Schumpeter on Innovations and Profits

The Classical Heritage*

1. Introduction

Joseph Alois Schumpeter was a most attentive student of the history of economic thought. He was brought up in the Austrian tradition of doing economics which typically consisted in first studying meticulously the received doctrines and their historical roots in the particular field under consideration, followed by an elaboration of the author’s own view on the matter.¹ A particularly impressive case in point is Eugen von Böhm-Bawerk’s (originally) two-partite Kapital und Kapitalzins (Böhm-Bawerk, [1885, 1889] 1959). While the first volume is devoted to a detailed critical account of earlier and contemporary theories of capital and interest, in the second volume Böhm-Bawerk develops his own ‘positive’ theory. Schumpeter had studied with Friedrich von Wieser, Eugen von Philippovitch and also Eugen von Böhm-Bawerk in Vienna and had acquired an intimate knowledge of their contributions. His constructive work reflects what he had learned and adopted from his masters. However, he hardly ever simply adopted an idea found in some other author, whether Austrian or not, without adapting it to the specific purpose at hand. And he was not reluctant to diametrically

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¹ For a summary account of Schumpeter’s life, see Arnold Heertje’s entry in The New Palgrave, reprinted in Heertje (2006, chapter 1) and Kurz (2005).
oppose doctrines advocated by his former teachers when he felt they were flawed. He was no diplomat. In fact he thought that the answer Böhm-Bawerk (and other Austrians) had given to the most heatedly debated question of the time, namely, ‘Why are there profits, are they due to “exploitation”, as the socialist critics of capitalism maintained, and what determines their magnitude?’, was at best incomplete if not outright wrong. Böhm-Bawerk, Schumpeter implied, had not really grasped the nature of capitalism.

Did the contributions of other authors fare better in Schumpeter’s view? Léon Walras’ general equilibrium theory the young Schumpeter (1908) had praised as the Magfa carta of economics, but as time went by his admiration for the Lausanne economist’s achievements shrunk. Ironically, he kept him in high esteem essentially for allegedly having analysed an economic system – the so-called ‘circular flow’ – in which the differentia specifica of capitalism, profits and interest, are absent.

The classical economists are given slightly better marks. Yet the only author who according to Schumpeter deserves to be credited with having grasped at least some elements of the specificity and inherent dynamism of the capitalist mode of production, distribution and accumulation was Karl Marx.² Therefore it comes as no surprise that Marx figures prominently in Schumpeter’s interpretative and constructive work even and occasionally especially when there are no direct references to him. Interestingly, Schumpeter insisted that Marx’s theory of value and distribution was of classical derivation and that the classical theory was fundamentally different from the marginalist or demand-and-supply theory (see Schumpeter, 1914). He thus rejected Alfred Marshall’s interpretation according to which there was a continuous development of economic theory from the classical economists to the marginalists, all adopting a demand-and-supply framework.

There are two intriguing facts that form the starting point of this paper. First, in Schumpeter’s view the classical economists and Marx had more interesting things to say about the character

² As Geoff Harcourt recalled in a letter to me, Joan Robinson said Schumpeter was Karl Marx with the adjectives changed.
of capitalism, and, by implication, on the origin of profits, than the marginalist economists. Second, in his judgement the two theories, classical and marginalist, are not cast from a single die but represent analytically very different approaches to the issues at hand (see, especially, Schumpeter, 1914, parts 2 and 3). These two facts are probably not unrelated. Yet what is their connection? While this question is beyond the scope of this paper, elements of an answer to it can perhaps be found indirectly by taking a fresh look at Schumpeter’s theory of economic development against the background of the classical theory of value and distribution. In this way the specificity of Schumpeter’s explanation of profits can be brought to the fore and the relationship between his analysis and that of the old classical economists clarified. We will see that while Schumpeter is close to the classical economists in many respects, in his theory of economic development he retains the position of methodological individualism and explains economic change not as the outcome of systemic pressures on agents due to competition, conceived as rivalry, as the classical authors and especially Marx had done, but as the consequence of the volitions and actions of a particular group of men and women, ‘entrepreneurs’.

The composition of the paper is the following. Section 2 provides some evidence from Schumpeter’s works as regards his assessment of the contributions of the classical economists and Marx. Section 3 argues with reference to the works of these authors that his assessment is not always well grounded. Section 4 then starts the analytical part of the paper by first turning the attention to the concept of ‘circular flow’ in Schumpeter and giving it a thoroughly classical interpretation. Section 5 puts forward the model of a simple two-sectoral economy and prepares the ground for a discussion of important Schumpeterian (and classical) themes in this framework. Section 6 introduces the important concept of ‘extra profits’ (the classical authors) or ‘profits’ (Schumpeter) and ‘extra costs’ around which the following argument revolves. Section 7 then puts forward a typology of process innovations and traces in a

3 There is a certain tension, if not contradiction, between Schumpeter’s constructive and his interpretative work. As is well known, in the latter (see, in particular, Schumpeter, 1954) he unequivocally endorsed the marginal revolution as a scientific advance.
schematic way their implications for the economic system as a whole. Section 8 contains some concluding remarks. 4

2. Schumpeter on the classical authors and Marx

In Theorie der wirtschaftlichen Entwicklung, first published in 1911, Schumpeter comments on various schools of economic thought and what these had to say about the problem of economic development. He identifies Léon Walras as the main representative of the ‘static point of view’. He adds, however, that the Austrian economists ‘describe only the circular flow of the economy’ (Schumpeter, 1911, p. 100) 5, a characterization which probably did not amuse his former teachers. Adam Smith is said to have undertaken probing steps into the as yet unchartered territory of economic dynamics, but did not get very far because of a lack of imagination and analytical rigour. Whenever Smith talks of economic progress he is said not to explain it in terms of the economic process itself, that is, endogenously, but as a response to exogenously changing data. In Schumpeter’s judgement Smith focused essentially on static problems, allowing only for a little contamination of the analysis with dynamic issues. The same is said to apply also to Ricardo. In the English version of his magnum opus Schumpeter (1934, p. 60) insists boldly that ‘economic theory in the traditional sense contributes next to nothing’ to an explanation of the all-important phenomenon of economic and social development.

According to Schumpeter, in the entire history of economic analysis there is only a single exception worth mentioning: ‘The only greater attempt to come to grips with the problem of economic development is due to Karl Marx.’ (1911, p. 98) He adds:

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4 It goes without saying that in so short a paper many important tenets in Schumpeter’s economics of innovation cannot be dealt with; see therefore, for example, Metcalfe (1998) and Kurz (2005).

5 Translations from the first (German) edition of Theorie der wirtschaftlichen Entwicklung are mine.
Only Marx ... has tried to deal with the development of economic life by means of economic theory. His theory of accumulation, of immiserization, and of the breakdown of capitalism all follow from purely economic considerations and always does his attention focus on the aim to understand the development of economic life as such and not only of its circular flow. But the foundations of his theory are nevertheless of a static nature – being the foundations of the classical economists after all. (1911, p. 98)

Unfortunately, Schumpeter leaves it at that. The reader is neither told wherein precisely Marx’s merits lie, nor how Schumpeter’s own approach compares with Marx’s. (We shall briefly comment on this latter issue in the following section.) The situation does not change much in subsequent editions of the Theorie, including its translation into English (Schumpeter, 1934). However, in all editions Marx is praised for his respective achievements. In The Theory of Economic Development Schumpeter actually writes about his own novel conception of the economic process that it ‘overcomes a series of fundamental difficulties and thus justifies the new statement of the problem’ in his book. Interestingly he adds: ‘This statement of the problem is more nearly parallel to that of Marx. For according to him there is an internal economic development and no mere adaptation of economic life to changing data.’ Then follows the remarkable adjunct: ‘But my structure covers only a small part of his ground.’ (Schumpeter, 1934, p. 60 n) Schumpeter was not exactly known for his modesty, but here, at least, he displays a fair amount of it.

3. The classical view of innovations and competition

Schumpeter’s assessment of Adam Smith’s achievement regarding the explanation of socio-economic change cannot be sustained. The Scotsman had interesting things to say and depicted socio-economic change consistently as endogenous; think, for example, of his discussion of the fall of the Roman empire or his analysis of the loss of power and influence of the Roman-catholic church. Not for nothing he was dubbed one of the first ‘evolutionary’ economists by such diverse commentators as Ronald Coase (1976) and Richard Nelson (2005). Here it suffices to draw the readers’ attention to two closely interrelated aspects of Smith’s analysis. The first concerns the tendency for the rate of profitss to become uniform despite ongoing technological change, whereas the second concerns the establishment of what nowadays are called research and development activities as a part and parcel of an ever
deeper division of social labour.

According to Smith modern society is characterized by continuous innovations. He emphasizes especially the uncertainty associated with the introduction of new goods and new methods of production and insists that due to competition there will be a long-run tendency towards a uniform rate of return on the capital invested:

The establishment of any new manufacture, of any new branch of commerce, or of any new practice in agriculture, is always a speculation, from which the projector promises himself extraordinary profits. These profits sometimes are very great, and sometimes, more frequently, perhaps, they are quite otherwise; but in general they bear no regular proportion to those of the other old trades in the neighbourhood. If the project succeeds, they are commonly at first very high. When the trade or practice becomes thoroughly established and well known, the competition reduces them to the level of other trades. (WN, I.x.b.43)

Not least because of product and process innovations relative natural prices are bound to change in the course of time. They vary with the natural rates of wages, profit, and rent, which in turn vary according to whether the society is in an ‘advancing, stationary, or declining condition’ (WN, I.vii.33).

In chapter I of book I of The Wealth of Nations, ‘Of the Division of Labour’, that is, the chapter in which Smith is keen to lay bare the main source of increases in labour productivity, he stresses that improved machinery is not only due to what Nathan Rosenberg was to dub ‘learning by using’, but is often the result of the work performed in special research and development departments:

All the improvements in machinery ... have by no means been the inventions of those who had occasion to use the machines. Many improvements have been made by the ingenuity of the makers of the machines, when to make them became the business of a peculiar trade; and some by that of those who are called philosophers or men of speculation, whose trade it is, not to do anything, but to observe every thing; and who, upon that account, are often capable of combining together the powers of the most distant and dissimilar objects. In the progress of society, philosophy or speculation becomes, like every other employment, the principal or sole trade and occupation of a particular class of citizens. (WN, I.i.9; emphasis added)
The combinatoric metaphor as an abstract description of the innovation process is thus already (or also) to be found in Smith. The idea that the existing particles of knowledge can be newly combined in order to generate new particles of economically useful knowledge recurs in Schumpeter’s concept of ‘new combinations’ (see below).6

David Ricardo fully subscribes to Smith’s view of the role of competition. He writes:

He, indeed, who made the discovery of the [new] machine, or who first usefully applied it, would enjoy an additional advantage, by making great profits for a time; but, in proportion as the machine came into general use, the price of the commodity produced, would, from the effects of competition, sink to its cost of production, when the capitalist would get the same money profits as before, and he would only participate in the general advantage, as a consumer, by being enabled, with the same money revenue, to command an additional quantity of comforts and enjoyments. (Ricardo, [1817] 1951, p. 387)

Ricardo also has a clear understanding of the fact that, in general, new technical knowledge cannot for long periods of time be monopolized. Typically, it sooner or later becomes a ‘general good’ (ibid., p. 386), that is, it is non-excludable. Ricardo is also clear that new technical knowledge is non-rival. He therefore can be said to have anticipated somewhat the view entertained in recent contributions to growth theory that new industrial designs are public or quasi-public goods. It is, of course, the process of diffusion and imitation consequent upon the introduction of a successful new method of production enforced by competition that is responsible for gradually rendering what at first is a purely private good a public one.

Interestingly, Ricardo is well aware of the fact that a technical invention does not per se become an innovation and thus gain economic weight. In his chapter ‘On Machinery’, added in the third edition of the Principles (1821), he contemplates the possibility that a newly

6 It underlies also Martin Weitzman’s recent concept of ‘recombinant growth’; see Weitzman (1998). Weitzman relates his attempt ‘to provide microfoundations for an idea-based growth model’ (p. 332) to writings on the causes of progress in mathematics and the sciences and refers explicitly also to Schumpeter’s new combinations (pp. 335-6), but not to Smith.
discovered instrument of production can at first not be employed because at the then ruling money prices and wages it would not be profitable to do so. However, since in the course of the development of the economy money prices and wages are bound to change due to decreasing returns in agriculture, for example, a point may come where the instrument of production will be chosen by cost-minimizing producers (see ibid., p. 395). This is a case of induced innovation, induced by the price and wage dynamics of the economic system under consideration.

A discussion of Marx’s contribution to the theme under consideration is beyond the scope of this paper. We rather focus on a remarkable difference between the views of the classical economists and especially Marx on the one hand and Schumpeter on the other as regards the main source of innovations and economic change. The motivation behind innovations Marx discusses in the chapter dealing with ‘relative surplus value’ in volume I of Capital. He points out that a capitalist who introduces a new and superior method of production can sell the commodities above their individual, but under their social value ... This augmentation of surplus-value is pocketed by him, whether his commodities belong or not to the class of necessary means of subsistence that participate in determining the general value of labour-power. Hence, independently of the latter circumstance, there is a motive for each individual capitalist to cheapen his commodities, by increasing the productiveness of labour. (Marx, 1967, p. 317; emphases added)

‘Each individual capitalist’ therefore has a persistent motive to innovate. For fear of one of the rivals gaining a competitive advantage that endangers his or her existence, to innovate is not something left to the individual capitalist’s option, but an existential must, enforced by competition. Modifying a famous dictum of Marx, we might say: ‘Innovate, innovate! This is Moses and the prophets.’ In the classical economists and Marx a systemic characteristic is responsible for the permanent revolution of the types and qualities of goods produced, of the methods of production used and of the way in which firms and markets are organized. The ‘coercive law of competition’, of which Marx spoke, compels producers incessantly to

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7 See also Böhm (1987, pp. 20-21) who summarizes the criticism levelled at Schumpeter by Paul Sweezy and Shigeto Tsuru from a Marxian perspective.
introduce new methods of production in order to escape their competitors in given markets or to introduce new types or qualities of goods in order to escape them in newly established markets. Competition means rivalry, and in it only the successful innovator will survive. Innovations are not the result of a particular inclination of a group of people characterized by exceptional capabilities, they are rather the result of a behaviour of agents enforced by competitive pressures. Exceptional skills and capabilities are commonly advantageous in the battle of survival, they are not, however, the prime mover of development. The impulse comes from the institutional characteristics of the capitalist economy and translates itself into the aspirations and actions of people. In the struggle with their ‘inimical brothers’ – their competitors – capitalists are compelled to innovate on penalty of their own ruin. The competitive capitalist economic system, one might say without too great a stretch of the imagination, ‘breeds’ a particular brand of leaders, called entrepreneurs.

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8 Marx’s concept of competition has been anticipated by Adam Smith who insisted: ‘Monopoly ... is a great enemy to good management, which can never be universally established but in consequence of that free and universal competition which forces every body to have recourse to it for the sake of self-defence.’ (Smith, WN, I.xi.b.5; emphasis added)

9 Adam Smith also stressed: ‘The difference of natural talents in different men is, in reality, much less than we are aware of; and the very different genius which appears to distinguish men of different professions, when grown up to maturity, is not upon many occasions so much the cause, as the effect of the division of labour. The difference between the most dissimilar characters, between a philosopher and a common street porter, for example, seems to arise not so much from nature, as from habit, custom, and education.’ (WN, I.ii.4) Smith’s view gets some support, for example, from Howe (1999) who argues that geniuses do not form a breed apart but are first and foremost the result of a unique set of circumstances and opportunities.

10 In this context it is perhaps worth recalling that according to some economic historians the usury rule helped to nourish a spirit of entrepreneurship by discriminating against certain legal forms in which financial transactions were clothed. In particular, instead of arranging for a loan the provider and user of a loan might form a partnership, which would put the burden of entrepreneurship also on the financier.
Schumpeter’s view is very different and reflects his ‘methodological individualism’, a term coined by him (Schumpeter, 1908). Whereas in the classical economists and Marx the whole shapes the parts, Schumpeter sticks to the Walrasian view that the parts constitute the whole. He, too, is concerned with explaining endogenous economic and social change (see also Tichy, 1985). However, in his view it is not a systemic cause that keeps generating change from within the economic system, it is rather the existence of ‘a second type of economic action’. In addition to the genotype of ‘hedonic’ or ‘static’ men and women there is the genotype of ‘energetic’ or ‘dynamic’ ones, which is much smaller in number and constitutes an ‘elite’. The latter genotype is said to be the ‘agents’ of economic development.\(^\text{11}\) If this type did not exist there would be no economic change, a proposition which the classical economists and Marx would in all probability have strongly contested.

The problem with Schumpeter’s explanation, as seen by commentators such as, for example, Kuznets (1940) and Rieter (1985), is that it is unclear how the explanation of economic change could ever be endogenous, given the postulate that there is always a proportion of the population that represents ‘dynamic’ agents whose interest consists ex definitione in revolutionizing the existing state of affairs, in building economic dynasties, etc. Once the cause of economic dynamism is given from the outside, only the course the system takes is endogenous. In this perspective the criticism Schumpeter levelled at Adam Smith that the latter conceived of economic change exclusively as a response to exogenously changing data, recoils on the Austrian. With regard to Schumpeter’s idea of long waves, incorporated in the second edition of the Théorie and then elaborated in great detail in the Business Cycles (1939), Kuznets remarked drily that the whole story boils down to the assumption that Schumpeter’s heroes (and heroines), entrepreneurs, are getting tired about every fifty years.

Among the best known elements of Schumpeter’s doctrine of economic change is his list of five types of ‘new combinations’:

1. The introduction of a new good – that is one with which consumers are not yet familiar – or of a new quality of a good. 2. The introduction of a new method of production, that is one not yet tested by experience in the branch of manufacture

\(^{11}\) David Riesman’s distinction between internally and externally guided people is somewhat similar to Schumpeter’s.
concerned, which need by no means be founded upon a discovery scientifically new, and can also exist in a new way of handling a commodity commercially. (3) The opening of a new market, that is a market into which the particular branch of manufacture of the country in question has not previously entered, whether or not this market has existed before. (4) The conquest of a new source of supply of raw materials or half-manufactured goods, again irrespective of whether this source already exists or whether it has first to be created. (5) The carrying out of the new organisation of any industry, like the creation of a monopoly position (for example through trustification) or the breaking up of a monopoly position. (Schumpeter, 1934, p. 66)

As has been pointed out by several commentators, the five cases referred to are to be found already in the earlier literature, including the German one (see Streissler, 1994). Particularly noteworthy in this context are contributions by Albert Schäffle who in the late 1860s and early 1870s taught in Vienna and had Böhm-Bawerk among his students. Apparently his influence extended also to Schumpeter (see Borchartd, 1961, and Balabkins, 2003). Schäffle emphasized the role of the entrepreneur and pointed out the importance of swarms of imitators for propagating the initial innovative impulse. It should perhaps also be mentioned that in part 3 of his Theorien über den Mehrwert, a first edition of which was posthumously published by Karl Kautsky between 1905 and 1910, Marx summarized his account of the way capitalism develops and expands (see Marx, 1972, pp. 285-90). The account comprises practically all the items contained in Schumpeter’s list and considers innovation as a major weapon in the competitive struggle. Very much like Schumpeter, Marx conceptualized technological change and the institutionalisation of research and development as an integral part of the development of industrial capitalism. Social change, Marx insisted, was both an instrument and a consequence of the competitive struggle.

We now turn to Schumpeter’s concept of ‘circular flow’ – the starting and end point of his probing into the problem of economic change. The ‘law of motion’ of modern society, as Schumpeter sees it, unfolds in leaps and bounds. In abstract terms, economic development refers to the interval of time in which innovations shake up the original state of affairs, the old circular flow, until the system has fully absorbed the innovative shocks and has ideally reached a new circular flow, or self-replacing state.
4. Schumpeter’s concept of ‘circular flow’

Commentators on Schumpeter’s contribution have variously pointed out historical predecessors of his concept of circular flow. It was at odds with Eugen von Böhm-Bawerk’s concept of production as a linear process of final duration starting from original factor services and maturing in final consumption goods. It rather followed Friedrich von Wieser's observation that in developed economic systems there was no such thing as production carried out by unassisted labour: social production was invariably a circular flow (see von Wieser, 1884, p. 50).¹² The concept of a self-reproducing, or repetitive, economic system was a powerful tool of the analysis from William Petty to the physiocrats, the English classical political economists, especially Robert Torrens, and Karl Marx. The latter analysed its structural characteristics in great detail in his schemes of ‘simple reproduction’ in volume II of CAPITAL. However, before Schumpeter the concept was hardly ever meant to refer to an actual and recurrent state of the economy. The system experienced was not stationary, and because of profit-seeking behaviour on the part of capitalists could never be so, but was subject to continuous change in size and form from within. It was a system incessantly in travail. In earlier authors the concept was rather an analytical device designed to allow the theorist to set aside phenomena that blurred the view of salient features of the economic system. Looking at the economy through the lens of a self-replacing system might perhaps be compared to carrying out a controlled experiment in the sciences. Most important, it allowed the classical economists to render greater precision to one of their main analytical concepts: that of the ‘difficulty of production’ of a commodity. This in turn contained the key to the most basic version of the concept of value in these authors. In Schumpeter the concept of circular flow was instead meant to serve two purposes: (i) to provide a sufficiently accurate description of recurrent and, as things may be, possibly even relatively persistent states of the economic system, and (ii) to provide a powerful tool of the latter’s analysis.

¹² Schumpeter generally appears to have followed more in the footsteps of Wieser than Böhm-Bawerk. Another example where he took issue with Böhm-Bawerk’s doctrine was the assumption that a positive rate of time preference can be postulated independently of the socio-economic environment. Against this Wieser had already argued that a positive rate of time preference is an implication of a positive rate of interest and not the other way round.
Let us expound by way of a simple formalisation the conditions met in the ‘ideal state’ of a circular flow starting from the classical authors to whom Schumpeter frequently refers in chapter I, ‘The Circular Flow of Economic Life as Conditioned by Given Circumstances’, of his magnum opus. The simplest system we can think of in this context is an economy that is just able to reproduce what has been used up in the course of production, neither more nor less. This is an economy that produces for the sustenance of its population but is unable to produce a ‘social surplus’ which could be distributed as property income (profits, interest, rents) to capital or land owners or paid out in the form of above subsistence rates of remuneration of labourers. We may for simplicity start from a case with three kinds of commodities, tools (t), raw materials (m), and the food of the labourer (f). Let \( T_i, M_i \) and \( F_i \) designate the inputs of the three commodities (employed as means of production and means of subsistence) in industry \( i \) \((i = t, m, f)\), and \( T, M \) and \( F \) total outputs in the three industries. In the hypothetical case in which the economy is just viable, that is, able to reproduce itself without any surplus (or deficiency), we have \( T = \Sigma_i T_i, M = \Sigma_i M_i, \) and \( F = \Sigma_i F_i \).

From this schema, we may directly derive the corresponding system of ‘natural’ (Smith) or ‘absolute’ (Ricardo) values. Denoting the value of one unit of commodity \( i \) by \( p_i \) \((i = t, m, f)\), we have

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\begin{align*}
T_t p_t + M_t p_m + F_t p_f &= T_t \\
T_m p_t + M_m p_m + F_m p_f &= M_m \\
T_f p_t + M_f p_m + F_f p_f &= F_f
\end{align*}
\]

These linear equations are homogeneous and therefore only relative prices can be determined. Further, only two of the three equations are independent of one another. This is enough to determine the two relative prices.\(^{13}\)

The important finding is that the given socio-technical relations of production and productive consumption rigidly fix relative values. These values depend exclusively on necessities of

\(^{13}\) Alternatively, it is possible to fix a standard of value whose price is \textit{ex definitione} equal to unity. This provides an additional (non homogeneous) equation without adding a further unknown and allows one to solve for the remaining dependent variables.
production. They are the only ones that allow the replication of the initial distribution of resources and thus guarantee the unhampered continuation of the circular flow. The difficulty of producing a unit of any one of the three commodities expressed in physical terms is simply the bundle of commodities used up of the three commodities per unit of output. However, looking upon the system as a whole and solving the above set of simultaneous equations allows one to provide scalar expressions of how the difficulties of producing any two of the commodities compare with one another.

Schumpeter does not restrict the concept of circular flow to systems of production without a surplus product, but sees for it a much wider range of applicability. In fact, he subsumes under it all systems except those in which there are profits and interest. There can, however, be property incomes such as rents of different kinds of land. We may therefore provide a slightly more general expression of Schumpeter’s concept in which we refer explicitly to the wages and rents paid. We relate the argument directly to Walras’s Elements, which in Schumpeter’s view was the modern lócus clássicus of the concept of circular flow. We start from equations (4) in § 203 of the Elements (Walras, 1954, p. 240), which are here presented using matrix notation,

\[ P = C q + L w + A y \]  \hspace{1cm} (2)

where \( P \) is the vector of prices of outputs, \( C \) is the matrix of the production coefficients of land inputs of the operated methods of production, \( q \) is the vector of prices of land services, i.e. rent rates, \( L \) is the matrix of the production coefficients of labour inputs of the operated methods, \( w \) is the vector of corresponding wage rates, \( A \) is the matrix of the production coefficients of the produced means of production of the operated processes, and \( y \) is the vector of prices of the services of capital goods. If, following Ricardo, we take account only of the technology used at the margin (either extensive or intensive) and if we assume for simplicity that there is only one quality of labour and only circulating capital, we obtain, employing Schumpeter’s zero profits condition,

\[ P = w l + A P \]  \hspace{1cm} (3)

which is a system of \( n \) equations in \( n + 1 \) unknowns, where \( n \) is the number of products, some (or all) of which could be capital goods. Expressing prices in terms of units of ‘labour commanded’ (Adam Smith), i.e. \( p = P/w \), gives
\[ p = l + Ap \]  \hspace{1cm} (4)

or

\[ (l - A)p = l \]  \hspace{1cm} (5)

where \( l \) is the \( n \times n \) identity matrix. On the assumption that the inverse of matrix \((l - A)\) exists, we can solve for \( p \):

\[ p = (l - A)^{-1}l = l + A l + A^2 l + A^3 l + ... \]  \hspace{1cm} (6)

This shows that in the conditions under consideration relative prices are proportional to relative quantities of labour bestowed directly and indirectly upon the various commodities. That is, the Ricardian labour theory of value holds. Schumpeter is well aware of this: ‘We can resolve all goods into “labour ...” in the sense that we can conceive all goods as bundles of the services of labor ...’ (Schumpeter, 1934, p. 17)\(^{14}\) He concludes: ‘Hence, in an exchange economy ... the prices of all products must, under free competition, be equal to the prices of the services of labour ... embodied in them.’ (ibid., p. 30) The resulting system of relative values, he surmises, can be compared to the ‘genealogy of a mountain of experience’; the values are the ‘rational consequences of the given conditions in the surrounding world.’ (ibid., p. 40)

In this paper I will not enter into a critical discussion of Schumpeter’s widely disputed view that in a stationary economy profits (and interest) are of necessity zero and especially his attack on Böhm-Bawerk’s theory of interest (see, therefore, Kurz, 2005, pp. 42-53). For the sake of the argument I rather adopt Schumpeter’s zero-profits premise regarding stationary conditions and focus attention on the implications of this bold premise for the rest of the analysis. The reader is invited to develop the argument for the more general (classical) case in which the rate of profitss is non-negative.

In the following three sections I use for the most part a simple model with two commodities in order to deal with a number of important themes in Schumpeter’s analysis of economic change. The attention will focus on process innovations, that is, item (2) of his list of new

\(^{14}\) Schumpeter actually contemplates the case of a reduction to labour and (intensive) land (or ‘nature’). The reader can easily generalize the above argument to cover this case.
combinations. However, as we shall see, it will be unavoidable to touch also upon other cases of innovations. The two-sector framework allows for a relatively rich typology of cases of inventions and innovations.

5. A two-sector example

In order to discuss the problem of whether technical inventions – that is, newly available methods of production – will actually be introduced in the economic system and become innovations, and what the medium- and long-term consequences of this will be, we use a simple two-sector framework. The two commodities produced may be called for short ‘corn’ and ‘iron’; we shall also speak of ‘agriculture’ and ‘industry’. However, these are just names and the reader is asked not to connote with them more than is intended. It is for simplicity assumed that there are constant returns to scale throughout the economy.

We start from a given Schumpeterian circular flow characterised, inter alia, by the employment of one method of production to produce corn and one method to produce iron. Table 1 summarizes the technical features of the two production processes. Accordingly, \( a_{kh} \) (\( h, k = \text{c}, \text{i} \)) units of commodity \( h \) and \( l_k \) units of homogeneous labour are needed to produce one unit of commodity \( k \); obviously, \( a_{kh} \geq 0 \) (\( h, k = \text{c}, \text{i} \)).

<table>
<thead>
<tr>
<th></th>
<th>material inputs</th>
<th>outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>corn</td>
<td>iron</td>
</tr>
<tr>
<td>corn process</td>
<td>( a_{cc} )</td>
<td>( a_{ci} )</td>
</tr>
<tr>
<td>iron process</td>
<td>( a_{ic} )</td>
<td>( a_{ii} )</td>
</tr>
</tbody>
</table>

For a detailed exposition of the model under consideration, see Kurz and Salvadori (1995, chapter 3).
A commodity that enters directly or indirectly into the production of all commodities is a basic commodity; otherwise it is a non-basic commodity (Sraffa, 1960). It can be shown that both corn and iron are basics if and only if

\[ a_{c}a_{i} > 0 \]  \( (7) \)

With the product of the two coefficients being positive, each coefficient is strictly positive. Hence product \( c \) enters directly into product \( i \), and since product \( i \) enters directly into product \( c \), product \( c \) enters indirectly into its own production. Similarly with regard to product \( i \).

Unless otherwise stated, the following argument is based on the assumption that this condition is met, that is, both products are basics.

Corn is taken to be the only consumption good. The minimum consumption per unit of labour employed, or subsistence level of consumption, \( c_{s} \), is given from outside. The economy is said to be viable, that is, able to reproduce itself, if there are feasible activity intensities of the two processes, \( q_{c} \) and \( q_{i} \), such that

\[
\begin{align*}
q_{c} & \geq q_{c}a_{cc} + q_{i}a_{ic} + (q_{c}^{'} + q_{i}^{'} )c_{s} \\
q_{i} & \geq q_{c}a_{ci} + q_{i}a_{ij} \\
q_{c} & \geq 0, \quad q_{i} \geq 0, \quad q_{c} + q_{i} > 0 
\end{align*} \]  \( (8a) \)

It will be assumed throughout that conditions (8) are met. This means that the actual remuneration per unit of labour in terms of the consumption good ‘corn’, \( w \), satisfies the condition

\[
w \geq c_{s} \]  \( (9) \)

Schumpeter, as we have learned in the previous section, assumed free competition with regard to the circular flow, which presupposes the absence of significant barriers to entry in and exit from any given market. Let \( p_{i} \) be the price of one unit of iron in terms of corn, then the system of unit price equations corresponding to the circular flow under consideration in conditions of free competition is given by

\[
\begin{align*}
a_{cc} + a_{ci}p_{i} + w_{c} = 1 \\
a_{ic} + a_{ij}p_{i} + w_{i} = p_{i}
\end{align*} \]  \( (10a) \)

\[
\begin{align*}
a_{cc} + a_{ci}p_{i} + w_{c} = 1 \\
a_{ic} + a_{ij}p_{i} + w_{i} = p_{i}
\end{align*} \]  \( (10b) \)
with \( w \) and \( p_i \) as the unknowns.\(^{16}\) We may now illustrate this constellation by plotting each of the equations (10) in a \((p_i, w)\) plane as in Figure 1. Note that the decreasing straight line 1 corresponds to the corn producing process, whereas the increasing one I corresponds to the iron producing process. The negative slope of the line associated with the corn producing process can easily be explained in terms of the fact that if the price of iron increases relative to that of corn, the costs of the means of production will increase relative to the revenue, necessitating a fall in the real wage. Similarly, the positivity of the slope of the line associated with the iron producing process follows from the fact that with a rise in the price of iron relative to that of corn the revenue rises relative to the costs of the means of production, making room for a rise in the wage rate. The intersection between the two straight lines gives the wage rate \( w^* \) and the price of iron \( p_i^* \), both expressed in terms of corn, ruling in the economy. (By assumption (9) \( w^* \geq c_s \).

Fig. 1

Now the ground is prepared for dealing with one important case of Schumpeter’s main theme of inventions, innovations, and economic change. Our attention focuses on the introduction and diffusion of new methods of production in the two industries and the effects they entail for the economic system as a whole. We begin with a definition of the important classical (and Schumpeterian) concepts of ‘extra profits’ and ‘extra costs’.

6. Extra profits and extra costs

\(^{16}\) We know from the preceding section that with a zero rate of profitts the price of iron in terms of corn, \( p_i \), is equal to the ratio of the amounts of labour ‘embodied’ respectively in one unit of iron and one unit of corn, that is, the ratio of labour values. This is equivalent to the statement that with a zero rate of proftits prices in terms of the wage rate (or units of ‘labour commanded’) equal labour values. We will come back to this fact in the following section.
Assume that a new method of producing corn (or iron) is made available. Producers will assess the new method against the background of the prices and wage rate ruling in the actual circular flow, that is, $w^*$ and $p_{i}^*$. This brings us to the concepts of extra costs and extra profits.

While the classical economists did not assume that stationarity of the economic system implies the absence of interest and profits, Schumpeter assumes that in the circular flow profits and interest are zero. Consequently he refers to ‘profits’ rather than extra or ‘surplus’ profits, as the classical authors did, but the meaning is essentially the same. The reference is to above normal profits, irrespective of whether normalcy is defined with respect to a uniform rate of profits that is positive (the classical economists) or nil (Schumpeter). We shall henceforth use Schumpeter’s term (and notion).

Assume that there is a new process, $h$, available to produce corn which can be described by the triplet $(a_{c_1}^{(h)}, a_{c_1}^{(h)}, l_{c}^{(h)})$, and a new process, $k$, available to produce iron which can be described by the triplet $(a_{c_1}^{(k)}, a_{c_1}^{(k)}, l_{c}^{(k)})$. (In accordance with our assumption that both commodities are, and will remain, basic, we assume $a_{c_1}^{(h)} > 0$, $a_{c_1}^{(k)} > 0$, each $h$ and each $k$.)

With $w^*$ and $p_{i}^*$ as the ruling wage rate and iron price, processes $(a_{c_1}^{(h)}, a_{c_1}^{(h)}, l_{c}^{(h)})$ and $(a_{c_1}^{(k)}, a_{c_1}^{(k)}, l_{c}^{(k)})$ are said to be able (not to be able) to pay profits if

\[
\begin{align*}
    a_{c_1}^{(h)} + a_{c_1}^{(h)} p_{i}^* + w^* l_{c}^{(h)} & < 1 \quad (\geq 1) \\
    a_{c_1}^{(k)} + a_{c_1}^{(k)} p_{i}^* + w^* l_{c}^{(k)} & < p_{i}^* \quad (\geq p_{i}^*)
\end{align*}
\]  

(11a)  

(11b)

and they are said to incur (not to incur) extra costs if

\[
\begin{align*}
    a_{c_1}^{(h)} + a_{c_1}^{(h)} p_{i}^* + w^* l_{c}^{(h)} & > 1 \quad (\leq 1) \\
    a_{c_1}^{(k)} + a_{c_1}^{(k)} p_{i}^* + w^* l_{c}^{(k)} & > p_{i}^* \quad (\leq p_{i}^*)
\end{align*}
\]  

(12a)  

(12b)

We will not discuss the generation of new technical devices in research and development departments of firms, as they are analysed, for example, in contributions to endogenous growth theory.

See, for example, Ricardo (Works, vol. I, p. 120) and Kurz and Salvadori (2006).
respectively. Obviously, the shaded area above the straight line representing the corn (iron) process of the circular flow system in Fig. 1 concerns pairs of the wage rate and the price of iron for which the corn (iron) process under consideration would exhibit extra costs. Similarly, the area below the straight line representing the corn (iron) process of the circular flow system concerns levels of the wage rate and the price of iron at which the corn (iron) process under consideration would exhibit profits. Since any corn (iron) producing process can be represented by a decreasing (increasing) line, we can à fortiori ascertain immediately the profit and extra cost areas relative to the process.

If a process is able to pay profits, the innovator(s) will reap them. We may schematically describe what can be expected to happen as a consequence of the innovation. If the process invention is protected by a patent, prices and the wage rate are unchanged and the profits the innovator gets have the character of a differential rent. If the patent allows imitators to employ the new method, or if there is no patent, profit-seeking agents from the same industry and from the other industry will invest their capital in the new method. This involves a change in output proportions, with the commodity in whose production the innovation has taken place becoming relatively abundant. As a consequence, its price relative to that of the other commodity can be expected to fall. On the simplifying assumption that the producers of the commodity in whose production no innovation has taken place do not benefit from the change in prices, the wage rate increases along the straight line related to the process used by this industry, the rent of the innovators will gradually diminish and the producers in the industry, in which the innovation has taken place, who are not innovating will incur losses. Sooner rather than later they risk being driven out of the market. Schumpeter’s zero-profits condition with regard to the initial circular flow involves an extremely rapid transition of the economy to a new technique, whereas from a classical point of view the transition can be expected to take more time because ‘static firms’, to use Schumpeter’s notion, can be

19 In classical political economy the process under consideration is referred to as the ‘gravitation’ of ‘market’ prices to their (new) ‘natural’ levels.

20 Some sociologists have seen the diffusion of an innovation as a process that is formally akin to the spread of an infectious disease because it seems to be a personal contact that is most relevant in leading to the adoption of an innovation; see, for example, Coleman (1974, chapter 17). The population dynamics at work are beyond the scope of this paper.
expected to survive longer. It takes time for their profits to erode and give way to losses, whereas Schumpeter’s static firms will face losses as soon as the price of the commodity in the production of which a cost-reducing innovation has taken place starts falling. It seems that in the classical view the adjustment process towards the new system of production is more sluggish than in Schumpeter’s.\textsuperscript{21} It is not immediately clear how this aspect of Schumpeter’s view is compatible with his concept of ‘long waves’.

Via the channels indicated the successful new method will gradually diffuse through the economic system and replace the old method. The process will continue until the new method has become dominant and has established a new circular flow or, to use the terminology of the classical authors and those working in their tradition, has approached sufficiently close the new ‘centre of gravitation’ or ‘long-period position’.

In Schumpeter’s scheme the new circular flow is again characterised by the absence of profits, whereas in the classical authors it is characterised, in competitive conditions, by the establishment of a uniform rate of profitss which generally is positive. Schumpeterian profits (as the extra profits of the classical economists) are transitional phenomena to be traced back to cost differentials between different methods of production used simultaneously. Due to competitive pressures profits will in the long run be washed out and the system gravitate towards a new circular flow in which the rate of profits will again be uniform and equal to zero. Hence, in Schumpeter’s view profits are not due to the ‘scarcity’ of capital, as marginal productivity theory maintains, but due to differential productivities of methods of production used side by side.\textsuperscript{22}

What was perhaps not clear from the beginning but is now put into sharp relief is that Schumpeter’s zero-profits condition with regard to successive circular flows of the economy

\textsuperscript{21} In private correspondence with the author, Donald Winch referred to the criticisms of Ricardo for believing in ‘instantaneous’ adjustments of the stock market kind. Ricardo in fact realised that this is not characteristic of industries with large capital investments, but also regarded the length of the adjustment processes as due to the ignorance and irrationality of agents.

\textsuperscript{22} In Böhm-Bawerk’s classification of alternative interest theories (Böhm-Bawerk, 1885), Schumpeter’s construction belongs to the class of productivity theories.
implies that in the last instance the benefits of innovations go exclusively to workers in terms of higher real wages: It is a magnificent dynamics reflected in ever improving income levels of the population at large.23

We may now illustrate in the \((w, p_1)\)-plane various classical and Schumpeterian ideas. The point of reference is always the original circular flow, or long-period position, characterised by \(w = w^*\) and \(p_1 = p_1^*\).

7. Inventions and innovations: a typology of cases

We begin with a discussion of the availability of new technological knowledge which, however, does not stand the test of the market, that is, inventions that will not become innovations. Then we turn to single innovations and sequences of innovations.

(a) Invention, but no innovation

In Figure 2 it is assumed that there has been a process invention in agriculture which gives rise to the new straight line II. While the process incorporates new technical knowledge, cost-minimizing producers will not adopt it because at the ruling wage rate and price of iron the method exhibits extra costs. A similar case of an invention that does not become an innovation, but this time with regard to the iron industry, is given by the new method represented by the straight line II.

Fig. 2

23 As Adam Smith kept stressing in The Wealth of Nations, man is ‘led by an invisible hand to promote an end which was no part of his intention.’ (Smith, WN, IV.ii.9) We shall variously come across this theme as the argument unfolds. The above argument was explicitly developed on the basis of the assumption that there are no scarce natural resources, such as land. If there were such resources, a part of the net product would be distributed in terms of extensive or intensive rents paid to the proprietors of land; for a treatment of this case, see Kurz and Salvadori (1995, chap. 10).
New technological (or organizational) knowledge is therefore not $e_0 \mid p_0$ making its way into the economic system. Whether it does (or does not) generally depends not only on how the new method compares with the one to which it is an alternative, but also on the method(s) of production employed in the other industries of the economy. The reason for this is that the methods actually in use determine the wage rate and the price(s) and via these variables decide whether a new method is cost-minimizing or not.

The two cases of inventions depicted in Fig. 2 differ in the following respect. While method II is inferior to method I for all non-negative levels of $w$ and $p_i$, method 2 is inferior to method 1 only to the left of the point where the two straight lines corresponding to the two methods intersect, whereas to the right of this point it is superior. The point of intersection gives the pair $(w, p_i)$ at which both methods exhibit the same unit costs and are thus equiprofitable.24

(b) Innovation in agriculture

Figure 3 illustrates the case in which there is an innovation in sector one (‘agriculture’). The new process 2 allows the innovator to reap profits at the ruling levels of $w$ and $p_i$, $w^*$ and $p_i^*$. These can easily be calculated. Subtract from the unit costs associated with the old method, $a_{cc}^1 + a_{ci}^1 p_i^* + w^* l_c^1$, the unit costs associated with the new one, $a_{cc}^2 + a_{ci}^2 p_i^* + w^* l_c^2$, in order to obtain profits per unit of output, $\pi$:

$$\pi = a_{cc}^1 + a_{ci}^1 p_i^* + w^* l_c^1 - a_{cc}^2 + a_{ci}^2 p_i^* + w^* l_c^2 =$$

$$= (a_{cc}^1 - a_{cc}^2) + (a_{ci}^1 - a_{ci}^2) p_i^* + (l_c^1 - l_c^2) w^* > 0$$

Fig. 3

Fig. 3 informs us also about the new ‘attractor’, or centre of gravitation, or circular flow, towards which the system as a whole tends as a consequence of the introduction and diffusion of the new process and the replacement of the old one. The intersection of the line

24 The reader familiar with the modern theory of production, distribution and relative prices (see, for example, Kurz and Salvadori, 1995) will know that if the two methods in each of the two industries were to be compared with one another at a different level of the rate of interest, and not, as in Schumpeter’s case at a zero rate, the ranking of the methods can be different. Hence, an invention that at one level of the rate of interest will not become an innovation, at another level might become one.

23
representing the new process in agriculture 2 with the old process employed in industry I gives the new constellation of the wage rate and the price of iron, both in terms of corn, towards which the system is expected to move, given Schumpeter’s premise that competition will wipe out all transitory profits. Therefore, when the system is fully adjusted to the new dominant technique composed of methods 2 and I the wage rate will be equal to \( w^{**} \) and the price of iron will be equal to \( p_i^{**} \). Clearly,

\[
w^{**} > w^* \quad \text{and} \quad p_i^{**} > p_i^*
\]

The price of iron will rise relative to that of corn because corn is produced at lower unit costs, and in competitive conditions the cost reduction will sooner or later be reflected in a price reduction. Interestingly, in some absolute terms also the difficulty of producing iron will be reduced, because for iron producers a lower price of corn implies a lower price of corn input, etc. It can easily be shown that in the case depicted the amounts of labour needed directly and indirectly in order to produce one unit of corn or one unit of iron will both be smaller. It may be concluded that technical change within the Schumpeterian framework elaborated here is bound to be strictly labour saving.

This result puts again in sharp relief Schumpeter’s zero-profits assumption, which, as we have seen, implies that relative prices in the original circular flow, on the basis of which comparisons as to the profitability of new methods of production are carried out, are proportional to relative labour values. Hence, in order for an invention in some industry to become an innovation it must reduce unit costs which, in the case under consideration, requires that in the end it reduces the labour values of all commodities. This follows from the fact that in the new circular flow the wage rate expressed in any one of the commodities will of necessity be higher and, as a consequence, the price of any commodity in terms of labour will be lower. Yet, as we have seen, with a zero rate of profits the price of a commodity in terms of labour equals its labour value. Now it is well known that with a positive rate of profits a new method may be reducing unit costs even though it need not at the same time reduce the amount of labour embodied in the commodity (or vertically integrated labour coefficient). A consideration of this subset of possible cases is implicitly ruled out by Schumpeter’s zero-profits condition. The kind of process innovations he allows for are invariably labour-saving.

The circular character of social production implies that once a new method is introduced this triggers a whole avalanche of adjustments in the course of which the system is taken to gradually drift to its new long-period position. Since Schumpeter assumes that in the long period competition effectively abolishes all profits, the increased social productivity
eventually leads only to higher real wages.

In the new long-period position \( r = 0 \) and no producer can obtain a higher rate of profits by operating another process because the system is in a position of rest (given the data of the problem, including the zero level of the rate of profits). It should also be noticed that because neither of the two commodities can be produced without the other one, in a long-period position at least one process to produce each of the two commodities has to be operated. The new levels of the wage rate and the price of iron are such that (a) none of the processes is able to pay profits and (b) there is at least one process producing corn and at least one process producing iron that do not require extra costs. Accordingly, \((w^{**}, p_i^{**})\) represents a long-period position, or circular flow, at a zero rate of profits.

The diagram also reveals that as the wage rate and the price of iron tend to rise (relative to corn), producers still using the agricultural method 1 are progressively facing greater and greater losses and eventually will either have to adopt the new method or go out of business. In our schematic representation of the adjustment process caused by an innovation in Section 6 we have assumed for simplicity that producers in the industry in which no innovation takes place do not benefit from the wage and price dynamics triggered by the innovation. We may now briefly consider a case in which this is not so. If the producers in the iron industry benefit from the innovation in agriculture, then the wage rate is increasing along a curve that is below the straight line depicting the process of the iron industry but intersects the latter at the two long-period points. In Figure 3 the curve leading from the old to the new circular flow via point A illustrates the case under consideration.\(^{25}\) At the levels of \( w \) and \( p_i \) corresponding to point A, the following can be said about the three groups of agents considered, innovators in agriculture, static firms in agriculture and producers in the iron industry: (a) the innovator(s) introducing agricultural method 2 (and the imitators following on their heels) reap profits per unit of output that (for the lower wage level) are larger than in the case in which the adjustment process of the wage rate were to follow the straight line of the iron process; (b) producers sticking to the obsolete method face losses that are smaller than in the alternative case; and (c) producers in the iron industry are getting some profits. Iron producers, we may

\(^{25}\) Note that point A is necessarily below straight lines 2 and I and above the horizontal line going through \( w^* \).
say, are the lucky beneficiaries of an innovation introduced in another part of the economic system. This is so because in the case under consideration the rise in the wage rate in terms of corn is more than compensated by a fall in the price of corn relative to that of iron. The path the differential rent per unit of output follows, obviously depends on the time profiles of the developments of the levels of \( w \) and \( p_i \).

The nonintended consequences of purposeful activities such as the profits obtained by the non-innovating iron producers are occasionally even more interesting than the intended ones, not least because the latter may be totally overwhelmed by the former as a case in Subsection (f) below shows. Finally, it should be noted that the case under consideration involves what Schumpeter in Capitalism, Socialism and Democracy dubbed ‘creative destruction’. Producers who have invested their capital in the old and now superseded method 1 suffer from the changes that take place.

(c) Innovation in industry

Figure 4 illustrates the parallel case of an innovation in the production of iron (‘industry’). As was to be expected, in competitive conditions the price of iron in terms of corn is bound to fall, but the wage rate in terms of corn will invariably rise, given Schumpeter’s long-period zero-profits condition. This is not surprising in view of what has been stated in Subsection 7(b).

Fig. 4

(d) Innovations in both sectors

Figure 5 illustrates the case in which there is first an innovation in agriculture (method 2). The resulting new circular flow is given by point A. Subsequently there is an innovation in industry (method II) which leads to the next circular flow given by point B. In the final situation the system of production employs both novel methods 2 and II which have replaced methods 1 and I, respectively. Depending on the relative magnitudes and bias of the two kinds of innovations, the price of iron in terms of corn will in the resulting state of the system be larger or smaller, or in the extreme remain the same, while the real wage rate will again be higher.

Fig. 5
(e) Return of a process that had already been superseded

Figure 6 illustrates the case in which a given method of production is first superseded by a new method in the same sector, but then returns after a process innovation has taken place in the other sector of the economy. This suggests once again that the discussion of technical change ought to look at the economic system as a whole. A partial analysis will generally not do. In Fig. 6 due to an invention in agriculture method 1 is first replaced by method 2, leading to a new circular flow indicated by point A. However, due to a subsequent invention in industry (method II) the intermittently obsolete agricultural method 1 comes back again. This is a case of induced technical change in agriculture, induced by a technical change in industry and the effects it triggers. In the resulting system of production given by point B methods 1 and II co-exist.

Fig. 6

This possibility is of some interest because it provides a different argument for the case, also mentioned by Schumpeter, that a firm investing in a new process and thus the plant and equipment in which it is embodied may go bankrupt because of further innovations that render the firm’s capital obsolete. In the literature this case is typically traced back to secondary innovations in the same sector which improve upon the industrial design of the invention and remove teething troubles of new machinery etc. However, as the example of Fig. 6 shows there is another possibility: The newly adopted process 2 might be rendered obsolete by what is happening in some other sectors of the economy. In systems with a sophisticated division of labour and interdependent lines of production, things that happen at one point may have a decisive impact on what happens elsewhere. The case under consideration exemplifies once again the law of unintended social outcomes. To Adam Smith a great range of social activity has the characteristic that men in pursuing their own objectives seem frequently to contribute to outcomes which they did not intend or foresee. In the example of Fig. 6 the innovator in the iron industry is only keen to make profits, but the economic change he or she initiates goes far beyond this narrow motive. First, he or she forces upon his or her competitors in the same industry to switch from method I to method II. Secondly, mediated by the distributional and price effects this change triggers he or she also forces upon the producers in the corn industry to abandon the recently introduced method 2 and go back to method 1. The amazing thing to emphasize is that what begins as a small, even insignificant change: the introduction of a new process of production by a single producer,
may end in revolutionizing the entire economic system and compel producers at large to engage in decisions and actions they never intended or foresaw. This is how the ‘coercive law of competition’ makes itself felt and propels the economic system incessantly to transform itself both quantitatively and qualitatively.

(f) Induced innovation

In the literature on technical change it has variously been pointed out that in order for an invention in one sector to finally become an innovation it is frequently necessary that there is a complementary innovation in another sector. Such a case is illustrated in Figure 7. The new method 2 in sector one will at first not be adopted by cost-minimizing producers because it would not be profitable to do so. However, an invention alias innovation in sector two such as the one depicted by method II triggers variations in \( w \) and \( p_i \) which eventually render method 2, which was previously inferior to method 1, superior to it. As Fig. 7 also indicates, this is typically not the case immediately upon the introduction of method II, but can be expected to take time. Indeed, use of method 1 would for a shorter or longer time still be on the safe side. It is only after the pair \((w, p_i)\) has entered the shaded area in the diagram that the switch to method 2 becomes imperative.

Fig. 7

(g) A more general framework

The two-sector framework with two basic products and only circulating capital adopted in the main part of this paper limits, of course, the variety of cases that can be covered by our argument. Here it suffices to draw the readers’ attention to the following classes of phenomena which could be dealt with by generalizing the above framework.

1. Basics and non-basics

In a framework that allows both for basic and non-basic products, but preserves all the other simplifying assumptions, there is the possibility that an innovation in the same or in another sector may change the character of a commodity. For example, an innovation may render a
product that up until then has been a basic product, a nonbasic product, and vice versa.\textsuperscript{26} Since basics and non-basics play very different roles in the economy and affect the qualitative behaviour of the system, the conversion of a basic into a non-basic (or vice versa) is obviously of great theoretical and practical importance.

2. Joint production

If the single-product assumption is replaced by that of joint production an entirely new set of possibilities can be discussed. Here only one empirically important phenomenon will be mentioned. With multiple-product processes of production there is no presumption that all products will be goods, that is, things capable of satisfying human needs and wants. Some may be ‘bads’, or ‘discommodities’, that have to be removed because otherwise they might harm humans and other creatures. The attention will thus have to focus on systems of production-cum-disposal. It has been stressed by authors from Karl Marx to Alfred Marshall that the existence of bads whose disposal is costly provides a powerful incentive to firms to explore the useful properties of things. A successful invention in this regard is able to transform a bad, whose removal is costly, into a good, whose marketing is profitable. This is also a particular case of product innovation. It may, but need not, be associated with a process-cum-product elimination, because the transformation of a bad into a good may render the disposal process of the bad obsolete and with it all specific inputs that are employed in the process. For a discussion of some of the possibilities that emerge in a framework of universal joint production, and which have some real world counterparts, see Kurz (2006).

3. Fixed capital

With durable instruments of production one aspect that has been referred to in the above in a cavalier way can be argued more convincingly: the fact that innovations may, and often will, render investments in old techniques or rather the fixed capital items in which they are embodied obsolete. This is an important aspect of the phenomenon of ‘creative destruction’ Schumpeter emphasized. In Marx we read about the ‘moral obsolescence’ of fixed capital. For a discussion of obsolete used machines in a general framework, see Kurz and Salvadori

\textsuperscript{26} Horses, for example, may be said to have been basics and with the invention of the bicycle, the railway, the car etc. have become non-basics.
(1995, chapter 12, section 2). Here it is perhaps apposite to draw the readers’ attention to an important element of Schumpeter’s reasoning that has up until now found no mention in this paper. According to Schumpeter innovators have to use bank credit in order to start what typically will be a new business, because due to the zero-profit condition in the circular flow they cannot finance their innovative activity from retained profits. Bank credit will, however, increase the amount of money in the system. The system will begin to move, capital will accumulate and effective monetary demand will increase. A rising effective demand may be beneficial, at least temporarily, to the owners of some of the obsolete machinery and allow them still to employ it for what it is worth. Knut Wicksell spoke aptly of ‘rent goods’. This brings us to natural resources, such as land.

4. Natural resources

The argument above assumed constant returns to scale throughout the economy. With scarce natural resources this assumption has to be abandoned. Relative prices can be expected to change with a change in the relative amounts produced of the different commodities and the corresponding change of income distribution, such as, for example, the emergence and rise of the rents of some qualities of land. Such changes in relative prices and income distribution generally affect the costliness of different methods of production and thus can be expected to induce technical changes. This possibility has been discovered already at an early time and has found its perhaps most succinct expression in Ricardo’s famous dictum: ‘Machinery and labour are in constant competition, and the former can frequently not be employed until labour [that is, the money wage] rises.’ (Ricardo, Works, vol. I, p. 395) For a detailed discussion of Ricardo’s case of technological change induced by variations in money prices and the money wage rate, which, in turn, are entailed by changing output levels vis-à-vis decreasing returns to scale, see, in particular, Gehrke (2003). Exhaustible resources that are effectively exhausted bring with them the necessity of technical change. In the case of renewable resources the same is true when they are actually depleted; otherwise one may easily see why there are induced switches in the methods of production used.27

5. Externalities

27 For a discussion of exhaustible and renewable resources, see, for example, Kurz and Salvadori (1995, chapter 12, and 2001).
Production (as well as consumption) activities very often, if not always, engender positive or negative externalities. These externalities affect directly the conditions of production of single producers, entire industries or even the economic system as a whole, indirectly they affect relative prices and income distribution. They can thus be expected to have an impact on the costliness of alternative methods of production and therefore on the choice of technique of cost-minimizing producers. Once again, we are confronted with the possibility of induced technical change, this time induced by the economic effects of externalities.

8. Concluding remarks

The paper has discussed Schumpeter’s view on process innovations and profits against the background of the analyses of the classical economists and Marx within the simple framework of a two-sectoral economy producing two basic commodities. It is argued that there are remarkable similarities between the two views in terms of the overall outlook on the problem of economic change and also in terms of the mechanisms at work in competitive conditions. Schumpeter like his classical predecessors and Marx emphasized that technical progress is not of a uniform kind over time. Different forms of technical progress can be expected to engender different effects and adjustment processes. There is therefore no reason to presume that a steady-state analysis can adequately portray the path the economy takes over time. Schumpeter entertained the view that economic development follows a pattern of leaps and bounds that begins and ends with a circular flow, with the process of transition between the two in between. This process is triggered by one or several inventions, some or all of which become innovations. In the course of the diffusion process the new methods of production are then generalized throughout the system as a whole, thereby establishing a new system of relative prices and gradually eroding the (extra) profits reaped by the innovators and the first generation of followers, while late adopters run the risk of being driven out of the market. The system gravitates to a new circular flow because competition compels firms to innovate and imitate. Schumpeter’s zero-profits postulate regarding the circular flow implies that static firms rapidly face losses and, as a consequence, bankruptcy. There is reason to think that the postulate overestimates the speed at which the system absorbs the innovative shock. The paper goes on to discuss various possible cases of innovations and trace their long-term impact on wages and relative prices. In the short and medium run there will be cases of creative destruction; several examples are provided. With transitory profits being competed
away, and setting aside scarce natural resources, in the long period all benefits of innovations go to wage earners. In the new circular flow wages are invariably higher than in the old one.

There are also noteworthy differences between the views of the classical economists and Marx on the one hand and Schumpeter on the other. The most important of these is perhaps that the classical authors and Marx identify a systemic feature of the capitalist economy, competition, as responsible for the system’s innovative drive. Schumpeter places the weight of the argument instead on the existence of a particular genotype, ‘dynamic’ and ‘energetic’ people, that is, ‘entrepreneurs’. While in the classical perspective people with particular talents and skills play an important role in the process, they are not its driving force. The differentiation of society in different ranks of people is by and large the outcome of a socially reproductive process, of the social division of labour, and not so much, as in Schumpeter, a reflection of the special initial physical, psychic and mental endowment of a particular group of people. In the classical authors the most important force at work – competition – is systemic; it shapes people’s aspirations, decisions and actions. Schumpeter does not deny the importance of competition, but appears to reverse the order according to which systemic and individual factors in explaining the phenomenon of socio-economic change enter the stage and attributes different weights to them. The prime mover in his portrayal of economic dynamism is the entrepreneur, whereas competition sets in motion a mechanism that translates individual actions in social outcomes. In the classical view that mechanism is in motion all the time and cannot be expected to peter out. The circular flow conceptualized by Schumpeter as a picture of an actual economy rather than as a useful analytical tool is inconceivable from a classical perspective. Competition compels agents to innovate and imitate. Which kinds of innovation will take place, and when, is historically contingent upon, among many other things, complementary inventions in the same or in other industries, the distribution of talents and skills among the members of society, the development of these talents and skills in education processes, etc. Yet whatever the historical contingencies defining a particular situation may be, the profit motive, competitive pressures and the institutionalization of research and development as ‘the principal or sole trade and occupation of a particular class of citizens’ (Smith) will engender innovative activities all the time. There is simply no such thing as a state of affairs in which the forces of change are dormant.

References

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