Innovation, Creative Destruction and Price Theory

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Abstract

Our purpose in this paper is to consider developments in price theory required to facilitate the evolutionary analysis of economic change. Evolution is always a matter of change and, although its driving force is innovation, the price mechanism is central to how innovations are resolved into economic development. That is Schumpeter's great theme but he said relatively little about who sets prices or how and why prices are changed. We focus particularly on price determination in markets disrupted by innovations, where firms are necessarily heterogeneous. We contrast the evolutionary paths followed by prices and market structure when prices are determined by market clearing to the paths when prices are determined through the application by firms of administered rules and routines to achieve their strategic objectives. This links the analysis to theories of administered prices and post-Keynesian price theories more broadly. Interaction of innovators with their customers and with established competitors create the context for the evolution of pricing rules along with differential firm growth, which together generates structural change in the industry and the economy. We show that analysing how the introduction and diffusion of innovations impact on the rules and routines provides the foundation for a broadly applicable evolutionary price theory.

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1. Introduction

In a recent paper, Dick Nelson (2013) makes the case for developing a price theory that is consistent with the presumption of evolutionary economics, which is that capitalist economies are open systems always evolving in response to the impulses generated by their internal operation. He then focusses his attention on markets in which the interaction of buyers and sellers creates sufficient order to establish a market price. His objective is to provide a modified supply and demand analysis appropriate for evolutionary theorising, without depending on optimisation by agents or obtaining equilibrium of the sort assumed in neoclassical economics. This is our starting point and from it we set out an agenda for integrating theories of price-setting behaviour within a framework of evolutionary competition.

It scarcely needs stating that prices are at the heart of the evolutionary dynamic whether in terms of the ability of firms to grow by attracting customers, workers or investible funds at the expense of rivals or in terms of the relation between profits and growth in the productivity capacity of the firm. Evolution is always a matter of change and although its driving force is innovation the price mechanism is central to how innovations are resolved into economic development. That is Schumpeter's great theme but he said relatively little about who sets prices or how and why prices are changed. It is for this reason that we focus particularly on price determination in markets disrupted by

innovations in the production process, where there are heterogeneous production costs across firms.

The great paradox of the market economy is that its instituted rules and processes generate order and coherence while at the same time generating the means and the incentive to challenge that order from within. The system is self-ordering and simultaneously self-transforming. In a fundamental sense of being open to invasion by novelty, any market order is unstable and the interesting question is how it responds to innovation. Indeed this is the essential question about the operation of the competitive process and the way that new economic wealth is connected to new knowledge. Since prospective profit is one of the chief incentives motivating challenges to the status quo, the importance of the price system follows immediately. It is not possible to conceive of profit and its distribution across firms and industries independently of the structure of prices for goods and productive factors. Who sets prices and by what criteria are crucial questions for evolutionary economics.

Schumpeter (1950 [1942]) argues that innovations create unique positions and are necessarily inconsistent with the existence of perfect competition and zero profits, but a functioning market is still essential. Indeed, the essence of Schumpeter's theory of profit is that the price system generated by the status quo conditions the profit opportunities of the innovator and that adapting to the innovation will realign the price system to reflect the characteristics of the innovation. In this way each innovation shapes the terms on which future innovations can be made.

In Nelson's analysis the idea of equilibrium is replaced by the idea of a transient order. At any moment in time there is sufficient coherence to the system to create an

operational structure of allocated resources, a coherence based on a causal logic of economic interdependence as guided by the price system. However, this very structure continually creates incentives to challenge the status quo. Indeed, this is the essential point behind Schumpeter's claim that capitalism develops "from within", that is to say it is necessarily an out-of-equilibrium system.

Nelson (2013) further acknowledges substantial innovation disrupts the market order conception he proposes as an alternative to neoclassical equilibrium. With substantial innovation, there is the possibility, and often the necessity, for the innovating firm to augment or even supplant the prevailing connections between customers and suppliers, thereby providing sufficient order for transactions to occur. This dimension of creative destruction is no easy matter to manage and requires firms to build an external organisation to connect with buyers and suppliers, typical examples being alliances, joint ventures and long-term contracts. The innovating firm also engages in market-building activities well beyond production and pricing, including market research, advertising, supply chain management and providing technical support to buyers and suppliers. Price can hardly be considered the outcome of abstract, impersonal demand and supply forces when the strategies of innovators are so important to determining both demand and supply, when the innovator is essentially creating the market.

We aim to expand Nelson's (2013) evolutionary price theory, in which prices are set so as to balance supply and demand and clear the market, to include markets where firms substantially augment or supplant the market price mechanism by setting prices through internal administrative processes. Here, we draw upon existing theories of administered prices and post-Keynesian price theories more broadly. In these theories

each firm uses rules or routines to determine its desired price, where these rules or routines are designed to achieve the firm's objectives subject to the limitations of bounded rationality.

There is a rough correspondence between the market circumstances that lead to administered prices and the conventional requirements for market power as in models of monopoly, oligopoly or monopolistic competition. Yet, markets with market power can be and usually are orderly in Nelson's sense, with firms choosing prices that keep supply and demand in rough balance, albeit with ample reserve capacity or flexibility in order book backlogs to both ensure price stability and dissuade new competitors. At any time, it is only a subset of markets in which disruption from innovation means administered prices take on the additional role of guiding the transition to a new order. However, this subset is critical in the process of long-term economic transformation.

The working of administered prices and price leadership in disrupted markets is the main focus of our analysis, as it is here the specifics of the process of setting administered prices most clearly supplant market coordination and exercise an independent role in determining the course of market development. We demonstrate the importance of pricing assumptions in disrupted markets through contrasting price determination by administrative rules to price determination by market clearing. Order in markets is restored through structural change (reduced variance of firm size and increased concentration) with either administered prices or market-clearing prices, but the paths followed by prices and market structure differ notably as do the levels towards which price and market structure evolve.

We start in the next section by setting the context of a developing economy, one in which there are ongoing processes of innovation and creative destruction. We follow with a section discussing the role of institutions and rules or routines in a price theory that is compatible with evolutionary theorising. The fourth section reviews the literature on administered pricing processes, focussing particularly on cost-based pricing rules and the use of price leadership as a coordinating device where heterogeneity in costs or pricing rules would otherwise lead to substantial divergence in prices of similar products. We then compare the impact of innovation and creative destruction on pricing, investment and differential firm growth with administered price-setting rules to that with prices determined by market clearing. The penultimate section presents tentative hypotheses regarding observed pricing behaviour based on administered price-setting rules, while the implications for evolutionary theorising are discussed in the concluding section.

2. Uncertainty, Cyclical Growth and Structural Change

Before analysing price determination by administrative process, it is useful to consider the environment in which prices are set. We consider an economy that is undergoing economic development as envisioned by Schumpeter (1961 [1934]), which is a capitalist economy experiencing discontinuous innovations in products, production processes, distribution, input supplies or the organisation of these activities. Innovations disrupt markets and lead to structural change in the economy, the nature of which can't be foretold and which is necessarily uneven in its incidence. As Schumpeter (1950 [1942], p.82) puts it, 'Capitalism, then, is by nature a form or method of economic change and not only never is but never can be stationary.'

In spite of uncertainty regarding the specific innovations that will occur at the micro level of the economy, there have been general historical patterns at the macro level. First, there have been substantial improvements in productivity associated with innovations in products and process technology and the accompanying substantial investment in new capital equipment and increasing education for the labour force. Second, the process of growth has been far from smooth, with long waves or cycles clearly discernible in the paths of output, prices and other economic magnitudes. Hence, modern economies are characterised as experiencing cyclical growth (see Schumpeter, 1939).

Growth associated with innovation is uneven across industries as well as across time. Some industries stagnate or decline while others grow at substantial multiples of the average growth rate. Activities and firms that decline and disappear are as central a part of the capitalist dynamic as expanding or newly created firms. Even within industries, the growth rates of rival producers are far from uniform. The unevenness of growth across industries and firms is partly due to the varying impact of innovation on pre-existing products, processes and organisations of competition. As Schumpeter (1950 [1942], p.83) notes this type of competition, to which he gives the name, creative destruction, 'incessantly revolutionizes the economic structure *from within*, incessantly destroying the old one, incessantly creating a new one.' [italics in original]

From an evolutionary perspective, creative destruction is a selection process. Pre-existing products, processes and organisations are displaced by new ones that are better suited to the environment, which under capitalism generally means that the new are more profitable either because customers are willing to pay more for the characteristics they

embody or because they are cheaper to produce. New products and methods augment economic value and influence the pricing process, including wage determination, which shapes how that value is distributed between consumers, the workers in a firm and the firm's profitability. In turn wage and price outcomes impinge on the growth of demand, the growth of the labour supply and the growth of the firms' capacity to produce. In an ordered market context these growth rates eventually have to be consistent. Yet, the displacement process is gradual and uncertain rather than swift and certain.[1]

With the gradual diffusion of innovations, there will be a variety of the old and new methods in operation at any point in time and many activities will not exhibit current best practice. Indeed, in any market context there will typically be two dynamic margins, one defining best practice and the most profitable opportunity to invest, the other defining the worst-practice processes that just cover operating costs at the ruling prices. One is a characterisation of a Marshallian long-run process, the other of a short-run process and the two operate simultaneously (Salter, 1966). As the innovations gradually diffuse, some of the old methods are displaced and average productivity rises towards the new best practice, thereby contributing to the upward trend in productivity mentioned above. Institutional conditions and strategic decisions of firms, especially their pricing decisions, affect the speed and extent of adjustment as well as affecting the introduction of further innovations.

The heterogeneity of products, processes and organisations observed in an evolving economy reflects a more fundamental heterogeneity of knowledge. Diverse forms of knowledge have to be organised and this heterogeneity of knowledge is an essential part of the division of labour in modern economies. Specialisation of knowledge

allows individuals to know a very large amount about a very narrow part of the total knowledge set. Bringing together the specialised knowledge of many individuals through organisation then makes it possible to accomplish things that are beyond the limited cognitive ability of the isolated individual (Loasby, 1999).

Bloch and Metcalfe (2015) note that the coordination of many individuals with differing knowledge is a central task of management, as any working group needs to have enough knowledge in common to be able to work effectively together yet not too much common knowledge to lose the advantage of the division of labour. The management of ignorance is just as much a part of the division of labour as is the management of knowledge. Bloch and Metcalfe argue that the suitability of large firms for dealing with this coordination challenge is a major reason for their dominance in the modern economy, but even large firms occasionally lose their competitive advantage. Thus, the selection process is continually renewed, so that heterogeneity of products, processes and organisations is a sustained characteristic of a capitalist economy.

We capture the continual interplay between adaptation to innovation and the generation of further innovation in the phrase, restless capitalism, to highlight the out-of-equilibrium characteristics of a market capitalist economy. Fundamental to this idea is the complementary notion of restless knowledge. Indeed, capitalism is an out-of-equilibrium system precisely because knowledge is restless. As the modern theory of innovation highlights, major innovations open up new design spaces on which to premise economic activity, design spaces that provide the context for further innovation and the solution to particular problems with the understanding that the solution of each problem serves typically to open up new problems, so maintaining the search for solutions. It matters

little whether the solutions and their *sequelia* come from fundamental science or from practical engineering as the two are inextricably intertwined and stimulate one another.

Finally, we should remember that a fundamental innovation (such as the point contact transistor of 1948 or the intraocular lens of the same year) opens up a rich design space within which many design trajectories can be conceived and for which the evolutionary process plays out over extended time. Each one may be ultimately limited in its potential but the innovation of further trajectories overcomes this local limit (Dosi, 1982). How each trajectory develops is closely connected with the growth of production and use of the goods and services in view and so the market context shapes fundamentally the evolution of each particular innovation sequence. Whether demand pulls or technology pushes is a secondary question and it is clear that innovation, invention and diffusion are difficult to separate.

Notice how the notion of scarcity, so often the core of neoclassical theory of general equilibrium, provides a dynamic underpinning for innovation and the growth of useful knowledge. Scarcity is a problem and in the presence of problems knowledge cannot be in equilibrium. This is an essential element in the richness of the evolutionary Schumpeterian perspective, an evolution without conceivable limit.

3. Institutions, Rules and Price Determination

A key feature of modern evolutionary theorising is the close attention paid to institutions and the rules or routines that govern the behaviour of firms and households. As in mainstream economics, the key economic institution is the market, which is the usual domain for coordinating the behaviour of independent households and firms. Markets are

forms of organisation in which information is generated and disseminated in relation to decisions to produce and purchase goods and services. In this respect markets serve to coordinate the decisions necessary to benefit from the division of labour. However, evolutionary theorising also recognises the parallel importance of firms as institutions for the internal coordination of activities that might otherwise be left to the market. One key feature of modern capitalism is the dominant position of large-scale corporations in coordinating supply chains leading from diverse raw materials to a broad spectrum of finished products, stretching across national boundaries and traditional industry definitions.

With product and process heterogeneity as a key characteristic of the modern economy, it is reasonable to expect different buyers and sellers to have different ideas about their bid or ask price for a good, service or asset. This is abundantly clear in asset markets, where a range of bids and offers are regularly observed. If there are enough buyers and sellers for a homogenous type of asset and a mechanism for making information about the bids and offers widely available, the overlapping set of bids and offers gives rise to a stream of transactions at prices that rise and fall with changes to the ideas of the various buyers and sellers who remain in the market. Such is the experience with prices for shares of equity for private companies traded on stock exchanges or with prices for primary commodities traded on commodity exchanges.

Even without an organised exchange, Nelson (2013) suggests there is often enough stability in an evolving economy for individuals and firms to rely on ordered markets to determine the prices of the things they buy and sell. In this circumstance, the concepts of supply and demand can be meaningfully applied to the determination of price

in the market, even when the behaviour of individuals and firms is heterogeneous and according to bounded rationality or routines rather than maximisation. Nelson (2013, p.35) compares his approach to that of neoclassical price theory as follows: 'the basic arguments in price theory about how changes in demand and supply affect prevailing prices and quantities hold up under the theory of market order I have been developing, but without the encumbering baggage about the characteristics of market equilibrium.' Nelson uses the example of the market for houses to illustrate his argument, suggesting the achievement of some sort of balance of supply and demand in spite of very much bounded rationality on the part of buyers and sellers.[2]

Even in traditional market contexts firms are typically the setters of prices and in doing so are constrained by the pattern of information prevalent in the market In other important contexts where markets are imperfect we can treat prices as determined by the dominant actor or actors in the market, generally a firm (or a group of firms acting collectively or cooperatively) that controls a large share of the relevant market. On the selling side, examples abound in localised retail markets and, also, in many industrial markets. On the buying side such dominance is less apparent, although many large employers set wage rates, especially for skilled or managerial labour, with only loose reference to an external market. We refer to those prices that are the outcome of market interaction between buyers and sellers as market-determined prices and those prices that are set with considerable independence by a dominant buyer or seller as administered prices.

There is no sharp dividing line between administered prices and market-determined prices in terms of underlying market circumstances. Dominant actors clearly

take note of the potential reactions of other players in the market in setting their prices and only the pure monopolist, if such a phenomena can ever be identified, is able to set prices free from any external influence. Likewise, markets intermediate on the individual offers of sellers and bids of buyers, with some buyers or sellers having more influence than others. On a practical level there is a distinction between markets in which sellers or buyers publish prices that will apply to multiple transactions over a prolonged period and markets where offers to buy or sell are temporary, negotiated and for small quantities relative to the normal volume of transactions in the market. Durable published prices are a characteristic expected of administered price markets, while temporary prices are characteristic of market-determined prices.

From the perspective of evolutionary economics, the critical issue is capturing the essential drivers of price determination. If the price set by a dominant seller or buyer is largely independent of their own circumstances and strategies, for example due to the ready availability of imported substitutes or highly elastic consumer demand for the industry's products, it is appropriate to focus on the broader market forces of supply and demand as determining prices. However, when the circumstances and strategies of the dominant actor have considerable independent influence on the pricing outcome, it is appropriate to focus the analysis on their administrative process of price setting in at least the first instance. The neoclassical theory of perfectly competitive markets ignores this distinction by assuming that all market participants have full information on the potential supply and demand of all other participants as well as unlimited cognitive ability with which to determine an optimal price based on this information. With these assumptions,

the price based on market circumstances and the price based on administrative processes can't be other than identical.

Rather than assume the conditions necessary for prices to be market determined, evolutionary analysis recognises the complex relationship between the process of development and the behaviour of economic agents. Nelson (2013, p.34) argues that shifts in supply or demand are consistent with the maintenance of market order as long as the resulting changes in prices are 'compatible with continuation with the established ways of doing business.' a point that is analogous to Marshall's insistence on the "normal" as the framework underpinning economic action (Dardi, 2003). Furthermore, Nelson argues that even a regular flow of innovations is consistent with maintenance of market order as long as 'expectations can be reasonably well tuned to what is happening.' (Nelson, 2013, p.35) With this sort of stability in a market, individual bids and offers should be concentrated in a sufficiently narrow range to allow most agents to find counterparties for transactions, which means that prices can be treated as market determined.

We contrast the conditions for markets to have transient order with the lack of order following disruptive innovation, when increased heterogeneity across buyers or sellers destroys the conditions for long-run market stability. The innovator's circumstances diverge sharply from those of other market participants and their divergent strategies for both expanding production and expanding the market are likely to have a major influence on price outcomes. For example, Apple's pricing for the original iPhone arguably reflected its strategies and capabilities in both production and marketing as much as it reflected the supply and demand for mobile phones in general. Introduction of

the iPhone created instability in the mobile phone market and meant the information sets of buyers and sellers were suddenly out of date. Price theory that features administered prices can be applied to such cases of innovative disruption, so incorporating administered prices into evolutionary price theory can advance evolutionary theorising beyond the case of markets with transient order.

4. Modern Corporations, Administered Pricing Processes and Price Leadership

There is a rich literature on the use of rules and routines in price setting. In particular, post-Keynesian and evolutionary approaches to economic analysis generally rely on rule-based pricing rather than profit maximisation. Yet, these two schools rarely communicate with one another.

Explicit use of the terminology of administered price goes back at least as far as the work of Berle and Means (1932) on the impact of the rise of large industrial corporations in the US in the late 19th Century. They use the terminology to capture the ways in which then modern corporations adopt administrative processes that allow senior management to exercise control over the operations of large and complex organisations. These administrative processes lead to production and price decisions that are not directly a response to market conditions, but rather reflect a combination of external market forces and the internal requirements of managerial control.[3] Means (1935) sets out data on pricing behaviour in US industries dominated by large corporations to support the proposition that prices resulting from such administrative processes differ from market-determined prices.

The concept of an administered price fits well with evolutionary theorising as it puts emphasis on the processes used by firms to determine the prices of things they buy and sell. These processes generally take the form of routines and rules representing a boundedly rational response to the requirements for exercising managerial control of activities in the context of large and complex organisations. Nelson and Winter (1982) put the use of routines and rules by firms at the centre of their analysis of evolutionary change, although their focus is on decisions regarding investment and R&D expenditure rather than pricing.

Full-cost pricing is one generic type of pricing rule featuring prominently in the discussion of administered prices since at least the work of Hall and Hitch (1939). The full-cost price is set equal to a measure of unit cost for a product, including direct costs and an allocated portion of indirect costs plus an allowance for a return on capital. The return on capital is often expressed as a percentage margin on the unit cost, so the full-cost price is then equal to unit cost times the sum of one and a profit margin as follows:

$$p = (udc + uic)(1 + \textit{net profit margin}), \qquad (1)$$

where *udc* is unit direct cost and *uic* is unit indirect cost. In all such pricing theories, the fundamental question is who sets the margin and by what logic.

The role administrative process play in determining the full-cost price is clearly shown by the reliance on internal accounting procedures for the determination of the direct and indirect cost components. Cost accounting procedures divide costs for any period into categories of direct cost (generally production labour, raw materials and

intermediate product) and indirect cost (generally selling expenses, managerial costs, depreciation of plant and equipment and other overhead costs). In complex firms most costs are allocated at the level of the individual business unit, which still accounts for a large number of individual products. Within the business unit, the portions of cost relating to various different products are then identified and divided by the intended level of output of each product in the period to obtain a historical measure of unit direct cost (*udc*) and unit indirect cost (*uic*).

The dependence of historical measures of *udc* and *uic* on the level of output produced in a period makes these measures subject to shocks in either demand or supply that impact on production. Andrews (1949) suggests a variant of full-cost pricing in which unit cost is calculated based on "normal" output rather than the actual level produced in a period. "Normal" output is the level that would be expected without disruption to the production process, which is generally close to the output capacity of the firm's plant and equipment. The price equal to normal cost is by construction invariant to fluctuations in the level of output, but requires a managerial decision subject to bounded rationality in specifying the "normal" level of output.

Allocation of indirect costs across individual products of a firm can be problematic. One alternative is to assume proportionality between direct cost and indirect cost, in which case an allowance for indirect costs can be absorbed into the margin by which *udc* is multiplied. This yields the mark-up pricing rule of the type utilised by Kalecki (1971), where price is equal to a measure of unit direct cost multiplied by a mark-up factor (given by one plus a gross profit margin) as follows:

$$p = (udc)(1 + \textit{gross profit margin}), \quad (2)$$

Administrative process determines the size of the net profit margin or gross profit margin applied to accounting measures of unit cost in full-cost, normal-cost or mark-up pricing, but multiple explanations have been offered for the determination of size of the margin. In keeping with the evolutionary framework that views the application of a pricing rule as a routine, there is clearly persistence in the size of the margin both over time and over a broad range of products. This implies stability in prices with respect to fluctuations in output at the firm or industry level. However, as with any rule or routine in evolutionary analysis, margins do vary over time and between firms, so deeper explanations are required. These deeper explanations are crucial to the analysis of the impact of innovation and creative destruction on pricing rules in the next section.

A common feature of theories of administered prices is coordination through price leadership. Price leaders emerge historically from a combination of industry conventions and experimentation. Where industry conventions prevail, the identity of the price leader is not directly linked to its cost or margin, creating a degree of imprecision in the determination of the market price. Experimentation can be expected to stop when the price set is the lowest (highest) among any of the administered prices offered (bid) by a group of sellers (buyers) for a particular product.[4] However, experimentation might stop well before the extreme bid or offer price is reached, given that firms have some preference for price stability over achieving their own desired price. Thus, the adoption of price leadership among heterogeneous firms who follow administered pricing rules

results in an imprecise determination of the market price, even when the rule applied by each individual producer yields a precise determination of price.

5. Pricing, Investment and Differential Firm Growth

In this section we compare the analysis of investment and firm growth under two alternative pricing theories that are each compatible with the evolutionary analysis of differential firm growth. The two pricing theories are Nelson's theory of pricing for markets with transient order and post-Keynesian theory of pricing based on administrative rules or routines. Evolutionary analysis of differential firm growth generally proceeds by linking investment by a firm to its current level of profits, which in the simplest case involves setting investment equal to current profits. Linking profit outcomes and investment in capacity in this way through behavioural rules distinguishes evolutionary theorising from neoclassical theory of perfectly competitive equilibrium, where investment is determined to maximise discounted future profits without any direct connection to the current level of profits.[5]

Price in Nelson's theory is determined in the market to balance demand with production capacity, which has been a standard assumption in evolutionary analysis of changes in industry structure. For example, this assumption is used in the modelling of innovation and selection in Nelson and Winter (1982, Chapters 12 and 13) and in the replicator dynamics by Metcalfe (1994, 1998) and Andersen (2013 [1994]). As industry structure changes so do prices for the industry output, which means there is feedback between structure and pricing.

In contrast, post-Keynesian price theories generally have price above the market-clearing level, which creates excess capacity and changes the level and distribution of profits among firms. Firm strategy in terms of the choice of pricing rule becomes a determinant of profits and differential firm growth, potentially adding an extra dimension to evolutionary analysis. Furthermore, pricing rules are subject to change based on the pattern of differential firm growth and the resulting pattern of excess capacity, so as in the models mentioned above there is feedback from investment through excess capacity patterns to pricing rules.

An important example of how pricing rules and excess capacity interact within post-Keynesian analysis is provided by Steindl (1976 [1952]), who analyses differential firm growth with price leadership by low-cost firms who have been progressive in their adoption of new cost-reducing technology. All firms are producing a homogenous product and selling at the same price with any profits used to expand their production capacity through internal accumulation (the reinvestment of retained profits). The progressive firms have higher profits arising from their lower costs and their expanding output can yield economies of scale or allow the firms to introduce even more advanced technology. Thus, progressive firms expand faster than their higher cost rivals and the industry experiences relative concentration with the market share of the progressive firms rising, which also lowers the average unit cost for the industry.

The market price is rigid in the early stages of Steindl's analysis because the progressive firms are satisfied to continue expanding their sales and market share through a higher rate of capacity expansion than their higher cost competitors. Steindl demonstrates retained profit for the industry as a whole is just sufficient to finance

capacity expansion to meet the growth of market demand when the retained profit as a percentage of equity capital is equal to the growth rate of industry sales, provided there are no changes in financial gearing or capital intensity. With the relative growth of low-cost firms, the rigid price yields rising retained profits for the industry as a whole. Eventually, capacity expansion exceeds sales growth and excess capacity emerges. When the progressive firms respond by engaging in aggressive sales and price competition, high-cost (marginal) firms are eliminated and absolute concentration of the industry occurs. Thus, Steindl's analysis has an emergent process for change in market structure in terms of reduced variance of firm size and increased concentration along with a process for moderating capacity expansion through the erosion of profits.

The process of absolute concentration is a selection process that destroys variety, namely the heterogeneity of costs among producers of the homogenous product.[6] Steindl suggests that when the market share of marginal firms has shrunk to insignificance, progressive firms recognise their collective interest in stopping further aggressive price reductions and the re-investment of all their profits in additional capacity. In this stage of industry maturity, profit rates are no longer regulated by the rate of growth of market demand and profit margins rise.

Comparison of Steindl's (1976 [1952]) analysis of absolute concentration to the analysis of replicator dynamics in Metcalfe (1998) is instructive of the potential benefits of an evolutionary price theory that includes administered prices as well as market-determined prices. Both analyses start with heterogeneity of direct unit cost among a group of firms producing identical or at least similar products. They also both link firm growth to profitability through reinvestment of retained earnings in expansion of

production capacity. However, Metcalfe has price determined by equating market demand with full capacity output in a Marshallian long-period manner, while Steindl has a rigid price set at a historically determined level. In both analyses, the price is assumed to be at or above the level of unit direct cost for any producer.

In both analyses firms have heterogeneous profitability and so expand at different rates, with low-cost firms expanding relative to those with higher cost. This implies a downward trend in average unit direct cost, even when there is no change in the unit cost level for any individual firm. Further, the profitability of firms is such that expansion of capacity eventually exceeds market demand at a constant price.

Here the two analyses diverge. In Metcalfe's analysis of a perfect market, the price at any one time is equal to the costs of the least efficient producer in the market or the price is falling until the next most inefficient producer is identified. The prevailing marginal producer makes zero profits and is presumed not to invest, indeed its problem is how to manage decline rather than how to expand. It is the expansion of the more profitable firms that squeezes marginal producers out of the market as output is concentrated in the best-practice firm or firms. In this scheme aggregate capacity is kept in step with any growth of the aggregate market by a combination of the changing relative importance of the different firms and by adjustments in prices.

In Steindl's analysis excess capacity accumulates until it triggers a change in the price leader's policy. The two types of policy changes Steindl considers are price reductions (or intensified selling activity) and a cessation of investment in additional production capacity. This policy choice profoundly shapes the future path of industry development, with Steindl arguing that the second choice eventually is made in the stage

of industry maturity and results in industry stagnation. Thus, in Steindl's analysis there is a sequence of price rigidity and rapid expansion of production capacity, followed by aggressive competition and slowing expansion and, finally, restoration of price rigidity and cessation of capacity expansion.

Metcalfe (1998) has prices equal across all firms in the industry only in the extreme case of a perfect market.[7] Otherwise, there is limited substitution between firms and prices diverge to maintain balanced growth of production capacity and demand for each firm.[8] This implies that lower cost firms use part of their cost advantage to set lower prices and balance their higher rate of expansion in capacity against a higher rate of growth in demand for their products. Again, the adjustment is continuous unlike in Steindl's analysis where aggressive price (or selling) competition occurs only during the stage of the absolute concentration of industry when low-cost firms are driving high-cost rivals out of business.

Steindl's analysis and many other post-Keynesian analyses recognise the rich strategy space in which firms operate. Adjusting price to meet market conditions is only one way in which firms interact with the market. Price stability is generally sought and often maintained, especially in response to temporary fluctuations in demand or firm-specific changes in cost. Instead, output is allowed to fluctuate relative to production capacity, initially with changes in inventories or order backlogs. In the short run, firms might make adjustments to production runs or alter marketing activity. Only over a longer horizon do firms consider a change in their pricing rules and this is commonly done in connection with broader strategy settings, including advertising programs,

research and development projects, supply-chain management, outsourcing, distribution channels and organisational structure.

Price adjustment is not the only possible response to innovation and creative destruction nor, according to Schumpeter's argument in *Capitalism, Socialism and Democracy*, is quick price adjustment conducive to further innovation. Firms use their administrative processes to decide how to respond based on their own circumstances and objectives, which leads to differentiated actions. Evolutionary analysis then provides the framework for examining the implications of firm choices for their survival and growth, where price policy is but one dimension in which firms differ (see Markey-Towler, 2016 for an application to the evolutionary analysis of differences in firm price policies).

In order to move forward there is a need to focus on the broad strategy space in which firms operate, including all policies affecting the rate of change of demand in relation to the rate of change in the capacity to supply. A key issue is how many customers the business has and the chief effect of its pricing policy in these terms is to influence the rate of growth or decline of its customer base by inducing customers to switch from alternative sources of supply. Who a consumer buys from becomes the central issue and the amount each customer buys could be entirely price insensitive without losing the force of the customer switching mechanism to price setting.

The rate of growth of each firm's market will then depend on how its prices compare with those of its rivals and this is where absolute price differences matter in a way that depends on how well informed customers are as well as their readiness and ability to switch suppliers when they find offers that create more real value, due allowance being made for quality differences in the goods supplied. If there are no

barriers to switching supplier and if all consumers are fully informed of rival offers, then each supplier perforce must set the same price if its goods are of the same quality as those of its rivals. This is the evolutionary equivalent of the perfect market, a useful analytical standard but a poor reflection of most markets in practice.

Firms put a great deal of effort into making markets imperfect by creating barriers to switching. Indeed, the development of innovative products, novel marketing strategies and other attempts to gain customer loyalty are central to the competitive strategy of most modern firms. The resulting imperfect markets as well as cost differentials are then the background for understanding how prices can differ for similar goods and why allowing for independent price setting policies is essential in further developing evolutionary price theory.

6. Extending Evolutionary Price Theory to Include Disrupted Markets

Nelson (2013) argues supply and demand analysis can be applied for evolutionary analysis as long as markets satisfy the conditions for transient order. In such markets prices adjust to balance changes in supply and demand as in neoclassical price theory, but without the suppositions of optimal behaviour that lie behind neoclassical supply and demand curves. Innovation and creative destruction disrupt the transient order and create market circumstances inconsistent with even Nelson's conception of supply and demand analysis.

We argue firms in disrupted markets use administrative rules and routines in setting prices, such as those specified in full-cost, normal-cost, target-rate-of-return and mark-up pricing theories. We also argue heterogeneity across firms in disrupted markets

leads to potentially divergent prices, which encourages the use of price leadership as a coordinating mechanism. In this section, we ask what tentative hypotheses can be drawn regarding the observed pricing behaviour in disrupted markets and, specifically, how does this behaviour differ from prices determined to balance supply and demand in orderly markets.

First, administered prices are cost based, so price changes are primarily driven by cost changes. The margins applied in the full-cost, normal-cost and mark-up pricing rules are stable and generally applied uniformly by a firm across all its products or at least across broad categories of products. Demand changes don't normally lead to changes in an administered price, except indirectly through their impact on cost through productivity change and this influence may be only infrequently taken in account and even then may be attenuated as suggested below.

Second, price stickiness, or more precisely infrequent price change, is expected. Accounting data are generally compiled at infrequent intervals, such as monthly, quarterly or even annually. Further, there will be no change to the calculated unit direct or indirect cost unless there have been changes to input prices or productivity. Input prices often only change infrequently, such as annual wage changes or intermediate input price changes at expiry of a contract. Productivity depends on the flow of input and output, but unit cost calculations for determining the administered price are usually based on normal input and output rather than the actual flow, which tends to mean infrequent changes to the productivity measure. Thus, the cost basis on which an administered price is set is likely to change only infrequently.

Even when the cost basis for an administered price changes, there is likely to be a minimum threshold before the administered price is changed. Customers and competitors generally don't like price changes. The idea of menu costs is widely used to rationalise the infrequency of price changes.[9] In our approach, menu costs are only ancillary to the more fundamental influence of infrequent and small changes to the cost basis of administered prices. Further, firms building a market for an innovative product avoid frequent price changes that might create customer uncertainty. In place of adjusting prices, firms rely on changes to excess capacity or order backlogs in the short run and on changes across the spectrum of strategies for product development, marketing and capacity management in the long run.

Third, price instability is emergent when structural change is occurring in an industry due to the introduction and spread of innovations and this is the way in which demand also influences prices through the threat or realisation of lost customers.[10] An example is given in Steindl's analysis discussed in the previous section, where growing divergence in unit costs or capacity growth between progressive and marginal firms sets the condition for price reductions by the progressive firms with the aim of forcing marginal firms out of business. In general, innovations alter the relative cost position and capacity growth rates of producers of similar products, leading to potential changes in the price leader. While the dislike of price changes by customers and competitors works against firms challenging the existing leader, a challenge and resulting price instability is increasingly likely once the trajectory of unit cost diverges across firms.

Fourth, innovation and creative destruction impart a downward bias to prices as noted by Schumpeter (1939). Intuitively, innovations that lower costs are more appealing

than those that raise costs, as it is easier to pass on a price decrease than a price increase. A marketing campaign that leads to higher indirect costs per unit sold and raises consumer willingness to pay might increase profit. However, innovations that cut costs or improve the quality of intermediate products or capital goods (thereby allowing lower costs for the downstream producer) are generally more appealing to profit-oriented managers. Historically, innovations have led to substantial net positive improvements in productivity, leading to reduced unit cost and reduced administered prices via the various cost-based pricing rules. Of course, nominal wage increases have worked in the opposite direction, but the deflationary impact of productivity growth still shows up in rising real wages.[11]

Finally, the downward bias to price is partially offset by increases in obsolescence associated with the process of creative destruction. The development of new machines using less input, particularly labour, to produce the same level of output undermines the value of the existing machinery embodying older technology. Accounting methods sometimes recognise the potential loss of value through a reduction in the expected useful life from which depreciation charges are calculated, with the useful life based on the length of time for which the plant and equipment is expected to remain operating profitably rather than the time at which the plant and equipment wears out. For example, the accounting lifetime for computers and communication devices are generally much shorter than their physical operating lifetimes due to the rapid rate of technological change in equipment capabilities. A shorter accounting lifetime means higher depreciation charges and, therefore, higher indirect costs to be included in the cost basis for calculating the full-cost price.

Adjustments for expected obsolescence are still not that common in the determination of depreciation charges, particularly as the impact of creative destruction is often unforeseen. Where there is no cost provision for obsolescence, the uncertainty associated with the impact of creative destruction may still increase the administered price through a higher profit margin being applied in calculating the full-cost price. Ultimately, if prices aren't sufficiently high to recover the cost of plant and equipment before it becomes obsolete, the long-run viability of the firm is threatened.

The process of creative destruction associated with the diffusion of innovations restructures a disrupted market towards a new transient order. External influences then take over as drivers of cost and price. The impact of these external influences may operate through supply and demand analysis as in Nelson's pricing theory with price determined by market clearing or there may still be elements of administered rules influencing pricing behaviour as in Steindl's pricing theory in the stage of industry maturity.

A general theory of pricing compatible with evolutionary analysis would allow for price determination by either administrative processes or market clearing in markets with transient order and, indeed, for the possibility of prices being determined by market clearing in disrupted markets as with the replicator model of differential firm growth in Section 5. Price setting through administrative process is attractive to firms as a means to implementing firm strategy, but its practical influence is generally heavily proscribed by market forces. Our argument is that disruption of markets through innovation weakens the constraint of markets forces and provides greater opportunity for firm strategy as

expressed in pricing rules and routines to have the independent influence on price behaviour described in this section.

7. Conclusions

Our discussion of extending evolutionary price theory to cover markets disrupted by innovation yields the following propositions that potentially apply to all markets in an evolving economy but with greatest force to markets experiencing the disruptive impact of innovations. First, administered prices are cost based, so price changes are primarily driven by cost changes rather than demand shifts. Second, there is a tendency to price rigidity in the short run, at least relative to what might otherwise be expected with market-clearing prices. Only in the longer run will price changes reflect the impact of innovations on costs or market structure. Third, price instability is emergent when innovations are being introduced or diffused, as aggressive price competition is a primary vehicle for creative destruction. Fourth, innovation and creative destruction impart a downward bias to price through their generally negative impact on costs through rising productivity. However, this downward bias is partially offset by prices being increased to provide for the costs and uncertainty associated with the impact of creative destruction on the obsolescence of investments in embodied technology.

These propositions support evolutionary theorising. Prices retain evolutionary content when they are determined by emergent processes, which occur in our analysis with changes in pricing rules and in the price leader. These prices are best described as non-random draws from a population distribution rather than a single deterministic price, equilibrium or otherwise. Importantly, analysis of the formation of administered prices

suggests prices are more likely to exhibit the random-walk characteristics of a Markov process over time rather than to exhibit mean reversion, implying the starting point for future movements is more likely to be where we happen to be today than any position that might be considered a centre of gravity or equilibrium. In other words, prices are history dependent.

Also, the concept of long-run equilibrium prices is inherently flawed for disrupted markets. Future prices are beyond the realm of analytical calculation, even with rigid pricing rules, because future costs are unknowable. Further, in disrupted markets, the observed prices at any time are particular realisations of the underlying possibilities from the administered pricing processes of heterogeneous firms, so that administered prices are evolving. This adds to the path dependency of economic development as the observed prices affect expectations, which are formed on the basis of the past trajectory of prices along with the disparate imaginings of the future by market participants. These highly fallible projections and disparate imaginings mark the environment in which restless knowledge leads to the introduction of more novelty and subsequent selection through creative destruction, and so the process of economic development continues indefinitely.

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References

Andersen, Esben S. (2013 [1994]), *Evolutionary Economics*, London: Pinter.

Andrews, P.W.S. (1949), *Manufacturing Business*, London: Macmillan.

Berle, Adolph A. and Gardiner C. Means (1932), *The Modern Corporation and Private Property*, New York: Macmillan.

Bloch, Harry (1990), 'Price Leadership and the Degree of Monopoly', *Journal of Post Keynesian Economics*, 12: 439-51.

Bloch, Harry (2000), 'Schumpeter and Steindl on the Dynamics of Competition', *Journal of Evolutionary Economics*, 10 (3): 343-53.

Bloch, Harry, Jerry Courvisanos and Maria Mangano, (2011), 'The Impact of Technical Change and Profit on Investment in Australian Manufacturing', *Review of Political Economy*, 29(3): 491-511.

Bloch, Harry and Stan Metcalfe (2015), 'Restless Knowledge, Capabilities and the Nature of the Mega-Firm', in Andreas Pyka and John Foster, editors, *The Evolution of Economic and Innovation Systems*: *Economic Complexity and Evolution*, Switzerland, Springer: 431-53.

Dardi, Marco (2003), 'Alfred Marshall's Partial Equilibrium: Dynamics in Disguise' in Richard Arena and Michel Quéré, editors, *The Economics of Alfred Marshall*, Switzerland, Springer: 84-112.

Dopfer, Kurt and Jason Potts (2008), *The General Theory of Economic Evolution*, London: Routledge.

Dosi, Giovanni (1982), 'Technological Paradigms and Technological Trajectories', *Research Policy* 11: 147-162.

Hall, R.L. and C.J. Hitch (1939), 'Price Theory and Business Behaviour', Oxford Economic Papers, 2: 12-45.

Kalecki, Michał (1971), *Selected Essays on the Dynamics of the Capitalist Economy*, Cambridge: Cambridge University Press.

Lee, Frederic S. (1998), *Post Keynesian Price Theory*, Cambridge: Cambridge University Press.

Loasby, Brian J. (1999), *Knowledge, Institutions and Evolution in Economics*, London: Routledge.

Markey-Towler, Brendan (2016), 'The Law of the Jungle: Firm Survival and Price Dynamics in Evolutionary Markets', *Journal of Evolutionary Economics*, (published online 5 February 2016).

Means, Gardiner C. (1935), *Industrial Prices and Their Relative Inflexibility*, Senate Document no. 13, 74th Congress, 1st Session, Washington, DC: Government Printing Office.

Melmies, Jordan (2010), 'New Keynesians Versus Post Keynesians on the Theory of Prices, *Journal of Post Keynesian Economics*, 32 (3): 445-465.

Metcalfe, J. Stanley (1998), *Evolutionary Economics and Creative Destruction*, London: Routledge.

Nelson, Richard R. (2013), 'Demand, Supply and Their Interaction on Markets, As Seen from the Perspective of Evolutionary Economic Theory', *Journal of Evolutionary Economics*, 23 (1): 17-38.

Nelson, Richard R. and Sidney G. Winter (1982), *An Evolutionary Theory of Economic Change*, Cambridge, MA: Harvard University Press.

Salter, W.E.G. (1966), *Productivity and Technical Change*, 2nd edition (Cambridge: Cambridge University Press).

Schumpeter, Joseph A. (1961 [1934]), *The Theory of Economic Development* (translation of second German edition by Redvers Opie), London: Oxford University Press.

Schumpeter, Joseph A. (1939), *Business Cycles*, New York: McGraw Hill.

Schumpeter, Joseph A. (1950 [1942]), *Capitalism, Socialism and Democracy*, 3rd Edition, New York: Harper and Row.

Shackle, George L S (1970), *Expectation, Enterprise and Profit*, London: George Allen and Unwin.

Simon, Herbert A (1955), 'A Behavioral Model of Rational Choice', *Quarterly Journal of Economics*, 69 (1): 99 – 118.

Steindl, Josef (1976 [1952]), *Maturity and Stagnation in American Capitalism*, 2nd Edition, New York: Monthly Review Press.

[1] For example, a new machine may require less labour to operate than an old one, but cost the same amount to purchase and install. As long as the average total cost of the new machines exceeds the average direct cost of the old machines, the old machines remain competitive with the new. All new capacity will consist of new machines, but old machines will only be profitably replaced as their performance deteriorates with age. A rising real wage will speed the process of replacement and faster market growth will increase the proportion of new machines, but many years may still elapse before the average direct cost of the old machine (including the increasingly expensive labour) exceeds the average total cost of installing and operating a new machine (see Salter, 1966). Also, if demand declines temporarily old machines will be idled before new machines.

[2] By bounded rationality we mean people do the best they can to meet their goals in the circumstances they perceive and understand, but no two individuals necessarily have the same perceptions of the world or a common understanding of it. From the evolutionary view this gives reign to variety generation and enterprise. Our conception mixes elements of Simon's (1955) emphasis on the limits to human cognition and Shackle's (1970) emphasis on variety in human perception.

[3] Berle and Means (1932) argue that there is a separation of ownership from control in the modern corporation. As a result, the interests of shareholders in maximum profits and dividends need not be reflected in the administrative processes adopted by management.

[4] If all firms selling a homogenous product use mark-up pricing but with heterogeneous unit direct cost and gross profit margin, Bloch (1990) shows that the expected lowest price falls with the number of firms in the market providing an explanation for why price and profit rates rise with industry concentration.
[5] By assuming firms optimise investment based on access to complete information and operate in perfect markets (no transaction costs or barriers to finance) neoclassical theory abstracts from the evolutionary process in which markets are central to revealing best practice through differential growth and survival of heterogeneous firms.
[6] Bloch (2000) discusses the parallels between Steindl's ideal pattern of competition and Schumpeter's process of creative destruction.
[7] A perfect market is distinguished from the notion of perfect competition and refers to a market 'in which all transactions for identical goods or services are consummated at the same price.' (Metcalfe, 1998, p. 13)
[8] Metcalfe (1998) recognises that firms set prices rather than the market, but by assuming that the price is such to sales and production capacity, there is a unique price that achieves this balance. In contrast, the administered price approach allows for excess supply or excess demand to appear as a result of price decisions without necessarily triggering any price adjustment.
[9] Melmies (2010) discusses the role of menu costs in new Keynesian and Post Keynesian approaches to the theory of prices in the context of reviewing data from central bank surveys showing the frequency of price changes across 14 industrialised countries.
[10] Price instability is emergent in the sense it flows from but is not explicable in terms of our understanding of the background state. Price instability may occur but our incomplete understanding of the complex forces operating on firms leaves us uncertain and unable to provide a probability of occurrence.
[11] Rising real wages in turn encourage a labour-saving bias to innovations in production technology and capital equipment, leading to a cumulative process of productivity growth and rising real wages (see Bloch, et al, 2011) for evidence of the impact of the labour-saving bias in technical change on investment intensity in Australian manufacturing industries).