remain seated. Moreover, to the extent that consumers are prepared to take up credit to buy discretionary items, signing up for such mortgages does not necessarily require them to forego discretionary consumption in the present; rather, they will have to

maintain their working hours and/or retire later than they might otherwise have done, due to the need to repay all the debt and meet interest charges in the meantime.

During the high-inflation years of the 1970s and 1980s, the stress associated with such mortgages was often short-lived. With mortgages fixed in money terms (albeit with some period in which monetarism-inspired interest rate hikes substantially increased monthly repayment charges), rapid increases in money wages reduced the proportion of household income needed to service mortgage payments. However, if inflation remains under control, consumers in the coming decades will have no such easy escape from the mortgage treadmill.

To get an idea of the significance of changes in financial institutions' lending rules as drivers of real-estate prices, consider the buying power of a working couple, one of which earns $10,000 and the other $8000. If the lending rule is (as was common in the UK in the 1970s) 'up to 2.5 times the prime earner's annual gross pay', then they can borrow $25,000. However, if the rule is (as it had become in the UK during the 1988 property boom), 'up to three times total gross income', then they can borrow $54,000. Now combine such rule-relaxation with rising incomes and participation ratios and the pressure of demand for housing becomes all the more acute. Furthermore, relaxation of the rules about the percentage of the deposit required will enable buyers to enter the market sooner, adding to pressures on house prices caused by consumers taking up bigger loans.

A Schumpeterian view of the financial sector leads one to expect that loan/income ratios will be ratcheted up over the long run, in line with what has happened: in seeking to increase their market share and shareholder returns, banks will experiment with less onerous tests of creditworthiness (Minsky 1975; Whalen 2001). Success will be emulated, leading to pressure to push the risk-taking envelope even further. The ratchet process is not completely solid in the short run. Sometimes, the financial institutions will push their experiments too far, as with the sub-prime mortgages that underpinned the 2008 Global Financial Crisis. Following such overshooting, lenders temporarily retreat to more conservative rules (for example, by requiring higher deposit ratios to provide a bigger safety margin for the lender in the event of mortgage defaults and the need for forced sales of property). However, in the long run, competitive logic implies rising ratios of house prices and mortgage indebtedness to income, so long as real incomes rise and, with them, the fraction of take-home pay potentially available to service mortgages without causing undue default risks.

Rising hourly rates of remuneration will not result in fewer hours being worked, or earlier retirement, if increases in real hourly wages are absorbed by higher interest charges and principal repayments on larger mortgages for both first-time buyers and for those who are moving up-market. By increasing mortgage/income ratios, banks can foster property booms that encourage people to borrow as much as the banks are prepared to lend to them. Thus, even in the absence of population growth relative to the supply of housing, we should not expect long-run stability in real-estate prices and in the ratio of real-estate prices to household income, and we should not expect hours worked to fall as real hourly wage rates increase. The benefits of rising average income per head will mainly accrue to the relatively mature homeowners who have

reached the limit of their aspirations as regards the quality/size of home they wish to own.

The idea that housing will continue to become less affordable (in terms of house prices/income ratios) due to dynamic competition among financial institutions will no doubt perplex the many economists who try to understand macroeconomic phenomena without an appreciation of how the financial system works. They are likely to wonder where all the extra money for the banks to lend will come from if the population is going to be increasingly burdened with debt: without growing domestic savings, it might seem that the debts will have to be funded by overseas deposits. Banks have frequently made pronouncements in line with such a perspective, saying that they have had to raise their interest rates in order to attract deposits to fund mortgages. However, it is possible for banks to engineer a growing debt burden for future generations without any inherent need for increased levels of ex-ante saving as incomes rise.

Now, of course, if a higher volume of lending is to be done by *non*-bank financial intermediaries (NBFIs) such as building societies and credit unions, then they must attract deposits. If so, it seems as if we are in a pre-Keynesian world in which lending depends on the supply of 'loanable funds'. The deposits may come from, for example, people saving up their house deposits, or from those saving up for retirement. But deposits may also come simply via people switching their existing assets in favour of deposits at these institutions, without doing any new saving. Either way, these increases in deposits do not necessitate a reduction in the deposits of banks, given that the NBFIs also "bank" with the banks: a deposit at an NBFI entails a rise in the NBFI's deposits at its bank and, when it increases its lending, its bank deposits fall and there is an increase in the bank deposits of the vendor of whatever the loan was used to purchase.

Things are different for the major banks (who captured much larger shares of the mortgage markets from the 1970s onwards). For them, new acts of saving typically do *not* increase their total deposits: people save by not spending income that has been transferred into their accounts from the accounts of their employers. Their saving will only make it easier for the banks to lend insofar as they transfer the money into accounts from which they cannot withdraw it without incurring a penalty, as this improves the liquidity position of their bank. To establish a mortgage without having to compete aggressively to attract deposits from its rivals, a bank may simply create a loan credit (on the assets side of its balance sheets) and a matching deposit (on the liabilities side of its balance sheets) that is immediately transferred to the accounts of the property vendor.

To create credit in this way, banks need the following:

(a) Adequate reserve assets (or the ability to profitably acquire them from the non-bank private sector by creating deposits, or borrowing from their central bank). This is to ensure that, if they expand their balance sheets, they will not breach reserve asset requirements set by their central bank, and that they will be sufficiently insured against what they see as the risk of a liquidity crisis being caused by a spike in demands to withdraw deposits;

(b) Adequate reserves, from retained profits and shareholder capital, to permit assets values to be written down without causing a solvency crisis in the event that their estimates about the risk of borrowers defaulting prove to be correct; and
(c) Enough confidence that, via their liability-management strategies, they will be able to profitably maintain their deposits at the newly-increased levels rather than losing them to rivals.

If newly-created credit is used merely to buy existing properties, the chain of transactions that unfolds entails no new ex-ante saving: for example, a first-time buyer at the start of the chain ends up with a debt liability, while the person at the end of the chain, who exits the housing market, ends up with a bank deposit in place of a title to real estate. It is only in the process of servicing the debt that there will be (ex-post) impacts on the amount of income that is not spent on consumption (i.e., in Keynes's terms, on the flow of saving). These impacts do not have any particular relationship with the size of the additional deposit that the bank created to make the purchase of the house possible:

- Having to service the mortgage limits what the house-buyer can spend on current consumption of things other than housing, and may thus limit the incomes and saving of others.
- The house-seller may receive interest income on the sale-proceeds, and may choose to spend some of this and save the rest, or may dis-save by using the sales-proceeds for consumption.
- The bank will earn profit from the difference between what it debits as interest from the house-buyer's account each month, and what it pays in interest to the house-seller, adding to its reserves or shareholders' dividend incomes as a result.

These changes in saving and spending entail changes in who owns bank deposits; the mortgage created to facilitate the house purchase thus remains something that was simply created, along with the matching deposit, and independent of any saving, which contrasts with the loanable funds' view.

If a newly created deposit is used to buy a brand-new home, then the builder may use some of the proceeds to extinguish debts incurred in its construction (which reduces the scale of bank loans and deposits correspondingly), while the rest is an addition to the builder's bank account, until it is spent, as new ex-post saving. Again, as the mortgage payments are made, there will be impacts on the amount of income not spent on consumption.

Thus, as Keynes (1937: 668–669) realized, while facilitating additional spending requires the provision of finance, it does not have to entail an increase in saving and a reduction of other spending unless the economy is at full employment. In the latter situation, or where a country's producers are relatively uncompetitive, growing levels of indebtedness will entail rising net imports. It is in the latter situation that banks may indeed find themselves raising their interest rates to stop net losses of deposits. Here, they will end up replacing domestically-owned deposits with foreign-owned ones. However, such interest-rate increases are typically designed to *maintain* previously created deposit levels. Moreover, by providing an offsetting

capital-account inflow they prevent the country's exchange rate from falling and thereby correcting the current account outflow and, with it, their tendency to lose deposits to offshore suppliers of imports. [Note that if a country is at full employment and is 'living beyond its means', reducing its current account deficit will require a reduction in overall domestic spending, not merely a reduction in its exchange rate (see Alexander 1952)] The failure of a central bank to lower the rate at which it supplies funds to commercial banks keeps the country's exchange rate higher than it needs to be; promotes an increase in foreign indebtedness; and, by not putting pressure on commercial banks to offer lower rates of interest, ensures that those people with mortgages will have to keep working for longer, or work longer hours, than they otherwise might prefer to do.

The debt treadmill process potentially implies dynamic instability in future levels of aggregate consumption demand. Households with stressful mortgage commitments will not be able to enjoy many of the fruits of their being paid on the basis of higher productivity levels than their parents. To engage in non-housing discretionary consumption on a larger scale in a given year, they will need to borrow even more, which will then limit their ability to buy products in subsequent years as well as reduce their lifetime demand due to the interest charges that will be incurred.

Who is going to be buying this output that those in the mortgage belt will be producing in larger volumes but are unable to buy for themselves due to their housing costs? The answer lies with the composition of those on the other side of the balance sheets, namely those who receive interest or dividends from bank profits (from the 'spread' between deposit rates and loan charges, less overheads), and what they choose to do with it. Retained profits of banks augment the banks' reserves and permit the banks to create yet more credit, should they wish to do so.

One possibility is that chronic deflationary gaps will emerge, which will then need to be addressed via ever-larger fiscal deficits, given that owners of financial assets are likely to prefer to grow their wealth rather than fund consumption with what they receive as interest or earnings from their owning shares in banks. If policymakers respond by cutting taxes or reducing interest rates, this will enable the banks to step up the mortgage/income ratio even more, thereby potentially leading to a spiralling process of long-term growth in the public-sector deficit. An alternative possibility is that the presence of the mortgage treadmill will help to prevent what many have seen as a looming inflationary-gap problem potentially associated with ageing populations in advanced industrial economies. There is no guarantee that the two processes will exactly offset each other, especially since, as explored in Sect. 4, per-capita productivity growth driven by automation may eliminate the inflationary-gap issue despite the ageing of the population.

As different cohorts of consumers move towards retirement in decades to come, aggregate consumption will be affected by the decisions taken by those who manage to pay off their mortgages before they retire—in particular, what they decide to do with the equity they have built up in their homes. Some may downsize or relocate to areas with cheaper housing and then give their children, as a kind of pre-inheritance windfall, some of the proceeds of selling their original properties. Such gifts may be used as the deposits for their children's homes, enabling their children to get on the

property ladder sooner, but without them needing to borrow any less. The fillip this gives to the first-time buyers' market will have a complex chain of consequences: in keeping up pressure on prices of entry-level homes, it will enable intermediate-level buyers to trade up to the large homes being sold by the downsizers, thus helping to maintain prices at that end of the market. Alternatively, the retiring generation may spend lavishly and run down the equity in their homes, or they may eventually leave large sums to their children, allowing the latter to escape the mortgage treadmill.

The choices that older generations make about how to assist their children may be shaped by their attitudes towards intergenerational equity. For example, the scale of mortgages that banks can offer safely to upcoming generations will be limited by the extent of the student loan obligations that the latter have accumulated. If their parents opt to help them out because they are conscious of having not had such student-loan burdens themselves, reduced student loan burdens may simply be offset by higher mortgages, with either reduced consumption by the retiring parents or smaller inheritance-based spending/debt repayments further down the track.

3 Discretionary Consumption in the Future

Around the time that Keynes was finalizing his (1936) *General Theory of Employment, Interest and Money*, Allan G. B. Fisher's (1935) book *The Clash of Progress and Security* was published. In contrast to Keynes's focus on aggregate demand, Fisher wrote about how economic depressions could arise due to the barriers to switching the structures of economies towards the production of discretionary consumption goods and services as it became easier to meet basic needs. He noted both demand-side and supply-side issues. If working hours were not reduced, there could be problems in expanding the sales of non-essential goods and services whose consumption was time-intensive, and moreover workers might be inclined to save their growing incomes rather than spend them on discretionary consumption if processes of structural change made them feel insecure. Output of discretionary consumption products might be constrained, too, if capital and workers clung to familiar sectors in familiar locations and could obtain state support to enable them to do so.

Nowadays, we might want to revisit Fisher's concerns in the light of the endowment-effect and loss-aversion phenomena central to the work of Nobel Laureate Daniel Kahneman (2011). We might also want to revisit what might be called the 'ties that bind' in terms of the concept of 'embeddedness' proposed by Granovetter (1985), and develop this in terms of a complex systems/network perspective on barriers to the geographical mobility of labour. But evolutionary economists also need to be aware of the implications of viewing Fisher's work and Keynes's theory of employment as complementary. In fact, their complementary potential was swiftly spotted by one of the latter's former pupils, Brian Reddaway (1937). The perspective that emerges is important for thinking about the macroeconomics of consumption in the future, particularly if workers increasingly are going to

have to switch jobs frequently rather than spend their entire careers employed by just a few organizations, or if (as discussed in the next section) they face the prospect of becoming technologically unemployed.

Keynes (1936) had emphasized how fragile aggregate investment might be due to its dependence on confidence and 'animal spirits', though it must be noted that he had portrayed aggregate consumption as a function of income; he had thus not recognized that demand for non-essential consumption goods and services could also be at the mercy of consumer confidence. This is a surprising omission, for major electronic appliances, home-renovation projects, cars and houses are, essentially, investment items whose illiquidity may be problematic if the consumer's circumstances change. Modern online-market institutions such as eBay make it much easier than it used to be for consumers to dispose of their durable products at short notice, but this still entails a discount on the original purchase price that is much greater than is justified on the basis of any physical depreciation. Hence, prospective rates of financial depreciation of durable goods may be a significant issue at the time of purchase. If consumers opt to defer purchases in the hope of buying more cheaply in the future, or after they have resolved any lingering uncertainty about their circumstances, aggregate demand and income will end up being reduced today. Unless investment increases, however, holding back spending today will not result in any increase in total savings that could finance more demand in future. Hugh Townshend (1937: 160) realized this very soon after the *General Theory* was published, and he attempted to generalize Keynes's notion of liquidity preference beyond financial markets. But his message was not heeded.

After World War II, rising affluence fed the ownership of consumer durables on an unprecedented scale. But Keynesian models were not amended to include confidence-driven consumption functions, despite warnings from the psychological economist George Katona, most notably in his (1960) book *The Powerful Consumer*. Katona stressed that in affluent economies demand was a function of willingness to spend rather than merely of the ability to do so. In his view, the first post-war US recession, in 1957–1958, occurred as a result of a fall in consumer confidence that advertising was not able to hold in place; it was not the result of consumers hitting the limits of their spending and credit-using capacities.

If consumer durables are often replaced long before they are worn out or become unviable to repair, it is easy to delay their replacement when one is nervous about the future. By contrast, with consumer credit, it is easy to bring upgrades forward if one is in a buoyant mood, even if one's income has not gone up. Similar processes can operate in respect of the consumption of non-durable discretionary products, as with choices between dining out or eating at home, or taking a major foreign vacation versus a local, more modest alternative. The consequent instability in the consumption function has been evident in research using indices of consumer sentiment that were pioneered by Katona's Survey Research Center at the University of Michigan, as well as in research on the demand for cars undertaken by Ron Smith (1975) as a doctoral student under the supervision of Reddaway. But there is little trace of it in the mainstream and evolutionary economics literatures.

The need to take these ideas seriously when analysing consumption will be all the more acute in decades to come—and not merely because of the likely links between employment insecurity and reluctance to spend. Consumers will be living in a post-Schumpeterian world in which information technologies such as computer-aided design are used to speed up the pace of creative destruction. They will face uncertainty about when new technologies will arrive and the point at which these technologies will become affordable and/or safe to buy without undue risks of steep losses or falling prices. Such issues are already with us and may provide grounds for holding back on spending. For example, if we decide that our next car is going to be a electric vehicle, or plug-in hybrid, powered by yet-to-be-fitted solar panels on the roof of our house, we can probably keep our present vehicle running—far longer than we normally might have done—until we judge it is safe enough to enter the market without incurring the kinds of costs that early adopters will have to bear. Similarly, if we can get by without a 3D 'smart TV' for a few years, we can skip a generation in TV technology and jump straight to an affordable ultra-high definition 3D smart TV. Such discretion should make car and electrical-appliance manufacturers and retailers nervous. Heavy advertising and seemingly cheap credit may not always offset consumers' tendencies to be prudent.

Although rapid technological change and rising affluence may result in more instability in aggregate demand in coming decades, we need to recognize that the trend of growing discretionary spending over the past half century may be tempered by measures that may be deemed necessary to prevent a global environmental catastrophe. Spending on the kinds of products consumers have chosen to buy with their discretionary income may need to be curtailed, either by regulations or by tradable permits systems.

Of course, technological change may have many benefits in terms of the reduction of environmental pressures created by individual transactions and acts of consumption. For example, if shopping is done online, advanced logistical systems can ensure that delivery trucks emit far less per transaction than customers' cars would have emitted if each customer had driven to check out products on offer at brick-and-mortar retail outlets; indeed, technological change may economize on the consumption of resources in private vehicles by making it possible and attractive for consumers to call up driverless taxis. Demand peaks for such vehicles could be smoothed out by online real-time auctions through which price movements would result in some consumers opting to postpone their journeys, rather in the way that 'smart meters' are helping to reduce peak-load pressures in electricity grids. However, such benefits may be greatly offset by increases in the overall volume of consumption if improvements in productivity bring billions of consumers out of poverty.

If technological progress is insufficient to solve all the challenges that the plague of humanity is placing on the ecosystem, consumers may need to be forced to give up their freedom to choose. Whether they like it or not, consumers in future will probably have to lead very different lifestyles from those that are aspired to or taken for granted today. If the ecosystem is to survive, there needs to be a switch away from meat and dairy products towards vegan diets, rather than the reverse that

normally happens with rising affluence. Family sizes will need to be reduced and pet ownership eliminated insofar as this would involve carnivorous animals that have significant environmental footprints. Clearly, there is potential to limit average family sizes by imposing requirements that parents can only bring up children that they have been licensed to have because they have passed parental competence examinations and have either bid successfully at auction for the right to have a child, or have been lucky in a lottery that allocated such rights. Such measures may presently seem draconian, but they may eventually come to be seen as perfectly reasonable means towards preventing long-term environmental catastrophe.

Another major area of discretionary consumption that may end up having to be restricted is long-distance tourism. The problem is not merely about the supply of sustainable aviation fuel for jet airliners but also the prodigious fuel consumption and emissions of ocean-going cruise liners. Each passenger on a cruise typically travels with the equivalent of 20 tons or more of ship, so the fuel consumption per capita is several times worse than that of even large SUVs packed with family members and camping equipment. As this becomes more widely appreciated, and such consumption becomes duly frowned upon, we might see virtual tourism replacing actually 'going there', much as virtual conferences, meetings, and so on, should replace traditional face-to-face modes. In terms of Herbert Simon's 'Travel Theorem' (Simon 1991: 306–308), virtual tourism should readily suffice as a means for gathering information about other places; the other things one gets from tourism can be achieved via other ways of spending leisure time that do not involve travelling long distances and/or staying in environmentally sensitive locations.

In short, and insofar as the mortgage treadmill fails to ramp up in line with rising disposable incomes, consumers in the future may have greater power to generate economic instability because of their rising levels of discretionary spending. Nonetheless, they may also need to have their discretionary spending curtailed for environmental reasons. If Katona's 'powerful consumer' thesis is correct, advertising may have only limited power to propel the economy forward in the traditional, unsustainable way. The challenge for macroeconomic policy management is not that of maintaining discretionary spending at levels that will promote economic growth and hence create job opportunities, but to help to scale back the overall impact of economic activity on the environment, partly by reducing the discretionary spending of the rich and ensuring that everyone can meet their basic needs.

4 Macroeconomic Ramifications of Robotic Production Systems

Over the next few decades, robotic technologies will become spectacularly cheaper to purchase and operate, even compared with the Unbounded Robotics UBR-1 one-armed robot, whose cost of just $35,000 made it the subject of headlines in late 2013/early 2014 (see, Hoge 2013; Simonite 2014; Westlake 2014). This may

have major implications for domestic life by freeing up leisure time from chores and making caring roles easier to undertake. However, I will focus here on the macroeconomic consequences of this cheapening of robots and programmed production systems. The upcoming robotic revolution has the capacity to enforce a reduction in the hours of work available to those who lack hard-to-programme skills (such as the ability to use expertise to answer infrequently asked questions). It is on a collision course with the banks' efforts to keep the debt treadmill turning and it reinforces the clash of progress and security discussed in the previous section.

Historically, automation has permitted both rising living standards and a shorter working week for the masses, rather than resulting in chronically growing unemployment/underemployment. Because automation acted to reduce costs of some products, it increased the real incomes of those whose jobs were not displaced, enabling them to spend more on other kinds of products. So long as this was happening in the midst of rapidly growing investment spending, there was no deficiency of aggregate demand when workers lost their jobs to machines; rather, unemployment was eliminated due to growth in sectors with income-elastic demand. Indeed, if there were economies of scale to be had in such sectors, prices of their outputs would fall, causing further increases in real income (Young 1928; Kaldor 1972).

This time, however, the process may be different: when prices fall in one sector, due to workers being displaced by robots, the demand growth in other sectors may be met by further investments in robots. Indeed, as a sector's output increases, programming becomes more viable since its fixed costs can be spread across more units of output, while each robot might be programmed to undertake multiple tasks in sequence rather than requiring that many workers be trained, as per Fordism, each to do separate, simple tasks. Hence, sectors with income-elastic demand may, as they expand, shed labour in favour of robots, rather than helping, via their growth, to soak up workers being displaced by robots in other sectors.

It should be noticed that although those who become 'technologically unemployed' may be forced to spend less because their incomes have been cut—and although robots, unlike people, do not spend—robots do generate income for their owners. In principle, then, economies in the future could witness a co-existence of growing pools of unemployed blue-collar labour—and unemployed professionals whose expertise has been programmed into automated systems—alongside thriving incomes for those with non-programmable knowledge-based jobs and those who provide the financial capital to buy the robots. However, there would be no automatic reason for the total volume of spending to be equal to the total revenue anticipated by the owners of the production systems. [There would also continue to be the kinds of micro-structural coordination problems central to the work of Richardson (1960): though many robotic production systems might be highly adaptable to alternative outputs via fresh programming, there could still be misjudged sunk costs of investments in product development and in the fixed costs of programming.]

A future world of robotic production potentially presents an extreme version of the labour-market divide emphasized by Rajan in *Fault Lines*, his (2010) book about

the enduring underpinnings of the Global Financial Crisis. There, he highlights the contrast between the global shortage of graduates and the global surplus of workers who lack any tertiary-level educational qualifications. He argues that, rather than addressing this via redistributive policies, the US authorities tried to make higher levels of consumption possible by expanding the availability of credit to blue-collar workers who, in the past, would not have been able to buy their own homes.

In the robot revolution, very rapid structural change towards programmed production systems seems to entail a further 'fault line': those who suddenly and unexpectedly find themselves with no foreseeable job prospects may have to default on their mortgages or even face bankruptcy because of the scale of their commitments to the debt treadmill. Housing markets could be greatly disrupted, and not merely in working-class suburbs: programmed production may wipe out many professional jobs, such as those of academic teachers and medical practitioners. To be sure, not all of a professional's skills may get embodied in programmed systems, but to the extent that their skills get turned into computer programmes, there will be fewer full-time jobs around for them unless there is massive growth in final demand for their sectors' non-programmable outputs. Those who are displaced from their sources of paid work by cheaper automated systems will be able to consume for a time by running down their assets, but eventually they will only be able to do so with the aid of transfer payments financed by public-sector borrowing (to the extent that there is a deflationary gap caused by those who are receiving income but not spending enough of it), or by taxing capitalists and those whose skills have so far not been programmed into robots.

Given the neo-conservative opposition to providing welfare hand-outs to today's unemployed, it seems unlikely that right-wing voters are going to accept taxation on a far greater scale to support a growing part of the population for whom unemployment is going to be a *permanent* phenomenon. Those who face such taxes seem likely to favour the spreading out of remaining work via a shorter working week. If revolutions are to be avoided, or more peaceful democratically-based imposts on those with financial and knowledge-based assets are not to happen, robotic production will need to cheapen the cost of living by enough to offset the fall in nominal income from fewer working hours being available. Even if the displaced workers manage to maintain their real consumption levels, inequality seems set to grow as relatively more income goes to those with capital, especially with the return on capital being far higher than the rate of growth in real wages for those still working, as Piketty (2014) has emphasized. It is hard to see how some kind of social revolution could be avoided in a world in which robot-dominated production was increasingly being geared to producing luxury-consumption items for those with income from financial capital.

It is possible that the price of using robots will fall below the subsistence wages of humans in some economies. If real wages of blue-collar workers are being squeezed towards this level, and without expectations of redistributive transfer payments, workers who see 'the writing on the wall' for their prospects may be expected to adapt in various ways. In terms of life-cycle theories of the consumption function, they would be predicted to increase their saving rates in order to prevent future

reductions in their consumption below subsistence levels, and to fund bigger bequests to those of their children that face a bleak outlook. We might also expect people to reduce the number of children they have and to try to invest more in ensuring that those that they do have can become knowledge-based workers. In the long run, in the absence of redistributive policies, the working class could fail to maintain its numbers if robotic production made its prospects so bleak and there remained limited chances of children turning out to be knowledge-based workers who could enjoy a comfortable income and possibly support them in old age. In other words, if robotic production did result in collapsing living standards for many workers, children would become consumption luxuries that they could not afford.

As robots fall in price, they will pose a threat not merely to workers in advanced industrial economies whose jobs and living standards are being threatened anyway by lower-paid workers in newly industrializing economies; robots will also become viable replacements for 'low-wage' workers. While, say, a $35,000 robot costs less than a year's pay for a worker in an advanced industrial economy, it may, over an operating life of, say, even only 5 years, be cheaper than a worker in a newly industrializing economy who is only paid the equivalent of $150 per week and cannot work a 24-h daily shift. In the service sector, programmes for diagnosing customers' needs online and arranging delivery of what they need can be applied globally at zero marginal cost once they are up and running (see further, Earl and Mandeville 2009). The long-run future for call-centre workers in, say, India may thus be bleak, despite their short-term success in gaining jobs at the expense of workers in high-wage economies.

In short, for many products, technological improvements are making it possible to 'solve' the economy problem of producing on a vast enough scale to satisfy the mass of the world's population without actually employing most of those who consume the output. In such a world, income distribution becomes a key issue: if location ceases to become critical for profitability, in the way that it has been over the last couple of decades of globalization, then how might the world's poor come to benefit from the robot age? If taxing the rich to support the jobless is a problem within an advanced industrial economy, we should not hold out much hope for international income transfers. However, we should also not forget that newly industrializing Asian economies have very high savings rates despite their relatively low levels of income. They could end up owning large slices of companies that own robotic production systems, whether located in Asia or in the West. This would add a new twist to Piketty's analysis: even if the incomes that their populations get from working are held back by the robotic revolution, their purchasing power may nonetheless grow based on their asset accumulations.

5 Conclusion

In this paper I have attempted to reflect on the future of consumption by trying, as far as possible, not to discuss how consumers might live their lives several decades from now. Instead of, say, trying to imagine what new technologies might imply, or trying to extend Keynes's analysis of the psychological impact of great increases in leisure time, I have sought to focus on the macroeconomics of future consumption by building on what we know about the drivers of aggregate consumption in increasingly affluent economies. I think it is important to do this, especially since some of these issues, though recognized long ago, have still not been covered in mainstream macroeconomics. Here, I have sought particularly to draw attention to the significance of discretionary spending and the ability of the financial system to create credit without any need for prior savings. As things stand, models of the macro-economy typically continue to operate as if aggregate consumption is some mechanical function of other economic variables and as if 'the money supply' is not endogenously determined. If such modelling practices continue, they are likely to result in nasty surprises in decades to come. The paper is thus intended not merely to provoke discussion about the future but also to shed light on what has been occurring in twenty-first-century macroeconomics, such as the Global Financial Crisis, problems with housing affordability, and growth in public-sector deficits.

Taken together, the factors explored in this paper point towards a potentially very turbulent future, rather than a Golden Age of economic growth in which the robotic revolution and other productivity-enhancing innovations 'solve' the economic problem. Affluence brings opportunities for discretionary spending in general, but consumers will have little discretionary spending power if they allow themselves to become indebted to the limits of their capacity to stay solvent. The way the debt treadmill is engineered by the financial system results in the fruits of economic growth going disproportionately to middle-aged and senior consumers who had the good fortune to enter the real-estate market in decades in which prices were lower and they neither needed nor were able to borrow so much. The future looks especially bleak for those who are not merely relatively young but also unable to acquire non-programmable skills, notably if they build their lives around working in sectors that depend on discretionary spending but which then run into environmental constraints on demand.

What Richardson (1960: 178–180) calls 'dislocation effects' will beset not merely those who build up their lifestyles on the basis of debt commitments that prove impossible to meet, but will also apply for those whose asset values depend on such commitments being met. Those with financial assets might seem set to prosper in a world in which dividends from robotic productions systems provide the means to purchase the output from these systems. However, financial instability seems likely to derail this if such wealth-owners are overly concerned with growing their wealth rather than consuming, and if they remain unwilling to share their wealth with those whose prospects are wrecked by structural change.

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Ars Ultima Spes? Some Notes on the Unsustainability of Today's Capitalism and Culture as a Possible Remedy

Mario Cedrini and Marco Guerzoni

Abstract Current forms of capitalism demand the continuous creation of new industrial sectors, for both supply-side and demand-side reasons. Partly derived from the nature of technology, which often exhibits economies of scale, and partly from actors searching for investments in R&D to reduce production costs, increasing returns in the production of goods and services are responsible for any resulting increases in productivity. The system is thus sustainable in the long-run only if the advent of new sectors favours the absorption of excess labour-supply and generates new income. On the demand side, consumerism has created the conditions for the continuous increase in the goods and services perceived to be needed by consumers. Whether this dynamic balance is sustainable in the long-run is highly questionable. On the one hand, consumers might face the satiation of their needs. On the other hand, a constant increase in the production of goods and services requires a corresponding increase in the use of resources, engendering harmful production externalities, such as pollution, and in the disposal of old artefacts. This paper identifies the main mechanism underlying the structural dynamics that have steered the way along this path during the century-old shift from craft- to mass-production. Focusing on Scitovsky's idea of creative consumption and the relevance of active public policies and an educational turn for fuelling it, the paper attempts to offer a suggestive solution on how the path may be reversed.

Keywords Structural dynamics · Creative consumption · Capitalism · "Cost disease"

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1 Introduction

In a much-debated essay first presented in 1928 and then published in 1930, *Economic Possibilities for Our Grandchildren* (hereafter *EPOG*), John Maynard Keynes sketched the dream of a human race finally free from the economic problem of material scarcity. A hundred years of capital accumulation and technological progress will result in the advent of abundance, he wrote. Then, "man will be faced with his real, his permanent problem—how to use his freedom from pressing economic cares, how to occupy the leisure, which science and compound interest will have won for him, to live wisely and agreeably and well" (*The Collected Writings of John Maynard Keynes*, hereafter referred to as CWK, Vol. 10, p. 328). We will have learnt, Keynes believed, to occupy ourselves with the "real problems" of "life and of human relations, of creation and behaviour and religion" (CWK, Vol. 10, p. 17). Although Keynes' estimates about prospective economic growth have proved quite accurate, his reflections on the future of capitalism (envisaging full employment with highly reduced working hours) now appear over-optimistic, to say the least. Recently revisited by a number of leading economists as an essay wishing "to challenge posterity to put predictions to test" (Pecchi and Piga 2008, p. 1), *EPOG* illustrates Keynes' precise, though complex, vision of capitalism. For Keynes, capitalism is a means to an end, an indispensable contribution to solving the economic problem—to ensuring, that is, the material preconditions for the enjoyment of the non-material ends (required to express authentic human qualities) of an "Aristotelian" good and happy life. But this system rests on bad instincts, such as hoarding, purposiveness and greed, love of money for money's sake, rather than "as a means to the enjoyment and realities of life" (CWK, Vol. 9, p. 329), and thus runs counter to the ambition to cultivate the "arts of life" (p. 332) once material scarcity has been left behind.

Contrary to what is commonly believed, the moral, anti-utilitarian dimension embedded in *EPOG* represents a cultural struggle against the mental fetters, so to speak, created by the "forecast of inevitable scarcity" (Goodwin 2000, p. 406) which imprisons people in a capitalist society and prevents them from enjoying what Keynes called "the possibilities of personal life" (CWK, Vol. 10, p. 125). What matters here is the *perspective*: one wherein people cease to overestimate the importance of the economic problem even before, both logically and temporally, the transition to a society of abundance has been accomplished. This helps to explain the famous but apparently paradoxical call, in the *General Theory*, for "central controls"—the enlargement of state action—to protect, rather than repress, the advantages of "individualism". Keynes identified such individualism with "personal liberty", a wide "field for the exercise of personal choice" and the resulting "variety of life" (CWK, Vol. 7, p. 380). But he also believed that "a revolution in the criteria

for state action—away from Benthamism" (Moggridge 2005, p. 246) was absolutely required. Possessing (contrary to individuals) the practical ability to be disobedient to "pecuniary tests" (CWK, Vol. 21, p. 243) and disavowing the utilitarian ideal celebrated in capitalist societies, the state must set the example, with a view to demonstrating the practical possibility of implementing the above-cited perspective.

This view of Keynes' speculations about the end of the "economic problem" (in general, see Carabelli and Cedrini 2011) serves here as a background for interpreting what may seem to be a structural crisis of current capitalism, and for suggesting possible solutions for it. The paper puts forward a suggestive interpretation of the production and consumption mechanisms underlying the dynamics of today's capitalism, before surmising this structure may not be sustainable in the medium- to long-run. Current capitalism, in fact, demands the continuous creation of new industrial sectors, for both supply-side and demand-side reasons. Partly deriving from the nature of technology, which often exhibits economies of scale, and partly representing strategic investments by actors in R&D to reduce production costs, increasing returns to the production of goods and services are responsible for those increases in productivity that nation-states need to survive and thrive in a competitive environment. In aggregate, however, higher productivity leads, *ceteris paribus*, to a decrease in demand for labour. Increased output promotes (further) mechanisation of production, which in turn biases input allocation, by favouring capital over labour. But lower demand for labour can also trigger a reduction in aggregate income, resulting in its over-supply (see Pasinetti 1983; Saviotti 1996). The system is therefore sustainable in the long-run only if the introduction of new sectors or goods—machinery, if we adopt a Marxian view (Marx 1867; Vivarelli 1995), or products, according to a Schumpeterian perspective (Schumpeter 1934)—favours absorption of excess labour supply and generates new income.

On the demand side, due to network externalities—such that the value of a good or service depends on the total number of actors consuming it (Shy 2001)—the diffusion of innovative products tends to saturate markets (Rogers 1976). In mass consumption societies, such social network externalities tend to be pervasive, owing to imitation effects and herdish behaviour (Hazlitt 1818; Guerzoni and Soellner 2013). Moreover, the rapid diffusion of new products accelerates a downturn in the learning curve for producers, and amplifies the increasing-returns effects of technology. Furthermore, to adopt (following Bianchi 2003) a distinction introduced by Hawtrey (1926) and later developed by Scitovsky (1992[1976]), current demand patterns are often the result of defensive rather than creative consumption. While "goods intended to deliver positive satisfaction or gratification" (actively participating in a rewarding philosophical discussion, or seeing a play at the theatre) require the consumer's engagement, in terms of time, efforts, and skills, "goods devoted to preventing pain or distress" (such as driving home instead of walking) make life easier by reducing the amount of time, effort and skills required. The problem is that, as shown by Scitovsky, modern societies are biased towards defensive consumption. Pleasure deriving from such consumption is only temporary, for habituation reduces enjoyment and ultimately causes consumers to experience distress. Creative consumption can also perpetuate itself: its enjoyment demands an initial investment in a

stock of cultural capital, but once this is attained, such consumption works to increase the overall stock and enhances the potential enjoyment. Conversely, defensive consumption frees time and energy to consume more goods and services and, consequently, creates a demand for products from new sectors (Witt 2001). Hence there are mechanisms at work, on both the supply and demand sides, to generate the continuous introduction of new goods, services, and industries (Chai et al. 2007). The sustainability of capitalism may thus depend on the strength of the habituation effect, which is likely to trigger crises of over-production when (given increasing amounts of time and energy) new possibilities for consumption do not find concrete realization. It should also be noted that the creation of the required level of demand necessitates sufficiently high wages in both old and new industries. In other words, sustainability requires the operation of a dynamic form of Say's law (Pasinetti 2001). Finally, continuous introduction of new goods also runs the risk of harmful environmental effects.

In *EPOG*, Keynes envisioned a future where human beings work significantly less and tend to consume art and culture in their leisure time. Could creative—rather than mass—production and creative—rather than defensive—consumption thus result in a more sustainable version of our troublesome and decaying, though once vibrant and growing, capitalism? We here elaborate on Baumol and Bowen's (1965) reflections on the "cost disease" affecting cultural activities. Although a problem for the cultural industry, the cost disease might conversely generate opportunities for the economy as a whole (following Thorsby 1995), especially when the sense of "art" and "culture" is extended to include the (potential) components of any (and craft-produced in specific) object (Chartrand 1988). Yet, consumption patterns are also likely to evolve to accommodate the growing importance of art and culture in both production and consumption, not to mention required adjustments in the use of "other" goods and services. The continuous quest for stimuli through the consumption of new varieties which require low consumption skills thus represents a perfect demand-side mirror image of mass-production technology. Firms market the distinctive kind of consumption that ensures the absorption of production, while pervasive media disseminate the myth of defensive consumption; imitation and herdish behaviour therefore tend to become the rule among consumers.

Whether this dynamic balance is sustainable in the long-run is highly questionable. On the one hand, consumers might face satiation of their needs, as well as constraints in the time available to consume (Chai and Moneta 2008). On the other hand, a constant increase in the production of goods and services requires a corresponding increase in the use of resources, engendering harmful externalities of production, such as pollution, and requiring disposal of old artefacts. Witt (2011) therefore doubts that the ecological and socio-economic system can sustain this pattern of development:

> It would be an illusion to believe that, in an economy committed to growth, producers could escape from the spiral of saturated markets triggering innovations that aim at creating additional demand that sooner or later is satiated too. It would be illusionary to assume that producers facing increasing saturation in the rich economies would not seek, or even press for, the opportunity to expand into non-saturated markets of the developing

> economies—advertising and propagating the devastating, resource-intensive consumption patterns there to hundreds of millions of future consumers. (p. 113)

This paper identifies the main mechanism that has steered this century-long shift from craft- to mass-production. Focusing on creative consumption (to use Scitovsky's expression) and the role of active public policies towards educating the public, the paper attempts to offer a suggestive solution on how the path may be reversed.

2 The Endogenous Limits of the Capitalist Mode of Production

In the *Wealth of Nations*, Adam Smith considers how the relationship between the division of labour and the size of markets acts as a key driver of modern economies. In his analysis, the division of labour leads to productivity gains by allowing workers to focus on a single step of the production process. Exclusive attention to only one or a few defined tasks increases the dexterity of the worker, as well as chances for technological or organizational improvements in the process. Along the same lines, Marx pointed out that the division of labour is the prerequisite for the substitution of labour for capital: the production process needs to be divided into simple tasks because machines cannot perform complex operations. In addition, according to Smith (1909[1776]), the size of the market imposes a constraint on the division of labour because efficiency requires that workers perform only a few tasks:

> When the market is very small, no person can have any encouragement to dedicate himself entirely to one employment, for want of the power to exchange all that surplus part of the produce of his own labour, which is over and above his own consumption, for such parts of the produce of other men's labour as he has occasion for. (p. 24)

However, increases in productivity generated by the division of labour may ultimately reduce prices, make goods affordable for a larger segment of the market, and expand demand by relaxing the limitation of the division of labour itself. Despite his faith in the ability of the system to self-adjust, Adam Smith acknowledged that labour substitution was not necessarily positive for everyone involved, since it could foster deskilling for some workers. Moreover, it is important to underline that Smith defined demand as a "limit", highlighting its potential role as a constraint. This lexical choice might be read as an *ante-litteram* disagreement with Say's law—"production of commodities creates, and is the one and universal cause which creates a market for the commodities produced" (Mill 1808, p. 81)[1]—famously suggesting that shortfalls on the demand side cannot be conceived as (and pose) limits.

[1] James Mill's definition of Say's law is adopted here, for it does not directly evoke any monetary assumption, as in Say's original formulation.

However, existence of a feedback loop between productivity gains and demand growth has rarely been challenged in mainstream economics, notwithstanding numerous early warnings in economic theory. Karl Marx, for instance, introduced the concept of technological unemployment, and discussed the implications of productivity gains for workers. In the Marxian view, capitalistic systems of production deeply modify the nature of the use of a technology: notably, the pre-capitalistic system is characterized by craft-production, wherein technology is seen as an extension of human ability, while process technology in modern capitalism replaces man-power with machineries. It should be noted here that different types of technology have a strong impact on the outcome of production processes (Guerzoni 2010, 2014). Use of machine-based production does not result in standardization and productivity enhancement of necessity. On the one hand, by creating order and, consequently, by reducing uncertainty, standardization enables the efficient systematization of the production process. Moreover, contrary to the received view, it does not necessarily impinge on product quality. Rather, standardization can increase accuracy in the definition and production of standards: or, in other words, "the alleged sacrifice of quality to quantity is a myth" (Rae 1984, p. 53). However, at the same time, a trade-off does indeed exist between standardization and variety: "the consumer gets lower costs but at the expense of variety" (ibid.). Overall, the shift from craft production to the greater reliance on machines, as occurred for the American system of production in the mid-nineteenth century, changed the output of production from highly customized expensive goods to standardized cheaper products. A most displeasing outcome of this shift in the mode of production is reflected by technological unemployment: human craft simply becomes obsolete for the execution of certain tasks that can be better and more cheaply performed by machines, as shown by the example of the hand-loom operators, whose "extinction [was] finally sealed in 1838" (Marx 1867, Chap. 15).

In this regard, even while recognizing that part of the now-unemployed workforce could be reabsorbed by the machine-manufacturing sector, Marx still predicted that a large portion of dismissed workers would feed an "industrial reserve army" (ibid.). The Marxian tradition generally maintains that a high percentage of the population in poverty could limit the extent of the market and, therefore, act as a mechanism triggering periodic crises of overproduction. However, works in this tradition also propound an unambiguous political (and revolutionary) agenda and, despite their continuing importance in political debates, have been neglected in the economic literature for the most part. In the political sphere, conversely, we can observe how both Rosa Luxemburg (1921) and Lenin (1917) interpreted the tensions among nations which ultimately resulted in World War I as having their roots in the quest of industrialised countries to gain access to new markets and thereby escape overproduction in Europe.

Nevertheless, the more optimistic interpretation of Adam Smith's thought has become the cornerstone for modern political economy. But then, at least in the United States, the early years of the nineteenth century provided a great deal of evidence for positive feedback loops between labour-substitution rates and market size. By way of example, the sharp division of labour that occurred with the

introduction of the moving assembly line at the Ford Factory, and the subsequent replacement of labour with mechanical presses across various production stages, made the Ford Model "T" affordable for millions of Americans. The ever-growing size of the market then allowed the automotive industry to hire a number of workers significantly higher than that of labourers made obsolete by the machine (Womack et al. 1991). Moreover, the remarkable growth of the automotive industry led to increased demand in both upstream (steel) and downstream (roads, building, oil) industries, and raised average wages on a wider scale (ibid.). In other words, the case of Henry Ford offers evidence for a positive feedback between division of labour, labour substitution and the extent of the market (Guerzoni 2014).

Notwithstanding the legacy of Smith's work, economic theorizing in the early nineteenth century generally disregarded the role of the positive effects of an increase in market size on technological processes. Indeed, equilibrium-based approaches have difficulty incorporating the increasing returns derived from such positive feedbacks, i.e. without abandoning the hope of defining any analytical form of equilibrium. While offering, within "The irrelevance of equilibrium economics", the most detailed account of this dyscrasia in Smith's influence upon economics, Kaldor (1972) acknowledged both Young (1928) and Myrdal (Myrdal and Sitohang 1957) for their pioneering role in raising the issue of increasing returns. Young (1928) analytically explained the increasing returns resulting from the interplay between size of the market and division of labour both within and among industries, thereby prefiguring endogenous growth theory (Kaldor 1972). And yet, mainstream economic theory has, de facto, incorporated positive reinforcement mechanisms only in endogenous growth models. But the models that incorporate such mechanisms necessarily predict explosive growth paths when assuming productivity gains and market-size increases. In short, at least until the advent of complexity economics (see Arthur 2014), mainstream models have carried on embedding increasing returns without discarding the traditional equilibrium approach. Put simply, while the latter applies an over-optimistic interpretation of Smith's writings to use of a static model, mainstream economics develops growth models relying on those same, over-optimistic ideas.

The first author to take serious consideration of the word "limit" in the Smithian expression of "the division of labour is limited by the extent of the market", and to reflect upon the early warnings of the unintended consequences of productivity gains and labour substitution, was Pasinetti. Pasinetti's (1983) work adopts a meso-economic approach wherein the macro-level aggregate is conceived as an interlinked system of sectors; it thus highlights the impact of intermediate and final demand, income distribution, and composition of expenditures upon growth. The title of Pasinetti's work, "Structural change and economic growth", clearly reflects that change, not equilibrium, is *the* central issue in economics, with Pasinetti analytically demonstrating how change, in the long-run, is driven by demand conditions. In the words of Pasinetti (1983): "This other series of solutions say that the quantities to be produced depend on demand factors, namely on the per capita evolution in time of consumers' preferences and on population" (p. 141).

In a subsequent work, Pasinetti (1993) also incorporated increasing returns and the possible effects for unemployment owing to productivity growth. Unfortunately, Pasinetti's work on structural change has not received the attention it deserves; his book "Structural economic dynamics: A theory of the economic consequences of human learning", published in 1993, has been largely neglected by the literature. A notable exception is the work of Saviotti (1996, 2001) and Saviotti and Pyka (2004, 2009), wherein Pasinetti's intuition is used as the starting point for developing a more dynamic model of structural change. By highlighting the imbalances generated by increasing returns and changes in consumption level and composition, Saviotti's contributions belong to a stream of innovative studies adopting a very dynamic perspective on industrial sectors. In this regard, maybe the most convincing account of sectoral evolution is the Industry Life Cycle (ILC) theory first propounded by Abernathy and Utterback (1978).

From the perspective of ILC, each new sector undergoes, at the industry level, the historical transformation of the capitalistic system. Consider a sector that emerges in the market to exploit the opportunity of a new technology, as in the case of the personal computer industry after the invention of microprocessors (Malerba et al. 2001). In the early days of the industry, neither producers nor consumers knew exactly what kind of needs the new technology could fulfil. In situations such as this, firms try out different designs of the product, where the word 'design' is conceived as a match between consumers' needs and technology opportunities, and each product design represents an attempt to find the best match between needs and opportunities (Alexander 1964). During this time, the high uncertainty about future product characteristics and very limited initial size of the market make mechanization of production unviable. In this context, goods are still often hand- or craft-produced by small companies, as for instance in the legendary garage in Silicon Valley. With the passing of time, however, both consumers and producers gain a better understanding of both technology and market needs until a firm's capacity to identify and then supply the most satisfying product design allows it to rapidly gain market share, establishing its product as the de facto standard in the industry. This product is thus labelled the "dominant design" (Abernathy and Utterback 1978). When a dominant design appears in the market, the industry dramatically changes, for most firms realize that they are simply unable to align their production to the new design, causing them to ultimately leave the market. The few surviving firms no longer compete on product quality and design, but on price. The consequent need to decrease the costs of production, coupled with declining levels of uncertainty in the market, induces firms to invest in capital-intensive technology and to produce a cheaper version of the good. Increased diffusion of the good, triggered by both lower price and the incidence of imitative behaviour, activates the positive feedback loop among standardisation, mechanization, and the extent of the market.

Despite the evident need to reduce costs, firms do not necessarily welcome standardization, because price competition drastically reduces potential margins and profits. Similarly, from a demand perspective, consumers, over time, may tend to avoid *keeping up with the Joneses* and other forms of herd behaviour: possession can instead emphasize distinction (Starr 1965; Guerzoni 2014). With the maturing of an

industry, such an aversion of both consumers and producers to standardized products usually results in the adoption of strategies of product differentiation, which, however, tend to generate variations on the dominant design, rather than truly new products (Corrocher and Guerzoni 2009; Corrocher and Guerzoni 2015). The mass-customization paradigm, postulating a mode of production that yields economies of scale while overcoming the trade-off between quantity and variety (Pine 1993) nevertheless remains, for the time being, a false promise (Agrawal et al. 2001).

Inspired by Pasinetti's work, Saviotti explored the implications of this theory at the aggregate level. An economy characterized by sectors that shift from product to price competition, and leveraging on productivity gains enabled by standardization, mechanization and production, is specifically argued to be constrained to the production of an increasing quantity of output with a relatively declining share of labour. Moreover, markets may reach a state of saturation: this occurs when all potential consumers have already purchased the product, a second-hand market is well established, and replacement occurs only rarely. At the aggregate level, this manner of sectorial dynamic generates imbalances, since labour substitution may produce unemployment and hinder the aggregate demand for consumption (Saviotti 2001). Saviotti thus concluded that the development of new product varieties, which cause new industries emerge, is a necessary component of modern capitalism. More precisely, it can be argued that "growth in variety is a necessary requirement for long-term economic development" (Saviotti and Pyka 2004, p. 269), and moreover that "variety growth, leading to new sectors, and productivity growth in pre-existing sectors, are complementary and not independent aspects of economic development" (ibid.). Both these hypotheses, however, assume the possibility of significant changes to consumption, which may make it hard to absorb an increasing number of goods and services. The next section discusses this issue with reference to Scitovsky's work.

3 From the Mode of Production to the Mode of Consumption

In his first article on how economic growth impacts consumption (see Bianchi 2003), Tibor Scitovsky speculated on the reasons why things had gone differently than Keynes' predictions in *EPOG*. Despite economic progress and higher living standards, there had been little effect on leisure time, or to the time devoted to cultivating the "art of life". According to Scitovsky's interpretation, this was due to the fact that leisure time had simply been redistributed from professional people to manual labourers, and also reflecting a parallel increase in labour costs (due to productivity growing less rapidly) in the sectors of personal and repair services, which induced the middle class to perform such services for themselves. As Bianchi explains, this shows Scitovsky—anticipating Baumol and Bowen's (1966) "cost disease" argument (see also Besharov 2005) on the existence of productivity lags for a number of

sectors producing goods and services, including the live arts—highlighting the consequences of leisure activities being especially time-consuming. This general issue was also addressed in *The Joyless Economy*, where Scitovsky (1992[1976]) made use of extant advances in neuro-psychological studies into motivation and individual welfare, in particular explanations of economic behavior focused on the concept of arousal. Scitovsky elaborated upon a distinction drawn by Hawtrey (1926) between defensive and creative products, that is, between products intended to prevent pain and those goods that deliver positive satisfaction. He thus introduced a distinction between comfort and pleasure, where "comfort" refers to activities intended to relieve physical pain and distress, or to avoid fatigue and/or save time, effort and skill, whereas "pleasure" is used to describe activities that delight the senses and enrich one's faculties.

On this basis, Scitovsky then distinguishes between comfort- and novelty-activities in terms of the underlying motivations: notably, freeing oneself from discomfort (such activities are outcome-oriented) and enjoying the process-oriented rewards derived from working toward the goal itself. However, a conflict may arise, and usually does, between the resulting patterns of defensive and creative consumption. It does so for two reasons. First, activities intended to deliver positive satisfaction or gratification (participating in a rewarding philosophical discussion, or watching a play at the theatre) require the consumer's engagement in terms of time, knowledge, and skills. Conversely, those activities devoted to preventing pain or distress (such as driving home instead of walking) are intended to reduce the level of effort required. Second, pleasure can come only at the expense of comfort, and vice versa. In the underlying neuro-psychological theory for his framework (Berlyne 1971), overstimulation and under-stimulation are both sources of discomfort: e.g. comfort is derived from removing causes of discomfort. Pleasure, however, is correlated not so much with levels of stimulating situations as with changes in such levels. Instead, pleasure is the result of relieving too much or too little stimulation: it increases when the individual passes from boring to less boring situations (via arousal-boost mechanisms) or from threatening to familiar situations (via arousal-reduction mechanisms). Hence, comfort signifies a negative state of progressively declining pleasure; such that both stimulating and comfort-producing activities, with the passing of time, erode one's degree of pleasure. Creative consumption derives its importance from being a source of pleasure produced by the desired change in the level of stimulation: that is, "because of the skills they require, their complexity and variety, and their separateness from mere need, [creative activities] can be a constant source of novelty and change" (Bianchi 2003).

In contemporary societies, patterns of defensive consumption prevail. As a result, economists are mainly interested in attaining freedom from discomfort, and consequently tend to neglect excitement deriving from novel activities that challenge a person's faculties (as in the case of enjoyment of the arts, an activity that does not require previous states of comfort; see Pugno 2014). There are three basic reasons for this (see Gilead 2013): first, the natural tendency to seek comfort that makes life easier and offers immediate forms of pleasure; second, the influence of Puritanism and other religious traditions favouring exactly such forms of consumption; third,

the benefits that accrue to entrepreneurs who can exploit the larger market of defensive goods (intended to serve common human needs) that have immediate appeal to consumers, and the resulting possibility of economizing on the scale of production.

Today's societies keep individuals in a state of comfort and intermediate level of stimulation, so that it becomes increasingly difficult to achieve higher levels of pleasure. Pleasure is inevitably sought in defensive consumption itself, and therefore in continuously consuming the standardized products of mass production, which exhibit very limited novelty and variety. Despite the rapid replacement of goods, as in the case of fashion items (see Bianchi 2002), or their rapid accumulation (both occurring much faster than required for functional reasons), "the stimulus associated with mass-produced new varieties fades much more quickly than the initial pleasure they yield would lead us to anticipate" (Bianchi 2003). Such goods, moreover, present a package to the consumer over which s/he has no command: the "extra comfort one buys with novelty in this way can be much greater than expected or than one was willing to pay for" (Bianchi 2003). This produces socially harmful outcomes, like excessive emphasis on, and absolute necessity of, continuous and rapid economic growth, expensiveness, exhaustion of natural resources along with permanent damage to the environment, as well as reduced well-being and individual satisfaction.

Scitovsky is therefore compelled by his chosen theoretical framework to introduce "skills" in order to explain how people can be motivated to seek novelty even without having previously experienced a state of discomfort—or, in other words, to clarify why people tend to prefer novelty-activities to consumption-activities. The notion is absolutely central. Consumers are endowed with various amounts of "consumption" (i.e. "leisure" or "life") skills that constitute an initial source of competitive disadvantage for creative consumption relative to defensive consumption: hence, relatively high costs of access, so to speak, make creative activities more onerous and—reflecting a further disadvantage—not immediately rewarding. Consumption skills consist of culture (knowledge acquired through experience and training) and skills in learning. If consumers do not, in general, publicly express their dissatisfaction—Scitovsky's analysis is a powerful challenge to the idea that preferences can be inferred from consumers' actual behaviour and choices—, this is due not only to the economic and cultural roots of defensive consumption but also to the lack or scarcity of consumers' skills (Bianchi 2003).

Permeated by a culture of production and a puritanical ethic, mass-production societies favour professional training and specialized production skills, with the ultimately paradoxical result that any increases in productivity (which free up time and energy) do not produce an incentive to cultivate those "arts of life". While production efficiency requires specialization, consumption efficiency however requires general abilities: production skills cannot therefore be used as consumption skills. Consumption is in fact an activity that involves various, if not all, dimensions of people's lives in order to fully enjoy its fruits; it requires skills, engagement and investment in both information and experiencing novelty itself (see Bianchi 2003).

Both novelty- and comfort-activities can thus be characterized by "internal economies" and "diseconomies", which respectively enhance or impair individual abilities to evaluate all the consequences of a consumption activity. Experiences of novelty can then help to accumulate consumption skills (provided that they are adequate, i.e. neither overabundant nor scant) and, theoretically at least, permit the expansion of creative consumption over time. However, any enjoyable stimulus creates a positive reinforcing effect that must counteract the law of diminishing pleasure associated with the formation of habits: habits provide comfort, which prevents us from breaking them. The tragedy, so to speak, of defensive consumption is that comfort (ultimately) prevails, defeating the quest for novelty which would otherwise provide an antidote to adaptation to comfort itself.

4 Ars Ultima Spes: A Beneficent Interpretation of Baumol and Bowen's "Cost Disease"

Baumol and Bowen (1965) famously pointed out that cultural industries, and specifically the performing arts, cannot enjoy the productivity gains available over time to other sectors of the economy. It is not, in fact, possible to deepen the division of labour within an orchestra, or in a theatre group; nor is it conceivable to employ machines to directly substitute for manpower. Moreover, cultural industries "can serve as a textbook illustration of activities offering little opportunity for major technical change" (Baumol and Bowen 1966, p. 500). These authors theoretically discussed (1965) and empirically proved (1966) that, while productivity remains generally constant, labour costs increase proportionally to the economy's average productivity growth. As a result, the cost per output, relative to other sectors, grows without limit: the combination of increasing labour costs, slow increases in price, and an impossibility to reduce fixed costs subjects firms operating in those sectors to financial instability in the long-run.

Nevertheless, the economic problem of cultural industries could represent an "economic possibility for our grandchildren". There is long-standing debate in the literature on a possible beneficent side of the "cost disease", stemming from expansions in "the set of feasible output combinations" that accompanies the increase in relative costs, adopting the words of Bradford (1969). However, the case for a more optimistic interpretation of the cost disease depends on the positive network-externalities of arts and their alleged public-good nature. But the "cost disease" can also be read as a reflection of the impossibility, for some industries, to comply with the shift—favoured by division of labour, learning economies, labour substitution, and technical change—from craft—to mass-production, as characterized the industrial revolution. Such a shift evidently affected the historical evolution of industries as well, with an obvious exception made for cultural industries: after all, culture cannot be standardized. Every theatre play, every symphony is intrinsically different from all others, also because any single live performance is unique.

Likewise, the value of a work of visual art consists in its rarity. It is true that, as in the aesthetics of Walter Benjamin (2008), the technological reproducibility of works of art has evidently impacted on the cultural industries: technology is able to detach a work of art from both its spatial and temporal uniqueness. Yet this decoupling has mainly occurred in the popular industries of music and movies (in a word, entertainment), which only marginally overlap with art and culture. Despite technological feasibility, high-volume replication of art is not broadly viable without damaging artistic content. This property of the relation between technology and manpower makes arts and culture not scalable, and entails the impossibility of exploiting economies of scale. In other words, the means by which the output is produced in cultural industries is much closer to craft- than mass-production: technology and tools do not substitute for labour, rather they are an extension of the worker that is used to enhance her/his ability. There is probably no better illustration of the complementarity between the perfection of a technology and human *noesis* than a musician in the act of playing her/his instruments. Bradford's intuition about the expansion of output combinations can thus be interpreted in terms of the impossibility, for cultural industries, to trade variety for cheaper production costs. In this framework, it is therefore fundamentally wrong to characterize the anomalous nature of cultural industries solely in terms of the cost structure, since differences in costs are mere epiphenomena of underlying technologies.

Moreover, the consumption of arts and culture is not wholly compatible with mass-produced culture. Instead, it fits with Scitovsky's category of active consumption. This might be of help for the identification of possible (theoretically, at least) alternatives to the unsustainable dynamics of today's capitalism. From this perspective, Baumol and Bowen's cost disease is thus a disease only in relative terms: what matters is the price-to-cost ratio relative to other sectors. The fact that cultural industries cannot but resist the shift towards mass production, and must necessarily compel demand to sustain creative forms of consumption, might then be seen in a positive light, as an illustration, that is, of the fact that different configurations of production and consumption are still possible for other sectors as well. The "disease" implied by Baumol and Bowen's effect would obviously be of a reduced magnitude if craft production and creative consumption tended to be the rule rather than the exception: small increases in productivity would evidently involve the economy as a whole.

Whether and in what direction the production and consumption of goods and services will evolve is a purely speculative matter, and there are no reasons to expect a major change in this regard. In fact, market forces alone cannot produce such a change, since competition obliges firms to invest in cost-reducing technologies. For the same reason, firms have no incentives to market to (nor indeed encourage the growth of) active-consumption habits. On the contrary, they tend to plan for the obsolescence of mass-produced new varieties, even shorten the life-cycle of products to speed up replacement time. Moreover, consumers are locked into their defensive consumption habits, since creative consumption requires skills which can be costly to acquire. The solution thus lies elsewhere: public intervention is

required. The next section will therefore elaborate upon Keynes' and Scitovsky's respective views on this matter.

5 Arts, Culture, Education, Consumption

As Bianchi (2008) has observed, Scitovsky (1987) was firmly convinced that Western societies had already passed the point of satiety. If mainstream economics could however continue to assume a world of insatiable demand, Scitovsky believed this was due to an overinvestment of individual and social resources in defensive activities. Scitovsky's and Keynes' analyses seem to converge on this point, a telltale sign of their corresponding attention to the arts and a shared tendency to highlight this enjoyment as a possible counterweight to, respectively, the social prevalence of the utilitarian ideal and of defensive activities. The arts, as Pugno (2014) maintains, play a key role in Scitovsky's analysis of culture. What is wrong with the arts is what is wrong with society, Scitovsky (1972) wrote. By exploiting the motivation to learn as a type of learning skill emerging during infancy and childhood, people endowed with artistic culture come to be able to easily decode uncodified information from objects of art in order to derive enjoyment. This explains (along with the above-mentioned economic and production reasons) why society tends to underinvest in creative activities, such as enjoying the arts, which would seem, conversely, a natural source of potentially endless demand (Bianchi 2007). According to Scitovsky (1972, p. 62): "If the arts get insufficient attention and insufficient funds. . . consumers' preferences are mainly to blame and changing them the best remedy."

To explore this further, Scitovsky proposes a change of perspective: the real question is why the minority able and willing to enjoy the arts has remained a minority, despite increases in the overall standard of living. The existence of an elite is a product of money and education, as human societies from classical Greece to eighteenth-century Europe have illustrated quite well. And yet, even with the freeing of greater time and energies from not having to work as much, people seemed to have little interest in the arts of life. The "unskilled consumer" of contemporary societies does not "exert himself to enjoy and enrich his life", in the words of Scitovsky (1972, p. 65), and so "the satisfactions accessible to [the consumer] become pretty restricted". He therefore further observed that the economic difficulties of art have more to do with consumers' preferences, such that "our very modest appreciation of the arts is part and parcel of our very modest enjoyment of life" (p. 68). In this vein, he explains that even "our government's miserly attitude towards the arts is again an integral part of a larger collective preference system, which is fully in keeping with consumers' preferences as revealed in the market place" (ibid.). But, echoing Peacock (1993), Scitovsky argued that no purely economic motivation exists for publicly subsidizing the arts. In his words: "The only valid argument" is instead that "it is a means of educating the public's taste and that the public would benefit from a more educated taste" (ibid.). He believes that society

must experience "continuing education" as a result, even if the outcome depends on how and where funds are spent. Even within the arts, one may distinguish between those that are safe and comfortable and those more experimental and demanding. Society, once again, tends to favour the former over the latter, whereas all arts deserve equal treatment, that is, "if we aim not at national prestige but at helping the public to learn to enjoy the arts" (ibid.). Interestingly, Scitovsky mentions Covent Garden as an example of safe, over-subsidized (by the Arts Council of Great Britain) art. And he argues in favour of spreading subsidies as a "means of maintaining competition and consumers' market pressure to keep prices and costs from skyrocketing" (p. 69).

All this brings us to Keynes and his plea for public support of the arts. In *Art and the State*, published in 1936, an ideal but necessary complement of *EPOG* (and, as Mini 1994 observed, the "end" achieved by the "means" of the *General Theory*), Keynes outlines the foundations of a sort of non-materialistic welfare state. "In dealing with the arts", writes Moggridge (2005, p. 539), Keynes' view of the role of the state "was hardly economic in the modern sense", where by "modern" Moggridge admittedly has in mind Baumol and Bowen's analysis of the "cost disease" or Peacock's *Paying the Piper*. Its non-economic character depends, however, on the fact that Keynes wanted the state to play a vanguard role in favouring that type of change of *perspective* which he associated with the end of the economic problem. Indeed, according to Keynes, this is just one element of a complex dynamic wherein it will be possible to change policies "if we change the philosophy underlying them" (CWK, Vol. 28, p. 347). It is the state, as has been already observed, that must show how to be disobedient to the pecuniary test: "It is the conception of the Secretary of the Treasury as the chairman of a sort of joint stock company which has to be discarded" (CWK, Vol. 21, p. 243).

Environment, culture, and the arts are the issues at stake in *Art and the State*. It is the state that must preserve both the countryside from exploitation "for reasons of health, recreation, amenity or national beauty" (CWK, Vol. 28, p. 343), as well as the national monuments, i.e. "the permanent monuments of dignity and beauty in which each generation should express its spirit to stand for it in the procession of time" (p. 344). But even more important are:

> the ephemeral ceremonies, shows and entertainments in which the common man can take his delight and recreation after his work is done, and which can make him feel, as nothing else can, that he is one with, and part of, a community, finer, more gifted, more splendid, more care-free than he can be by himself. (ibid.)

Moreover, it is a primary task of the state to "abolish the positive impediments which, as some odd relic of Puritanism, we still impose on the business of public entertainment" (p. 345). For instance, Keynes observed that the state should subsidize by all means, instead of burdening "with a heavy, indeed a crushing, tax" or even making it "a proper object of taxation", the "new and difficult business requiring large-scale, costly experiments, capable of revolutionising the relation of the state to the arts of public entertainment, contributing more both to the recreation

and to the education of the general public than all other mediums together" (ibid.), namely the BBC.

A remarkable feature of Keynes' reflections on arts and public support (see Moggridge 2005; Cedrini 2006; Dostaler 2010) is his insistence on the possibility of self-organisation and self-sufficiency, so to speak, of the two sides of the arts "market". When discussing the relevance of arts during wartime, the therefore argues that:

> if with state aid the material frame can be constructed, the public and the artists will do the rest between them. The muses will emerge from their dusty haunts, and supply and demand shall be their servants. (CWK, Vol. 28, p. 361)

State aid plays a key role in this vision. First an art collector, then a patron, and finally the chairman of the British Council for the Encouragement of Music and the Arts (CEMA), the predecessor of the Arts Council of Great Britain, Keynes believed that in the future, "the theatre and the concert-hall and the gallery will be a living element in everyone's upbringing, and regular attendance at the theatre and concerts a part of organised education" (ibid.). In *EPOG*, Keynes claimed that we have been "expressly evolved by nature—with all our impulses and deepest instincts—for the purpose of solving the economic problem" (CWK, Vol. 9, p. 327), whereas "if one believes at all in the real values of life, the prospect at least opens up the possibility of benefit" (ibid.). In this way, he stresses that the "wives of the well-to-do classes" and the "old charwoman" will only exploit this possibility, rather than experiencing a nervous breakdown, if prepared to do so. Or, in Keynes' more expressive tones: "With psalms and sweet music the heavens'll be ringing … yet it will only be for those who have to do with the singing that life will be tolerable—and how few of us can sing!" (pp. 327–328).

With additional emphasis on the social dimension, Keynes argued that "we must not limit our provision too exclusively to shelter and comfort to cover us when we are asleep and allow us no convenient place of congregation and enjoyment when we are awake" (CWK, Vol. 28, p. 370). If Keynes did not live long enough to assert that "what's wrong with the arts is what's wrong with society" (Scitovsky 1972, p. 65), it could still have been Scitovsky who wrote those three above-cited lines. And yet, ironically enough, the reading he puts forward for Keynes's economics is the more conventional one:

> Keynes rescued the respectability of spending money, if not as a source of enjoyment, at least as a means of stimulating production, employment and profit; but we have never overcome our moral embarrassment over spending time and effort on enjoyment or acquiring the skills of enjoyment. The American consumer has relinquished to the producer all initiative, expertise, even discernment, concerning the taste and quality of most consumers' goods, from the food he eats and clothes he wears to the furnishing around him. He takes a passive attitude to consumption, relying on the seller to supply the know-how and relieve him of the bother. He even takes pride in being an unskilled consumer. (ibid.)

Scitovsky, too, focused his attention on the importance, in negative as well as positive terms, of education for the well-being of individuals in society (see Gilead 2013). In affluent societies characterized by high degree of competition and surplus

skilled manpower, production-oriented education, with its emphasis on the professional and technical skills that support production (and the resulting crowding-out of humanities and culture from curricula), is directly responsible for the formation of an over-trained workforce. This comes with the paradox that, by inducing greater demand for it, production-oriented education tends to be self-reinforcing. And it favors defensive over creative consumption (which should lead to "the enjoyment of extending and deepening one's experience and knowledge of the world in any of its aspects"; Scitovsky 1986, p. 60), instead of providing alternative sources of stimulation. Arts are moreover a special form of creative consumption: their consumption "is intended to yield pleasure by affecting stimulation levels but also demand skills and previous knowledge that open the door to new forms of enjoyment" (Gilead 2013, p. 632). However, Scitovsky maintained that sports, games of skills and a taste for quality food perform similar tasks, and are therefore to be classified as creative forms of consumption as well.

A (more) humanistic education can conversely help individuals to escape the duality between comfort and pleasure by inducing a shift away from defensive towards creative consumption—wherein comfort usually enhances, instead of reducing, pleasure. Humanistic education, above all, furnishes people with the consumption skills required to access the (otherwise difficult to calculate) value of creative consumption and perform a costs-benefits analysis of investing in consumption (rather than production) skill. Enhanced consumption skills would generate considerable increases in the pleasure that can be derived from consumption itself, and reinforce the spread of its creative version by contributing to the diffusion of, and further demand for, cultural activities.

As Gilead shows, Scitovsky's conception of education, and his desire for educational reform, end up being quite limited. In notable contrast to Keynes, who instead adopts an Aristotelian view of the potential betterment of life, Scitovsky fails to consider the benefits of education in non-instrumental terms. In spite of this, he still offers an alternative to both the mainstream (fully utilitarian) consumer-sovereignty view of education as "primarily aiming to teach consumers to fulfill their desires" (Gilead 2013, p. 635) and its main competitor, developed by critical theory, which tends to see consumers as victims, so to speak, of capitalism and culture industries. Gilead convincingly argues that Scitovsky is the first economist to have provided a justification for education in arts and humanities that is well-grounded within the economic discourse. Scitovsky connects them in fact to economic aims and existing economic realities, and above all offers compelling arguments for supporting humanistic education through his use of a non-elitist framework which relates it to consumption rather than production.

The motivation behind Keynes' practical attempts to educate people on the enjoyment of arts find an ideal supplement in Scitovsky's critical work on affluent societies, and specifically on the tendency to almost exclusively favor, on both supply- and demand-side reasons, defensive patterns of consumption, as well as the supportive role played by education in promoting a production-oriented culture. The Keynes-Scitovsky dialectic could thus offer possible bases for rethinking the unsustainable path followed by current capitalism. In particular, Keynes' picture

(and practical suggestions to prepare for the advent) of the desired society after the end of the economic problem highlights the importance of the perspective that will be used to cope with the troubles of decaying capitalism in an era of affluent societies. In this regard, Scitovsky can be seen as freeing Keynes' analysis from the moral dimension embedded in his work as a "capitalist revolutionary" (see Backhouse and Bateman 2011), and as shedding light on the inherently economic implications of the prevailing patterns of consumption. Scitovsky provides a theoretical framework through which it is possible to address the complementarity between the demand-side and supply-side mechanisms at work. Indeed, it is this feedback loop which crucially nurtures the system via its continuous generation of new goods, services and industries, ultimately resulting in structural overproduction and socio-environmental unsustainability in the medium- and long-term.

That being said, the speculative nature of these reflections somewhat prevent us from discussing the solutions that could be devised to address capitalism's troubles. Nevertheless, although their contribution could use updating (and provided that the paternalist character of the prospected solution is adequately addressed), both Keynes's insights into a possible non-materialistic evolution of the welfare state and Scitovsky's insistence on the importance of correcting the educational biases of our societies in order to promote a culture of creative consumption could serve as guideposts for the way forward. In particular, it seems necessary to reformulate the extant concept of "culture" so as to include those various forms of non-standardized products that make it possible to highlight both the importance of variety and the possibility for its enjoyment. A change of perspective (as expressed by the proposal to take the positive rather than dramatic implications of Baumol-Bowen's analysis of the cost disease) is therefore required, though not to cure the moral inefficiency of capitalism, but rather to correct its unsustainable evolution before having to take more drastic measures.

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Part II
New Perspectives on the Long-Run Evolution of Demand

Tackling Keynes' Question: A Look Back on 15 years of Learning to Consume

Andreas Chai

Abstract Two centuries of continuous economic growth since the industrial revolution have fundamentally transformed consumer lifestyles. Here Keynes raised an important question: will consumption always continue to expand in the same manner as it has in the previous two centuries? If so, how? This paper critically reviews a body of work that has adopted the Learning To Consume (LTC) approach to study the long run growth of consumption (Witt 2001). By borrowing certain established insights from psychology and biology about how consumers learn and what motivates them to consume, it highlights how rising income, new technologies and market competition have combined to trigger important changes in both the underlying set of needs possessed by consumers and how they learn to satisfy these needs. Methodological issues and open questions are discussed.

Keywords Demand growth · Consumer learning · Needs · Endogenous preferences

JEL Classifications D11 · D01 · E21 · 033

1 Introduction

Two centuries of continuous economic growth since the industrial revolution have fundamentally transformed consumer lifestyles in Western economies and raised living standards (Lebergott 1993; De Vries 2008). As John Maynard Keynes (1933) noted in the "Economic Possibilities of our Grandchildren", such rapid progress

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raises an important question: will consumption always continue to expand in the same manner as it has in the previous two centuries? If so, how? Most contemporary macroeconomic models of growth typically do not consider how economic growth influences the composition of household demand and assume that any extra income generated by increases in the productive capacity will be converted into increases in demand ad infinitum (Stiglitz 2008). In contrast, Keynes –following other scholars preceding him (i.e. Menger 1871)– considered the nature of the underlying needs that motivate consumption and how rising affluence may impact their satisfaction. He conjectured that there are two types of needs: absolute and relative needs. Absolute needs are satiable and Keynes argued that within a hundred years, these needs would be sufficiently satisfied to the extent that further energies could be devoted to non-economic purposes (Keynes 1933; Pecchi and Piga 2008). However, relative needs are insatiable because their satisfaction is linked to a desire for superiority over others.

This paper critically reviews a body of work that has adopted the Learning To Consume (LTC) approach to study the long run growth of consumption (Witt 2001; Witt 2016), Witt in this issue). By borrowing certain established insights from psychology and biology about how consumers learn and what motivates them to consume, this body of work aims to provide a more contemporary answer to Keynes' original question. It delivers some insights into the various behavioral forces driving the long run expansion of consumption expenditure and how this process is in some ways intrinsically linked to rising social affluence and technological progress. In the existing Evolutionary Economics literature, it has already been noted how consumer learning processes can play a critical role in various aspects of economic evolution. For example, models of structural change emphasize highlight how the industrial composition of economies can respond to changes in the household composition of demand (Metcalfe et al. 2006; Bertola et al. 2006; Saviotti and Pyka 2008; Ciarli et al. 2010). They also play a role in the formation of niche markets and the degree of demand heterogeneity faced by industries (Malerba et al. 2007; Guerzoni 2010). Multi-agent models of consumer learning further highlight how they influence market dynamics (Aversi et al. 1999; Babutsidze 2011; Valente 2012). A comprehensive account of long run economic growth must consider both the character and speed at which household preferences evolve as household income grows.

Beyond growth, the LTC approach is also relevant to the ongoing question of how to promote the rapid and voluntary adoption of more environmentally sustainable (and less carbon intensive) forms of consumption (Dietz et al. 2009, Woersdorfer and Kaus 2011; Witt 2011). A crucial issue here is to uncover the causes of path dependency in consumption patterns, i.e. why are consumption patterns 'locked-in' (Røpke 1999, 2009; O'Hara and Stagl 2002)? Some potential answers to this issue can be found in the LTC studies that have sought to identify the social, technological and economic conditions in which consumers rapidly accumulate knowledge in a particular consumption domain and actively modify the consumption acts to suit their refined preferences.

The paper is structured as follows. Section 2 summarizes the LTC approach and describes the various types of needs that drive consumption. Section 3 reviews emerging themes in the body of work that has adopted the LTC approach. Section 4

discusses the various factors from these studies that accelerate the accumulation of consumer knowledge. Section 5 critically discusses the methodological benefits and pitfalls of this approach and briefly considers the implications for achieving more sustainable forms of consumption. Section 6 concludes.

2 Learning To Consume

The goal of the LTC approach is to study the underlying process by which consumer preferences are formed. Standard microeconomic models assume preferences are given and fixed. Consumers already know what they want and do not need to learn about which goods will deliver them utility (Stigler and Becker 1977; Swann 2002). Yet to properly explain the long run growth of consumer spending it is vital to consider how consumers come to discover which goods and services are useful in the first place (Menger 1871; Ruprecht 2002). LTC tackles this challenge by borrowing key insights from biology and psychology about what motivates human behavior and how they learn. These insights support Keynes' conjecture that not all 'needs' are the same. There are important differences in terms of how universally shared they are across a population of consumers, how stable they are over time, and the extent to which social environs may shape them.[1] This section will categorize 'needs' into three subtypes: innate needs (fixed, universally shared), acquired wants (subject to slow change, not universally shared) and cognitive motives (subject to fast changes, not universally shared).

2.1 Innate needs

Innate needs are fixed and universally shared by agents due to human biological evolution. They are triggered by hedonic sensations (pleasure and pain) which have evolved to guide behavior and enhance the probability survival (Rolls 2005; Damasio 2003). These sensations guide behavior by encouraging (rewarding) or discouraging (punishing) the behavior that elicit these sensations. Table 1 provides some examples of 'primary reinforcers', which have been experimentally shown to deliver somatic value and thereby encourage or discourage associated behavior.

Some, but not all, of these sensations are related to internal homeostatic mechanisms that require organisms to regularly consume inputs in order to ensure survival. This includes the need for a stable temperature, adequate amounts of water, sleep, nutrition, oxygen, and so on. Lades (2013) models the extent to which an innate need i motivates consumption in category j as:

[1]The view that needs are dynamic and heterogeneous across a population of consumers also distinguishes this approach from other needs approaches found in the social sciences (i.e. Maslow 1943; Max-Neef 1991).

Table 1 Some primary reinforcers (source Rolls 2005:19)

Reinforcer	Effect
Salt taste	Reward in cases of salt deficiency
Sweet	Reward in cases of energy deficiency
Bitter	Punisher, indicator of possible poison
Sour	Punisher
Putrefying odour	Punisher; hazard to health
Pheromones	Reward (depending on hormonal state)
Pain	Punisher
Touch	Reward
Temperature	Reward if tends to help maintain normal body temperature
Crying infant	Punisher to parents
Novel stimuli	Rewards
Sleep	Reward; minimizes nutritional requirements
Group acceptance	Reward
Breathing	Reward

$$v\left(\theta_{i,t}, p_{i,t} \cdot c_{i,t}\right) = f\left(\theta_{i,t} - p_{i,t} \cdot c_{i,t}\right)$$

Where $\theta_{i,t}$ is the level of expenditure required to achieve complete satiation of need i, $p_{i,t} \cdot c_{i,t}$ represents expenditure on the goods as a product of prices $p_{i,t}$ and quantities $c_{i,t}$. The need deprivation level is thereby defined as the difference between the level required for complete satiation and the current level of expenditure, $p_{i,t} \cdot c_{i,t}$.[2] Lades develops a demand functions for goods in which demand is dependent on the relative deprivation of the need and the usual budget constraint (Lades 2013:1022).

This formulation enables one to consider how rising income can trigger changes in the composition of demand by enabling consumers to reach $\theta_{i,t}$ for certain needs. Similar to Keynes' notion of relative needs, both Cordes (2009) and Lades (2013) suggest that for certain socially-orientated needs, rising income can influence $\theta_{i,t}$ such that affluent consumers are driven to consume more in order to attain social esteem (see *inter alia* Scitovsky 1976; Frank 1985; Hopkins and Kornienko 2004). Thus the amount of expenditure needed to satisfy such needs will grow as the average household income rises.

2.2 *Acquired wants*

Another type of consumption need is generated in the learning process that is the general process by which a species adapts to change and behavior is modified in

[2]Note that it is assumed that each need precisely corresponds to one expenditure category. Thus j is not present in the formula, since $i = j$.

response to environmental stimuli (McFarland 1987:2). LTC recognizes the presence of two types of learning, non-cognitive and cognitive learning, that are linked to acquired wants and cognitive motives, respectively.[3] Non-cognitive learning that describes the classical conditioning process (Skinner 1953). An important feature of this process is that the set of stimuli which deliver reinforcement can themselves also change with experience. Specifically, secondary reinforcers are formerly neutral stimuli whose repeated pairing with primary reinforcers results in them exerting a reinforcing effect in their own right (Anderson 2000:39). For example, if a consumer is repeatedly exposed to a certain type of bed sheet when they sleep (a reinforcer, see Table 1), they may acquire a liking for such bed sheets that exists independently of how tired they are. In this way a range of 'acquired wants' are likely to emerge as consumers experience reinforcement and accumulate associations between these experiences and the material environment which surrounds them. These acquired wants will be neither universally shared nor fixed across a population of consumers due to differences in each agent's material environment and the types of reinforcement to which they have been exposed, these acquired wants will be neither universally shared nor fixed across a population of consumers. It is possible to construct a taxonomy of goods according to the type of reinforcement to which they were originally associated (Alhadeff 1982:16, Foxall et al. 2004). Many advertising strategies are based on encouraging consumers to want goods by forming associations between products and reinforcement (Stuart et al. 1987). Through this process consumers can thereby acquire likes and dislikes that are unique to their particular learning history. Lades (2014) elaborates on how acquired wants may be linked to impulsive consumption behavior (see also Laibson 2001; Bernheim and Rangel 2004).

2.3 Cognitive motives

A final type of need is related to cognitive learning by consumers. In contrast to non-cognitive learning, cognitive learning typically describes a problem-solving sequence in which consumers deliberate and use their imagination to find new solutions to a given problem (Earl 1986). Outcomes depend on the creative capacity of agents to access socially available information, analyze open-ended situations, gain insights and find appropriate courses of action (Hergenhahn and Olson 1997:263). In many instances consumers develop strategies for consumption that are based on developing complementarities between different consumption domains and their identity (Earl 1986, 1998). This process helps create demand for '*higher*

[3]These learning modes coexist because the enlargement of human brain capacity did not evolve in a way in which there was a smooth substitution of more advanced learning mechanisms for more primitive ones (Flinn 1997:33, Sartorius 2003). Rather, development was sticky: more advanced mechanisms emerged to complement older mechanisms. This presence of two learning systems is also recognized in dual process theory (Gigerenzer et al. 1999; Kahneman 2003).

order' goods that do not directly satisfy innate needs, but are instead used as inputs into a transformation process for the production of final goods (Menger 1871; Ruprecht 2002; Cordes 2005). For example, an innate need is the avoidance of pain, such as that caused by an illness (see Table 1). As scientific knowledge has generated new socially available knowledge about human illnesses and how they may be avoided, the consumer's knowledge of what constitutes a healthy lifestyle has dramatically transformed and now affects a variety of different consumption activities, including what agents eat, where they live and what clothes they wear (Mokyr 2000). Witt (2001) posits that another source of consumption growth is the increasing degree of scientific and cultural knowledge and the number of higher order goods that agents can utilize in satisfying their needs. This type of demand is not subject to satiation and is discussed further in Section 4.

3 Emerging themes

The literature adopting the LTC approach consists of both historical case studies and empirical studies. Table 2 reports a small sample of the case studies to illustrate how it covers a wide range of consumption domains including nondurable foodstuffs (food and alcohol), manufactured durables (washing machines and shoes expenditure) and services (recreational travel services). One overarching theme present in these studies is that the long run growth rate of consumption in any one particular domain is rarely ever linear (Kindleberger 1989). Rather, consumption growth tends to occur in a discontinuous fashion that features periods of intense acceleration mixed together with gradual slowdowns in consumer spending. While some of this volatility may reflect changes in income growth and supply conditions, demand side factors also contribute towards shaping phases of accelerations and slowdowns. Some of these factors are detailed as follows.

3.1 Demand satiation

One prominent theme is that demand growth for certain goods closely related to the satisfaction of innate needs is subject to periodic slowdowns. 'Demand satiation' is when per capita quantity consumption of a good (with a fixed set of characteristics) ceases to rise beyond a particular level even as household income continues to grow and the good's production costs good tends to fall. This implies $\theta_{i,t} - p_{i,t} \cdot c_{i,t} = 0$ and represents a growth bottleneck (Pasinetti 1981). The key point made by many of these case studies is that these slowdowns in per capita demand reflect changes in individual preferences that take place precisely because the underlying needs that originally motivated demand growth have been satiated. As a result of demand satiation, markets may potentially stagnate as further gains in income tend to be redirected towards the satisfaction of other needs. This contributes to fostering a

Table 2 Some historical case studies employing the LTC approach

Author	Good Years	Need	Demand satiation (Section 3.1)	Satiation escape (Section 3.2)	Non-cognitive learning (Section 2.2)	Specialisation (Section 4)
Ruprecht 2002	Food Sweeteners 1800 -present	Hunger, arousal and health	Satiation identified in the consumption of sugar in post-war US and German markets	Artificial sweeteners emerged as a low-calorie substitute for sugar, enabling further growth in overall consumption of sweetness.	Sweetness is a genetic reinforcer and was used by producers to realize economies of scale by increasing sugar content across a variety of foods.	Social norms concerning health helped create the demand for artificial sweeteners .
Manig and Moneta 2009	Food 1990-2000	Hunger, arousal	Recent Russian food expenditure data shows evidence of satiation in the quantity of certain foods types consumed.	Shifts in satiation level thought to be linked to the growth of food varieties as consumers tend to consume more food if eaten together with other types of food.	As consumers become more affluent, eating for the sake of arousal has superseded the original motive of eating for the sake of avoiding hunger.	evidence suggests that Nutritional information about food seems to have little impact on how much consumer's decide to eat
Frenzel Baudisch 2006	Footwear 1960- 1991	Social recognition, comfort	Satiation identified in the post-war US and German footwear market with respect to consumers demand for comfortable footwear	Satiation drove a separation of process and product innovation in structure of footwear industry in order to achieve economies of scale and scope	As consumers become more affluent, wearing shoes for the sake of status signalling superseded the original motive of wearing shoes for the sake of maintaining comfort	Changing social structure drove changes in how consumer undertook social comparisons & shoe consumption

(continued)

Table 2 (continued)

Author	Good Years	Need	Demand satiation (Section 3.1)	Satiation escape (Section 3.2)	Non-cognitive learning (Section 2.2)	Specialisation (Section 4)
Woersdorfer 2009	Washing machines 1850s – present	Social recognition, Health, drudgery avoidance	Satiation is found to be present in the current US and German consumption of washing machines.	Current satiation levels washing machine consumption is determined by the socially acceptable standard of cleanliness	The want for drudgery avoidance, health and social recognition, rather than demand for time savings, motivated the adoption of washing machines by low income consumers.	The social norms of cleanliness played an important role driving consumer's adoption of washing machines
Chai 2007	Tourism Services 1800 -present	Arousal, Health	No instances of satiation identified.	Urbanisation of domestic environments caused holidays 'away' from cities to be reinforcing, leading to emergence of resort tourism in 19th century	the habituation effect plays an important role in mediating what types of recreational activities consumer engage in, and the rate at which seek exposure to new travel destinations	New communication technologies triggered historic changes in consumer learning patterns, driving demand for remote locations

market environment in which product innovations emerge (as will be discussed below).[4]

The most prominent example of demand satiation is the case of food consumption used to satisfy the need for hunger (Ruprecht 2005; Manig 2010). Amongst the world's poorest, food spending typically represents over half of total household expenditure (Banerjee and Duflo 2007). As households become more affluent, it has been widely observed that their budget share spending on food tends to decline as household income grows (Clements and Chen 1996; Chai and Moneta 2010). In a case study of the growing demand for food sweeteners among Western economies, Ruprecht (2005) highlights how per capita sugar consumption, measured in terms of calories consumed, is typically subject to strong slowdowns in the 20th century. Throughout the Western developed world, the consumption of sweeteners did not rise above 1000 calories per capita per day. This slowdown took place even though household income grew substantially and the actual price of sugar consistently fell throughout the 20th century. Ruprecht argues that this slowdown reflects the fact that as growing income enabled households to consume more calories, this also contributed to satiation in the growth of calorie demand. This is a good example of how the evolved biological nature of humans that has shaped human needs has important implications for the growth rate and structure of economic systems, which have emerged to serve these needs.

Moneta and Manig (2014) provide more evidence for satiation in food consumption. In their cross sectional empirical investigation of contemporary Russian food spending patterns, the authors examine the relationship between calorie consumption and income (see *inter alia* Bouis and Haddad 1992). Moneta and Manig (2014) find that average calories consumed per person in the household per week tends to flatten out at about 2857 calories per day. After reaching this level, their results indicate that increasing income appears to stimulate close to no increases in average calories consumed. It should be noted that while average household calorie consumption is flat, there is substantial variation around this average. This suggests that some households do in fact continue to increase their calorie consumption well beyond the average satiation level.[5]

Is satiation observed among other types of goods besides food? Several case studies confirm the existence of demand satiation in a wide range of goods that satisfy a diverse set of needs including spending on alcohol (Volland 2012), washing machines (Woersdorfer 2010a) and shoes (Frenzel Baudisch 2006). Each of these studies identify periods in which the characteristics of the goods in question were relatively stable and demand growth was very slow in spite of both falling prices and

[4]Several other scholars have noted the important role that critical thresholds in the consumer's demand for certain characteristics play in industry evolution (Lancaster 1971; Adner and Levinthal 2001; Windrum 2005).

[5]In addition, note that making inferences about individual behaviour from such Engel curves assumes that the aggregation process does not substantially influence the shape of Engel curves. Many other factors may influence the shape of Engel curves, such as how consumers change the manner in which they learn from their peers as they become more affluent (Cordes 2009).

rising household incomes. For example, Frenzel Baudisch (2006) examined U.S. shoe spending between 1955 and 2002 and found strong evidence that footwear spending exhibited satiation between 1955 and 1970. Although footwear spending accelerated quickly after 1970s, this was preceded by a prolonged period in which the growth of spending on footwear was relatively stagnant. In this period, demand satiation occurred at a spending level where the average consumer purchased about three pairs of shoes per year. The budget share of footwear spending was declining, which implies that footwear was a necessity – rather than a luxury good. The author reasoned that the slowdown in the growth rate of demand was due to functional satiation (Frenzel Baudisch 2006). It was only after the 1970s that shoes were used to signal status and more specialized types of shoes, such as athletic shoes, started to be consumed *en masse* by U.S. households (discussed in the next section).

Other studies have sought empirical evidence for the satiation hypothesis by investigating the shape of Engel curves using data on household expenditure (Kaus 2013a; Moneta and Chai 2014; Moneta and Chai 2014; see also Bruns and Moneta in this issue). It should be noted that some of the expenditure categories used here tend to be aggregated across goods with different characteristics. Moreover, the demand satiation hypothesis describes slowdowns in the *quantity* of goods consumed, whilst real expenditure data reflects both changes in relative prices and quantities consumed. In spite of this, several of the empirical findings appear to support the conjectures made in some case studies. For example, consistent with Ruprecht's finding of satiation in sugar consumption, the Engel curve for sugar expenditure among British households displays a clear downward trend and a tendency to become flatter between 1974 and 2001 (see Fig. 1 below). This implies that the income elasticity for sugar is trending towards zero over time. Similarly, flat Engel curves that exhibit downward trends over time have been revealed for several food items such as beef, milk, tobacco and fish (Moneta and Chai 2014). Examining an even broader range of expenditure categories, they also found that such flat and

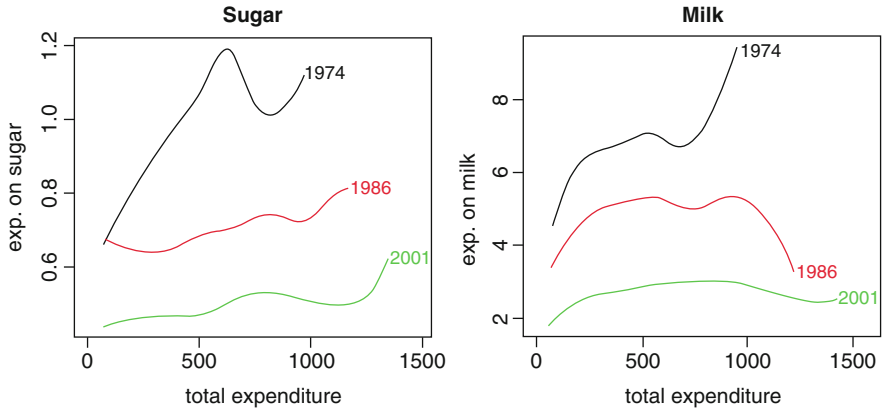

Fig. 1 Non-parametrically estimated Engel curves for sugar and milk for the UK (source Chai and Moneta 2014, Moneta and Chai 2014)

stable Engel curves (consistent with the satiation hypothesis) tend to be more pronounced in goods, but much less prevalent in services. This finding that demand satiation is more prevalent in goods is consistent with existing stylized facts that rising household income is positively correlated with a reduction in the share of consumer spending on goods and an increase in the share of consumer spending dedicated to services (Herrendorf et al. 2013; Boppart 2014).

As a result, demand satiation does not take place consistently across all consumption domains. Several markets exhibit exponential growth rates where no evidence for demand satiation is found. Demand satiation is less frequent in markets that:

i) Serve needs that are difficult to satiate (e.g. status goods)
ii) Feature frequent product innovations (e.g. radio and television)
iii) Are related to services (discussed above).

Concerning point i), Cordes (2009) and Lades (2013) suggest that for certain socially-orientated needs, rising income can influence $\theta_{i,t}$ such that affluent consumers are driven to consume more in order to attain social esteem (see *inter alia* Frank 1985; Hopkins and Kornienko 2004). Thus, as income rises and social peers become affluent, so too does the amount of expenditure needed to satisfy these needs (Charles et al. 2009; Kaus 2013a). Point ii) above is supported by findings in Moneta and Chai (2014, see Fig. 2) and Bils and Klenow (2001b).

3.2 *Escaping satiation*

If demand satiation is present in some markets, how can these slowdowns be overcome, if at all? A second theme of the LTC studies is that the ongoing formation and reformation of connections between goods and the needs can trigger renewed

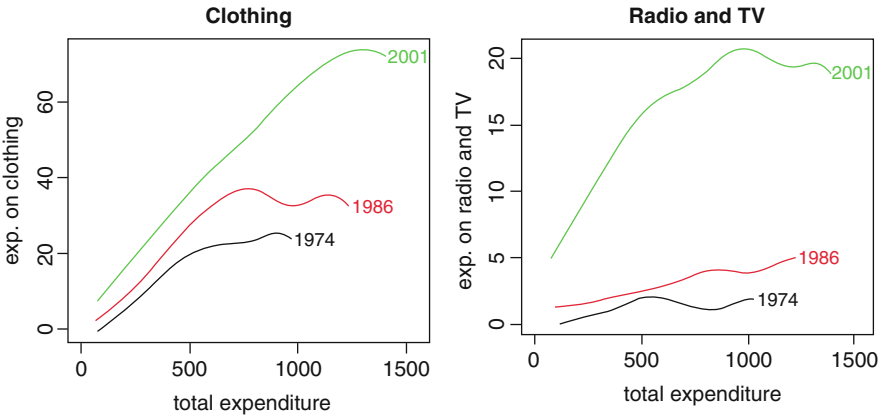

Fig. 2 Non-parametrically estimated Engel curves for clothing and radio & television for the UK (source: Moneta and Chai 2014)

phases of accelerated demand growth. As a consequence of this process, the functional nature of goods – which can be defined as mapping between needs and goods & their characteristics – may be subject to change as entrepreneurs search for new profit opportunities and consumers acquire new motives and knowledge from their experiences. We highlight below three factors that were identified as playing some role in the formation of these new connections between goods and needs.

Firstly, short run consumer learning patterns can stimulate rapid consumption growth when consumers creatively discover new connections between their needs and goods. In some instances, this growth may emerge even when no supply side product innovation has taken place and the physical characteristics of the good have remained constant. We dub these "functional mutations". For example, in the case of U.S. shoe consumption (Frenzel Baudisch 2006), the 1980s witnessed a remarkable acceleration in per capita shoe spending that coincided with the variety of shoes available on the market. Frenzel Baudisch argues this occurred because a shoe was no longer perceived as just a shoe: these goods were no longer consumed merely for the sake of comfort. Rather, consumers began to use them as a way to signal their social status to other consumers. As reflected in Run DMC's 1986 successful single "My Adidas", athletic shoes began to be used by urban U.S. youths to signal their group affiliation (Cunningham 2008). A shoe turned into a communication device which helped consumers signal to others information about the individual's identity and values. As a result, U.S. household spending on shoes experienced renewed growth and the number of registered trademarks related to shoes also grew. Another case that features short run consumer learning is the adaption of bicycles that were formerly used for transport and recreation (Buenstorf 2003). Consumers actively modified the characteristics of bicycles to better suit their own needs. Far from being random events, such short run consumer learning dynamics highlight the importance of taking into account the knowledge base of consumers and their propensity to innovatively use goods (Bianchi 1998, Hippel 2005). These issue is discussed further in Section 4.

A second demand side factor is the long run shifts in the type of needs driving expenditure. Many recognized that the underlying needs that drive consumption are subject to significant changes as consumers become more affluent (Scitovsky 1976; Lebergott 1993, Frank 1999, Witt 2001). A shrinking proportion of household spending is dedicated to the satisfaction of innate needs that are easier to satiate (such as hunger) while an increasing proportion of spending is dedicated to goods related to harder to satiate needs, such as social status, the demand for novelty and cognitive health concerns. Thus, a possible avenue for overcoming demand satiation and slow demand growth is for entrepreneurs to modify the characteristics of the goods such that they appeal to needs that are not yet satiated (Witt 2001). Witt and Wörsdorfer (2011) find that the characteristics of washing machines initially designed to deliver clean clothes were later modified to reduce the time and physical effort required to undertake washing. Chai (2007) discusses how the characteristics of British inland and seaside resorts that were initially based on Roman medical doctrines to treat serious illnesses slowly evolved between the 17th and 19th centuries to appeal to the need for novel stimuli (see Table 1) via entrepreneurial

effort manifested in the construction of new entertainment infrastructure such as pleasure piers, promenading areas, and theatres (Walton 2000:95). Preliminary empirical evidence for the satiation-escape conjecture was found by studying the co-movement the satiation level of Engel curves and average household income (Moneta and Chai 2014).

In relation to food consumption, several studies have pointed out that in spite of slowdowns in the quantity of food consumption, total spending on food nevertheless continues to rise with income. Ruprecht (2005) showed that by replacing sugar in food with newly developed artificial sweeteners, food producers reduced the calorie contents of food that appealed to consumers' growing concerns about their personal health and body weight. Manig (2010) further argue that one underlying factor for this is that food consumption is an activity that has increasingly come to be associated with other moitvations beyond the need for nourishment. Increasingly affluent consumers tend to no longer eat food just because they are hungry, but because they enjoy the novelty of exotic ingredients that food can deliver. This may account for why the demand for variety in food has grown (Thiele and Weiss 2003). Hence demand continues to grow as goods and their characteristics evolve to appeal to a wider set of needs.

Third, these studies also highlighted how market institutions foster satiation escape by facilitating the formation of new connections between needs and goods. Through markets, consumers come to discover new goods and ways to satisfy their needs, while producers discover how their goods may be too complicated to use or may not serve the consumer needs or their broader lifestyle (Earl 1986; Swedberg 1994; Loasby 1999; Langlois 2001; Potts 2001). This is typically reflected in the messages producers send to consumers via advertisements that highlight the benefits of their products. For example, in the case of washing machine advertisements, these messages have changed in character to educate consumer about new characteristics highlight how the washing machine can satisfy a wider set of needs (Witt and Wörsdorfer 2011).

This underlines the observation that markets are not mechanisms for exchange, but also a type of social tool that facilitates interaction between consumers & producers and helps coordinate expectations, behavior and knowledge accumulation across these groups on either side of the market (Potts 2001; Langlois 2001). The character of market competition is thus to some extent influenced by what consumers know and the needs they seek to satisfy. More knowledgeable consumers seek greater control in using products as they modify the consumption acts to better suit their own unique set of needs. Hence, the type of product innovations present in markets serving knowledgeable consumers tend to be 'performance-orientated' in that they deliver more control to the consumer such that they can tailor the final consumption act (Chai 2011). For example, Scitovsky (1976) gives the example of sports cars that have acquired more gears, more gauges, more lights, differential locks, and other attributes that are designed to give the driver more control over the vehicle, but at the same time may require more driving skill, which may prove aversive to non-specialized consumers (Scitovsky 1976:273). Another example is cameras, which have become much more performance orientated as a substantial

segment of consumers have accumulated knowledge about cameras and seek more technical control in the act of taking a picture (Windrum 2005).

In other instances, where consumers possess relatively little knowledge, market competition and product innovations may tend to be 'convenience orientated', as goods evolve to better appeal to a wider range of needs and consumer lifestyles. Product innovations in such markets aim to reduce the cognitive effort in the consumption act (Bianchi 2002, Saviotti 2002:122). The effort to make goods and services more convenient and easier to use may involve introducing new product characteristics that satisfy a wider set of needs. For example, pre-cooked frozen meals available in supermarkets. Whilst in the past these saved consumer's time and effort in not having to cook, a new generation of such meals emerged in the 1990s, designed to be more "healthy" in that they contain fewer calories and less fat. Not only is the consumer hunger satisfied, but their concern for being healthy is also addressed. In contrast to performance-orientated competition, functional change is more geared toward improving the convenience of goods and how efficaciously they fit into the consumer's lifestyle.

4 Consumer specialization

Understanding precisely what determines the degree to which consumers learn and accumulate knowledge is a topical issue in Evolutionary Economics (e.g. Babutsidze 2011; Valente 2012). LTC posits that the presence of acquired wants may influence cognitive learning since consumers tend to collect information and develop highly differentiated knowledge about the technological and aesthetic details of things they like (Witt 2001:35). Moreover, cognitive learning may also influence non-cognitive learning as consumer knowledge may enable consumers to enjoy new experiences through which acquired wants may emerge (Witt 2001:36). This dynamic interaction between learning modes can result in a specialization process through which both their knowledge and preferences become more refined. Some cognitive concerns that have been studied in the case studies include concerns about obesity (Ruprecht 2005; Manig 2010), environmental concerns (Buenstorf and Cordes 2008; Woersdorfer and Kaus 2011) and the desire for a consistent self-image (Lades 2014).

Here a crucial question that was not covered tackled in the original LTC framework is what social, economic and cognitive factors may accelerate or inhibit the rate at which consumers accumulate knowledge and develop preferences in a particular consumption domain. The LTC studies highlight a number of such factors:

I. Social availability of knowledge: the ability of agents to store and access information aids cognitive learning (Flinn 1997:36, Mokyr 2002). Technological breakthroughs such as the invention of the printing press, radio, television, and the internet have with little doubt fostered specialization processes and the emergence of new consumer subcultures (DeFleur and Ball-Rokeach 1989:26, Buenstorf 2003).

II. Social norms & experts: Consumer learning is guided by the social rules and conventions surrounding how knowledge is accepted and legitimized (McCloskey and Klamer 1995; Mokyr 2002). Social experts feature prominently here, especially in consumption domains in which goods are increasingly complex (i.e. credence goods) (Earl and Potts 2004, Dulleck and Kerschbamer 2006). Their advice can actively encourage or discourage consumer learning. For example, Ruprecht (2005) highlights how nutritionists promoted greater awareness of the unhealthy consequences of sugar consumption, which encouraged consumers to adopt artificial sweeteners. Similarly, public information campaigns encouraged consumers to use washing machines (Mokyr 2000; Woersdorfer 2010b) and discouraged alcohol consumption in post-war Germany (Volland 2012). Woersdorfer (2010a) studied the evolving demand for cleanliness in clothing and the home environment in Western economies and found that it was not the outcome of individual learning but rather strongly governed by social norms which determined the extent to which agents sought clean clothing and home environments. As these social norms evolved, so too did the consumer demand for clean materials and tools (Woersdorfer 2010b).[6]

III. Modularity of goods: The extent to which consumers may experiment and customize goods encourages cognitive learning (Langlois and Cosgel 1998, Langlois 2001). For example, a crucial role was played by the modularity of goods during the invention of the mountain bike in the early 1970s (Buenstorf 2003). This good emerged from the ability of expert consumers to modify and change some design features of the mountain bike, including frame geometry, gearshift with thumb shifters and cantilever brakes (see also Hippel 2005).

In terms of its character, specialized demand may be relatively less stable than demand motivated by innate needs. Compared to traditional industries such as agriculture which primarily serves innate needs, industries that serve cognitive concerns are thought to be relatively less stable as the use of the goods is based on knowledge that may be rendered obsolete by the ongoing emergence of new scientific knowledge. A good example of this is the 16th and 17th century British resort industry that was originally based on the Roman medical paradigm in which certain elements found in the natural environment could be used for the treatment of serious illnesses. Much of this paradigm was rendered obsolete with the emergence of modern medicine and hospitals located in urban areas (Chai 2007).

Another feature specialized demand is its heterogeneous nature. The types of cognitive concerns possessed by individuals are uniquely dependent on their own history of experiences and cultural influences. The growing prominence of such demand could account for the increasingly indeterminate household spending patterns, as demonstrated by the well-established positive relationship between income and the observed heterogeneity in spending patterns (Lewbel 2008). Houthakker

[6]Elsewhere, the acquisition of preferences is also shaped by families and the socialization process (Volland 2013) and the availability of (non-working) time (Chai et al. 2015).

(1992) argues that the tendency for heterogeneity in household spending to increase at higher income levels reflects the growing amount of discretionary power that emerges when innate needs are satisfied. Others have also pointed out that the growth of demand heterogeneity may also help account for the rising demand for services (Gallouj and Weinstein 1997). One particular function of services is that they customize lower order goods in accordance with the consumer specific preferences (Hipp and Grupp 2005). For example, a travel agent is used to customize the features of a holiday. As such, the predominance of the services sector in developed economies could be driven by the growth of customization and knowledge-based demand.

5 Discussion

5.1 Future directions

A central theme in Evolutionary Economics is to develop a more realistic account of learning and knowledge accumulation by agents, firms and industries (Nelsan and Winter 1982; Dopfer et al. 2004). On the demand side, this implies developing new ground in understanding how consumer tastes are neither fixed nor homogenous. Rather, tastes seem subject to change according to what consumers learn (Nelson and Consoli 2010) and are open to the influences of social and commercial environments (Aversi et al. 1999; Babutsidze 2011; Valente 2012). As Schumpeter himself recognized, understanding the precise magnitude and nature of how such external influences shape consumer tastes ultimately delivers important insights into how market-based capitalist economies grow in a self-perpetuating fashion (Jonsson 1994).

Here the LTC studies underline how a key determinant of the rate at which demand evolves is the extent to which consumers are learning in a cognitive or non-cognitive fashion. In most studies of consumer behavior it is assumed that consumers are either learning in one or the other, but not both. Few studies consider the possibility that both modes of learning may coexist. Doing so enables scholars to consider what events and conditions, such as the emergence of new goods, may trigger switches in consumer learning modes (Brenner 1999; Buenstorf and Cordes 2008).[7] The presence of two learning modes may thereby help explain why consumers display relatively passive, routine driven behavior in some circumstances (Nelson and Consoli 2010), but act in a highly creative and innovative manner in

[7]The key to progress on this issue is to recognize that different modes of behavior coexist (e.g. Hayek 1960; Gigerenzer et al. 1999; Witt 2001; Kahneman 2003) and to identify how agents may transition between modes and the different circumstances in which these modes tend to dominate (Brenner 1999; Lades 2014).

other instances (Bianchi 2002).[8] Further studying how switches between cognitive and non-cognitive learning modes take place may also be useful in developing effective policy that encourages consumers to rethink their entrenched consumption habits (discussed below).

Beyond the individual level, another theme in evolutionary economics is how the heterogeneous nature of demand and niche markets can play a critical role in industry evolution (Saviotti 1996; Bresnahan and Gambardella 1998; Lipsey et al. 2005; Guerzoni 2010; Malerba et al. 2007). The LTC studies show there are several different sources of demand heterogeneity. In a given population of consumers, heterogeneity in demand may be driven by differences in i) what consumers know, ii) the type of acquired wants & cognitive motives they possess iii) the connection between goods and the underlying needs they serve. It is worth noting that the focus on the evolving connection between goods and needs (Section 3.2) bears some similarity with the recent discussion of 'disruptive innovations' that emphasizes how functional change of goods can have major implications for industry structure (Christensen 1997; Baudisch 2007; Markides 2006). Differentiating between these sources of demand heterogeneity thereby helps deliver a better understanding of when and how industries can foster the emergence of niche markets (Buenstorf 2003; Babutsidze 2011).

On the macro level, the industrial composition of the economy tends to undergo important structural changes that can affect unemployment, growth and the income distribution. Many scholars posit that the non-homothetic nature of consumer demand co-determines the direction of structural change (see *inter alia* Pasinetti 1981; Aoki and Yoshikawa 2002; Metcalfe et al. 2006; Bertola et al. 2006; Saviotti and Pyka 2008; Ciarli et al. 2010). Here, the LTC studies provide a behavioral account for observed differences in income elasticities across goods produced by different industries (Cordes 2009; Lades 2013; Kaus 2013b; Moneta and Chai 2014). These studies help explain why some markets experience demand satiation. Another interesting question for future work is to examine whether the responsiveness of the industrial composition to final demand is growing as specialized demand is becoming an increasingly prominent component of household spending.

5.2 Methodological issues

Adopting the LTC approach has some clear drawbacks. Firstly, due to an inability to directly measure the influence of needs on behavior, it is not possible to know with full certainty which needs motivate a particular act of consumption. Conclusions can only be reached through developing informed conjectures based on scientific knowledge about the nature of need sand carefully studying the behavior of consumers.

[8]This also has implications for welfare economics (see Sartorius 2003; Binder 2010; Schubert 2012).

More effort needs to be made to develop an empirical methodology that can uncover the underlying forces driving observed expenditure patterns (see for example Barigozzi and Moneta 2011; Chai and Moneta 2012).

Second, the case studies show that many characteristics of needs are highly domain-specific in nature. This raises the question as to the possibility of making generalizations about needs that apply to all consumption domains. Food consumption, for example, is linked to an internal homeostatic mechanism where calories are periodically required to preserve the basic functioning of the human organism. The same cannot be said for other innate needs, such as the need for novel stimuli (see Table 1). This need can also be satisfied by eating and drinking and its temporal ability to motivate consumption to some degree also depends on how deprived other needs are (Parker and Tavassoli 2000). However, the need for food does not depend on how deprived consumers are of novel stimuli. These issues reflect an inevitable tradeoff between generalizability and realism in the sense that scholars forego making generalizable statement that hold for a wide range of phenomena when constructing more realistic explanations that rest on detailed scientific knowledge about the biological foundations of human behavior.

Third, compared to existing neoclassical consumer theory, the LTC approach is less tractable. Even when scholars thoroughly investigate all primary historical sources and market data, it is difficult to discern between the influences of cognitive and non-cognitive learning processes cognitive rather than non-cognitive learning processes. Moreover, much of this needs-based approach rests on., the ability to identify the relationship between goods and the needs that they serve rests on current scientific knowledge about the nature of needs and the consumer's learning patterns. As far as this scientific knowledge about needs is itself fallible and subject to change, so too are the theories based upon this knowledge.

5.3 Endogeneity and the sustainability agenda

The LTC studies have highlighted a number of different ways in which demand is 'endogenous' in the sense that it has been influenced by economic conditions and market institutions (Bowles 1998). First, due to the satiable nature of (some) innate needs, rising household income has enabled a major shift in the composition of demand away from the satisfaction of innate needs. Second, new technologies and institutions for storing and sharing information (including markets) have enhanced the cognitive learning process and the rise of knowledge-based demand. This type of demand is more volatile in nature, and is likely to be more heterogeneous than demand related to the satisfaction of innate needs. Third, it is likely that producer advertising has contributed towards the generation of acquired wants via non-cognitive learning in which products are repeatedly associated with appealing primary reinforcers such as images of very attractive people. The experimental evidence makes it hard not to conclude that suppliers, under certain conditions, possess some capacity to generate acquired wants that motivate spending (Stuart

et al. 1987). This capacity is nevertheless limited by the fact that acquired wants are subject to extinction over time and the manner in which they motivate behavior is complex (Berridge et al. 2009).

In terms of the sustainability agenda (Jackson 2006), it may be tempting to conclude that because of this endogenous influence, consumption patterns are unlikely to change significantly in the future. A general pessimism pervades the literature about the extent to which sustainable consumption patterns will emerge (Norton et al. 1998). Current consumption patterns appear to be 'locked in' for a range of reasons, including social norms (Røpke 1999; Sanne 2002) and individual habits (Maréchal 2010). At the same time, much evidence suggests that most people are strongly concerned about climate change and the environmental impact of consumption (Nisbet and Myers 2007). There appears to be a yawning gap between these concerns and the consumer's propensity to *act* on these concerns by adopting sustainable consumption practices (Gifford et al. 2011). While this gap between stated environmental concerns and actual consumption behavior could be a reflection of 'cheap talk', it could also be the case that consumers do not possess the knowledge to act appropriately on their environmental concerns (Gifford et al. 2011). This can be done through public information campaigns. However, information alone may not be enough to trigger consumers to specialize and actively modify their behavior in a particular consumption domain (as discussed Section 4). Beyond providing information, another approach could be to foster the broader epistemic, social and economic conditions that encourage consumers to cognitively learn about how to act on their environmental concerns.

6 Conclusion

Returning to Keynes' question, a proper explanation of the long run growth of demand must go beyond merely assuming that consumer demand is homogenous and insatiable. Rather it must consider, as Keynes himself did, the underlying needs driving consumption and how these may evolve in the long run. The LTC studies make it clear that the continuous expansion of demand is not an inevitable occurence. Rather, it is the result of how individuals have adapted to tremendous changes in their economic, social and technological surroundings. It is also a reflection of how economic conditions and social institutions have influenced both the type of needs that motivate consumers, as well as enhanced the capacity of consumers to learn about how to satisfy their needs. Hence, the extent to which demand will continue to grow also depends on how much further future these can continue to shape demand by further enhancing the accumulation of consumer knowledge, promoting the generation of acquired wants and directing more spending towards needs that are insatiable.

Many open questions for future research still remain. An appropriate empirical approach to identifying the underlying connection between goods and the needs they serve is lacking and could deliver greater insight into how the satiation of needs

stimulate product innovation and the emergence of new goods. The notion of acquired wants and how these are subject to growth and extinction has thus far attracted little attention even though non-cognitive learning is widely acknowledged to be an important tool for advertising. Finally, more work could be done on formalizing the important differences about how needs motivate consumption. If economists are interested in answering Keynes' question, a closer look at the nature of what motivates consumption is unavoidable.

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The Evolution of Consumption and Its Welfare Effects

Ulrich Witt

Abstract In this paper the evolution of consumption is explained on the basis of a theory that connects preferences over actions to the motivational forces driving actions. More specifically, the hypotheses about what motivates consumption activities draw on insights from biology, behavioral science, and psychology. With secularly rising income, the growing consumption opportunities and the expanding consumption alter the underlying motivational forces and induce a change of preferences. As a consequence, the structure of consumption expenditures is systematically transformed. In the light of this explanation, the paper analyzes the effects of the growth and transformation of consumption on individual welfare. As turns out, the motivations driving the growth of consumption do not necessarily imply that this growth indeed results in welfare increases, particularly when the ability to spend on consumption is already high. Moreover, when preferences change, the measurement of the welfare effects of the growth and transformation of consumption depends on the arbitrary choice of a reference point. This implies an ambiguity that raises further queries about the normative foundations of the ubiquitous calls for continued consumption growth.

Keywords Consumption · Growth · Satiation · Consumer learning · Preference change

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1 Introduction

For millennia, poverty and starvation have been the fate of the largest part of human kind. "Nature's parsimony", as Ricardo once put it, has only been overcome quite recently. Since about two centuries, per capita income and consumption grow exponentially despite the rapidly rising human population (Maddison 2001). In the most advanced economies, already lower-income classes can now enjoy a standard of living that two centuries ago would have resembled a state of affluence. The flip side of the massive growth of consumption is an increasing toll on the natural environment. Both at a local and global scale, climate change, resource depletion, soil and water degradation, species extinction, and many other forms of environmental decay threaten the living conditions of future generations (see, e.g., UNEP 2014). Nonetheless, motivated by the quest for better life, calls for further economic growth still dominate in the political and public debate even in the most prosperous economies. But, leaving aside the social costs for the moment, is it at all likely that the equation "more consumption = better life" which was valid for the past two centuries continues to hold? Do ever higher expenditures indeed assure steady improvements in preference satisfaction irrespective of the level of consumption already reached?

As is well known, canonical text book economics approaches these questions as follows (see, e.g., Mas-Colell et al. 1995). Consumer preferences are assumed to be invariably given, i.e. the possibility of forming new preferences on innovations in goods and services is ignored. What the consumers' preferences are is not specified. They are only claimed to satisfy some formal properties which imply utility functions that increase monotonously with rising consumption expenditures. It then follows that consumers always attain a higher utility index, i.e. realize a welfare gain, by spending more. The equation "more consumption = better life" is guaranteed to hold. But can such a claim indeed be made without knowing how consumers satisfy what preferences? Moreover, can their preferences be taken as a invariable measuring rod for welfare that is independent of what it is supposed to assess, namely the growing consumption possibilities (see Binder 2010 for a critical reappraisal)?

Doubts regarding the empirical relevance of such a portrayal of economic behavior were raised early on (e.g., Veblen 1909, Sen 1977, Elster 1982). Evidence clearly points to preferences that are neither always consistent nor invariably given. If it is admitted that preferences do change, an inter-temporally consistent measuring rod for welfare may still be logically possible. The necessary proviso is, however, that individual preferences only change in a particular, unidirectional way (von Weizsäcker 2005, Bernheim and Rangel 2009). The relevance of this assumption cannot be assessed, of course, without a richer understanding of the causes and mechanisms underlying the changes of consumer preferences.

In order to advance this understanding a behavioral theory of preferences is needed. The key to such a theory, it will be argued in this paper, lies in the relationships between preferences over actions on the one side and the motivational forces driving actions on the other. From a preference subjectivism point of view, asking what *motivates* consumers to choose specific actions may appear futile, if it can be assumed that the reasons of choice reside in the individuals' inextricable subjective sphere. Admittedly, subjective idiosyncrasies are likely to result in some irreducible inter-personal variation in consumer behavior. This does not mean, though, that there are no commonly shared motivational forces which exert a systematic influence on the mean behavior in the population. As explained elsewhere (Witt 2001), among others innate needs and drives signify as human universals and provide a basis for a generic analysis of the reasons of choice and, hence, of the individuals' revealed preferences.

Theories assisting an analysis of human motivation in general and the motivation to consume in particular are interdisciplinary by their nature and refer to the evolutionary bases of human behavior (see Brown and Richerson 2014). To better understand the motivational forces and to develop a richer theory of preferences the present paper draws on hypotheses from several disciplines. Among them are the biology of drives and needs and of behavioral adaptations (Leslie 1996, Staddon 2014a, b), sociobiology (Wilson 1978), evolutionary psychology (Saad 2007), cognitive psychology (Bargh et al. 2010), empirical happiness research (Kahneman et al. 1999), and also the revival of sensory hedonism in economics (Kahneman et al. 1997). On this basis it can be discussed in detail why and how consumption changes systematically with a growing income and what the consequences are for human welfare.

The paper proceeds in three steps. Section 2 presents a brief review of relevant biological, behavioral, and psychological hypotheses. They relate to innate (heritable), learned (conditioned), and cognitive motivational forces. It is discussed how these forces change and whether such changes imply a shift in preferences. Section 3 derives some implications of these hypotheses for explaining the evolution of consumption. It is shown that a crucial role is played on the one hand by multi-level learning processes which affect existing motivations to consume, generate new ones, and thus induce preference changes. On the other hand, the development is characterized by differences in the satiation dynamics across different motivations. Both kinds of motivational changes become manifest and transform consumer behavior as increases in per-capita income raise the ability to spend and to learn new behaviors. Section 4 turns to the welfare-theoretic aspects of the evolution of consumption, i.e. to the question of whether and when the equation "more consumption = better life" holds true. As will turn out, the answer raises doubts about how calling for yet more consumption growth can be justified even in the most prosperous economies. Section 5 presents the conclusions.

2 Motivational hypotheses as key for understanding preferences

Originally, motivational hypotheses were a center piece of utilitarian economics. In the characteristic hedonistic interpretation, the reasons for taking actions were explained by the utility derived thereby in terms of enjoying pleasures and/or avoiding pains (both explicated in great detail).[1] Yet, in the later transformations of the utilitarian program, motivational hypotheses fell victim to the belief that by "a purging out of objectionable, and sometimes unnecessary connotations (of the Bentham, Sidgwick, Edgeworth variety) ... a much less objectionable doctrine" would result (Samuelson 1947, p.90). The new, "less objectionable" doctrine in question was Samuelson's own revealed preference theory. Now widely adopted in economic textbooks it can no longer explain what the utility index represents (Glimcher 2015). Correspondingly, the sensory hedonistic theory of welfare characteristic of the Benthamite tradition has given way to a positivist substitute based on a hollow notion of preference satisfaction.

However, Samuelson's revealed preference theory rests on a very strong concept of "rational" decision making. Nourished by experimental research in decision science, serious doubts have arisen more recently with respect to whether decision makers actually live up to that rationality standard (Kahneman 2003, Ariely 2009). Decision making anomalies and puzzles have caused behavioral economics to question Samuelson's doctrine and to again start a transformation of the theory of economic behavior (Camerer and Loewenstein 2004). Actual choices are now portrayed as coming about in two very different ways (Loewenstein 2000, Kahneman 2011). On one side there are the cognitive, belief-based choices of actions. They are subject to a number of systematic biases. On the other side, actions can be the result of unconditioned and conditioned response behavior that is much less, if at all, cognitively reflected. (In terms of Kahneman's distinction between systems of decision-making these are the system 2 and 1, respectively.) Correspondingly, behavior can systematically change over time as a consequence of either cognitive or non-cognitive learning processes.

Behavioral economics is thus much better able to account for the richness and complexity of human decision making and learning. Yet, with few exceptions (e.g. Loewenstein 2004), the question of what drives or motivates economic behavior continues to be left out, and welfare theory remains bound to a hollow preference satisfaction criterion (Burnham et al. 2015). To make progress on this front, the results of motivational research in the neighboring sciences have to be integrated into the behavioral approach to economics. A first important step is to recognize that, in

[1] Motivational hypotheses "...describe why a person in a given situation selects one response over another or makes a given response with greater energization or frequency", Bargh et al. 2010, 286). If, for example, a consumer chooses to buy food, the Benthamite explanation would be that this action is motivated by the expectation of the pleasure of eating and/or the avoidance of the pain of hunger.

choosing their actions, human decision makers follow different kinds of motivations depending on time and circumstances.

A basic motivational force is constituted by innate needs and drives. As part of the genetic endowment, such needs represent human universals. They are therefore a good starting point for identifying generic features of human preferences, i.e. features that, excepting the genetic variance, are widely shared among humans. A significant feature of these needs is the role that need deprivation plays for motivating action. The more deprived a need is, the stronger is the motivation to take actions that are directed at reducing or removing deprivation. If the need is satiated, deprivation vanishes and so does the motivation to act.

For needs related to the biological metabolism of the body, deprivation can be easily identified by symptoms of physiological imbalance or deficiency. The need for food can serve as example. Feeling hungry motivates organisms to engage in foraging behavior. The foraging motivation vanishes once caloric intake reaches the satiation level – albeit reappears when these calories have been burned off. Similar homoeostatic patterns are present for needs such as for water, sleep, food, physical activity, sex, shelter, and clothing, i.e. protecting the body against pain and cold. Prominent needs not directly related to the biology of the body are those for affection, care, sensory and cognitive stimulation (or "arousal"), positive self-image, and status and social recognition. They are also contingent on an existing state of deprivation. The motivation to act is again directed at reducing or removing deprivation. However, the question of whether and how satiation of the needs is eventually attained is more complex (see below).

Consider an action that is motivated by the attempt to satisfy one or several (possibly differently) deprived needs by means of consuming one or several goods. A particular need may be served by consuming several different goods and/or a combination of them. Further, the consumption of one and the same good may serve not only one, but several needs simultaneously. Goods having this feature may be called "combination goods". For example, eating something can be motivated by a deprived need for food, more precisely for calories. But eating something, i.e. experiencing varied taste, scent, texture, and other properties of food, can simultaneously also serve the satisfaction of a deprived need for sensory stimulation (arousal). In this sense, food can be a combination good.[2] Similarly, housing expenditures are not only motivated by the need for shelter, but often also by a deprived need for status and social recognition (Frank 2007).

In terms of a utilitarian representation these conditions can be captured as follows. Suppose at the time of making a choice a decision maker conceives of a set of action options which appear to be feasible given the decision makers budget constraint. Each action option i in the set consists of consuming a bundle of goods and services $j = 1, \ldots, m$ that is described by a vector $\boldsymbol{x}_i = (x_{i1}, \ldots, x_{ij}, \ldots, x_{im})$. If $\boldsymbol{x}_i$ would serve

[2]Combination goods typically possess several characteristics in the sense of Lancaster (1971). However, there is no unique correspondence between characteristics and needs: one characteristic can be relevant for several needs and several characteristics for one need.

need h exclusively, the *partial* utility derived from satisfying need h by the corresponding action would be given in the familiar form by

$$u^h = u^h(\boldsymbol{x}_i). \tag{1}$$

Satiability of a need h then means that the partial utility function (1) has a maximum – the bliss point. If feasible, satiation is attained by consuming a (not necessarily unique) need-specific vector $\boldsymbol{x}_{\bar{h}}$ of goods by which the bliss point with respect to h is reached.

However, often the assumption that a consumption activity serves one need exclusively is not satisfied. Some of the m goods included in a consumption bundle can be combination goods, i.e. serve to satisfy several needs and other action motivations (such as those discussed below) simultaneously. Consider for the moment a set N of innate needs with elements $h = 1, \ldots, n$. The *total* utility U_N derived by their satisfaction through the consumption of the bundle $\boldsymbol{x}_i$ is therefore determined by the functional

$$U_N = U_N\left[u^1(\boldsymbol{x}_i), \ \ldots, \ u^n(\boldsymbol{x}_i)\right]. \tag{2}$$

i.e. the product or the sum (depending on the specification of the functional) of partial utilities which $\boldsymbol{x}_i$ generates with respect to each of the n needs.

The question is how the vector $\boldsymbol{x}^*$ that maximizes U_N subject to the income constraint is determined.[3] Formally, the solution can be found by calculus of variation. However, in animal studies it has been found that the brain of higher animals – not to speak of humans – is capable of generating in an automatic fashion a single, aggregate value for each of the actions in the set of perceived options as long as that set is small enough. This provides the basis for choosing the highest option value automatically.[4] In economic diction, the option values can be interpreted as an automatically generated prediction of total utility associated with the different actions or consumption bundles (Glimcher 2015). Accordingly, U_N gives a measure of the spontaneously emerging motivation for undertaking specific consumption activities in order to satisfy a (set of) deprived innate need(s).

[3] If the available budget allows to reach the bliss point of need h, the motivation to further expand consumption serving need h vanishes by definition. However, a consumption bundle may include combinations goods that serve other, less rapidly satiable, consumption motivations as well. In the optimum, these motivations can drive the consumption of a combination good j beyond the bliss point of one or some of the involved needs. Put differently, due to the existence of combination goods, maximizing the utility functional (2) can result in $x_j^* > x_{j,\,\bar{h}}$ for some h.

[4] See Shizgal (1999). Automatic here means that the neural processes involved in the generation of the option (or predicted reward) values occur at the non-cognitive level. Although the processes are not yet fully understood, it seems that they are represented by the local dopamine concentrations. The generating processes are strongly context-dependent and may be conditioned by neurochemical influences (Glimcher 2015); see also Schultz (2002) and Daw and Tobler (2013).

This motivation is subject to two different kinds of systematic change over time. On the one hand this is the satiation dynamics which will be discussed in more detail in the next section. It reduces in a way specific to each single need the motivation to consume contingent on the amount consumed (per period) to serve the need. On the other hand there is a learning dynamics that changes the relative strength of the motivation across different needs as a result of the experienced relative success in obtaining need satisfaction. This works as follows. If the choice of a particular consumption activity indeed reduces the degree of deprivation of the underlying need, the effect is a rewarding experience by the decision maker. Such an event has been demonstrated in behavioral research to be an instance of primary reinforcement.[5] Since there are usually many alternative consumption activities serving different needs in different ways, the motivation to choose among them is adapted by reinforcement learning to the respective relative rewards experienced to result in terms of relative need satisfaction.

Put differently, the motivation to act adapts to the decision maker's opportunities for obtaining reward by consuming different consumption bundles. These opportunities depend on economic factors such as availability, relative prices, and income, but also on the agents' ability or comparative advantages in experiencing a reward feeling by some actions rather than others. As a consequence of these differences, consumers tend to "specialize" in many different ways, e.g., as gourmets, computer freaks, opera lovers, bodybuilders, spiritualists, and so on. Indeed, a significant part of the empirically observable adaptations over time in idiosyncratic consumer behavior described, but not explained further, in the literatures as "habit formation" (see Pollak 1970, and 1978), can be attributed to such specialization processes guided by reinforcement learning.

Besides adaptations in the frequency of a set of given actions through reinforcement learning there is yet another behavioral mechanism that is heritable and contributes to behavior adaptations. It is labeled conditioning learning and works as follows (Leslie 1996, Chap. 2.13). Suppose a particular action consisting of consuming good j is observed to occur. Suppose further that it results in a rewarding experience so that it is subject to primary reinforcement. Now assume that this action (the consumption of good j) happens to coincide with the consumption of another good k which is experienced as neither rewarding nor aversive in itself. If the coincidence recurs several times, the rewarding experience resulting from consuming good j comes to be associated with the consumption of good k. By virtue of this association, consuming good k starts to be reinforced as well. In this vein, good k emerges as a conditioned or secondary reinforcer.

The correlate of this kind of reinforcer is a new, spontaneously emerging motivational force for which utility is then also automatically predicted. For sake of

[5] Staddon and Cerutti (2003). It should be noted, however, that the deprivation of innate needs is not a necessary condition for reinforcement to occur in the behavior of a species.

distinction call it an "acquired want".[6] In this way, a new, not previously existing preference for the corresponding action is created. It typically involves new or not previously considered goods and services. Hence, the dimensionality of the utility functional (2), defined above for the innate needs in isolation, has to be expanded (see Eq. (3) below). The effect of conditioning learning thus goes beyond mere habit formation. The extension is crucial for explaining how innovations enter and alter consumer preferences and, it will be argued below, for understanding the evolution of consumption.

So far the motivation driving consumer behavior and the learning processes that modify it have been discussed as phenomena occurring at a non-cognitive level. However, a characteristic of human behavior is that a motivation to act and related learning processes can be triggered at the cognitive level as well. First, relating to the above discussion of innate needs it has to be added that there are needs of genuinely cognitive nature such as the need for autonomy (Hagger et al. 2006) and the need for a positive self-image and self-esteem (see, e.g., Gollwitzer and Kirchhof 1998, Pyszczynski et al. 2004). Their motivational force derives from states of deprivation as in the case of the previously discussed needs. The need for a positive self-image is particularly relevant for consumption behavior (Lades 2012a). If one's self-image is cast in doubt, the cognitive dissonance that arises causes a situation of need deprivation that prompts strong aversive emotions. In order to reduce deprivation, decision makers are often motivated to engage in consumption activities that symbolize their ideal self-image, if no other options for restoring a positive self-image are feasible (Dunning 2007).

Second, a major way in which the motivation to act is modified is cognitive deliberation and insightful learning. They lead to cognitive goal-setting and its motivational correlate, goal-striving (i.e. the deliberate pursuit of the goals and sub-goals whose accomplishment is experienced as rewarding, see Bargh et al. 2010). In the context of consumption behavior, goal-striving can be directed at accomplishing cognitively constructed objectives for their own sake such as the satisfaction of efficiency, safety, or convenience considerations by consuming suitable goods and services. But goal-striving can also be instrumental in the context of means-ends relationships, i.e. when the motivation originates from some "deeper"

[6]See Witt (2001). To give an example, let good j be gyros or any other dishes served in the hotel restaurant while on vacation in Greece. Let good k be the Sirtaki music that is continuously played in the restaurant. Assume that for the consumer this music is an entirely new and initially neutral experience. Conditioning learning between eating the dishes and listening to the music can then result in Sirtaki music becoming an acquired want, i.e. a rewarding experience in its own right. For the effect of conditioning learning to be maintained, the association between consuming goods j and k must at least sporadically be reaffirmed. For that reason, it is possible for acquired wants to be "unlearned". Despite some common cultural influences, the idiosyncrasies of the individuals' conditioning histories cause a substantial inter-personal variation with respect to what wants are acquired.

needs or wants whose pursuit is cognitively controlled. [7] In any case, the motivation to act depends also on the cognitive goal-setting process, on how means-ends relationships are constructed, and on how the agents discount the time factor.

To account for the utility derived from satisfying acquired wants and cognitive goals, the functional depicting total utility has to be extended to $U = U(U_N, U_W, U_G)$. U_W and U_G are utility functionals constructed analogously to Eq. (2). They represent the utility generated by the satisfaction of acquired wants and the accomplishing of cognitive goals respectively. If the number of acquired wants is given by w and the number of cognitive goals by g, we get as the extended total utility functional

$$U = U\left[u^1(\boldsymbol{x}_i),\ \ldots,\ u^n(\boldsymbol{x}_i),\ u^{n+1}(\boldsymbol{x}_i),\ \ldots,\ u^{n+w}(\boldsymbol{x}_i),\ u^{n+w+1}(\boldsymbol{x}_i),\ \ldots,\ u^{n+w+g}(\boldsymbol{x}_i)\right], \tag{3}$$

In its full complexity, utility maximization thus requires finding a vector $\boldsymbol{x}^*$ that maximizes the extended utility functional (3).

The analysis is complicated by the fact that goal-setting often leads to contemplating not previously recognized consumption activities including new goods and services so that the perceived choice set is extended.[8] The same holds when, by conditioning processes, associations with new consumption activities are learned. If a consumer innovation s (a smart phone, say) is introduced to the market and recognized by the consumer as a choice option, the vector of goods and services is extended to $\boldsymbol{x}_l = (x_{l1}, \ldots, x_{lm}, x_{ls})$. As a consequence, the dimensionality of the total utility functional (3) expands accordingly.

3 Motivational change and the evolution of consumption: the differential satiation hypothesis

In its process of growth, consumption has been undergoing significant transformations. In order to explain the evolution of consumption, focus in this section is on the reaction which the consumers in an economy show when their income, i.e. their ability to spend, increases. This means that, as usual, the reaction will be explored at the level of population averages. They are described in terms of the income elasticities of consumption expenditures and/or Engel curves. The latter depict the variation

[7] Humans can train themselves to delay the rewarding experience of goal attainment, i.e. the ultimate gratification in terms of the need or want satisfaction, until a date far into the future by "mental time traveling" (Suddendorf and Corballis 1997).

[8] The proviso is, of course, that the increasing number of alternatives does not make the decision maker forget options she was previously aware of. Cognitive learning processes are always selective with respect to what new consumption possibilities gain attention. For that reason, cognitive learning contributes to consumer specialization.

in the size of the diverse aggregate household expenditure categories as a function of income. Engel curves come in two versions (see Chai and Moneta 2010). One version focuses on the variation of expenditures on particular consumption categories across different income classes at a given time. The other (longitudinal) version describes the changes of the size of the different expenditure categories when the average household income in the economy rises over time. Engel curves (as well as income elasticities) are descriptive tools. They allow to visualize and classify empirical observed changes of consumption, but they do not allow to explain them.

To fill the theoretical gap that exists here we can draw on the motivational hypotheses outlined in the previous section. The question then is whether and, if so, how income-induced changes of consumer expenditures differ depending on the purpose they serve: to satisfy innate needs, acquired wants, or cognitive goal-striving. Hence, the relevant version of the Engel curve is given by the function

$$X_{ht} = X_{ht}(I_t), \tag{4}$$

where X_{ht} denotes the expenditures of the households in the economy in a period of time t (usually a year) on a category of goods and services whose consumption is motivated by the force $h = 1, \ldots, n + w + z$. I_t denotes average household income (exclusive of savings).[9]

To begin the discussion of how the motivational forces can be conjectured to shape aggregate consumption patterns when rising income enables higher spending consider the innate needs first. Consumers share these needs (with some variation). Their responses can therefore be assumed to be similar and, hence, properly represented by the empirically observable time series of the national averages of the household expenditures. Regarding the average reaction to rising income, two hypotheses can be proposed. One hypothesis relates to the average expenditure corresponding to the bliss points of the consumers' partial utility function (4). In terms of real prices, they can be expected to correspond to the satiation level. The second hypothesis is that, $X_{\bar{h}}$ is not equally rapidly approached for all n needs when the expenditures serving them are increased. Let there be two needs f (food) and a (arousal) and assume that f is more rapidly satiable than a. This means that the income at which $X_{\bar{f}}$ is reached according to Eq. (4) is lower than the income at which $X_{\bar{a}}$ is reached. When income grows, the motivation for additional spending on need f levels off earlier than in case of need a. Likewise, the income level at which the

[9]Maximization of Eq. (3) subject to an expanding budget constraint results in individual income-expenditure curves for the goods and services. These curves for the individual consumers could, in principle, be summed over all consumers yielding the aggregate Engel curves. A prerequisite is, however, that the growing income does not result in preference changes through the emergence of new wants and cognitive goals and/or in an expansion of the choice set by consumer innovations. This condition is not met during the evolution of consumption. Instead of a "micro foundation", i.e. the aggregation step by which Eq. (4) would be derived from Eqs. (3) and (4) is therefore directly based here on the available aggregate household expenditure data.

expenditure or budget share $\sigma_{ft} = X_{ft}/I_t$ starts to decrease is lower than the income level at which σ_{at} start to decrease.

The need for food or, more precisely, calorie intake is indeed a good example of a satiable need. The empirical evidence for a decreasing expenditure share is very robust.[10] Data for a whole century available for the U.S. show that per-capita income has risen in real terms by a factor of 6 between 1901 and 2002. Over the same period, the share of household expenditures on food declines from 42.5 % to 13.1 % (Chao and Utgoff 2006). The shrinking expenditure share notwithstanding, the convergence to the satiation level can, of course, be delayed by the fact that other, less rapidly satiable needs than that for calorie intake may simultaneously motivate the consumption of food. As already mentioned, this may be the need for arousal (or sensory and cognitive stimulation) which, for reasons explained below, is not that rapidly satiable.

Eating snacks at all occasions outside the main meals or having "refreshment" drinks etc. may become a form of entertainment which results in buying more foodstuff (quantity effect). If not simply wasted, the additional food drives up calorie consumption – often even beyond the satiation level for calories with the consequence of a growing body weight. The need for arousal can be conjectured to also contribute to the rapidly growing away-from-home food consumption, particularly when it involves sampling restaurants offering foreign cuisines. Moreover, the need for arousal seems to drive a trend to consuming more refined, exotic, and in any case more expensive, "gourmet" food (quality effect).[11] Another example of a motivation influencing food consumption which also seems to induce a quality effect is cognitive goal striving related to health and life-style considerations.

When, as a result of an increasing satiation, the motivation that previously dominated the growth of consumption levels off, this means that the respective

[10]Pooling long term data from the UN National Accounts Statistics for 64 countries, Kaus (2012) estimates cross-country Engel curves for all COICOP (UN classification of individual consumption according to purpose) expenditure categories. The estimate for food expenditures clearly supports the theoretically expected relationship $d\sigma_f/dt = \frac{\partial \sigma_f}{\partial I_t}\frac{dI_t}{dt} < 0$ for the budget share σ_f of food.

[11]Given that calorie content is an objective measure, food consumption is a good example to illustrate the two effects. Let a composite commodity j be the only good that serves the need for calorie intake (a food basket whose elements are consumed in fixed proportions, say). Assume that x_j units, each with calorie content c_j, are consumed on average per period (time index suppressed for convenience). The result is an average intake of (i) $q_j = c_j x_j$ calories per period. If p_j denotes the price, the average food expenditure is (ii) $X_j = p_j x_j$. By inserting (i) into (ii) the expenditure satiation level follows as (iii) $X_{\bar{j}} = \frac{p_j}{c_j}\bar{q}$, where $\bar{q}$ is the satiation level for calories. However, if the consumption of j is also motivated by additional, less rapidly satiable needs, this may lead to $X_j > X_{\bar{j}}$ when income increases sufficiently, i.e. the quantity effect implying waste of food and/or overeating. The additional motivations may, of course, also induce a higher willingness to pay for a recomposed commodity with similar calorie content but more entertaining features. Since the price per calorie p_j/c_j in eq. (iii) represents a degree of freedom, accepting a higher price shifts $X_{\bar{j}}$ upwards – the quality effect. For an empirical study of the effects see Manig and Moneta (2014). In elasticity terms, the two effects can be decomposed into $\eta_j = \frac{\partial p_j}{\partial I}\frac{I}{p_j} + \frac{\partial x_j}{\partial I}\frac{I}{x_j}$.

consumer goods industry is confronted with increasing market saturation. The need for calorie intake is a case in point. The food industry typically responds by creating innovations that in some way try to shift the bound at which the consumption motivation is satiated.[12] A frequent strategy aims at triggering a quality effect by appealing to other, less easily satiable motivations than the need for calories. Examples are foodstuffs with new features or combined with additional services aiming to provide additional sensory stimulation or to appeal to cognitive goal striving informed by health and life-style motives. The incidence of quality and quantity effects and product innovation explains in good part why food expenditures, despite their declining share in the household budgets, still increase in absolute terms. In the U.S., for example, the increase from 1901 to 2002 was 46 % calculated in $ of 2002 (Chao and Utgoff 2006).

Why are other motivations underlying consumption behavior less rapidly satiable than homoeostatic biological needs such as the one for calorie intake? Regarding the need for arousal this can be explained as follows. The need is in a state of deprivation whenever the sensory and cognitive system lacks sufficiently strong stimuli. One may think here of the nagging feeling of boredom described by Scitovsky (1981). Owing to such boredom, a motivation to act emerges. It drives consumers to seek out actions which trigger pleasant sensory and/or cognitive stimulation, e.g. "entertaining" consumption activities. (The stimuli are perceived as pleasant if they are neither too strong nor too weak, an assessment contingent on the strength of previous stimulations.) However, the removal of deprivation by such activities is only a transitory episode, because it is subject to a stupefaction effect or, in utilitarian terms, to hedonic adaptation.

Increases in spending temporarily raise the level of arousal. But as the adaptation to this level of stimulation proceeds, deprivation of the need reemerges, and with it the motivation to act. In comparison, in the case of the need for calorie intake, deprivation regularly recurs as well but can be reduced by repeating *the same* consumption activity. In the case of the need of arousal the stupefaction effect prevents this. Rather, consumption activities are required which offer stronger stimuli. They can be obtained by switching to goods and services that are usually more expensive – if a growing income makes such an option feasible.[13]

The potential for unceasing growth in expenditures corresponding to the need for arousal was, in fact, already envisioned by Scitovsky (1976). Cognitive and sensory

[12]In a study of the history of sugar consumption, Ruprecht (2005) shows that the food industry in the U.S. responded in the 1960s to growing dietary health and life style concerns (a concomitant of rising per-capita income) by innovative products. Sugar as high-calorie sweeteners was replaced by artificial, low-calorie sweeteners as, e.g. in the newly introduced Diet Coke. By eq. (iii) in footnote 11 a reduction of c_j shifts $X_{\bar{j}}$ upwards.

[13]The history of tourism and of the entertainment industry offers much evidence, see Chai (2007). One of his instructive examples is that of the British working class that considered at the end of the 19th century a leisure trip to Blackpool as major source of arousal. To nowadays reach a level of arousal comparable to the one once elicited by a trip to Blackpool, it is necessary to venture as far as the Balearic Islands or so.

stimulation can be obtained by a multitude of consumption activities, many of which may simultaneously serve other needs and wants as well. Striving to satisfy this innate need can therefore be argued to represent an essential motivational force which underlies overall consumption growth. Its influence is especially prominent, however, for the massive growth of the household budget shares of two expenditure categories able to attend to the need for arousal. One of them is "recreation" (including tourism).[14] The other is "entertainment" (including consumer electronics, communication, and social media). Using the example of the U.S. household data again spending on this category grew from 54 $ per year in 1901 to 828 $ in 2002, i.e. by factor 15, (calculated in $ of 2002), the highest relative increase among all expenditures categories (Chao and Utgoff 2006).

A similar adaptation process is also present in the case of the need for positive self-image. Consumers can temporarily reduce an annoying discrepancy between how they currently perceive themselves and their ideal self-image – i.e. a deprivation of their need for a positive self-image – by engaging in consumption activities symbolic of the ideal individual they would like to be. This is particularly true for consumers who tend to define their ideal self-image in terms of material possessions (Lades 2012a, b, Chap. 5). When, as usual, the ideal is not really attainable by the symbolic consumption activities, the discrepancy between the actual and ideal self-image recurs and triggers a motivation to engage in an intensified symbolic consumption. For economies with a high per-capita income it can be expected that the budget shares of expenditures on goods and services typically serving that need tend to rise over time. Among them are, e.g., jewelry, and other personal accessoires, cosmetics, cosmetic surgery, "fitness" enhancing goods and services, bodybuilding, anti-aging products.

The reason for why the motivation to consume is not rapidly satiable is a different one in the case of the need for status and social recognition. Comparing oneself to others is an innate human tendency. Through this comparison, a state of deprivation can be caused when one's status is felt deficient relative to the status of those to whom one is compared, or to whom one compares oneself. This is often the case when one feels insufficiently recognized especially by one's peer group. Actions aiming at a status improvement by which deprivation would be reduced are then usually informed by comparisons with individuals or groups just above oneself in the hierarchy (Frank et al. 2014). In economic diction, the preference for status and social recognition therefore represents a positional preference (Hirsch 1978).[15]

In many social environments, personal income would count as a major determinant of relative social status – if income were reliably observable. Since this is rarely

[14]The Engel curve corresponding to this expenditure category shows the most consistent, monotonous increase among all expenditures categories in the cross-country estimations conducted by Kaus (2012) on the data mentioned in footnote 10.

[15]In order to account for positional preferences, the model in Section 2 would have to be extended. Not only the own action and corresponding consumption vector would have to be entered into the individual partial utility function (1) specific to the status need but also those of the comparison group. The individual total utility functional (3) would have to be expanded accordingly.

the case, proxies for income, such as the life style one can afford, serve to assess the relative size of income. In case of a deprived need for status and social recognition one can therefore try to signal an improved status by engaging in suitable consumption activities. Goods and services one buys in order to signal status have to be visible to, and appreciated by, those one wants to impress (Heffetz 2011). Whether this condition is fulfilled by a particular consumption item is largely a matter of conventions that are specific to groups and strata in society (Witt 2011). Moreover, consumption must be sufficiently exclusive so that the status signal cannot easily be imitated. Buying expensive status symbols not economically feasible for those with lower income is a way of ensuring exclusiveness. Examples are large, i.e. expensive, homes, exclusive furniture, fancy cars, jewelry, luxury wristwatches, expensive clothes, visits to exclusive clubs, bars, restaurants, hotel (Charles et al. 2009).

However, if consumers strive to gain social recognition and status by imitating individuals or groups just above them in the social hierarchy, the exclusiveness and status-differentiating effect of symbolic consumption is continually challenged when income is secularly rising. Ever more consumers can then afford to engage in the consumption activities symbolizing a higher status. The consequence is a status-consumption race that on average just preserves everyone's relative status position (Hirsch 1978, Frank 1999 and 2011).[16] Due to this inherently instable situation, the budget share of status-related aggregate consumption expenditures can be expected to rise over time, if per-capita income is growing. Empirical evidence supports this hypothesis,[17] as also the long time series of the U.S. household budget shares shows: housing expenditures rose from 23.3 % in 1901 to 32.8 % in 2002, or (in $ of 2002) from $806 in 1901 to $5344 in 2002.

When the growth of income and of the ability to spend continues, innate needs that cannot rapidly be satiated (in an enduring manner) can thus be expected to increasingly be the drivers of the growth of consumption. This argument has been developed exemplarily here for the needs for status and social recognition, arousal, and a positive self-image. The relative insatiability of such needs causes a massive substitution processes and restructuring of the consumer goods industries as rising income brings expenditures on "basic" needs to the point of satiation. However, the less rapidly, or not at all, satiable needs are not the only drivers of the further growth of consumption and its changing composition. Preference learning through conditioning and cognitive learning as it has been discussed for acquired wants and cognitive goal setting also play a decisive role. Wants and goals that presently

[16]Status-signaling by means of consumption activities conforming to social norms that change in a trickle-down fashion across social strata can also result in delayed or not enduring need satisfaction. See the discussion of "fashion cycles" in Weidlich and Brenner (1995) and Chai et al. (2007) or of personal cleanliness norms slowly winding up in Woersdorfer (2010).

[17]Kaus (2012) follows Charles et al. (2009) and identifies status-signaling behavior with the expenditure categories "housing & utilities", "furnishings & household equipment", "transport", and "miscellaneous goods & services". Based on the data mentioned in footnote 10 he estimates cross-country Engel curves for each of these expenditure categories and finds the hypothesis supported.

exist could eventually be satisfied with rising income. Yet, the fact that new wants and goals are learned over and again prevents this form of consumption motivation from ever vanishing.

The two kinds of learning are a concomitant of the previously described specialization of consumers in particular activities. The more specialization proceeds, the finer are the distinctions between products and services which consumers can make and the more refined their demand becomes. By the same token a willingness to pay is created for differences that non-specialized consumers are unable to appreciate or even to recognize. In this way, consumer specialization generates opportunities for ever new niche markets that would not be viable without substantial consumer expertise and sophisticated preferences.

The consumer goods industries are eager to fill these niches by actively nurturing the consumers' learning and preference formation processes in order to postpone market saturation. A frequent promotion activity is, for example, the attempt to create by various means an association between newly launched products and primary reinforcing instances. The intention is to induce consumers to acquire a preference for the products by conditioning learning at a non-cognitive level. Another promotion strategy aims at the cognitive level. It consists in highlighting product features such as functionality, efficiency, convenience, flexibility, reliability, or safety which are believed to appeal to the consumers' means-ends-reflections and in this way to elicit cognitive motivation for a buying decision.[18]

4 Implications for human welfare: when is more consumption better?

The hypotheses developed in the previous sections offer a basis for analyzing how the evolution of consumption affects human welfare or well-being (terms used synonymously here). The point of departure is again the role played by the motivations underlying consumer behavior. More specifically the question is: do welfare

[18]How consumer learning and supply-side promotion of innovations jointly drive consumption growth and transform an industry has been highlighted by Frenzel Baudisch (2006) in his case study of the U.S. footwear industry. American consumers traditionally owned and, hence, bought relatively few pairs of shoes until in the early 1970s. Correspondingly, until then footwear demand had an income elasticity smaller than one. From that time on, however, the income elasticity turned greater than one. The reason was the unfolding of an innovative, functional diversification of footwear after the monopoly of the United Shoes Machinery Company was broken up in the late 1950s. Starting with the athletic shoes fashion wave new materials and new production methods allowed not only more rapidly changing fashion colors, forms, textures, and design-driven branding (adding status signaling and entertaining features to the function of footwear). The industry also began to massively advertise speciality shoes for each and every different purpose (appealing to cognitive goal striving). U.S. consumers responded by purchasing and owning significantly more shoes per period so that, notwithstanding the fact that the average price fell, footwear expenditures started to grow more rapidly than per-capita income.

improvements depend on how growing consumption expenditures are motivated? Put differently, does it matter for the welfare assessment what preferences the growing consumption expenditures are intended to satisfy? Questions like these are not part of the agenda of modern welfare economics. Lacking hypotheses about the content of preferences, welfare judgments are derived – following the logic of revealed preference theory – from the assumption that all actions are chosen voluntarily in a rational way. It is inferred, therefore, that if they would not make consumers better off (whatever their preferences are) they would not be chosen. It then follows that the growth of consumption means a welfare improvement or, to put it that way, enables consumers to live a better life.

Under conditions of poverty and starvation (as in some countries still prevalent today) it may stand to reason that being able to consume more indeed amounts to a "better life". In the high-income economies, however, the reality of consumption has moved far beyond such conditions, and the growing expenditures serve purposes whose welfare-improving effects are not so obvious. Phenomena such as hedonic adaptation, self-image problems, and positional (status) preferences, raise doubts about the welfare-enhancing quality of these choices. In addition, individual preferences may change when the set of known options is growing and/or changing. For assessing the welfare effects of the evolution of consumption it is therefore essential to go beyond a theory based on an unexplained preference order or utility index. A behavioral welfare theory needs to account for the impact of the different motivations and the effects of the corresponding adaptation mechanisms.

To start with, consider first the preferences related to innate needs in isolation. In terms of the model in Section 2, satiability of an innate need h means that the partial utility function (1) has a maximum corresponding to a need-specific vector $\boldsymbol{x}_{\bar{h}}$ (consumed per period of time). As explained, examples of needs for which a bliss point can comparatively rapidly be reached when consumption grows steadily are those for food, clothes, and shelter. Typically, deprivation of these needs is associated with poverty and starvation. Not accidentally, needs like these have been labeled "basic needs" in development economics, and their satisfaction was considered part of the essential requirements for human existence (Streeten and Burki 1978). Actions implying an increased consumption of goods serving these needs do raise welfare provided the satiation level of the needs has not yet been reached.

For innate needs that cannot rapidly, if at all, be satiated by increasing consumption, the welfare implications depend on the kind of adaptation mechanism that is triggered by raising consumption. A significant case in point is the need for status and social recognition. As discussed, income increases tend to fuel a status-consumption race in the course of which all participants on average just tend to preserve their existing relative status. For that reason, a continued growth of expenditures motivated by status seeking alone (i.e. not including combination goods serving other motivations simultaneously) does not result in increased positional preference satisfaction. A welfare gain being absent, increased status expenditures can be argued to be a waste of resources (Frank 1999, 2011).

The need for arousal is another significant case in point. The reason given above for why continued increases in consumption fail to bring about an enduring satiation

effect in this case is a special form of endogenous preference change: hedonic adaptation (see Frederik and Loewenstein 1999 on the latter). To be more specific consider the (now time-indexed) partial utility function (1) specific to actions serving the need for arousal ($h = a$). Suppose that at a time $t < T$ a vector $\boldsymbol{x}_o$ of goods and services maximizes $u^a_{t<T}$ subject to the income constraint. Assume further that in $t = T$ income increases so that, everything else being equal, a consumption vector $\boldsymbol{x}_{o'} \neq \boldsymbol{x}_o$ now maximizes Eq. (1). It implies higher consumption expenditures and leads to a welfare gain since

$$u^a_{t=T}\,(\boldsymbol{x}_{o'}) \;>\; u^a_{t=T}\,(\boldsymbol{x}_o). \tag{5}$$

Now let hedonic adaptation develop its full effect until time $t > T$. This means that the higher level of arousal that was attained by the income increase is eroded. The partial utility function (1) is shifted downwards. The temporary welfare gain associated with the expanded consumption disappears by and large such that

$$u^a_{t>T}\,(\boldsymbol{x}_{o'}) \;\approx\; u^a_{t=T}\,(\boldsymbol{x}_o). \tag{6}$$

Because of the stupefaction effect, stronger and usually more expensive stimuli are necessary to (temporarily) bring back an elevated arousal and preference satisfaction. Once further income increases make this feasible, the process starts anew. The comparison of the relationships (5) and (6) shows a time asymmetry in assessing welfare gains from increased consumption that is typical in the presence of hedonic adaptation. Whether or not there is a welfare improvement depends on whether a *pre*-preference-change or a *post*-preference-change perspective is taken.[19]

In the case of preferences changes caused by conditioning learning (acquired wants) and/or cognitive goal setting a welfare analysis in terms of the partial utility function (1) is no longer possible. Instead, the relevant welfare measure is the (now time indexed) total utility functional (3). However, the welfare effects of consumption growth are ambiguous here too. The ambiguity relates not least to consumer innovations which have been argued above to induce preference changes of this kind. While in politics and in the public innovations are generally considered highly desirable nowadays, their actual welfare effects may not support such a view. In order to make this point consider a situation at a time $t < T$ in which a vector $\boldsymbol{x}_r$ of goods and services maximizes the utility functional (3). If income were increased by an amount ΔI at that time, a consumption vector $\boldsymbol{x}_{r'} = (x_{r'1}, \ldots, x_{r'm}) \neq \boldsymbol{x}_r$ would maximize the functional (3). Everything else being equal, a higher consumption expenditures and a welfare gain would occur because $U_{t<T}(\boldsymbol{x}_{r'}) > U_{t<T}(\boldsymbol{x}_r)$.

[19]The contradictory welfare assessments can be argued to point to a hedonic treadmill effect (Binswanger 2006). For an important part of their consumption, consumers make ever greater expenditures without ever getting really happier. A similar argumentation also applies for the need for a positive self-image, but will not be developed here for reasons of lacking space.

Now assume that an innovative consumer good s (like smart phone) is introduced to the market at that time. Since the adaptation of preferences to innovations takes time, the consumer does not immediately acquire a want for s and/or make it an object of cognitive goal striving. Let this happen only at time T. This means that for $t \geq T$ both the vector of goods and services is extended by the component s and the utility functional by a corresponding new acquired want or cognitive goal. If it is a new cognitive goal that is added, the total utility functional is thus given by

$$U_{t\geq T} = \varphi\left[u^1_{t\geq T}(\boldsymbol{x}_l), \ldots, u^n_{t\geq T}(\boldsymbol{x}_l), u^{n+1}_{t\geq T}(\boldsymbol{x}_l), \ldots, u^{n+w}_{t\geq T}(\boldsymbol{x}_l), u^{n+w+1}_{t\geq T}(\boldsymbol{x}_l), \ldots, u^{n+w+g+1}_{t\geq T}(\boldsymbol{x}_l)\right] \tag{7}$$

with $\boldsymbol{x}_l = (x_{l1}, \ldots, x_{lm}, x_{ls})$. For the sake of the argument assume that, after the new preferences including s have been formed, income indeed happens to increase by the amount ΔI. Let the maximization of Eq. (7) subject to the higher income result in the optimal consumption vector $\boldsymbol{x}^* = (x^*_1, \ldots, x^*_m, x^*_s)$. Obviously,

$$U_{t\geq T}\left(\boldsymbol{x}^*\right) > U_{t\geq T}(\boldsymbol{x}_{l'}). \tag{8}$$

This means that from a *post*-preference-change perspective underlying relation (8) the increase in consumption expenditures, including the spending on the innovation, results in a welfare gain. In such a perspective, foregoing the consumption of smart phones, say, would amount to a welfare sacrifice. When considered from a *pre*-preference-change point of view, however, the opposite holds:

$$U_{t<T}\left(\boldsymbol{x}^*\right) < U_{t<T}(\boldsymbol{x}_{l'}), \tag{9}$$

because an expenditure on something that is not (yet) valued would result in a welfare loss.

Thus, to the extent to which the secular growth of consumption is driven by newly acquired wants and cognitive goal setting, it is an open question whether such growth results in welfare gains. The answer depends on what time perspective is chosen for measuring welfare. The reversal of the inequality sign in relations (8) and (9) means that any of the welfare judgments regarding the growth of consumption is contestable. Consumers in high-income economies usually choose the post-preference-change perspective when making such assessments. This attitude is quite in line with a mindset that emphatically welcomes stimulation through experiencing the novel things which are readily supplied by the consumer goods industries. *Post festum*, the credo "more consumption = better life" always turns true.

However, the ceaseless development of consumer innovations – with their influence on acquired wants and cognitive goal setting – paves the way for further instances of preference change. Consequently, every post-preference-change situation can be equally said to represent a pre-preference-change situation. Under such

conditions, the pursuit of enhanced preference satisfaction through expanding consumption becomes a *drift* process. Its direction is contingent on what preferences happen to be learned when. From a normative perspective, the ambiguity in assessing welfare is suggestive of strong preference relativism. The choice of either the post-change or the pre-change preferences as the measuring rod reflects an implicit value judgment. Utilitarian ethics offers no criterion by which it could be decided which one to choose. If, perhaps as a consequence of recognizing the preference relativism, a commitment to measuring welfare from the pre-preference change perspective is made, one can control and constrain one's cognitive and non-cognitive learning processes.

There are indeed acute reasons for considering such a self-imposed moderation, namely the private and social costs of the way in which consumption evolves and grows. With respect to the private costs, the rising income that fuels expanding consumption is not feasible without increasing effort and strain on the part of the economic agents. In the high-income economies, doubts can be raised as to whether the continued growth of consumption makes the agents happier (see also Helliwell et al. 2013). As mentioned, concerns about being caught in a hedonic treadmill may be justified (see Binswanger 2006). The question is whether the additional consumption is worth the greater effort and strain. This is particularly true also with respect to consuming ever more new goods and services if one recognizes that their appreciation has in many cases only recently been learned.

Concerning the social costs, doubts of whether additional consumption is worth it are even more pronounced. Until now, the evolution of consumption has always entailed the greater exploitation of materials, biomass, energy, atmosphere, fresh water, and space. The ongoing changes to the global climate foreshadow the potential for catastrophic future developments (McNeill 2000). If the social costs caused this way had to fully be privately internalized, this would reduce the welfare gains whatever measuring rod for welfare is chosen. The evolution of consumption would then take a different path. However, even when there were hope for that to happen (which is not the case), an evolution of consumption still following the mantra "more consumption = better life" would be unlikely to be sustainable (see, e.g., the Millennium Ecosystem Assessment 2005). Massive concerns are justified especially given that the developing countries with huge populations are likely to try to follow the lead of high-income countries on their path of consumption growth.

As has frequently been criticized, once preference subjectivism is left behind, the utilitarian focus on individual welfare provides much less of a normative orientation than often believed (see Sartorius 2003, Gowdy 2005, Binder 2010). On the basis of the motivational underpinnings discussed in the preceding sections a more differentiated picture emerges that, in view of the mentioned private and social costs, suggests two questions of normative relevance. Can it be ignored that in the richer countries ever larger parts of the growing consumption are motivated by innate needs which induce growing expenditures but improve preference satisfaction only temporarily or not at all? Can it be ignored that much of the growing consumption is driven by a demand for goods and services that would not be missed, had the preference for them not been learned in the first place?

5 Conclusions

Modern microeconomic theory treats preferences as an unexplained "black box". More recent developments in behavioral economics, including the few contributions to establishing a behavioral welfare theory, have basically left the black box untouched. However, the theoretical lacuna makes it difficult to explain the evolution of consumption and its welfare effects. In this paper it has been suggested to fill the theoretical lacuna by an inquiry into the motivational foundations of economic behavior. To accomplish this, one can draw on well-established research results from biology, behavioral science, and psychology. In this way, the understanding of both the evolution of consumption and the conditions under which the equation "more consumption = better life" holds, can be improved.

As a result of rising income, consumption activities in the developed world have been scaled up over the past century to previously unprecedented levels. At the same time, the composition of consumption has changed substantially as expressed in the household expenditure statistics. By the same token, the consumer goods industries had to massively restructure. The core thesis implied by the motivational foundations advocated here is that the observed changes in consumption can be attributed to two causal mechanisms.

The first mechanism rest on the fact that some of the motivations which drive consumption activities start to unfold and change once the resources available for their satisfaction are growing. These are the motivational forces arising from acquired wants and cognitive goal setting whose transformations have been discussed in detail. New preferences are then formed and the utility function is extended by new arguments. As long as the ability to spend increases, consumption that is motivated in this fashion can grow without bounds. Whether the corresponding growth process is welfare-enhancing has been shown to depend on whether or not the most recent, i.e. the post-change, preferences are used as the measuring rod for welfare. If such a moving measuring rod is used it can be argued, however, that the very idea of a better life is subject to a drift process which, in turn, implies a strong preference relativism.

The second causal mechanism relates to consumption motivations that result from innate needs. When the ability to spend increases, some of them seem to be quite rapidly satiable when the consumption of goods serving them goes up. These needs have been referred to as "basic needs" in development economics. Up to the satiation point, expanding consumption results in welfare gains. However, unlike in the low-income economies, signs pointing to stagnating demand and saturated markets for the relevant products indicate that the level of satiation either has already been reached or is closely approached in the high-income economies.

Other innate needs do not seem as rapidly satiable, at least not in a lasting way. The needs for status and social recognitions and for cognitive and sensory stimulation (arousal) have been discussed exemplarily for this type of needs. In the first case, it can be doubted whether any welfare gain can be expected to result from raising the corresponding expenditures. The status preference is a positional

preference, and the status position cannot be improved by raising expenditures as long as everyone engages in a status consumption race. In the second case, increased spending does indeed result in an improved need or preference satisfaction and, hence, a welfare gain. Yet this is only a temporary effect. Due to hedonic adaptation (stupefaction) much or all of the previous welfare gain disappears after a while.

Thus, unlike in low-income countries, the growing consumption in the high-income economies is motivated in part by needs that are difficult to satiate and therefore promise little, if any, welfare gains when expenditures are raised further. In part, consumption growth is driven by newly emerging preferences whose satisfaction does, or does not, result in welfare gains, depending on what state of the preferences is used as measuring rod. Taking a normative perspective, both findings are problematic, given the massive social costs and environmental threats of a continued consumption growth. It does not seem easy under these conditions to provide a normatively convincing legitimization for the calls for having even in the high-income economies ever more consumption growth.

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How Where I Shop Influences What I Buy: The Importance of the Retail Format in Sustainable Tomato Consumption

Chad M. Baum and Robert Weigelt

Abstract Although interest in sustainable food has increased substantially in recent years, the actual demand for such products has often risen quite unevenly across people. Making sense of the variable pace of behavioral change thus requires us to explore the foundations of sustainable consumption more closely, especially the importance assigned to specific attributes and the types of tradeoffs that prevail. Accordingly, this study utilizes a type of discrete choice experiment (DCE) to explore the influence of retail formats on decision-making processes. Stated-preference methods such as DCEs have proven useful to explain how and why individual willingness to pay (WTP) for qualities such as organic, fair trade, and locality can differ. By mostly focusing on product qualities, however, the importance of the retail format where products are purchased, and their impact on the valuation of attributes, is left unexplored. Framing this DCE in relation to tomato consumption, we find that type of retail format is a significant determinant of purchasing behavior, both on its own and via its interaction with the other qualities.

Keywords Sustainable consumption · Retail format · Discrete choice experiment · Willingness to pay

JEL Codes D12 · Q13 · Q18

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1 Introduction

Questions of preference and taste are always challenging for those who study consumption. With increasing capacity to express themselves with their choices, consumers in developed countries are able to adopt and refine an array of behaviors reflecting what matters to them and where their interests lie. This can partly explain why even more traditional, low-involvement sectors such as food are suffused by increased product variety and the demand for novel qualities to satisfy an expanding list of needs and wants (e.g. Costa and Jongen 2006; Earle 1997; Harvey et al. 2002; Menrad 2004). For instance, global sales of organic food have grown fourfold in the last decade to now surpass $64 billion (Sahota 2014). As the largest market for organic food, total sales in the United States recently amounted to an estimated $35.9 billion, which represents nearly 5% of the entire food industry (OTA 2015). Similarly, the global market for fair-trade products has grown annually in excess of 20%, now amounting to $8 billion (Fair Trade 2014). In both cases, we can thus observe the extensive growth within markets for sustainable food production.

Nevertheless, even though interest has grown substantially, actual consumption of products has usually proceeded unevenly. As such, only a small subset of passionate consumers shopping at alternative venues such as farmers' markets and independent organic retailers are ultimately responsible for most of the overall growth (Padel and Foster 2005; Pearson et al. 2011). This is relevant for two reasons. First, it implies that, for the majority of consumers, there is a sizable gap between what is said and how they actually behave (Bamberg and Möser 2007; Gifford 2011). In spite of the stated willingness to pay a higher amount, and in a context where most individuals (81%) see themselves as (at least) occasional consumers of sustainable food (OTA 2013), there are other factors, psychological and contextual, which constrain behavioral change. Second, the uneven pace of such change also speaks to the implicit role of alternative retail formats. Alongside the upsurge in sustainable forms of food production, there is also the (re-)emergence of models that feature shorter supply chains and personal connections with food producers. For instance, the number of farmers' markets in the United States grew by 150% between 1994 and 2006, with total sales via such channels exceeding $1.3 billion (Brown and Miller 2008; USDA 2014). Signifying yet another dimension for this transformation, innovative arrangements, such as community-supported agriculture (CSA), have introduced other approaches to sharing risks between farmers and consumers. Though practically nonexistent two decades ago, 13,000 CSAs now exist in the United States (USDA 2014), along with a further 6300 CSAs operating across Europe (Volz et al. 2016). Together, CSAs in these two contexts serve around a million consumers. Moreover, due to the strong association between alternative retail formats and the likelihood of purchasing local and organic food (Bond et al. 2008a; Hsieh and Stiegert 2012; Yue and Tong 2009; Umberger et al. 2009), it is necessary to have a closer look in this direction.

Nonetheless, insufficient attention is typically given to processes of consumer specialization in the domain of sustainable food. While there is a tendency toward

the elaboration of 'profiles' of consumers in terms of, for instance, income, gender, education, and degree of environmental concern (e.g. Govindasamy and Italia 1999; Hughner et al. 2007; Nurse Rainbolt et al. 2012; Pearson et al. 2011), what is overlooked are the dynamic learning processes through which such individuals garner the knowledge, motivation, and capabilities that are required to engage and persist in this type of consumption. This is critical because, given implications that some people behave more sustainably simply since they more closely resemble the prototypical sustainable consumer, it remains difficult to understand how, and in fact whether, differences in willingness to pay can evolve over time. In this regard, such an interpretation almost assumes out of hand that the 'mainstreaming' of the organic-food sector, by making products cheaper and easier for consumers to purchase, is necessary to ensure stable and continued growth remains feasible. Owing to the resulting stress on making behavior as convenient as possible, however, this is likely to result in a neglect of all the other ways that retail formats matter. As such, it may overlook exactly those features of alternative formats that contribute to processes of consumer specialization and help explain the uneven pace of behavioral change that is occurring.

For this reason, we make use of Witt's (2001) theory of consumer specialization to offer insights into a potential relationship between retail formats and sustainable consumption. In specific, we highlight how, in addition to the product attributes, the type of retail format might furnish crucial inputs for individual learning vis-à-vis the credibility of quality claims and thereby strengthen processes of consumer specialization. We therefore apply to this framework to motivate a hypothetical discrete choice experiment (DCE) that serves as an initial exploration of how such a relationship expresses itself in terms of consumer preferences. In specific, we explore if a product being sold at a particular type of retail format influences the perceived value of sustainable production attributes (i.e. organic, fair trade, and local), that is, separate from the impact of product labels. This methodological approach is appropriate for two reasons. First, stated-preference methods like DCEs have proven broadly useful to understand how and why demand for sustainable attributes varies across individuals. Furthermore, as this approach is more product-focused in nature, it enables us to explore the impact of type of retail format alongside product attributes. By integrating type of format (discounters, supermarkets, and independent organic retailers) into choice tasks directly, we can therefore provide results of two kinds: (1) from the main effects, the direct impact of retail format-type on purchasing likelihood; and, by looking at the interaction terms, (2) the relationships between specific formats and quality attributes. We then use the results to deliver willingness to pay estimates, including for the interaction terms, before concluding with a discussion of the impact of retail formats on consumer specialization.

2 Retail Formats and Sustainable Consumption

The overall intent of this section is to piece together evidence and arguments from the literature on sustainable consumption regarding the importance of the retail format. In specific, we consider how and why type of retail format may influence the sustainable purchasing decisions. Regardless of whether or not it is ensuring the availability of sustainable food or the credibility of quality claims, the type of shopping venue is widely acknowledged as an essential determinant of organic consumption (Schifferstein and Oude Ophuis 1998; Thompson and Kidwell 1998; Zepeda and Li 2007). For instance, the tendency to shop at alternative retail formats, such as farmers' markets, is linked with the greater likelihood of purchasing local and organic food (Bond et al. 2008a; Yue and Tong 2009). Strikingly, there is also evidence that type of format can have an influence on the quality perception and price sensitivity of individuals (Umberger et al. 2009; Hsieh and Stiegert 2012). That is, the fact that one shops at a given format is linked with the greater willingness to attend to quality attributes, and less to price when higher quality is available.

Nonetheless, owing to a focus on products and product attributes in the literature, it is often difficult to provide greater clarity on the relationship between retail formats and sustainable consumption. As a result, one of the most prevalent explanations centers on the role of the retail format in searching for information about product quality. Stopping short of actual differences in product quality, it is instead asserted that formats might differ regarding the costs of information search. On the one hand, this could simply be because a certain type of product, e.g. organic, is more widely available. Consumers would thus have greater variety available to them, and without having to engage in costly search activities (Vermeir and Verbeke 2008; Zepeda and Li 2007). If this is true, then it is not necessary to assign additional significance to retail formats beyond ensuring sufficient access to sustainable produce. On the other, existence of familiar quality labels or a reputation for credibility could reduce the costs of searching. This is especially relevant given the types of qualities that are under consideration: credence qualities. Since credence qualities related to the production process (e.g. fair trade and organic) cannot be directly verified either before or after consumption (Darby and Karni 1973), it becomes necessary to rely on other attributes as cues to infer quality. Notably, the visibility and perceived trustworthiness of shorter supply chains is therefore assigned additional significance in various studies (Meyer and Sauter 2004; Henseleit et al. 2007), perhaps owing to a correlation between these types of chains and the credibility of quality claims. Hence, if individuals are willing to pay more for food transported shorter distances (Grebitus et al. 2013) or from smaller farms (Darby et al. 2008), this could reflect the specific value of locality, a perceived link between shorter supply chains and quality production, or perhaps a combination of the two.

There are thus a number of reasons why people value an attribute like local production, including its relevance as a cue to infer other qualities. To make sense of how credibility is relevant, Dentoni et al. (2009) thus outline a conceptual framework distinguishing 'direct' and 'indirect' benefits from one another. The authors

characterize indirect effects as "mediated by [the] belief that other desirable product attributes... are present" (ibid.: 384–5). Aside from local production, a host of attributes, including the type of retail format, can function as cues of product quality. This can be expressed more clearly via the equation below, adapted from Dentoni et al. (2009):

$$Quality\ Evaluation\ (Product) = \sum_{i=1}^{n} e_i b_i$$

Here, overall evaluation of product quality is expressed vis-à-vis the summation of the expected values of all attributes comprising the product.[1] In specific, i is an attribute of the product, e_i reflects the evaluative judgment for an attribute i, and b_i is the belief strength that attribute i exists. Holding the evaluative judgments constant, we observe that any factor that increases belief strength that a particular attribute is present will have an impact on quality evaluation. We can thus discern two ways consumers obtain greater value from an attribute: (1) because the consequences engendered by the attribute matter to them; or (2) given its use as a cue, there is greater belief that other valuable attributes are present. Taking the case of organic products, two consumers who shop at distinct retail formats may end up expressing an identical 'value' for an attribute even if, e.g., the first consumer places greater importance on organic production. That is, if the first is less sure that this quality is present because of where they shop, then it could be possible for the second, though caring less, to value the produce the same because they have access to more credible information. As such, any preference heterogeneity could either reflect either an underlying difference in value assigned to a given attribute or, conversely, the difference in their respective levels of belief strength. If the latter is the case because, e.g., retail formats diverge in terms of the credibility of their quality claims, the type of format may provide one particular reason why we find that preferences vary across consumers.

Conversely, a misleading picture takes shape if we solely focus on costs of information search. In this regard, many studies (Bond et al. 2008b; Onozaka et al. 2011; Yue and Tong 2009) make use of retail formats only in order to distinguish consumers in relation to where they purchase most frequently. The tendency to shop at certain types of retail formats therefore becomes something akin to another socio-demographic factor. In other words, as an (external) change in one's preferences is likely to correspond to a shift in the shopping venue, the preference for a certain venue can serve as a basis for "'sorting' consumers with similar motivations and values" (Onozaka et al. 2011: 583). As a result, it is no longer necessary to understand the underlying differences in preferences, let alone how these are shaped by the retail context. Instead, the format that is favored is affixed as a kind of place-holder. Even as a first step to clarifying why the type of retail format matters, an *in situ* explanation of its relationship with consumer decision-making thus remains

[1] One limitation of this approach is that it is unable to account for interaction effects between attributes. We turn our attention to this in the following section.

absent. In fact, with format choice so statically characterized, there is only a limited scope for contextual factors to influence the content of preferences. Rather, it would appear that one simply *is* a sustainable consumer for reasons that are difficult or unnecessary to explain.

Hence, something more is required to explain the uneven pace of behavioral change. After all, this puzzle emerges out of a dynamic process and is therefore difficult to explain through one-off instances of decision-making. If we want to understand why some individuals are more likely to engage in specialized forms of consumption than others, it is necessary to look closely at what drives such processes in general. In this regard, we note that, while credibility is certainly a crucial differentiating factor across retail formats, only attending to this factor runs the risk of abstracting from the wider importance of retail environments as venues to browse and explore preferences. In this vein, Earl and Potts (2000) underscore that it is those unplanned purchases that occur while one is browsing that are, far from being random, deeply related to un(der)satisfied needs and wants of which one was previously unaware. Shopping, and browsing in particular, thereby assumes the quality of an open-ended process through which consumers gain insight into their needs and wants and, significantly, where the retail environment makes a crucial contribution. From this perspective, the uneven pace of behavioral change cannot be defined in terms of motivations and values, and certainly not search costs or convenience. Rather, given that consumers place intrinsic value on the opportunity to explore their preferences, there is an inherently contextual quality to specialization processes (Chai 2012).

In order to re-evaluate credibility and its importance for consumer specialization, we thus apply Witt's (2001) theory. This framework argues that the change in preferences over time, at both the level of individuals and (differentially) across populations, is a result of the dynamic interplay between two types of learning: non-cognitive and cognitive. While the former is evolutionarily older and grounded in associative connections, i.e. between rewarding activities and innate needs, the latter is reliant on the quality of information available. In specific, such information serves as the foundation for preference learning in two crucial respects. First, in cases where attributes of a product are not immediately explicit, we need information to understand what a product does or how it works. A clear example comes from the proliferation of electronic devices such as smartphones and portable MP3 players whose usage requires a modicum of expertise. However, given the frequent confusion about how organic products differ from their conventional counterparts (e.g. Ayres and Midmore 2009; Padel and Foster 2005), such information gaps are apparent for sustainable consumption as well. In fact, the sizable divergence between consumer expectations of fair-trade certification and lived experiences of actual farmers offers us one notable example (Getz and Shreck 2006; Griffiths 2012). Accordingly, if the information from certification systems is not perceived as credible, it cannot be assumed that use of labels is a sufficient basis for quality evaluation (Jahn et al. 2005; Janssen and Hamm 2012). In support of this, it has been found that a plurality of consumers view labels as 'marketing tools' that do not necessarily guarantee what is promised (Rousseau 2015). As a result, consumers

must utilize other cues to 'indirectly' evaluate quality claims, including the perceived credibility of sellers (Cuthbertson and Marks 2008; Moser et al. 2011) or trustworthiness of certification agencies (Janssen and Hamm 2012; Olynk et al. 2010; Van Loo et al. 2011). In both regards, and by granting access to better information or only stocking those products with sufficient level of quality (Mayo and Fielder 2006), the type of retail format can help to establish the pre-conditions for consumer specialization.

Besides their influence on credibility, retail formats are potentially significant also with regard to the type of information provided. In this respect, Witt (2001) makes a point of highlighting the needs and wants satisfied by a given consumption activity. In this vein, various authors have highlighted how particular needs like novelty (Bianchi 2002; Chai 2012) and obtaining relatedness (Ryan and Deci 2000; Thøgersen 2005) serve as the incentives for preference learning and further consumer specialization. Seen in this light, another important feature of consumer specialization is the opportunity to 'browse' the greater assortment of needs that might be satisfied by an activity like food consumption (see Bianchi 2002). By expanding the types of rewards that are available, the fact that individuals differ in terms of their 'values' for sustainable food is then open to re-interpretation. Notably, this may reflect an outcome of their ability to learn about additional properties of the products and, moreover, how these can satisfy their needs and wants. If behavioral change has been uneven for sustainable food consumption, we hypothesize this may instead reflect the distinct features of retail formats, i.e. and not because the motivations and values of individuals differ. As a potential example, we note how retail formats vary in terms of opportunity provided to interact with, and receive information about and from, the people and places involved in the production of one's food. Indeed, access to detailed knowledge is often highlighted as a distinguishing feature of more specialized consumers (Bougherara et al. 2009; Russell and Zepeda 2008). Speaking to a link between preferences and shopping venues, Russell and Zepeda (2008) also note how CSA participation could motivate individuals to 'adapt' their preferences, for instance, by developing preferences for seasonality and an appreciation for the task of farming. Greater potential for preference learning owing to closer contact with the source of production has also been broadly replicated (Brown 2002; Hinrichs 2000; Zanoli and Naspetti 2004).

Whether it is the opportunity to communicate with knowledgeable networks or direct interaction with the people and places involved with food production, it is thus increasingly evident how the social context of consumption activities, and the type of retail format in specific, is crucial for consumer specialization. For the sake of this article, we focus on the credibility-related features of this discussion and use these to motivate our discrete choice experiment.

3 Designing the Discrete Choice Experiment

Driven by the growing interest in sustainability, consumer science has increasingly turned to stated-preference methods to understand demand. Instead of what people purchase or have purchased, such approaches use survey responses to clarify (non-market) valuations of quality improvements (Arrow et al. 1993; Kahneman and Knetsch 1992; Turner et al. 2002). Even if markets are not well-established, such surveys "create an idealized market . . . whereby respondents face a choice between two different quantities of the good" (Carson 2000: 1414). Participants are thereby invited to express a preference between the status quo to which they are accustomed and one (or more) alternatives, often requiring a cost increase. Within a discrete choice experiment (DCE), preferences are explored via (repeated) choice tasks where one is asked to choose from a set of products.[2] In this fashion, we can assess whether a market is viable, by comparing willingness of pay (WTP) of consumers to the price premium that is needed to support higher-quality production. If WTP is too small, then we have one explanation for why a market has not materialized.

To motivate our DCE, it is useful to clarify how demand is often conceived in this literature. Following Lancaster (1966), DCEs tend to disassemble products into component attributes. For sustainable consumption, this entails separating the distinct aspects (i.e. organic, fair trade, and locality) from one another to then estimate the value assigned to each. For instance, some studies have explored the value of fair-trade coffee as a means to grow farm incomes (e.g. Loureiro and Lotade 2005). Meanwhile, Onozaka and Thilmany McFadden (2011) find a premium for local over national production of $0.22 for apples and $0.38 for tomatoes. Crucially, WTP estimates such as these not only reflect the perceived values of the attributes but also foster discussion of how value can vary across countries and product categories (Rödiger and Hamm 2015). In consequence, many studies have used DCEs to explore to what extent WTP is higher for, e.g., meat versus fruits and vegetables (Lusk et al. 2003) and fresh versus processed foods (Hu et al. 2009; Meas et al. 2015).

Furthermore, interactions between the various attributes are useful to explore whether substitution and complementary effects exist. Firstly, it is possible for the overall effect of the attributes to differ from what the respective sums may indicate (Onozaka and Thilmany McFadden 2011; Meas et al. 2015). Bond et al. (2008b) thus reveal that WTP for a product with organic, local, and nutritional claims is only slightly higher than that for a single claim. Similarly, Yue and Tong (2009) find that local and organic production, although each worth $0.67, have a joint premium of only $1.06. On the one hand, we can thus conclude that the total effect is not

[2]The choice-driven nature of DCEs is one of their primary advantages, i.e. due to greater correspondence with real-world decision-making. In this vein, a contrast with experimental auctions is useful, especially given the potential for preference reversals when engaging in bidding rather than choice (Lichtenstein and Slovic 1971; Slovic and Lichtenstein 1983). As bidding is motivated by winning, it is not analogous to choice and can therefore lead to distinct outcomes.

necessarily additive. On the other, such interactions also point to a potential for 'indirect' effects of attributes on one another (e.g. Dentoni et al. 2009). In this regard, it is revealing that Onozaka and Thilmany McFadden (2011) fail to find any kind of 'organic' premium. Indeed, once they control for the influence of locality and fair trade, this attribute ceases to be important. It can thus be inferred that consumers either fail to see the merits of organic production or, maybe, that an attribute like locality offers sufficient assurance for the overall product quality (Meyer and Sauter 2004; Henseleit et al. 2007). In fact, such a role for locality has been verified in relation to quality claims for organic production and animal welfare (Darby et al. 2008; Thilmany et al. 2008). As a result, it is vital to include the entire range of relevant attributes to account for their various influences. In our DCE, this includes both the product attributes (i.e. organic, fair trade, and locality) and types of retail format. By including the interactions, the information from the repeated choices can be used to generate WTP not only for each attribute but also their joint influence. To better explore the potential for interaction effects, we also offer WTP estimates for these terms.

In spite of their advantages, DCEs have not been extensively used to explore sustainable food consumption. To our knowledge, only ten studies uses DCEs to explore the key determinants of sustainable purchasing (see Table 1).[3] Moreover, even fewer have examined interactions among attributes (Bond et al. 2008b; Meas et al. 2015; Onozaka and Thilmany McFadden 2011; Yue and Tong 2009).

To better highlight the interactions between the how and where of food production, we thus extend the literature by also including type of retail format. By integrating the format directly into choice tasks, we provide two types of results: (1) from the main effects, the direct influence of retail format-type on overall purchasing likelihood; and (2) through the interaction terms, the relationships between specific types of formats and quality attributes, e.g. organic and discounters. In this manner, we clarify how retail formats influence purchasing decisions in a more comprehensive fashion.

3.1 Survey and Data Collection

This survey was administered via computer at an open-to-the-public event in November 2013 in Germany. Participants are often motivated to attend 'Long Night of Science' events due to an interest in the work of local research institutes. Accordingly, these events represent an opportunity for data collection that avoids some notable shortcomings of student-based samples. Furthermore, as the

[3]Interestingly, some studies fail to recognize their method as a DCE. On this point, Louviere et al. (2010) argue that DCEs, in contrast to other multi-attribute valuation methods, are marked by their specific behavioral theoretical foundation (i.e. random utility theory) and superior flexibility and (external) validity for the modeling of decision-making processes.

Table 1 Summary of DCE studies

	Products	Key attributes	Attribute interactions
Lusk et al. (2003)	Beef ribeye steaks	Fed GM corn Given growth hormones	No
Bond et al. (2008b)	Red leaf lettuce	Organic certification Nutritional claim	No
Yue and Tong (2009)	Tomatoes	Organic certification Local production	Yes, between organic and local
Onozaka and Thilmany McFadden (2011)	Apples Tomatoes	Organic certification Fair Trade certification Origin (local, national, imported) Size of Carbon Footprint	Yes, between all relevant attributes
Van Loo et al. (2011)	Chicken breast	Organic certification (distinct types of logos)	No
Janssen and Hamm (2012)	Apples Eggs	Organic certification (distinct types of logos)	No
Rousseau and Vranken (2013)	Apples	Organic certification Origin (local, Spanish, Australian)	No
Garcia-Yi (2015)	Yellow chili peppers	Organic certification Fair Trade certification	No
Meas et al. (2015)	Processed blackberry jam	Organic certification Origin (local, state, other) Nutritional claim Farm size (large, small) Type of brand (national, regional, store-specific)	Yes, between farm size, organic, and origin
Rousseau (2015)	Chocolate	Organic certification Fair Trade certification Origin (Belgian, Swiss, Dutch)	No

second-largest market for organic and fair-trade products (Schaack et al. 2014), Germany signifies a suitable context to explore sustainable consumption. Furthermore, the retail sector here is quite diverse. On the one hand, there is a prevalence of discounters and supermarkets, accounting for almost three-fourths of the market share (Minhoff and Lehmann 2015). Yet, alternative formats also play a prominent role, especially if issues of trustworthiness emerge (e.g. GS1 2006).

The survey begins by providing information about the experiment. Initial instructions about the DCE are given to instill an appropriate decision frame, with individuals asked to imagine themselves going to shop for, *inter alia*, tomatoes. They are requested to complete all choice tasks alone and to answer as accurately and spontaneously as possible. Given that learning effects and fatigue are often prevalent for computer-administered surveys (Savage and Waldman 2008), the sequence of tasks within the blocks is randomly determined. In this way, we ensure, as much as

Table 2 Socio-demographic characteristics

Characteristic		Sample	Population
Gender	Male	37.9%	49.1%[a,c]
	Female	62.1%	50.9%[a,c]
Average age (years)		32.7 (*12.84*)	42.4[a,c]
Nationality	German	94.3%	94.8%[a,c]
Education	High-school degree (equivalent)	96.8%	70.9%[a,d]
	University degree or higher	50.0%	22.3%[a,d]
Employment	Full-time	48.4%	42.2%[a,c]
	Part-time and mini-job	21.8%	24.8%[a,c]
	Unemployed (incl. students and homemakers)	23.4%	26.5%[a,c]
Number of children (avg.)		0.69 (*1.04*)	
Household size (avg.)		2.84 (*1.56*)	
Household income per month	<1000€	27.4%	13.1%[b,d]
	1000–1500€	12.1%	26.6%[b,d]
	1500–2000€	14.5%	18.4%[b,d]
	2000–2500€	11.3%	14.8%[b,d]
	2500–3000€	12.9%	10.3%[b,d]
	>3000€	21.8%	16.1%[b,d]
Responsible for shopping		84.7%	

Notes: Sample size N = 124. Standard deviations are in parentheses
[a]City-level data (Jena); [b]State-level data (Thuringia)
Sources for population values: [c]Stadt Jena, Jenaer Statistik; [d]Thüringer Landesamt für Statistik

possible, that the variation in the sample reflects the underlying preference heterogeneity.

The total number of participants completing the DCE was 125, and resulting in an eligible sample of 124: one failed to complete the socio-demographic questionnaire. Using the software MODDE 9.0, a D-optimal fractional factorial design was used to generate product profiles. We opt not to exclude any possible profiles, with the sole exception of the pair of 'organic retailer' and 'conventional', which was found to introduce unnecessary confusion. Two uneven blocks of tasks were then created, with the first block having 15 choices and the second 14. Once participants were randomly assigned to blocks, we end up with a total of 1808 observations.

3.2 Sample Characteristics

A comparison of the socio-demographic characteristics for sample and local populations are shown in Table 2. Since the experiment focuses on purchasing decisions, a minimum age of 18 is introduced. Women are more prevalent than men, not unexpected owing to our focus on food purchasing. Moreover, the fact that

85% of the sample identify themselves as the one responsible for household shopping is more important for the validity of the experiment.

Due to the nature of open-to-the-public events, there is however potential for self-selection bias. In this regard, the sample seems to have a higher level of educational attainment overall, with half of the participants having at least the equivalent of a Bachelors' degree. However, this can also be partly explained by the high proportion of university employees to the general population in the local context.

3.3 Experimental Design

There are three core features of any DCE: (1) the attributes and levels used to describe products; (2) how the status quo is specified; and (3) the structure of choice tasks. Each sub-section will therefore take up one specific topic in outlining the experimental design.

3.3.1 Attributes and Attribute Levels

Selection of the attributes was determined through an extensive review of the literature. The full list of attributes and attribute levels is seen in Table 3.[4] Four of the five attributes also appear in other studies: price; production location; organic production; and ethical standards. Prices are for 500 g of red round tomatoes, and reflect those in the broader experimental context. Further, the levels for production location were selected based on availability, with Spain and Mexico both leading exporters of tomatoes to Germany. As one of the largest states for tomato production in Germany, the survey region (Thuringia) is also used to represent tomatoes of local origin. To avoid choices reflecting distinct levels of understanding, we also give some background on organic production and ethical standards.[5]

Three types of retail formats, i.e. discounters, supermarkets, and independent organic retailers, are also included to highlight salient differences.[6] So that

[4]Two distinct rows for the price attribute are needed to ensure that no two products in a choice task are completely identical. This modification is required by the introduction of an individual-specified status quo.

[5]Usage of labels is eschewed in favor of the phrases 'organic' and 'fair' in the experiment. Labels are avoided in view of a tendency for value to be placed on the logo, irrespective of its link to quality (Lotz et al. 2013). For instance, Janssen and Hamm (2012) observe that a 'fake' logo in Switzerland was assigned higher WTP than generic organic labeling. Our interest in underlying processes of decision-making therefore justifies this approach.

[6]The corresponding German translation of 'independent organic retailer' is the more familiar 'Biomarkt'. Hereafter, the shorter form of 'organic retailer' is thus used with no intended change in meaning.

Table 3 Attributes and attribute levels

Attribute	Attribute levels
Price per 500 g	1.50 €; 2.50 € (Status quo)
	1.00 €; 2.00 €; 3.00 € (Alternatives)
Country of origin	Local (Thuringia)
	Mexico
	Spain
Retail format	Organic retailer
	Discounter
	Supermarket
Organic production	Organic
	Conventional
Ethical standards	Fair
	Not fair

participants do not just rely on their existing perceptions of retailers, we portray formats using features like store size, product variety, prices, and ownership structure (cf. Wortmann 2004; Herrmann et al. 2009). Supermarkets are thus defined as the largest format, having the most diverse product assortment, and with access to national or international distribution networks. Discounters are identified by an emphasis on low prices, more limited product selection, and less use of advertising and service personnel. Finally, organic retailers are distinguished by the entire product range being oriented toward a single quality (i.e. organic) and that they are often independently owned and operated. The latter feature is observed to potentially foster partnerships with small-scale, regional producers and, as a result, a higher percentage of local and regional products.

3.3.2 Specification of the Status Quo

As the baseline against which product alternatives are compared, the status quo is an integral aspect of the DCE. To offer a realistic choice situation, it is important that the status quo reflects relevant differences in consumption histories; otherwise there is the risk that the choices taken do not necessarily one's underlying preferences. For the sake of convenience, it is however usual to assign the same status quo to all participants, e.g. one denoting the most purchased product in a given region. Regardless of whether one has ever tasted Fair-Trade coffee or purchases all her food from a farmers' market, the status quo is thus considered to be the same. Unfortunately, there are a number of issues with this simplification. First, by imposing an unfamiliar status quo, we could constrain the ability of individuals to respond accurately, thus limiting the validity of the experiment. If I am accustomed to eating local and organic produce, a status quo that does not reflect my expectations is likely to have limited meaning, for instance. By neglecting the diversity of consumption histories, we moreover ignore one factor likely to be influential for preference heterogeneity, which is after all what we wish to understand.

Consequently, we enlist participants to help specify the status quo for their respective set of choice tasks. After being given some initial information about the attributes and attribute levels, individuals are asked to pick the level that best reflects their typical consumption pattern. For instance, individuals are asked whether they tend to pay 1.50 € or 2.50 € for 500 g of tomatoes. By replicating this procedure for each attribute, a description of the typical tomato is realized for each participant.[7] To our knowledge, this is the first experiment in the sustainable consumption literature that uses such an individual-specified status quo. We see this as beneficial for various reasons, notably the potential to reduce experimental complexity by offering a more familiar baseline against which alternatives can be compared (cf. Christie and Gibbons 2011). More importantly, the further step of identifying one's typical tomato could foster a greater sense of ownership rendering "trading off" from the status quo more difficult. In this regard, individual-specified status quos can also make overall interpretation easier. One advantage of DCEs is thus the potential opportunity to highlight the specific combination(s) of attributes that encourage individuals to forsake the familiarity of the status quo. By using details about consumption histories, the choice tasks are thus rendered more reflective of actual decisions and thereby improve the accuracy of the WTP estimates.

3.3.3 Description of Choice Task

In each choice task, participants are presented with pictures of two tomatoes that vary only in terms of the noted attributes (Table 3). Participants are informed that the tomatoes are otherwise identical. An example of the choice task is shown in Fig. 1. Note 'Tomato A' represents the individual-specified status quo, thus remaining the same for all choice tasks of a participant; however, 'Tomato B', as the alternative, varies throughout. Participants are also given an 'opt out' option to purchase neither product. As such, every choice task is comprised of three possible options. Inclusion of an opt-out option is generally recommended, both to increase the realism of choice tasks and to obtain as much preference-information as possible (Boxall et al. 1996; Carson et al. 1994; Louviere et al. 2000). Moreover, when people are forced to choose, even if a clear preference does not exist, the likelihood is greater that the stated preferences will deviate from actual purchasing behavior (Kontoleon and Yabe 2003). Lack of an opt-out option can therefore give reason to doubt the validity of the results and resulting willingness-to-pay estimates.

[7]Full results for the individual-specified status quo are available upon request.

Three choices are available: Buying one of the two tomatoes that are described or choosing neither of them. Please mark only one box.			
	Tomato A		Tomato B
			
	2.50€ / 500g		2.00€ / 500g
	Local		Spain
	Organic retailer		Supermarket
	Organic		Organic
	Fair		Fair
Please choose one:	I would buy tomato A. ☐	I would buy tomato B. ☐	I wouldn't buy either of them. ☐

Fig. 1 Example of choice task

3.4 Model Specification

Discrete choice experiments (DCEs) represent one specific type of application of the random utility theory (RUT), first proposed by Thurstone (1927) and later extended by McFadden (1974). Applying the characteristics approach of Lancaster (1966), DCEs make use of the assumption that individuals gain utility through consuming the attributes comprising the product under evaluation. By utilizing this framework, we can represent the utility a decision maker n obtains by choosing alternative i amongst I alternatives in choice situation t in terms of a discrete-choice specification of the following form:

$$U_{nit} = \nu(A_{nit}, \beta) + \varepsilon_{nit} \tag{1}$$

As shown by Eq. (1), utility (U_{nit}) can be decomposed into two additively separable components: a systematic part $\nu(A_{nit}, \beta)$ that is a function of observable factors including the attributes of the alternatives, the socio-economic factors of the respondent, and the features of the decision context; and a random error term ε_{nit} from unmeasured preference heterogeneity (Boxall et al. 1996; Louviere et al. 2000). It is thereby assumed that an individual n will select the alternative with the highest utility from among I alternatives for each of T choice situations. The probability (P_{nit}) of choosing alternative i over any alternative j in choice occasion t is thus:

$$\begin{aligned} \mathrm{P_{nit}} &= \mathrm{Prob}\left(U_{nit} > U_{njt}\right) \\ &= \mathrm{Prob}\left(\nu_{nit} + \varepsilon_{nit} > \nu_{njt} + \varepsilon_{njt}\right) \\ &= \mathrm{Prob}\left(\varepsilon_{njt} - \varepsilon_{nit} < \nu_{nit} - \nu_{njt}\right) \forall j \neq i \end{aligned} \tag{2}$$

Further, by varying how the random components are distributed, it is possible to obtain different types of discrete-choice models. In this chapter, we allow all coefficients in the model, except price, to vary across individuals. That is, all coefficients are random parameters. A mixed-logit model specification is then used to analyze the results (Greene and Hensher 2003). If we (momentarily) ignore subscript t, the principal equation for the choice probability of taking alternative i over j in a mixed-logit setting can be expressed as follows:

$$\mathrm{P_{ni}} = \int \mathrm{L_{ni}}(\beta) f(\beta|\theta)\, d\beta \tag{3}$$

with

$$\mathrm{L_{ni}}(\beta) = \frac{\exp\left(\mathrm{x'_{ni}}\,\beta\right)}{\sum_{j=1}^{J} \exp\left(\mathrm{x'_{nj}}\,\beta\right)} \tag{4}$$

where $\mathrm{L_{ni}}(\beta)$ is the logit formula evaluated for the coefficient β and $f(\beta|\,\theta)$ is the density function of β (Hole 2007).[8]

Choice probabilities are then evaluated numerically by simulation (Train 2009). In specific, we specify R as the number of replications, such that β^r is the r-th draw from density function $f(\beta|\,\theta)$ in order to then calculate the logit formula for each β^r. As a result, simulated choice probabilities can be written as:

$$\mathrm{SP_{ni}} = \left\{ \frac{1}{R} \sum\nolimits_{r=1}^{R} \mathrm{L_{ni}}(\beta^r) \right\} \tag{5}$$

The simulated log-likelihood function is thereby created from the simulated choice probabilities. However, this also means that the θ parameters can only be estimated by maximizing a simulated log-likelihood function of the following form:

$$\mathrm{SLL}(\theta) = \sum\nolimits_{n=1}^{N} \ln\left(\mathrm{SP_{ni}}\right) \tag{6}$$

Using Eq. (6), we are able to obtain coefficient estimates for all relevant attributes β_k. Adopting a similar approach to calculate the coefficient of the cost attribute β_c, it is thus possible to express the willingness to pay for an improvement in a given attribute k as the negative ratio of the respective coefficients of the attribute and cost attribute. Before doing so, however, our use of effects coding for the categorical

[8]This approach is operationalized in Stata via the *mixlogit* command.

independent variables requires that we multiply all initial WTP estimates by 2 (Bech and Gyrd-Hansen 2005):

$$WTP_k = -2\frac{\beta_k}{\beta_c} \tag{7}$$

where k is an effects-coded attribute and WTP_k the marginal WTP for attribute k. Regarding the joint WTP for two attributes and the interaction effect, i.e. WTP_{k*m}, this is calculated as follows:

$$WTP_{k*m} = -2\frac{(\beta_k + \beta_m + \beta_k{*}\beta_m)}{\beta_c} \tag{8}$$

where k and m are effects-coded attributes, and $\beta_k * \beta_m$ expresses the interaction between them.

4 Results and Discussion

To estimate the DCE, we utilize a mixed-logit model specification with two-way interactions among the attributes. Estimation is undertaken by means of the *mixlogit* command in Stata 13.1 (Hole 2007). As all random effects are significant, this specification better reflects the preference heterogeneity in the sample than either a multinomial or fixed-effects logit specification.[9] All main effects are modelled as random parameters with the single exception of price, which must be fixed to have WTP estimates with normal distributions (Train 2009). Inclusion of two-way interactions between the attributes also offers superior fit to the standard mixed-logit model, a finding robust to the choice of information criterion. Interactions of the main effects and socio-demographic factors were considered as well, with a total of 14 terms selected by a sequence of significance tests. As only three such interactions were significant ($p < .05$) in the final model, they will not be discussed further, though we do opt to include such interactions for the greater explanatory power provided and overall improvement in model fit. Results are presented in Table 4.

[9] Although generally advisable (Hoyos 2010), a constant term is not included as this term became insignificant once the random effects were included. Further, the use of effects coding for the categorical independent variables limits the potential for correlation with the intercept, even if interactions are included (ibid.).

Table 4 Results, mixed-logit model with two-way interactions

Attribute	Parameter estimate	*SE*	*p*-value	CI (95%)	
				Lower limit	Upper limit
Main effects					
Local[a]					
Mean	1.64***	0.579	.005	0.51	2.78
SD	1.86***	0.285	.000	2.32	2.42
Mexico[a]					
Mean	−2.27***	0.464	.000	−3.18	−1.36
SD	0.80***	0.303	.008	0.21	1.40
Organic retailer[a]					
Mean	−0.63	0.412	.130	−1.43	0.18
SD	0.92***	0.201	.000	0.53	1.32
Discounter[a]					
Mean	−1.68**	0.714	.019	−3.07	−0.28
SD	0.94***	0.211	.000	0.53	1.35
Organic[a]					
Mean	2.03***	0.727	.005	0.61	3.45
SD	1.96***	0.296	.000	1.38	2.54
Fair[a]					
Mean	3.74***	0.634	.000	2.50	3.45
SD	1.56***	0.251	.000	1.07	2.06
Price (fixed)	−3.60***	0.359	.000	−4.31	−2.90
Attribute interactions					
Local × Organic Retailer	1.37*	0.719	.057	−0.04	2.77
Local × Discounter	0.42	0.494	.392	−0.55	1.39
Local × Organic	−0.36	0.702	.605	−1.74	1.01
Local × Fair	−0.03	0.566	.956	−1.14	1.08
Mexico × Organic Retailer	3.04***	0.730	.000	1.61	4.47
Mexico × Discounter	1.27**	0.587	.030	0.12	2.42
Mexico × Organic	−0.30	0.721	.674	−1.72	1.11
Mexico × Fair	0.11	0.662	.874	−1.19	1.40
Discounter × Organic	−0.84*	0.504	.093	−1.83	0.14
Discounter × Fair	−0.17	0.514	.746	−1.17	0.84
Organic Retailer × Fair	−0.31	0.661	.635	−1.61	0.98
Organic × Fair	−1.07***	0.612	.001	−2.26	0.13

Notes: *SE* = standard error; CI = confidence interval; *SD* = standard deviation; sample size N = 123; number of observations = 5334; log-likelihood = −697.80; BIC = 1592.89
*$p < .10$, **$p < .05$, ***$p < .01$
[a]Effects-coded variables

4.1 Main Effects

First, it is notable that six of the seven main effects are significant and with the expected signs. As the coefficient for price is negative, we can conclude that the

more costly tomatoes are less likely to be purchased. In addition, positive coefficients for 'organic', 'fair', and 'local' demonstrate the beneficial impact of quality claims related to sustainable production. Consistent with our use of effects coding for the categorical variables, interpretation of production location and retail format differs slightly, i.e. the impact on purchasing likelihood must be assessed relative to an (implicit) reference tomato from Spain and sold in a supermarket. We thus note that only two levels are represented for both of these attributes. Given that the coefficient for local production is significant and positive, it is evident that this attribute increases overall purchase likelihood, while the opposite is true for Mexico. Regarding the type of retail format, there is one significant result and one significant non-result—the latter that there is no difference in the effects of organic retailers and supermarkets. In contrast, the negative and significant effect of discounters implies such formats are perceived to be broadly inferior. That is, no matter the combination of attributes, consumers are willing to buy tomatoes from these formats only if they are sold at a discount, demonstrating one way that the type of retail format impacts sustainable purchasing decisions (see Schifferstein and Oude Ophuis 1998; Thompson and Kidwell 1998; Zepeda and Li 2007).

4.2 Interaction Effects

Turning to interaction effects, only three are determined to have a significant effect: Mexico × Organic Retailer (+); Organic × Fair (−); and Mexico × Discounter (+). First, the interaction between organic production and ethical standards (Organic × Fair) demonstrates that the presence of both claims results in a cumulative impact less than the sum of their separate values. Contrary to assertions organic and fair-trade labels do not affect one another (Onozaka and Thilmany McFadden 2011), this study offers further support for a non-additive relationship (e.g. Bond et al. 2008b; Meas et al. 2015; Yue and Tong 2009). Conversely, no interaction with local production appears to be significant, suggesting that this attribute has distinct significance among the set of sustainable claims. If this attribute has a separable impact, one explanation could be that local production is associated with the environmental impact of long-distance transport, and is thus linked with notions like 'food miles' (Coley et al. 2009; Grebitus et al. 2013). Whatever the reason, it is clear that higher value cannot be created by simply bundling multiple attributes into a single product.

Regarding retail formats, the number of significant interactions that involve one type of format illustrates their moderating influence on production practices and locations. For instance, organic retailers and discounters are both found (relative to supermarkets) to impact the likelihood of purchasing Mexican tomatoes. With regard to the interaction between discounters and Mexico (Mexico × Discounter), the negative (main) effect of the format is thus slightly diminished for this pairing. Overall, these two results indicate that produce from less familiar locations is perceived negatively when sold at a supermarket. Importance of the type of format

is further borne out if we consider two interactions on the margins of significance. Notably, the negative interaction between organic production and discounters (Discounter × Organic; $p < .10$), suggests that the organic premium is contingent on the format involved. As the main effect for discounter is negative, the (detrimental) impact of discounters is therefore even greater for organic produce. In contrast, the positive relationship for organic retailers and local production (Local × Organic Retailer; $p = .057$) hints at a link between these tomatoes and one shopping at alternative formats (Bond et al. 2008a; Yue and Tong 2009). As the attribute of "organic retailers" is positively related to the purchase of both local and Mexican tomatoes, moreover, this indicates a broader importance of these formats for quality evaluation. That is, whereas discounters negatively impact purchasing decisions overall, organic retailers appear to have an influence only for specific quality claims. We thus hypothesize that consumers may feel a greater need to trust retailers in situations where the intermediate steps in the value chain cannot grant sufficient assurance, i.e. because there are not enough intervening links involved ("local") or the checks that are performed are not sufficiently trustworthy ("Mexico").[10] Additional research is required to explore this potential relationship further.

4.3 WTP Estimates

If we wish to compare the relative desirability of the attributes, coefficient estimates are however insufficient. For this reason, mean WTP estimates for attributes and interactions are presented in Table 5. Focusing on WTP values for the main effects, the first thing to note is that a discount of 0.93 € is associated with any tomato sold at a discounter. Irrespective of the combination of quality claims, the fact that a tomato is sold at a discounter reduces value by almost 1 €. On the one hand, this may reflect the broad association between this type of format and an emphasis on lower costs. However, it should also be noted that retailers often provide valuable guidance by, e.g., 'choice editing' and only stocking produce deemed to be sufficiently sustainable (Mayo and Fielder 2006). If such assistance is perceived to be lacking, this may offer one explanation for the negative impact of discounters. Elsewhere, it is found that healthier packaging design only has an impact on quality evaluation for discounters, not 'green' supermarkets (van Rompay et al. 2016). Since discounters are places where one can expect greater variation in product quality, this might suggest that other packaging elements, such as labels, are needed to substitute for the involvement of retailers. In any case, there is a real possibility of 'overgeneralizing' the role of labels from one format to another so long as differences across formats are not considered.

Furthermore, sizable premiums are also apparent for all aspects of sustainable production. Surprisingly, ethical standards offer the most value, fetching a premium

[10]We are thankful to an anonymous reviewer for raising this possibility.

Table 5 WTP estimates for main effects and interactions

Main effects	WTP estimates	Interactions	WTP [interactions]
Organic***	1.13 [0.37; 1.89]	... × Fair***	2.61
		... × Discounter*	−0.27
Fair***	2.08 [1.45; 2.71]	... × Organic Retailer	1.56
		... × Discounter	1.05
Local***	0.91 [0.29; 1.53]	... × Organic	1.32
		... × Fair	2.97
Mexico***	−1.26 [−1.77; −0.75]	... × Organic	−0.30
		... × Fair	0.88
Organic Retailer	−0.35 [−0.79; 0.09]	... × Local*	1.32
		... × Mexico***	0.08
Discounter**	−0.93 [−1.72; −0.15]	... × Local	0.21
		... × Mexico**	−1.49

Notes: For *Main Effects*, the significance level indicates whether this effect is statistically different from zero
For *Interactions*, this shows whether the interaction between the relevant attributes is statistically different from zero
N = 124; Lower and upper limits are for 95% confidence intervals
*$p < .10$, **$p < .05$, ***$p < .01$

of 2.08 €. One potential explanation here may be a tendency for consumers to link fairer and local, small-scale production together (Darby et al. 2008; Meas et al. 2015). However, since the interaction between 'local' and 'fair' (Local × Fair) is not significant, this appear not to be the case. Moreover, it is not certain that ethical standards really offer the most value if one considers the full complement of origins. Recall that WTP for local and Mexican tomatoes (+0.91 € and −1.26 €) are both calculated relative to Spain. If we specify Mexico as the base level, the WTP for locality would be 2.17 €, rendering this the most valuable. Indeed, this finding is in line with a number of studies (e.g. Hu et al. 2009; Meas et al. 2015; Onozaka et al. 2011). In addition, since the average cost of 500 g of tomatoes is about 2 € in the experiment, this premium is close to that of Darby et al. (2008), who find WTP to be between 48% and 118% more for local products than those of unknown origin.

As with the coefficient estimates, we must consider WTP results after interaction effects are also included. Otherwise, these estimates only reveal the independent effects of attributes, i.e. after the impact of the other attributes has been filtered out. Since many attributes necessarily comprise a product, WTP estimates with interactions are likely to be the most revealing. For instance, recall that the impact of an organic retailer is only evident through its interactions. Hence, we observe that the premium for local tomatoes at an organic retailer (Local × Organic Retailer) is 1.32 €, a substantial increase from the initial premium of 0.91 €. Conversely, the markdown for Mexican tomatoes at discounters (Mexico × Discounter) is less than was first expected due to the positive interaction between the two, i.e. −1.49 € instead of −2.19 €. In both cases, we see a pairing between the highest and lowest levels for attributes: with, e.g., the 'lowest' level of retail format (Discounter) and the

'lowest' level of location (Mexico) each reinforcing one another. Consequently, we posit that the credibility problems that typically confront discounters may be less prominent if quality is less expected. If a type of format is generally associated with lower quality, the fulfillment of quality expectations may foster a more beneficial evaluation of a given pairing, relatively speaking, in the minds of consumers. Of course, it bears mentioning that such improvements remain relative, as a 'discounter' tomato from Mexico is valued much less than a 'supermarket' tomato from Spain.

More generally, the importance of type of retail format is evident throughout vis-à-vis the upward and downward shifts in WTP values of all production-related attributes. The clearest expression of this emerges if we contrast two interactions: Mexico × Organic Retailer and Organic × Discounter. After accounting for interaction effects, we observe that Mexican tomatoes sold at organic retailers receive a premium of 0.08 €, whereas the organic tomatoes sold at a discounter require a discount of 0.27 €. Regarding the Mexican tomato, it thus seems that involvement of an organic retailer effectively overcomes any quality concerns of having 'less desirable' origin. One potential explanation is that alternative retail formats are better able to address certain types of concerns, e.g. if there is less information about the production conditions owing to greater distance. Maybe it is the case that having a reputation for product quality can cause consumers to believe the retailer is less likely to stock a lower-quality product, at least not without risking a substantial loss in trust and credibility. In contrast, organic 'discounter' tomatoes end up being as desirable as a conventional tomato that is sold anywhere else. As such, negative perceptions of discounters appear to result in a reduced premium for organic production, even if the label remains the same. The presence of organic labels alone is thus unable to provide sufficient assurance with regard to product quality in all situations. Rather, owing to the heterogeneity that exists for organic systems (Knoblauch et al. 1990; Bourn and Prescott 2002; Pieper and Barrett 2008), we expect that type of retail format and other supply-chain considerations can also act as a source of credibility information and quality assurance. On a final note, these results also illustrate how 'preference reversals' can occur owing to differences across retail formats: with tomatoes from less desirable locations seen to be more valuable than those that are organic if and when the first come from a discounter and the second from an organic retailer.

5 Conclusion

By bringing the importance of retail formats to the fore, this paper makes use of a hypothetical DCE to explore interactions between the how and where of food consumption. In specific, we show that there are (at least) two mechanisms by which type of retail format impacts purchasing behavior. First, as exemplified by discounters, the format can have a direct influence on overall purchase likelihood. Whatever the attribute, people are thus less likely to purchase produce from discounters. Second, as demonstrated by the significant interactions with sustainable

attributes, alternative formats appear to represent another basis for quality assurance. As a result, one may distinguish 'distant' signals (e.g. certification systems and labeling schemes) from those more 'proximate' to production conditions (e.g. local production and short supply chains). If there are questions about the former because of, e.g., fraudulent claims, the latter could then step in and play a compensating role by delivering information needed for quality evaluation. In fact, there is anecdotal evidence of exactly this, where "interactions with producers serve as direct assurances for the effectiveness of . . . purchase decisions", reducing the demand for third-party certifications (Onozaka et al. 2011: 586; Thilmany et al. 2008). Beyond certification systems and labeling schemes, retail formats therefore have a crucial role for purchasing decisions: that is, by providing credible information about product quality.

Nonetheless, while this experiment has illustrated the potential for retail formats to differ with regard to perceptions of credibility, this only represents a part of the story. Indeed, our application to Witt's (2001) theory of consumer specialization has pointed to a number of ways in which the type of retail format might explain differences in individual behavior. For instance, we have outlined how the activity of consumption is infused with the quality of an open-ended process through which people gain unique insight into their needs and wants and where, significantly, the retail environment itself plays a crucial role. By using an evolutionary approach to sustainable consumption, we thus contend that, if individuals vary in terms of the value that is assigned to sustainable products, this is not necessarily because there are underlying differences in motivations and values or because one more closely resembles a prototypical sustainable consumer. Instead, retail formats could differ in terms of, *inter alia*, the opportunity to interact with, and receive information about and from, the people and places involved with the production of one's food. The resulting influence on not only the credibility of information but also the types of needs that can be potentially satisfied through food consumption thus represent the incentives and foundation for preference learning and further consumer specialization (Bianchi 2002; Chai 2012; Witt 2001). Hence, if behavioral change has been uneven, we hypothesize this to be the result of differences among retail formats, specifically the types of relationships cultivated with individual consumers. In order to further explore this possibility, future studies should focus on how experiences differ, over time, across these different formats. For instance, one can utilize insights from self-determination theory (Deci and Ryan 2000; Ryan and Deci 2000; Kasser 2017), given that this shares the need-theoretic approach of Witt (2001). In particular, it would be possible to conduct diary studies of people's day-to-day experiences and thereby observe, e.g., the level of need satisfaction individuals obtain in different formats and/or how this evolves over time. If we are to confront the issues of environmental degradation and climate change, such insights into the relationship between these contextual factors and the attained pace of behavioral change will be ever more necessary (Baum and Gross 2017).

Besides exploring the relationship between types of retail formats and sustainable consumption, this study is the first in this literature to make use of the consumption histories of participants to increase the realism of choice tasks. To make individual-

specified status quos more widely applicable for DCEs, however, some potential issues must be addressed. First and foremost, effectiveness of this method is contingent on the answers of respondents being realistic. In our study, this could not however be taken for granted for all attributes, i.e. origin and ethical standards. While, on the one hand, these sorts of problems are somewhat expected for a new approach, it is equally possible that limited awareness of consumers or confusion regarding attribute levels is to blame. Maybe participants, upon not finding the origin of their typical tomatoes, then opted for the highest level so as to approximate the level of quality with which they are familiar. The fact that an unexpectedly high number of participants described their typical tomato as locally produced may thus reflect the absence of a production origin better representing particular their situation. In this regard, some degree of confusion could also be linked to the use of potentially troublesome options, such as Mexico in our case.

A more challenging obstacle for the greater use of individual-specified status quos, however, is the potential for hypothetical bias. Taken broadly, future studies with individual-specified status quos can therefore benefit by being accompanied by, e.g., a 'cheap talk' strategy directly informing individuals of the potential bias to report higher WTP (Cummings and Taylor 1999; Lusk 2003) and/or non-hypothetical experiments inviting them to buy one of the randomly drawn choices (Yue and Tong 2009). In other words, some bias can be addressed by improving the experimental design. Furthermore, the use of individual-specified status quos may even offer a tool for dealing with hypothetical bias. Significantly, a meta-analysis finds that much of the variation in hypothetical bias across studies can be explained by how familiar people are with both the task and context (Schläpfer and Fischhoff 2012; Schläpfer 2008). In fact, they stress that stated-preference methods should only be used if "the good and the context can be made familiar and meaningful to respondents" (Schläpfer and Fischhoff 2012: 46). Owing to their capacity to offer meaningful context and make choice tasks more realistic, we argue that individual-specified status quos have potential to improve our understanding of the determinants of sustainable consumption.

Finally, it must be acknowledged that the external validity of this study is somewhat limited due to sample issues. In particular, over-representation of students, while reflective of the local setting, limits the potential to make generalizations. Future studies should therefore pursue a cross-country comparison or apply this approach to distinct product categories. Indeed, each of these extensions would be useful to understand the mechanisms at work better. For instance, are the differences among the types of retail formats more relevant for fresh than processed foods? Furthermore, could the findings for Germany, owing to the broad emphasis on low prices and discounters, differ substantially from those for the United Kingdom, where supermarket chains have historically been more important?

To address questions such as these, future studies could use latent-class specifications to clarify whether attribute significance varies by group (Greene and Hensher 2003; Lagarde 2012). That is, there may be those for whom organic retailers and supermarkets indeed differ significantly, yet this result is 'drowned out' once all participants are clustered together. Consequently, the fact that there is no significant

difference between supermarkets and organic retailers for the overall sample may not be true for all groups, i.e. those who often purchase from such formats. Finally, we want to underscore that the decision to purchase tomatoes from a farmers' market is not necessarily the same as opting to visit a farmers' market for the explicit purpose of purchasing tomatoes. Given the growing tendency for consumers to shop at multiple formats, a two-stage process integrating both format choice and product choice could be explored (see Hsieh and Stiegert 2012). We fully welcome such extensions as opportunities to further explore the many ways in which where I shop influences what I buy.

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Innovation, Structural Change and Multisectoral Economic Growth

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Abstract In this work, we draw upon the Neo-Schumpeterian concept of *sectoral systems of innovation* to reflect on the uneven sectoral patterns of productivity growth observed in modern economies. Inspired by recent contributions within evolutionary economic theory, we present a formal proposal to integrate uneven sectoral productivity growth in a *multisectoral growth model*. In this model, certain demand-side elements turn out to be crucial. More precisely, we explore the interactions between technological factors, income growth, and distinct *income elasticities of sectoral demand* underlying *structural change*. Thereby, we obtain a representation of economic growth as a long-run property which emerges from complex interactions between sectoral innovation, and certain (often-overlooked) demand-side fundamentals.

Keywords Economic growth · Structural change · Demand · Sectoral productivity

JEL Classification B52 · O33

1 Introduction

The Neo-Schumpeterian economics of innovation shows that the patterns of innovation strongly differ among co-existing sectoral activities (Dosi and Nelson 2010; Hanusch and Pyka 2007; Cantner and Malerba 2006; Antonelli 2002). Intersectoral disparities have been explained by resorting to different intrasectoral mixes of sources of technological innovation (Pavitt 1984; Winter 1984; Dosi et al. 1995; Dosi 2000) and, also, by relating intersectoral diversity to the different phases of the "industry life cycle" (Utterback and Abernathy 1975; Andersen 1994; Klepper

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1996). These lines of work highlight technological differences among industries and technological differences over time, respectively; one may also add economic sources of disparity which co-evolve with technology and institutions (as we have explored in Almudi et al. 2012, 2013).

In this work, we apply the concept of *sectoral systems of innovation* (SSI) (Malerba 2004) in order to reflect, in Sect. 2, on underlying factors that may drive labor productivity growth at a sectoral level. As will be seen, using the concept of SSI allows us to integrate the aforementioned visions on sources of uneven sectorial technological change. Moreover, as we will state in Sect. 3, the concept of SSI is easily connectable with certain ideas on industrial dynamics (e.g. Malerba et al. 2016) and with the evolutionary vision of economic growth and structural change, as explained by Nelson and Winter (1982), Nelson (1998, 2005), Witt (2003), Metcalfe et al. (2006), and Saviotti and Pyka (2013). Clear empirical evidence on this conception can also be seen in Quatraro (2009).

Thus, we claim that Malerba's (2004) conception of sectorial *SSIs*—i.e., as sets of new and established products and/or agents engaged in market and non-market interactions, innovating on the basis of a given knowledge base and specific learning processes, goals, and organizational structures, and thereby undergoing processes of self-transformation through co-evolution—is a fruitful departure point to integrate stylized versions of this idea into multisectoral models of adaptive economic growth (*á la* Metcalfe et al. 2006). In fact, in this work, we devote Sect. 2 to formally elaborate the ideas of SSI and the industry life cycle to offer a mechanism of sectoral labor productivity growth, which is then inter-woven (in Sect. 3) in a multisectoral structure. In this way, we show how sectoral growth drives overall income and labor productivity growth in a non-trivial way. In turn, per-capita income growth is shown to fuel the uneven expansion of different sectors, i.e. due to the co-existence of distinct income elasticities of sectoral demand. Finally, this feedback spurs economic change in an overall sense, leading to a representation of growth and structural change as self-organizing processes.

More precisely, in Sect. 3, we take into consideration the modeling approach (at a sectoral level) that is proposed in Sect. 2, thus following important contributions to evolutionary theory (Metcalfe et al. 2006; Ciarli et al. 2010; Saviotti and Pyka 2013) in order to incorporate our sectoral proposal within a multisectoral evolutionary growth model. The framework proposed by J.S. Metcalfe (see also, Pasinetti 1993) turns out to be ideal to integrate our sectoral proposal inspired by SSIs into a multisectoral model. In fact, it is also fruitful to explore how different income elasticities of sectoral demand, operating within a framework of co-existing growing industries, drive overall income growth and the corresponding pattern of structural change. In this sense, the model we present in Sect. 3 combines our formal sectoral approach (from Sect. 2), with some elements of Metcalfe's models (Metcalfe 1998; Metcalfe et al. 2006). The resulting evolutionary growth model allows us to delineate alternative techno-institutional and demand-related settings from which we can check (using simulations) the sensitiveness of endogenous growth and structural change to changes in the basic parameters.

As we will see, our analysis reveals (in Sect. 4) interesting policy implications, which fit well with recent concerns put forward in Lerner and Stern (2012). From a methodological point of view, we follow analytical approaches of Malerba et al. (2016) and Saviotti and Pyka (2013) for the simulations. In any case, since we obtain explicit (easy-to-interpret) expressions for the model dynamics in Sect. 3, the simulations in Sect. 4 serve as illustrative experiments and guides for future research. It is easy to keep extending the results of the model, moreover, by using the tools of *non-autonomous* systems or ordinary (non-linear) differential equations.

The model can be easily extended in many directions, both theoretically and for empirical testing. On the one hand, Ulrich Witt's *Theory of Wants* (see, e.g., Witt 2001, 2003, 2017), together with recent extensions and findings by Chai et al. (2015), provide elements to incorporate fresh endogenous dynamics for income elasticities. On the other hand, incorporating dynamic increasing returns into our sectoral dynamics of productivity growth, and linking this with endogenous elasticities of sectoral demand, could further enrich the dynamics of the model, offering new results for empirical testing, not to mention novel methodological challenges. In any case, the simplicity of the basic framework in this article is directly amenable to straightforward econometric treatment, since all our variables in the model are either observable or statistically accessible. Finally, let us remark, regarding the policy implications from the current model, that we focus here on presenting some examples to act as guidance for future research. We leave aside a fuller exploration of the results for future research, which is indeed already advancing from this model-platform along the lines suggested by Chai et al. (2015). We close the paper with some concluding remarks on the essential (often overlooked) role of demand in long-run innovation-driven growth.

2 Innovation and Sectoral Productivity Growth

During the last decades, we have seen enormous advances in our understanding of innovation processes at the levels of the firm, the sector, and even national systems and beyond. Regarding industrial dynamics, the concept of technological regimes of Nelson and Winter (1982), sectoral taxonomies (Pavitt 1984), and the literature on industry life cycles (Klepper 1996) are examples of these crucial advances. In addition, there have been integrative efforts to explain the uneven patterns of innovation at the sectoral level by combining the aforementioned approaches. Thus, the efforts by Malerba (2004) to define sectoral systems of innovation and production is very significant. In essence, Malerba defines a sectoral system of innovation and production, namely as a set of products and agents carrying out market and non-market interactions for the creation of knowledge, and the production and sale of goods and services. In a sectoral system, we can thus separately distinguish a knowledge base, specific (technical) conditions of cumulativeness and appropriability, changing demand structures and supporting institutions, and learning processes co-evolving with organizational competencies and structures.

In this section, we consider how this concept can integrate many elements of previous contributions and findings in Neo-Schumpeterian economics. We therefore draw on a highly-stylized interpretation of the dynamics of sectoral systems (Malerba et al. 2016) in order to develop certain formal assumptions suitable for modeling productivity growth at the sectoral level. Afterwards, we will incorporate these sectoral dynamics within a multisectoral evolutionary model of economic growth also including crucial demand-side components. Now, we put forward the specific sectoral assumptions, consistent with the Neo-Schumpeterian view of sectoral innovation, and which capture, in a simplified way, essential aspects of the relevant approaches by Malerba (2004), Malerba et al. (2016) and others.

Formally, at time t, economic agents (firms, supporting institutions, etc.) operate at the sectoral level (drawing on the underlying base of technological opportunities) and reflect (and realize) trajectories of co-evolving techno-institutional change, while market processes and sectoral transformations show up (along with the other variables) as measurable trajectories of productivity growth (see Quatraro 2009). It is thus clear that firm size, the various sources of technological change underlying sectoral innovation, technological opportunities, conditions of cumulativeness and appropriability in the sector, and phases of the industry life cycle, all condition the speed and patterns of technological change and productivity growth (see Dosi and Nelson 2010). As time goes by, each sector thus reveals transformations that ultimately become evident in the co-evolution of institutions, technology, market structures and agents driving technical change.

In very simple terms, we propose, in what follows, a few *assumptions* in order to model (in a highly-stylized way) the dynamic transformation of sectoral systems underlying the trajectories of long-run sectoral productivity growth:

2.1 Assumption 1

The rate of labor productivity growth in sector j ($j = 1, \ldots n$) at t—denoted by $\hat{q}_j(t)$—results from technological advances incorporated in firm production processes, which may result from one of three different innovation sources (or *engines* of productivity growth):

a) New entrants carrying more effective technologies which spur productivity growth in the sector.
b) Process innovations by incumbents engaging in formal efforts to innovate, and which enhance sectoral labor productivity growth (e.g. through formal R&D activities to improve efficiency).
c) Productivity improvements coming from other minor internal sources of new knowledge and improvement, such as *learning by doing*.

2.2 Assumption 2

The relative contribution to sectoral productivity growth $\hat{q}_j(t)$ of each of the aforementioned engines at t, is different for the different sectors, depending on techno-institutional conditions, and also the phase of the industry life-cycle which prevails in each sector.

2.3 Assumption 3

As time passes, the relative contributions of the three sources of new knowledge and efficiency-gains also change. We assume that the relative contributions of these three engines of sectoral labor productivity growth $\hat{q}_j(t)$ thus change according to the following factors:

a) Entry barriers appear over time, with a strength and rhythm that differs across sectors. Therefore, as time goes by (at least in the medium-run) the influence of new entrants on labor productivity growth usually diminishes.
b) The systematic exploitation of prevailing technological opportunities ends up limiting the opportunities for further sectoral innovation. Thus, over time, as the sector gets more mature, we may observe less formal activities (e.g. R&D) and the higher relative importance of informal mechanisms of learning (e.g. learning by doing).

2.4 Assumption 4

We propose specific functions of labor productivity growth for each sector in the economy. A detailed formal exploration of the rationale underlying our proposal can be seen in Almudi et al. (2012, 2013). In this work, we focus on the meso-level of the economy (Dopfer 2005); hence, we depart from the sectoral level and explore intersectoral interactions in Sect. 3. Thus, we consider the co-existence of n sectors in the economy, indexed by ($j = 1, \ldots n$), and propose the following dynamic equation for the rate of labor productivity growth in each sector j:

$$\hat{q}_j(t) \equiv \frac{\dot{q}_j(t)}{q_j(t)} = \alpha_j e^{-\delta_j t} + \left(1 - e^{-\delta_j t}\right)\left[e^{-\varepsilon_j t}\beta_j + (1 - e^{-\varepsilon_j t})\gamma_j\right],$$
$$\text{with } \left(0 \leq \alpha_j, \beta_j, \gamma_j < 1\right) \text{ and } \left(\delta_j, \varepsilon_j > 0\right) \quad (1)$$

Let us note that Eq. (1) can be decomposed as follows:

$\alpha_j e^{-\delta_j t}$: this component represents the contribution of new entrants that incorporate new, more efficient processes to labor productivity growth to the sector. We

interpret α_j as the "starting out" productivity growth rate at sector level ($\hat{q}_j(0) = \alpha_j$), as new entrants tend to be the key source of efficiency gains in Eq. (1) during the emergence of sector j. The value of α_j depends on external sources of knowledge and the potential base of technological opportunities for the "young" sector. As seen in Eq. (1), this source of new knowledge and efficiency-gains becomes less important as the sector matures. Thus, we expect entry barriers to rise in the sector, and we assume that the speed with which entry barriers operate in the sector is determined by δ_j. It is therefore clear that cumulativeness and the specificity of knowledge, scale economies, not to mention patents and regulation, all underlie the value of δ_j. The faster entry barriers arise in sector j, the higher the value of δ_j, thus tending to erode the influence of α_j, and the higher the advantages of incumbents for promoting their innovative efforts.

$(1 - e^{-\delta_j t})\beta_j e^{-\varepsilon_j t}$: This component reflects the contribution to sectoral labor productivity growth $\hat{q}_j(t)$ from incumbent formal activities (e.g. R&D). Parameter β_j marks an upper limit (bound) for the growth rate of sectoral productivity in j from this specific source. The wider the base of sectoral technological opportunities, and the higher the amount of resources that agents tend to allocate to R&D, the higher the value of β_j. The factor $(1 - e^{-\delta_j t})$ indicates that, as time goes by, the rising entry barriers and increasing appropriability conditions work to favor this source of growth (Dosi 2000). On the other side, $e^{-\varepsilon_j t}$ captures the fact that technological opportunities become less and less obvious (and even may be exhausted) as time passes, and with this process of exhaustion occurring at a speed ε_j.

$(1 - e^{-\delta_j t})(1 - e^{-\varepsilon_j t})\gamma_j$: Finally, this last component represents the contribution to sector-j labor productivity growth $\hat{q}_j(t)$ from informal mechanisms of innovation and learning, such as learning by doing. We assume that the (already-established) factors that stimulate the deployment of internal sources of new knowledge also stimulate non-systematic informal mechanisms. On the other side, the exhaustion of opportunities for formal innovation, can also stimulate the exploitation of less-systematic learning activities. Notice that we capture, with the value of γ_j, the potential in sector j for gaining efficiency through these non-systematic informal sources of learning.

Thus, through the dynamic Eq. (1), we capture the processes of sectoral transformation and the resulting labor-productivity growth-paths characteristic of the n sectors comprising the whole economy. Sectoral growth thus depends on the sectoral-specific values of parameters $(\alpha_j, \beta_j, \gamma_j, \delta_j, \varepsilon_j)$. The proposed functions for sectoral labor-productivity growth will allow us to check the sensitivity of sectoral paths $\hat{q}_j(t)$ to changes in the corresponding techno-institutional sectoral conditions (conditions such as those mentioned in Castellacci and Fevolden (2015) or Lerner and Stern (2012)).

We will go into the analysis of these effects in Sect. 4. But, first, we devote Sect. 3 to integrating the proposed sectoral dynamics in an evolutionary multisectoral

framework in order to study economic growth and structural change. Accordingly, we will focus on central meso-level mechanisms (Dopfer 2005) driving growth. As will be seen, the role of demand (as stated in Sect. 3) is crucial for the emergent dynamics that are obtained in Sect. 4.

3 Economic Growth and Structural Change

We draw upon Metcalfe (1998) and Metcalfe et al. (2006) to develop our evolutionary multisectoral model of economic growth. Similar to Pasinetti (1993) (see also, Andersen 2001; Fatas-Villafranca and Saura 2004), we model multisectoral growth using a highly abstract framework designed for a labor-knowledge economy. That is to say, at least in this first version of the model, we leave aside capital dynamics for the sake of formal simplicity. This is a typical simplifying assumption, even within recent mainstream DSGE models (Galí 2008). Likewise, we take into account recent studies on the diversity of spending patterns in modern economies (see Chai et al. 2015) to establish intersectoral interactions in the model. In previous works, much deeper analysis at the level of microeconomic foundations of demand from an evolutionary perspective is apparent, see also, Witt 2001, 2017; Fatas-Villafranca et al. 2007, 2009; Fernández-Márquez et al. 2017; or Almudi et al. 2017. In this model, we focus on the meso-level and, taking into account findings from previous works, state the following fifth assumption:

3.1 Assumption 5

We assume that the sectoral rates of output growth $g_j \equiv \dfrac{\dot{Q}_j}{Q_j}$ perfectly match the sectoral growth rate of demand for sector-*j* activities, so that $g_j = g_j^d$. On this basis, we move, as will be seen, towards an (at least partially) demand-driven growth model. Furthermore, we propose that the growth rate of demand for sector-*j* activities ($j = 1, \ldots, n$) can be represented through the following expression (Metcalfe 1998; Metcalfe et al. 2006):

$$g_j^d = \phi_j \hat{q} + l, \tag{2}$$

where $\hat{q}$ is the growth rate of output per worker/income per capita $q \equiv \left(\dfrac{Q}{L}\right)$; and l denotes the rate of population growth, which we assume (for simplicity in a long-run model) to be fully employed at any time. Finally, ϕ_j is a sectorial parameter that captures the income elasticity of sectoral demand (for sector *j* activities) with respect to income per-capita growth.

In order to explore some of the consequences of this assumption, let us define as $s_j = \frac{Q_j}{Q}$ the relative share (output share) in global GDP of sector j production at any time. From the condition $g_j = g_j^d$, we can then obtain (with $\overline{\phi} = \sum s_j \phi_j$) the following expression:

$$g \equiv \frac{\dot{Q}}{Q} = \sum s_j g_j = \sum s_j g_j^d = \overline{\phi}\hat{q} + l$$

It thus results that, in a pure knowledge-labor economy, there is a global condition involving output growth, productivity growth and population (employment) growth that must be fulfilled. In specific, this conditions states, for the specific case of an open economy, that $g = \left(\hat{q} + l + \tau\right) = \overline{\phi}\hat{q} + l$. Notice that τ is a (changing) adjustment foreign-trade factor, which we assume to be relatively small for the simulations, and which assures that aggregate supply matches aggregate demand at any given time. In this way, we ensure that inner output growth (i.e. domestic output growth), which is determined by productivity growth and employment growth from the supply side, plus a small adjusting factor τ (required net exports/imports as determined by, perhaps, the existence of excess demand or supply), follows the growth of aggregate demand given by $g^d = \overline{\phi}\hat{q} + l$. Another possibility to close the model is to consider the case of a closed economy. Given that this would require the equilibrium growth condition $g = \left(\hat{q} + l\right) = \overline{\phi}\hat{q} + l$ is also verified, it would be necessary in this model for $\overline{\phi} = \sum s_j \phi_j = 1$. This is thus an interesting alternative which opens the way to the endogenous formulation of (at least) one of the elasticities, so that $\overline{\phi} = \sum s_j \phi_j = 1$. Additionally, relationships of complementarity among the sectoral elasticities could be stated in such a way that a wide variety of complex dynamic patterns could emerge. Furthermore, along the lines of the formal work outlined by Dosi (2000), we could assume that rationing and non-coordination of supply and demand growth may exist. However, we opt to stay as close as possible here to the Metcalfe-Foster theory of adaptive growth (Metcalfe et al. 2006).

For the time being, and since this is a first version of the model, we assume, in our open system, that τ tends to be small, and we allow $\overline{\phi}$ to be different (though not too different) from 1. Thus, by using assumptions 1–5, we can now examine the aggregate dynamics of the model in terms of output growth, global productivity/income per capita growth, and structural change.

Since we know that the sectoral output share is given by $s_j \equiv \frac{Q_j}{Q}$, and that output growth is, essentially, demand-driven, then, the process of structural change in our economy (as given by Eqs. (1) and (2), and the aforementioned conditions for equilibrium) can be synthesized (with $g = \sum s_j g_j$) through Eq. (3):

$$\hat{s}_j = g_j - g = \left(\phi_j - \overline{\phi}\right)\hat{q}, \tag{3}$$

where $\hat{s}_j$ is the rate of change of the output-share of sector j in terms of aggregate output. Of course, as seen by Eq. (3), we still must obtain the aggregate rate of productivity and income per capita growth, where dynamics from Eqs. (1) to (3) will show up (see formal details for the replicator equations in Hofbauer and Sigmund 1998).

To do this, let us keep in mind that $q \equiv \frac{Q}{L}$, $s_j = \frac{Q_j}{Q}$, and the sectorial labor productivity for sector j is given by $q_j = \frac{Q_j}{L_j}$ (and with the corresponding dynamic paths for productivity growth driven by Eq. (1)). It is thus straightforward to obtain that:

$$q = \left(\sum \frac{s_j}{q_j} \right)^{-1} \tag{4}$$

3.2 Economic Growth and Structural Change

From expression (4), it is clear that the dynamics of q depend on the dynamics of s_j and q_j ($j = 1, \ldots n$). If we now calculate $\hat{q} = \frac{\dot{q}}{q}$ in Eq. (4) while considering Eqs. (1)–(3), we can obtain:

$$\hat{q} = \frac{\sum \omega_j \hat{q}_j}{\sum \omega_j \phi_j}, \quad 0 < \omega_j = \frac{s_j q}{q_j} < 1, \quad \sum \omega_j = 1, \tag{5}$$

where $\hat{q}_j = \alpha_j e^{-\delta_j t} + \left(1 - e^{-\delta_j t}\right)\left[e^{-\varepsilon_j t}\beta_j + (1 - e^{-\varepsilon_j t})\gamma_j\right]$, $(j = 1, \ldots n)$

This expression provides us with the endogenous rate of income per capita growth for our evolutionary multisector model.

As seen by Eq. (5), economic growth from an evolutionary perspective must be conceived as an emergent property that arises from the processes described in Sect. 2, though still dynamically coordinated through the sectoral income elasticities of demand driving structural change. The process of structural change is thus jointly driven by Eqs. (3) and (5).

In the following section, we will present, by means of illustrative simulations (as the explicit expressions for the endogenous growth rate and structural change have been already obtained above), the model dynamics in a graphical (more easily understandable) way, before then suggesting some policy implications.

4 Simulations and Policy Implications

Using the model we have developed, along with certain initial conditions given for $\{s_j(0), q_j(0)\}_{j=1}^{n}$ and by considering alternative parametric settings, we can obtain specific aggregate-growth paths for $\hat{q}(t)$ and $q(t)$, and n sectoral paths $\{\hat{q}_j(t)\}_{j=1}^{n}$, $\{q_j(t)\}_{j=1}^{n}$, together with a further n trajectories $\{s_j(t)\}_{j=1}^{n}$ reflecting structural change.

For illustrative purposes, let us consider an economy comprised of five sectors, each of which have identical initial output-shares in overall production and equal initial productivity levels. We do however assume there to be different sectoral income-elasticities and distinct sectoral techno-institutional characteristics (see Table 1). By running the model for this setting, we obtain the results for the sectoral quotas (or shares) $q(t)$, $\{q_j(t)\}_{j=1}^{5}$, $\{s_j(t)\}_{j=1}^{5}$ in Table 1:

From Fig. 1, we can thus see how the model generates both an aggregate path for income per capita growth $q(t)$ and the underlying sectoral paths for productivity growth and structural change. We also observe a smooth process of structural change since we depart, for simulation setting 1, from a not-too-diverse distribution of sectoral income-elasticities. For the purposes of illustration, we also suppose that all sectors depart from identical output-shares in production. Nevertheless, we know from history that, during certain historical phases, societies have been subject to intense processes of structural change which have had major impacts on growth (which are moreover not envisioned by mainstream growth models). In the following subsection, we therefore show how the model can reproduce intense processes of structural change of this kind.

4.1 Intense Structural Change

Turning to simulation setting 2 (see Table 2), we keep constant the technological conditions of setting 1 while specifying a distinct distribution of sectoral income elasticities with a higher level of dispersion. We also consider different departure points with respect to the initial relative importance of the different sectors. The results that we obtain from setting 2 appear in Fig. 2, where we depict an evolving

Table 1 Simulation setting 1

	α	β	γ	δ	ε	φ	$s_j(0)$	$q_j(0)$
sector1	0.01	0.09	0.02	0.02	0.5	0.75	0.2	1
sector2	0.021	0.1	0.02	0.1	0.3	0.5	0.2	1
sector3	0.03	0.06	0.02	0.1	0.1	0.813	0.2	1
sector4	0.02	0.04	0.02	0.02	0.05	1.2	0.2	1
sector5	0.013	0.08	0.01	0.04	0.08	1.737	0.2	1

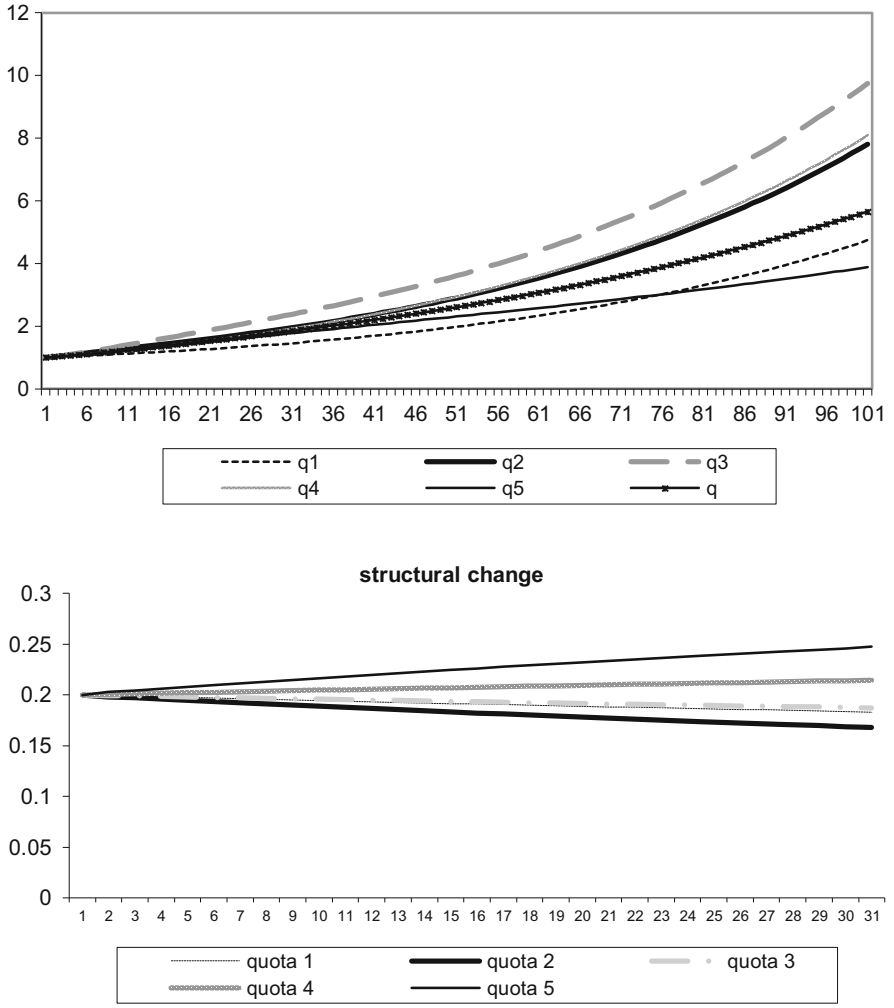

Fig. 1 Economic growth and structural change for setting 1

Table 2 Simulation setting 2

	α	β	γ	δ	ε	φ	$s_j(0)$	$q_j(0)$
sector1	0.01	0.09	0.02	0.02	0.5	2	0.25	1
sector2	0.021	0.1	0.02	0.1	0.3	0.5	0.1	1
sector3	0.03	0.06	0.02	0.1	0.1	0.3	0.3	1
sector4	0.02	0.04	0.02	0.02	0.05	1.2	0.15	1
sector5	0.013	0.08	0.01	0.04	0.08	0.9	0.2	1

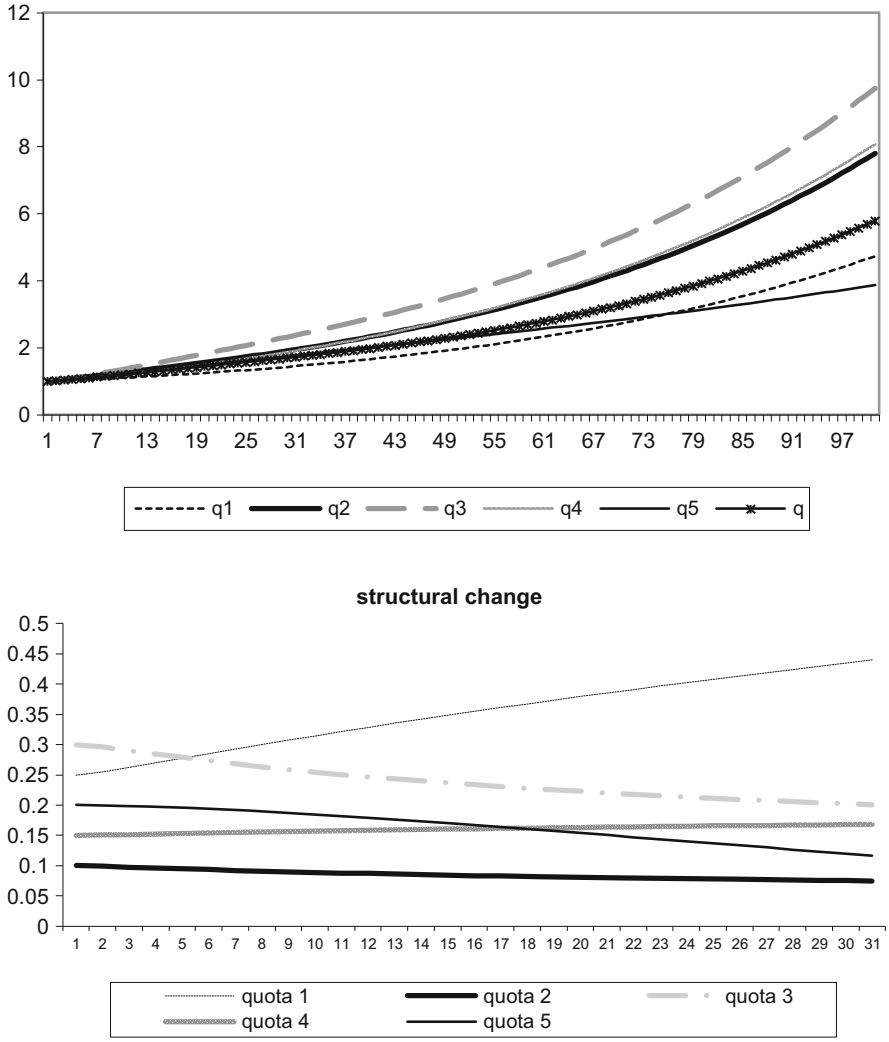

Fig. 2 Economic growth and structural change for setting 2

process of endogenous growth, together with an underlying intense process of structural change (visible by the strong changes in sectoral quotas or relative output shares in overall output).

In Fig. 2 we see a slow decline in sectors 2, 3 and 5 (those with lower income elasticities), together with an increase in the relative importance of sectors 1 and 4. Looking at expression (3), we clearly see that the intensity with which structural change takes place is directly proportional to the growth rate of q; furthermore, in a sustained growth scenario, it is clear that the direction of change is given by the signs

Table 3 Simulation setting 3

	α	β	γ	δ	ε	φ	$s_j(0)$	$q_j(0)$
sector1	0.01	0.5	0.05	0.1	0.5	5	0.05	1
sector2	0.03	0.1	0.005	0.1	0.3	0.6	0.4	1
sector3	0.03	0.2	0.005	0.05	0.1	1.5	0.15	1
sector4	0.0001	0.1	0.005	0.1	0.1	1.5	0.1	1
sector5	0.013	0.08	0.0005	0.3	0.1	0.3	0.3	1

of the differences among the sectoral elasticities of demand and the average elasticity.

It is crucial that those sectors with higher sectoral income-elasticities of demand gain weight in the global economic structure in order to have stronger effects on global growth as structural change evolves. Here we see the crucial role of evolving demand on growth patterns (an effect which is not that clear from mainstream growth models).

4.2 Structural Change and the Dynamics of q(t)

Now we will show how the time-path of growth for income per capita is also highly dependent on ongoing process of structural change. This is an essential fact. It is true that the uneven pace of technical change across multiple sectors is a source of growth. But, it is also highly significant that the (uneven) sectoral processes are reflected at the aggregate level as well, with higher or lower intensity contingent on the role of demand as the key driver of structural change.

We visualize this effect in Table 3 and Fig. 3.

We have set the simulation scenario shown in Table 3 and Fig. 3 in a way that, whereas sectors 2 through 5 eventually exhaust their technological opportunities, resulting in a slowdown in productivity growth, sector 1 (with fixed ε_1 and γ_1, see Table 3) experiences productivity growth in a more intense, sustained way. Initially, the economy takes advantage, at a global level, of fresh technological opportunities for all sectors. But in the case of sector 1, and recalling the term $(1 - e^{-\delta_1 t})\beta_1 e^{-\varepsilon_1 t}$ in Eq. (1), the effect of the high values for ε_1 and γ_1 on $(1 - e^{-\delta_1 t})(1 - e^{-\varepsilon_1 t})\gamma_1$ results in a continued potential for innovation through non-systematic, informal activities, even after formal opportunities have vanished. This feature avoids the slowdown in sectoral productivity growth observable in the other sectors.

Regarding structural change, what is perhaps most interesting about this illustration is how, owing to the relatively small weight of sector 1 in the overall economy and the slow pattern of structural change that accompanies its growth, the potential of sector 1 shows up quite smoothly the an aggregate level. It is true, on the one hand, that the sector gains importance due to the nature of its income elasticity, but both this process and its effect on growth are relatively slow. This simulation shows clearly the role of demand in growth and suggests some policy implications related

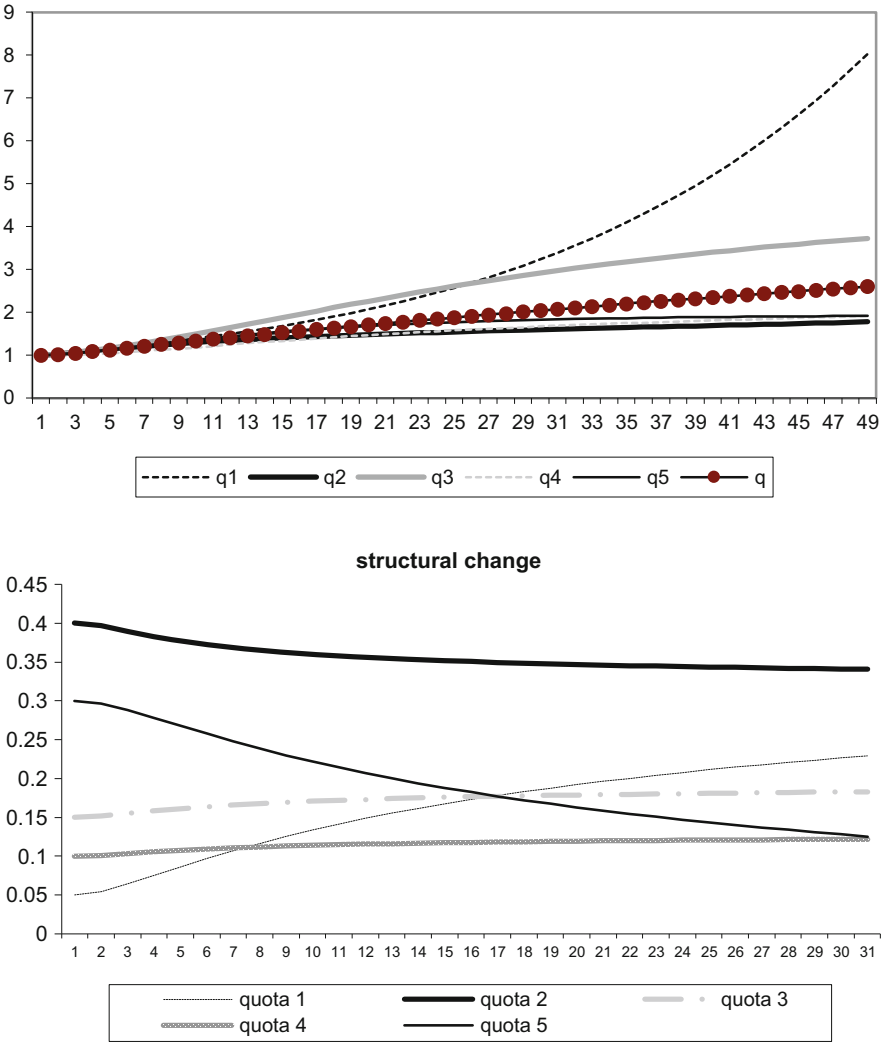

Fig. 3 Economic growth and structural change for setting 3

to the potential for sectoral elasticities of progressive sectors to reinforce each other, or even that those sectors that maintain sustained growth may end up being more vulnerable to the (sudden) ups and downs of productivity growth.

Table 4 Simulation setting 4

	α	β	γ	δ	ε	φ	$s_j(0)$	$q_j(0)$
sector1	0.013	0.08	0.01	0.1	0.08	2	0.2	1
sector2	0.013	0.08	0.01	0.1	0.08	0.6	0.2	1
sector3	0.013	0.08	0.01	0.1	0.08	0.3	0.2	1
sector4	0.013	0.08	0.01	0.1	0.08	2.5	0.2	1
sector5	0.013	0.08	0.01	0.1	0.08	−0.4	0.2	1

4.3 Appropriability Conditions and Growth

As another example of the possibilities of the model, let us consider what we discussed in Sect. 2 regarding the role of parameter δ_j, which captures the speed with which entry barriers arise in a given sector. As such, this factor reflects the appropriability conditions for incumbents. The question is: from the perspective of technology policy and the interactions with demand, how does appropriability policy affect aggregate economic growth?

To explore this issue, we consider the scenario in Table 4, a situation where we consider all sectors to have identical techno-institutional conditions, such that they only differ in terms of income elasticities (column φ in Table 4). As shown in Fig. 4, the sectoral growth paths will overlap, since we are considering similar conditions for all sectors. We therefore see an initial accelerated phase, followed by a S-shaped pattern of growth slowdown.

Now, regarding the earlier question, it may be interesting to increase the value of parameter δ in one sector, so that we can see how enforcing appropriability conditions in this sector will affect aggregate macroeconomic performance. We therefore fix $\delta = 0.75$ (instead of $\delta = 0.1$) for the sector with the lowest income elasticity of demand (sector 5). After this, we can also carry out a new simulation on the basis of setting 4, though we now fix $\delta = 0.75$ (instead of $\delta = 0.1$) in the maximum-elasticity sector (Sector 4). Accordingly, we can easily check whether the effects of a supply-side (appropriability conditions) policy would have different aggregate effects depending on the demand-side factor (i.e. the sectoral elasticities of the sector we are trying to promote). On a further note, we want to mention that enforcement of appropriability conditions is much more visible and effective at an aggregate level if we intervene in a sector with high income-elasticity of demand. We will not discuss this further but we believe this result can offer new perspective to conventional technology policies, that is, when mediated by the role of demand.

4.4 Technological Opportunities and Growth

Something similar could also be obtained if we try to apply policies aiming to enlarge the sectoral bases of technological opportunities (e.g., by supporting the development of applied scientific disciplines and cultivating linkages and

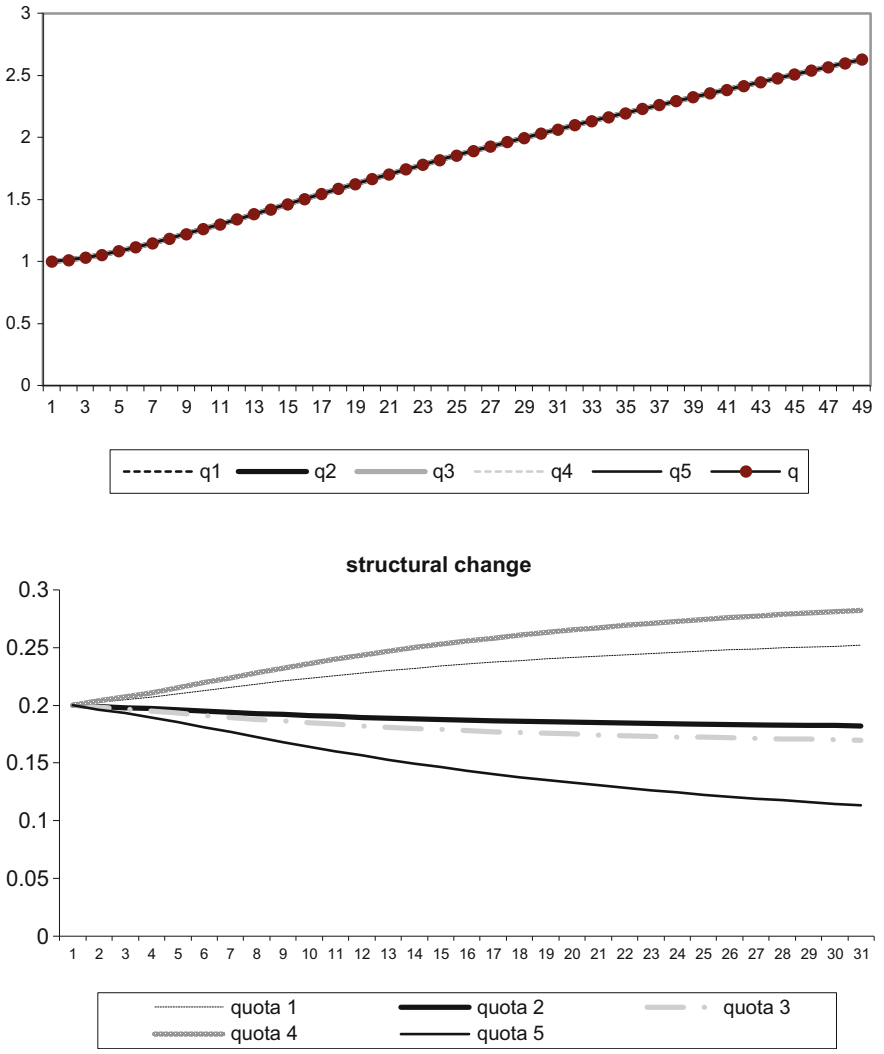

Fig. 4 Economic growth and structural change for setting 4

technology transfer between firms and universities) in order to re-invigorate economic growth. As noted in Sect. 2, the component $(1 - e^{-\delta_j t})\beta_j e^{-\varepsilon_j t}$ in the functions of sectoral technical change (Eq. 1) would be affected by these types of policies. In fact, as illustrated by Eq. (1), both appropriability policies and the promotion of technological opportunities (which constitute traditional supply-side policies) interact with one another according to our stylized modelling of sectoral productivity growth. In any case, and this is the main point of a model like ours, what our model adds is how the overall growth effects of such policies and their capacity to spur income per-capita growth are very much dependent on the income-elasticities of the

relevant sectors. Again, we find the demand dimension inevitably interferes in the effective influence of traditional industrial and technology policies on economic growth.

5 Concluding Remarks

In this work, and following the evolutionary tradition, we have modeled endogenous expressions for the processes of economic change (expressed in terms of the rate of economic growth and patterns of structural change) as resulting from the interactions between uneven sectoral patterns of innovation and the multisectoral links provided by sectoral income-elasticities of demand. Diverse patterns of intersectoral innovation can thus be explained by technological and institutional conditions underlying the typology and dynamics of specific sectoral innovation systems. Accordingly, we represent multisectoral evolutionary growth as an emergent property that arises from the preferences and consumption/demand patterns (captured by sectoral elasticities) and the sectoral supply-side structures and dynamics, as given by both the configuration of sectoral innovation systems and the corresponding phases within the industry life-cycle. These factors are able to explain uneven sectoral productivity-growth patterns in the model, as well as the way in which these uneven paths combine to engender overall growth.

In this fashion, we have delineated a map of linkages according to which the productivity-driven growth in income per capita drives, with differing intensity, the growth in demand and output for co-existing innovative sectors, thereby engendering structural change. In turn, this structural change re-shapes the composition of overall growth rates, thus influencing per-capita income growth and, eventually, the broader processes of economic transformation. The model clearly reflects the crucial role of income elasticities for trying to understand the way in which sectoral productivity-growth patterns are reflected in macroeconomic long-run growth. A final conclusion of this work is that, when formulating industrial or sectoral policies, the effects of demand-driven structural change and its influence on the composition of the economy must be taken into account. Indeed, this fact turns out to be essential in our model when assessing the effectiveness of alternative technology policies vis-a-vis the promotion of economic growth.

Appendix: List of Symbols

$\hat{q}_j(t)$: labor-productivity growth rate in sector j.
$q_j = \frac{Q_j}{L_j}$: labor productivity in sector j.
n: number of sectors in the economy.
$\alpha_j e^{-\delta_j t}$: New firms' contribution to sectoral productivity growth.

$(1 - e^{-\delta_j t})\beta_j e^{-\varepsilon_j t}$: Incumbents' contribution to sectoral productivity growth through formal R&D activities.

$(1 - e^{-\delta_j t})(1 - e^{-\varepsilon_j t})\gamma_j$: contribution to productivity growth through *learning by doing*.

g_j: sectoral output growth rate in j.

$\hat{q}$: overall rate of labor productivity (or income per capita $q = \left(\frac{Q}{L}\right)$) growth.

ϕ_j: Income elasticity of sectoral demand (sector j).

$s_j = \frac{Q_j}{Q}$: output share of sector j in global GDP.

$g = \sum s_j g_j$: GDP growth rate (rate of economic growth).

$\omega_j = \frac{s_j q}{q_j}$: relationship between productivities and output shares.

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