

論 説

Industrial development and policy: revisiting Schumpeter in the 21st century

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Abstract

Joseph Schumpeter characterised economic development by the continuous interplay of growth and qualitative change. He considered entrepreneurship, venture finance, and competition as three core drivers of the dynamic market process to explain the innovation driven growth of living standards, fluctuations and crises, continuous structural change, and even the transformation into a post-capitalist society. This article addresses Schumpeter's agenda for industrial development and demonstrates its undiminished relevance to economic education, research and policy from a contemporary perspective.

JEL Codes: L11, L22, L41, M13, O33

Key Words: Schumpeter, entrepreneurship, venture finance, innovation, competition,

1 Introduction

Scientific theories are not meant to be engraved in stone. The more radical and ground breaking new ideas are, the more they will be challenged and the more likely they will be overturned or amended. It is the wealth of competing hypotheses, controversial arguments, and ongoing debate that signals intellectual success. The present article addresses the Schumpeterian agenda from such an angle, illustrating its relevance together with the need to develop a contemporary perspective.

Given the immense scope of the topic one cannot strive for comprehensiveness or draw a panoramic picture, not even a survey of the literature. Instead, the aim is to demonstrate some modern avenues towards Schumpeter's theory of development through selected examples. If successful, they shall inspire further research in the area.

The paper is organized as follows. Section 2 briefly sketches the main elements of Schumpeterian development. In Section 3 we discuss in more detail the varied ideas about

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entrepreneurship and its different economic functions. Section 4 picks the case of venture capital to illustrate the problem of entrepreneurial finance. Section 5 then turns to the endogenous relationship between competition and innovation as well as their joint impact on productivity. Finally, the concluding section sketches the idea of Schumpeterian economic policies that focus on an economy's capacity to evolve.

2 Industrial development

Schumpeter is probably the most famous economist one has never learned about in the standard economic textbooks. Though regularly credited for influential ideas that he had contributed to such varied fields as entrepreneurship, innovation research, industrial organization, finance and growth, business cycles, public choice, or the history of economic thought, these are mostly received in a very partial manner and often serve as mere catchwords. In contrast, Schumpeter's (1911) general theory of innovation driven development rarely receives its due attention. This is the more surprising, as the basic elements are rather straightforward and have much intuitive appeal to practitioners in business and policy alike. They would also be simple enough to become part of our general economics education.

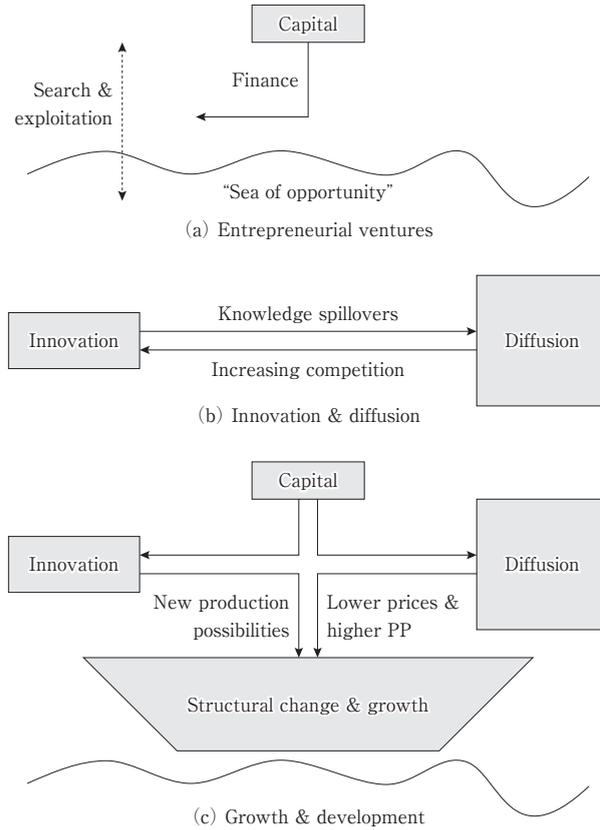
In contrast to Schumpeter's own exposition, that is rich in detail and informed by a deep understanding of history and the heterogeneous sources of economic thought, the graphic representation in Figure 1 is provocatively simple. The purpose is to demonstrate a facile yet meaningful narrative, which one could easily communicate in elementary classes in economics as well as other disciplines (e. g., legal studies, engineering, management, and political sciences). The focus here is on the overall reasoning. In the later sections we will turn to selected specific elements of his theory.

To begin with, the model presumes that there exist no definite boundaries to innovation, neither from running out of technological opportunities nor an ultimate saturation of demand. On purely logical grounds one cannot preclude either, and the recurrent fear of secular stagnation is a reasoned possibility. But the historical record on technological change and the psychological trait of continuously rising aspirations suggest to expect otherwise.¹⁾ Development will nevertheless pass through prolonged phases of temporary exhaustion and consequent downturns on top of other causes for the regular business cycle.

Schumpeter basically depicts the entrepreneurial venture as navigating a turbulent and uncertain, but also fundamentally *open* 'sea of opportunities' (Figure 1, Panel a).

A second premise is that innovation requires deliberate effort to search and exploit opportunities by the *entrepreneur*. This in turn depends on the pre-financing of effort, which refers to the complementary *capitalist* function of providing and allocating purchasing pow-

Figure 1: Embarking the Schumpeterian AdVenture



er. Both the entrepreneurs and capitalists must invest their respective resources under conditions of fundamental uncertainty²⁾ about the ultimate success and later returns to be earned by the venture. Their creative vision and realization of opportunities makes them the essential characters of the play. We will discuss them in more detail in Sections 3 and 4. Each impersonates a different function, with the entrepreneurs being the principal agent of change, and the capitalists occupying its “headquarters”. They control the means of production and make the ultimate choices about their allocation.

For Schumpeter, it is only a matter of time until innovations leak and generate positive spillovers to other firms that learn to adopt new techniques, imitate and may even challenge the incumbent by their own innovations (Panel b). As a consequence, competition increases and the temporary surplus profits are destroyed by new innovations. This involves a fundamental endogeneity of competition and innovation, which we will discuss in Section 5. In the end it is the widespread diffusion of new productive knowledge, which fuels the aggregate growth of per capita income via the associated expansion of goods or services and decline of prices (Panel c). The latter is responsible for the rise of real purchasing power that brings the benefits of innovation not only to the pioneering users but also to the mass of consumers.

What can Schumpeter's theory of development tell us about contemporary concerns? Let's briefly turn to the current fear of technological unemployment caused by increasing digital intelligence. To begin with, digitalisation should be discussed in combination with the fear of secular stagnation. As long as markets are competitive, the foremost impact of automation is to lower prices and thereby raise real incomes. If demand is not saturated, the additional income can be spent on other goods and services creating new demand for labour. This is not to deny severe problems of adjustment, for example, when labour must acquire higher skills or will inevitably shift towards new tasks, that cannot easily be replaced by programmed algorithms. However, by and large these difficulties correspond to past developments, which the standard model well explains.

If "this time is really different", it must be because the long term prospects for the growth of demand cannot match that of productivity. In other words, a qualitatively new problem arises if two popular fears come together: First, the rise and disruptive potential of robots, progressively displacing human labour in production.³⁾ And second, the hypothesis of an ultimately diminishing value of new ICTs and other innovations to consumers.⁴⁾ In such a scenario, labour would indeed be squeezed out. Large scale unemployment, inequality, and poverty would call for fundamentally new social arrangements that probably lead the way towards a post-capitalist society.

Schumpeter was a 'technology optimist', who believed in undiminished opportunities of value creating innovations and hence also demand (at least for the foreseeable future). In the current situation, he would probably point towards the manifold opportunities for new products and services that arise in the application of new ICTs. These are systematically underappreciated by our general perception, which is exactly what makes them a business opportunity for the visionary entrepreneur. Though acknowledging that historic events are unique, he probably would not consider the current situation that much different from past waves of technological change.

However, Schumpeter (1942) also offered a supply-side reason, why entrepreneurial capitalism may eventually run out of steam. This one may bear even more relevance to the long-term scenarios of the digital age. Instead of the saturation of demand, he pointed at economies of scale, especially in the large R & D labs of industries that were rapidly growing in importance at his time (e. g., chemicals or defense) and the consequent tendency of industry to become more concentrated. What he feared was a general tendency of routinization of innovation itself. The consequent concentration of industry would in the end lead society to take over the 'headquarters' and socialise the means of production.

Historically, at least two developments lead to the rebuttal of Schumpeter's bleak prediction on the future of capitalism. Both relate to structural change and the emergence of new industries. First, in many industries with high economies of scale rivalry remained largely intact. To a considerable degree this was owed to growing global competition. Low-

er prices thus transferred the productivity gains towards consumers instead of the incomes earned by industry. As a consequence, their importance relative to the growing services sectors, typically characterised by less economies of scale, smaller firm size, many start-ups, and mostly local competition, has actually declined.

To this process of tertiarisation one must add the digital revolution, which brought about many new and innovative enterprises in the ICT related sectors. There have always been certain large and dominant firms, but their relative fortunes easily shifted and have become especially colourful illustrations of Schumpeterian creative destruction. Overall, the ICT revolution has so far strengthened entrepreneurialism.

But in contrast to popular perception, the digital revolution is coming of age and the apparent commodification of many ICTs⁵⁾ indicates that the industry has entered a certain stage of maturity. Growing network economies create ever more powerful advantages to incumbents such as Google or Amazon. With rising barriers for new contenders, Schumpeter's process of creative destruction may again be at stake. Paraphrasing a popular quest,⁶⁾ society may start to ask, *who owns the algorithms* and controls the rising digital intelligence?

To conclude, Schumpeter provided an original, straightforward, and intuitively appealing narrative, which still captures essential elements of the dynamics of innovation driven growth and development. It is high time to admit it the due place in the introductory courses and textbooks of our discipline. To demonstrate its relevance also for contemporary research, the following examples add some detail to selected elements of his theory.

3 Entrepreneurship

Different from mere growth, Schumpeter characterized development by the ongoing qualitative transformations that drive the expansion of an economic system. The creative agent and prime mover of these changes is the entrepreneur, who fuels the process by own innovation. These innovations are not confined to technological change but must be understood very broadly, ranging from the introduction of new products or processes to the use of new resources, finding new markets, or changing the industrial organization of a market. The distinctive feature is the creation of novelty, by which entrepreneurs upset the current configuration of competitive advantages.

Inspired by his teachers from the early Austrian School, Schumpeter's definition of entrepreneurship was a radical break from the received theories of the classical and Marxist traditions as well as other marginalist schools. These had pictured entrepreneurs as mere undertakers, or managers, if considered at all, and focused on capital and labour as the two central factors of production. In contrast, technological change was assumed to be exoge-

nous and thus placed outside the economic system.

Once described as an “intriguing but elusive” (Baumol, 1968) concept, entrepreneurship research has since become a flourishing discipline. Engaging scholars from diverse fields of economics, business strategy, and organisational behaviour, it still confronts us with a puzzling plethora of theoretical approaches and definitions (Davidsson et al., 2006). Compared to these, Schumpeter’s concept exhibits a clear definition and purpose, but also a rather narrow scope. Practically, it is interchangeable with the notion of innovation.

Most important among alternative explanations are those by the later Austrian School from Hayek (1945) to Kirzner (1979). Instead of innovation, their focus is on the function of alert entrepreneurs to co-ordinate demand and supply by the discovery and exploitation of exogenously given imbalances in prices. Another influential alternative concept is the human capital theory of entrepreneurship by Theodore Schultz (1975), who emphasised the adoption and implementation of new technologies as the main characteristic of most entrepreneurs.

All three theories share a disequilibrium view of the economy. However, there are important differences. While Schumpeter’s entrepreneur is the source of disequilibrium, itself unsettling and transforming the system, the two other theories treat disequilibrium as exogenous, and characterise entrepreneurs by their adaptation to a constantly changing business environment and thus as an equilibrating force. The difference is most pronounced when we contrast Schumpeter’s focus on innovation, and Schultz, who stresses imitation. Essentially, the three approaches are complementary, each pointing at different entrepreneurial functions that are invariable important for the working of the economic system.

Going beyond Schumpeter’s narrow definition of entrepreneurship, Table 1 starts from a general behavioural definition. It then distinguishes between its different economic functions, occupational categories, and characteristic capabilities or skills. In short, the generic definition emphasizes the opportunity seeking nature of entrepreneurship, under which a large portion of the contemporary entrepreneurship literature can be summarized. It states in general terms, what is unique about that entrepreneurs do: the pursuit and exploitation of opportunities.

The notion of entrepreneurship originates in economics and therefore the traditional focus has been on *business* entrepreneurs, who pursue and exploit opportunities to make a pecuniary profit. This is also how Schumpeter used the term. In addition, the contemporary literature increasingly applies the concept also to other agents of change, e. g. in politics or the civil society, who pursue and exploit opportunities for social change (*social* entrepreneurs) or for environmental conservation (*ecological* entrepreneurs⁸).

For a comprehensive perspective, we must distinguish between two occupational categories that may both be the locus of entrepreneurial activity: First, independent entrepreneurs are opportunity-seeking in the sense of the general behavioural definition, but simul-

Table 1: Integrating different concepts of entrepreneurship

General behavioural definition	
Entrepreneurship is the pursuit and exploitation of opportunities	
for	<ul style="list-style-type: none"> ...profit (<i>business</i> entrepreneurship) ...social change (<i>social</i> entrepreneurship) ...conservation of the natural environment (<i>ecological</i> entrepreneurship)
Economic functions	
Adaptive (equilibrating)	<ul style="list-style-type: none"> (i) Market co-ordination (Hayek, 1945; Kirzner, 1997) (ii) Technology adoption/diffusion (Schultz, 1975)
Creative (disequilibrating)	(iii) Innovation (Schumpeter, 1911)
Occupational categories	
Independent entrepreneurs	Owner-managers running a businesses
Corporate entrepreneurs	Managers pursuing opportunities within the organisational context of a firm (Burgelman 1983a, b)
Special skills & capabilities	
Cognitive leadership (Witt, 1998)	
Judgemental decisions (Knight, 1921; Casson, 1982)	
New means, ends, or means-ends relationships (Venkataraman, 1997; Shane, 2004)	
"Jacks-of-all-trades" (Lazear, 2004, 2005)	

Source: Adapted from Peneder (2009).

taneously perform the functions of risk-bearing (ownership) and managing their own business. Alternatively, in firms with separate ownership and control the share-holders delegate the opportunity-seeking functions to its management. The locus of entrepreneurship is then with salaried employees, or corporate entrepreneurs.⁹⁾

Furthermore, entrepreneurship research has given rise to a number of different characterizations of specific entrepreneurial capabilities and skills, which are in principle independent from the occupational status and can apply to independent owner managers just as well as to salaried managers. Among them, Table 1 lists the selected tasks of "cognitive leadership", "judgmental decisions", creation of "new means, ends, or means-ends relationships", or the multifaceted and balanced portfolio of skills ("jacks-of-all-trades").

Finally, to understand how entrepreneurial behaviour contributes to the economic process, it is necessary to distinguish at least three particular economic functions. As a disequilibrating force, entrepreneurship creates (i) new opportunities by means of innovation. As an equilibrating force, the alert discovery and exploitation of given opportunities (ii) improves market co-ordination through the detection and elimination of imbalances in the price/quantity relationships; and (iii) incites technology diffusion through the adoption of novel practices and techniques. Some firms simultaneously conduct all the three functions at a time, whereas some may specialise in exploiting opportunities of a particular kind, and others may experience the three modes at different times.

Each of the three functions of market co-ordination, technology diffusion, and innovation originate in the entrepreneurial motive to pursue and exploit profit opportunities.

While the discovery of an opportunity is the appropriate characterization of the two former functions, the latter implies the creation of an opportunity. Since the notions of pursuit and exploitation of an opportunity encompass both, this general characterization identifies the only attribute that is both comprehensive and unique to the nature of entrepreneurship.

The important point to keep from this discussion is that all the three functions of entrepreneurship are essential and complementary forces of economic development. The economic system needs creative entrepreneurs for innovation as much as it needs adaptive entrepreneurs, who propel the diffusion of new technologies by imitation, or those who help to co-ordinate demand and supply by means of processing the price signals from the market. By increasing the overall efficiency of the system they contribute in important ways to the rise of a population's overall purchasing power.

In short, industrial development depends on all three entrepreneurial functions, commonly rooted in the pursuit and exploitation of profit opportunities. Without violating any of the essential mechanisms in Schumpeter's initial argument, acknowledging the related and yet distinct nature of these forms of entrepreneurship would be an important step towards a more comprehensive theory of development.

4 Venture finance

While Schumpeter is best known for his theory of innovation and entrepreneurship, venture finance occupied an enigmatic and much underrated place in his intellectual and personal life. As a theorist, he placed a unique emphasis on entrepreneurial finance, which he considered to be the constitutive and foremost function of the money and capital markets. In his view, credit and interest are created by and feed on the phenomenon of innovation-driven development. When money was generally accepted to be a mere "veil", affecting only the price level but without a lasting impact on real production, Schumpeter connected the monetary system to innovation, economic growth, and crises. He showed that beyond the mere facilitation of exchange, venture finance can enable and its lack obstruct certain trajectories of development. Thereby, he explicitly related the temporary entrepreneurial rent from innovation to Hilferding's concept of the "promoter's profit", which is the capitalized gains from founding, expanding, or restructuring a business and realized by selling new shares. It bears much similarity to what we today broadly call private equity, and with particular regard to early stage investments, venture capital.

Schumpeter pursued such profits actively during his brief and unfortunate history as a venture investor. After WWI, when still in Vienna, he invested on a grand scale in the foundation of new firms. Given the poor condition of industrial sites after years of war economy, the changed economic conditions due to the dissolution of the Habsburg Empire,

and the excess demand for goods, the economic rationale appeared sound, but the financial scheme, timing and practical execution were not.¹⁰⁾ Having built up large leverage, he was unable to refinance short-term loans when Austria was hit with its major banking crisis in 1924. As a consequence, the factories failed before they could produce a significant cash flow.

There is also an intriguing third chapter to Schumpeter's relationship with venture finance. When he was a celebrated professor of economic theory at Harvard University, the Boston area became the birthplace of modern institutional venture capital. Although Schumpeter was not directly involved, his venture theory contributed an intellectual stimulus to some of the creative new leaders in finance. One was Georges Doriot, the acknowledged "father" of institutional venture capital, who displayed a strong affinity to Schumpeterian ideas. Another was David Rockefeller, who repeatedly acknowledged Schumpeter's influence as teacher on his career as "creative banker".¹¹⁾ In short, Schumpeter was a creative venture investor already in the 1920s. But he failed, because of being overoptimistic, unexperienced, and struck by a banking crisis at the worst possible time. He also lacked the supportive institutional environment of the modern venture capital industry. Last but not least, he did not yet have a theoretical understanding of the agency problems involved comparable to that of contemporary corporate finance.

How does the rise of institutional venture capital affect our contemporary appreciation and relevance of Schumpeter's theory? For example, Kenney (2016) refers to venture capital as the "purest incarnation of the Schumpeterian perspective". It targets precisely the creative Schumpeterian kind of entrepreneurship at the right tails of the firm growth distribution. Even though it directly concerns only a very small fraction of the firm population, Schumpeter's model reveals its bigger impact on the entire economy: when venture capital helps innovative start-ups to rapidly expand their operations, these initiate imitation, capital accumulation and growth in other companies as well.

Schumpeter clearly understood that capital markets have to channel financial resources to their most profitable uses. Thereby, investment decisions are based on expectations about future returns; they rely on incomplete information describing possible future outcomes and thus involve uncertainty. In this situation, the accuracy of the allocation of resources depends on two critical factors: the availability of *information*, and the ability to interpret information properly, i.e. *knowledge*. To this, Schumpeter added the investor's ability to envision future opportunities for profit, as a counterpart to the entrepreneurial innovation.

In the meantime, corporate finance has developed an intricate understanding of financing constraints and their causes. For example, Schumpeter's emphasis on the role of the *creative banker* must be irritating to the modern reader.¹²⁾ In contrast, the contemporary literature suggests that it is precisely the small, young and innovative firms, which are most

exposed to financing constraints on traditional capital markets. They are also the most likely to seek venture finance.

Some enterprises generally are more affected by financing constraints than others. For small firms, transaction costs can be prohibitively high relative to the required volume of finance. Additional problems arise for young companies, which have not accumulated a steady cash-flow and typically lack collateral or a track record among creditors. Finally, the burden of being small and new is aggravated when the investment is on innovation.¹³⁾ One reason is the expensive expert knowledge needed to assess technologically complex projects. Another reason is the confidential nature of innovation that renders entrepreneurs more reluctant to disclose information. Both aggravate problems of adverse selection. Moral hazard increases, if investors have difficulties to distinguish between lacking effort and inherent risk as a cause of failure. Finally, innovative firms tend to have fewer tangible assets for collateral.

As a consequence, the optimal capital structure typically changes over time as firms grow and mature (Berger and Udell, 1998; Myers, 2001). Due to the high degree of informational opacity, young and small start-up companies initially rely most on insider funds. Access to intermediated funds increases as firms grow, successfully strengthening their reputations and accumulating other tangible assets. With a growing number of options available, the conventional *pecking order hypothesis* posits that firms prefer (i) internal financing from their own cash-flows and retained earnings in favour of external financing and (ii) issuing debt before equity, in the case that internal funds are exhausted. Internal financing is the cheapest method, because it avoids the problems of governance linked to asymmetric information. Debt financing is generally the favoured source of external financing, thanks to lower issuing costs and the entrepreneur's preference to maintain ownership and control.

Financial markets repeatedly create new means of overcoming inherent limitations and restrictions, when it comes to backing potentially profitable businesses. Thereby they follow the above logic of Schumpeterian development (Perez, 2002). Venture capital is one of its most remarkable examples. What makes it so special, is not only the focus on firms with high growth potential, but also the intense commitment in terms of the selection and monitoring of projects, which helps to mitigate the above problems of asymmetric information. Equally important, cash-flow is consistently reinvested, thus building-up company value rather than paying out dividends. Even though investments are of limited duration and investors must ultimately reap their returns through divestment, the episode of venture backed financing is the time, when an innovative entrepreneur can best pursue first-mover advantages and raise the scale of operations.

To conclude, offering specialised teams of active investors, venture capital operates at lower marginal cost of screening, contracting, monitoring or advise, and can thus mitigate

problems of moral hazard and adverse selection. It is itself a consequence of the Schumpeterian process of development. At the same time, it propels its further dynamics by overcoming traditional deficiencies in the financing of young and innovative firms that embark on his particular kind of entrepreneurial adventures. It provides a foremost example of the continuing relevance and further evolution of the Schumpeterian model of development.

5 Competition and innovation

Following the previous discussions of entrepreneurship and venture finance, this section briefly addresses a third pillar of Schumpeter's theory: the nature of competition and its endogenous relationship to innovation. One question in particular has attracted much attention in the field of industrial organization: Is competition conducive or an impediment to innovation?

Schumpeter (1911) raised the issue by pointing at an uneasy, almost paradoxical relationship: the process of economic development is driven by the ongoing competition for monopoly profits from innovation (Metcalfe, 1998). Thus, innovation feeds on the rivalry for monopoly power. However, if successful, innovation earns the biggest surplus by eliminating competition. As a consequence, incentives and effort for innovation will be largest, the more one can expect to monopolize the market. One may say, that if innovation is the motor of development, a variety of competitors is its fuel. But how can development be sustained, if the motor in full swing consumes all the fuel?

Schumpeter's solution to the dilemma is twofold. First, he argues that innovation is logically inconsistent with a situation of perfect competition, where all firms are identical and new technologies are immediately available to all. Competition reduces the payoff to innovation. But when the firm can earn no (or less) surplus profit, there is no (or less) incentive to invest effort (*rent-dissipation*)¹⁴. Second, monopoly power from innovation is only temporary—that is, markets must be contestable in order to trigger a competitive race for the next innovation. This brings us back to the first assumption in the discussion of Schumpeter's model of development. As long as that 'sea of opportunities' is open, incumbents face the threat of being displaced by entrants with a new technology or a better business model, etc. (*creative destruction*).

Arrow (1962) acknowledged the impossibility of perfect competition in a knowledge producing industry and considered Schumpeter's case of a contestable monopoly as a competitive situation. In his model, he compared it with a legally protected monopoly, demonstrating that the latter has less incentives to invest in innovation. The reason is that in a protected market the incumbent's innovation would foremost replace the rent which he previously held, leaving only incremental gains to be made, e.g., from reducing cost or rais-

ing the consumers' willingness to pay. However, in a contestable market the whole innovation rent is at stake (*displacement effect*). This considerably raises the incentives to invest in innovation for both the contender, who wants to gain the rent, and for the incumbent to defend it.

Different from how they are portrayed in the literature, Arrow and Schumpeter thus offer complementary answers to our question. Even though one highlights a negative and the other a positive impact of competition on innovation, their reasoning applies exactly to the opposite ends of possible initial conditions. Taken together, they make a strong case that neither perfect competition nor uncontested monopolies are conducive to innovation. This suggests a non-linear function that would be consistent with the contemporary interest in an inverted-U shaped relationship.

Scherer (1976a, b) was the first to observe an inverted-U shape empirically. Kamien and Schwartz (1976) were the first to provide an analytic solution. They modeled an innovation race, where firms choose the level of effort which maximizes the expected present value of an innovation. The firm faces a trade-off: a longer development period reduces the cost of innovation but also the expected stream of revenues. Maximizing the expected net return of innovation effort, more intense rivalry increases the risk of preemption and hence incites more R&D for low to intermediate ranges of that hazard. However, when the risk of rival preemption becomes sufficiently large, firms start to reduce their effort. The inverted-U relationship results from the fact that increasing competition raises the risk of preemption by rivals, but also the cost of winning the race.

Aghion et al. (2005) initiated the recent surge of interest in the inverted-U relationship. They extend the Schumpeterian growth model by distinguishing between the firms' pre- and post-innovation rents and relating them to the relative proximity of firms to the technological frontier. The rent dissipation effect captures the negative impact of competition on post-innovation rents. It occurs when competition is expected to be high even if the firm successfully innovates—that is, when the rents of the innovation are difficult to appropriate. In contrast, a positive escape competition effect dominates, if the innovation can give the firm a competitive edge over its rivals. More precisely, it occurs if competition affects the pre-innovation rents more than the post-innovation rents, thereby raising the incremental returns to the effort. The key prediction is that the positive escape effect of competition on innovation dominates at low levels of initial competition, while the negative dissipation effect dominates at high levels of competition. Of course, the precise trade-off depends on the technological characteristics of an industry.

Peneder and Woerter (2014) tested the predictions from the Kamien and Schwartz model within a comprehensively structured model for a pooled sample of Swiss firms. To take account of the endogeneity between innovation and competition, they estimated a simultaneous system of three equations. First, the innovation opportunity function addresses the

inverted-U relationship between the number of competitors firms report, and their innovation activity. Second, the innovation production function controls for the relationship between innovation effort and outcome. The latter is measured by different categories of creative and adaptive entrepreneurship (see Table 1). The final innovation impact function provides the estimates of how the entrepreneurial status affects the number of competitors.

They applied three-stage least-square estimations (3SLS) with sectoral taxonomies of technological regimes as the main exclusion restrictions to identify the system. The taxonomies account for the repeated concern about the relationship between innovation and competition being dominated by the specific technological and market environment (Gilbert 2006).

In short, the findings confirm a robust inverted-U relationship. This means that at low levels of initial competition, an increase in the number of competitors incites firms to do more research, but at a diminishing rate. The largest incentives for own research activities are found at intermediate levels of competition and then begin to decrease, when the intensity of competition further grows. Technology potential, demand growth, firm size, and exports also have a positive impact on innovation. Splitting the sample by firm types, the inverted-U shape is steeper for creative than adaptive entrepreneurs. This implies that for the former group innovation effort is more sensitive to changes in competition than for the latter.

The analysis reveals three potential stable equilibria. In the first equilibrium, monopoly is legally protected and hence not contestable. Innovation will be low or non-existent. In contrast, the second equilibrium is characterized by low competition and high innovation. Moving from monopoly to rivalry with a few competitors increases innovation. This is consistent with Arrow's (1962) case of a positive impact of competition on innovation. If competition further increases beyond a saddle point of unstable equilibrium, the industry moves towards the third equilibrium of no innovation and very high competition ('no innovation trap'). Comparing the second with the third equilibrium, the estimates are consistent with Schumpeter's negative impact of competition on innovation, and in particular the impossibility of innovation within a market of perfect competition.

To give a final example, Friesenbichler and Peneder (2016) extend the above model by integrating an additional productivity equation and test its validity for a large sample of firms from Central Eastern Europe (CEE) and Central Asia and Caucasus (CAC). The data originate from the *Business Environment and Enterprise Performance Survey* (BEEPS), conducted by the European Bank for Reconstruction and Development and the World Bank.

The results confirm the inverted-U shaped effect of competition on research effort also for these sample of firms in transition and developing countries. Furthermore, they show that both competition and innovation have a simultaneous yet independent positive impact

on productivity for sales and value added per employee. These separate effects are only identified, when controlling for the endogeneity of competition and innovation in the simultaneous system. In the single regressions with no account of their mutual causality, the competition variable is not significant.¹⁶⁾

To conclude, Schumpeter's understanding of the endogenous and complex relationship between competition and innovation is as relevant as ever. The theoretical literature on the problem has been prolific, applying ever more sophisticated tools and models and contributing a myriad of theoretical explanations for increasingly specific cases defined by different technological conditions and strategic environments. However, for large cross sections of firms at least, the inverted-U relationship has proven a powerful hypothesis that reconciles the Schumpeterian rationale with some of the major other mechanisms that shape the observed empirical variety of effects.

6 Summary and policy conclusions

What is an appropriate agenda of Schumpeterian economic policies in the 21st century? If we consider development as the combination of real income growth and qualitative transformations of the socio-economic system, there can apparently be no 'one-size-fits-all' solution to economic policy. The system perspective on mutual interdependencies calls for caution with regard to mechanistic expectations about the impact of public interventions. The nonlinear nature of the inverted-U hypothesis is a case in point. The idea of competition being detrimental to innovation and development is often used as a stalking-horse to oppose the application of strict antitrust and merger rules or the opening of markets to trade and entry, and other regulatory reforms. While in practice one must look at each case in detail, some general conclusions emerge, if we deliberately condition our considerations on the initial intensity of competition in the market.¹⁷⁾

For example, cases in antitrust and merger control typically are subject to closer investigation only when there already is reason to suspect a low level of initial competition. As a general rule, we should hence find most cases in the upward sloping part of the inverted-U, and expect that innovation also benefits from a strict application to maintain a high number of competitors. From this follows also a positive impact on productivity. Similar reasoning applies to regulatory reforms that open markets with territorial protection to the entry of new competitors. Starting from low initial rivalry, more competition will generally raise innovation and productivity. Finally, the implications of the inverted-U relationship are potentially ambiguous for the case of trade liberalisation. Disregarding other factors, it is however consistent with the principle of asymmetric liberalization, where less developed economies enjoy some temporary protection. The reason is that an overwhelming foreign

competition can otherwise inhibit the build-up of own innovation and production capabilities.

But there is also a more general point to make. Examining the prevalent logic of public interventions in the economic system, the common textbooks, which tend to reflect the majority view of our discipline, rationalize economic policy in terms of the well known market failures to be diagnosed. These have proven to be a powerful and flexible theoretical tool, which one can relatively easily mould to policies anyhow considered useful. There is, however, considerable disagreement within the profession. Roughly speaking, those to the right of the mainstream view continuously stress the perils of government failure as an argument against public interventions. Conversely, those to the left of the mainstream view like to invoke so called system failures, strategy failures, coordination failures or similar notions to justify them.

It is revealing that all the rationales refer to failures as the argument for or against certain activities. Can we think of any other area in which we accept such a *logic of failure* to motivate human actions? Probably not. It is a very peculiar attitude of our profession, which relates to our preoccupation with welfare economics and the way we accept hypothetical perfect states as a normative benchmark. But the Schumpeterian perspective tells us that in a dynamic and open system, normative benchmarks of hypothetical perfect states are ill-defined, and therefore the heuristic of failure is a poor foundation for intervention.

Seeking an alternative route, Peneder (2017) attempts a dynamic concept of competitiveness and industrial policy as drivers of Schumpeterian development. Proposing a dynamic logic of public intervention, he aims to reconcile the theoretic rationales with actual concerns of policy practice. He thereby turns to evolutionary economics, the aim of which “is to explain the growth of productive knowledge ... understood as the human ability to create (material) welfare” (Stoehlhorst, 2014, p. 677). “In contrast to explaining the allocation of given scarce resources,” the emphasis is on explaining “how cumulative change alters the resource constraints” (ibid., p. 670).

At the most general level, and consistent with a wide array of authors,¹⁸⁾ evolutionary change is characterized by the simultaneous interplay of the three elementary principles of variation, accumulation, and selection. These are not meant as an analogy from the natural sciences, but represent a higher level of abstraction (a meta-theory) to characterize different systems and forms. Combining these system functions with the ontological distinction between the micro-, meso- and macro-targets of intervention, he proposes a new taxonomy of economic policies. These are distinctively motivated by the dynamic rationale of Schumpeterian development rather than the welfare maximizing logic of market failure.

As a final remark, let's not forget that Schumpeter's most influential publication is more than 100 years old. If his agenda is enduring and fertile, one must find progress in re-

search on constitutive elements of his theory. These findings should add new perspectives and detail to our knowledge, or point at ambiguities and raise novel questions. As the various examples presented in this paper tried to demonstrate, Schumpeter's theory still provides a surprisingly strong and enduring thread to guide us towards challenging new research.

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Notes:

- 1) At the times of Schumpeter the ecological limits to growth were not yet on the agenda. But by his reasoning, environmental concerns clearly raise the social value of sustainable products and methods of production. Activities to improve our environment thus create value, and this value added should be counted as a rise in real income (that is, the quality of life we can afford). Consequently, the needed transformation towards a sustainable economy goes together with qualitative change and a rising standard of living, i.e. development precisely in his sense.
- 2) See Knight (1921).
- 3) Brynjolfsson and McAfee (2016), Ford (2016)
- 4) Gordon (2016).
- 5) See Kushida (2015), Kushida and Murray (2015).
- 6) See Freeman (2015).
- 7) See Peneder (2009).
- 8) Please note that for a meaningful transfer of the concept from economics to other areas of social activities, one must redefine the incentives in terms of individual, often non-pecuniary payoffs, and draft a proper institutional framework, which can complement or substitute for market selection.
- 9) As the Schumpeterian motive of temporary monopoly profits does not directly apply to salaried personnel, other pecuniary motives must be in place to drive their entrepreneurial initiative, such as performance related pay, the external valuation on the job market, or the prospect for promotions.
- 10) In addition to spending his own wealth, he borrowed heavily from his privileged bank account, repaying short-term loans as the value of assets increased, and he raised considerable funds from third parties. See Peneder and Resch (2015).
- 11) *ibid.*
- 12) This creative banker is no academic fiction, as innovation well existed before the emergence of institutional venture capital, and many innovations are still financed by credit (apart from own cash-flow, which is even more important). Schumpeter actually subsumed them all in his

functional interpretation of finance, where e. g. the owner-manager of a firm simultaneously exerts the entrepreneurial and the capitalist functions.

- 13) See Carpenter and Petersen (2002).
- 14) See Gilbert and Harris (1984), Fudenberg and Tirole (1987) or Gilbert (2006). The discussion goes back to Tullock (1967) and Posner (1975), who argued that firms competing for a monopoly raise their rent-seeking investments up to the expected value of the monopoly rent, which one should therefore add to the welfare loss of monopoly. Obviously, this conclusion contrasts sharply with Schumpeter's dynamic perspective of development where innovation is a productive investment.
- 15) See also De Bondt (1977) or De Bondt and Vandekerckhove (2012).
- 16) Among the exogenous variables education, foreign ownership and own exports are the most robust drivers of firm-level productivity. Impeding the diffusion of new technologies, better appropriability conditions *ceteris paribus* have a negative impact on total sales and value added per employee.
- 17) See Friesenbichler and Peneder (2016).
- 18) See, for instance, Nelson and Winter (1982), Metcalfe (1998), Peneder (2001) or Hodgson (2002).

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