

A DEVELOPMENT OF THE THEORY OF THE RICARDO EFFECT

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ABSTRACT: According to Hayek’s “theory of the Ricardo Effect” there is a “decline of investment” on the part of the consumer goods industries that starts halfway through the cyclical upswing. This “decline of investment” then gradually leads to the “scarcity of capital” in the consumer goods industries, which is the proximate cause of the upper turning point. This thesis was hardly made convincing by Hayek. I develop the theory of the Ricardo Effect by rebuilding it around the alternative theses that a decline of investment by both the machine producing industries and the raw materials industries leads to the “scarcity of capital.”

KEYWORDS: Ricardo Effect, Austrian Business Cycle Theory, upper turning point, circularities, structure of production

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1. INTRODUCTION

The concrete thesis in Hayek's theory of the Ricardo Effect is that the business cycle's upper turning point is brought about by a decline of investment in fixed capital on the part of the consumer goods industries, a decline that starts during the upswing. To Hayek, the upswing begins with a credit-induced "acceleration effect," a somewhat exaggerated demand for machinery by the consumer goods industries. Roughly halfway through the upswing, falling real wages make investment in machinery less attractive. This is the "Ricardo effect," which counteracts the acceleration effect. The decline of investment, on the part of the consumer goods industries, commences. Labor is reallocated from the machine producing industries to the consumer goods industries, because the funds destined for capital expenditure are reallocated to additional operating expenditure. There is increased capital utilization in the consumer goods industries in the latter half of the upswing, which initially strengthens the boom. However, the decline of investment leads in the longer run to a crisis, because machines in the consumer goods industries are not replaced once worn out, or only replaced by less-labor saving machinery. This eventually causes a diminished productive capacity in the consumer goods industry, a "scarcity of capital." The decline in investment spending leads, of course, also to a slump in the machine producing industries.

Hayek's thesis that a decline of investment by the consumer goods industries would take place, starting roughly halfway through the upswing, was hardly made convincing by him. His theory of the Ricardo Effect has generally not been well received (Klausinger, 2012, pp.15–24). I also believe that this concrete thesis is largely incorrect. But when Hayek's theory of the Ricardo Effect is looked upon more broadly than by just focusing on this concrete thesis, I believe it contains a lot of material that would support an alternative thesis that very much resembles Hayek's thesis.

In this paper I develop Hayek's theory of the Ricardo Effect by rebuilding that theory around the alternative thesis that a decline of investment by the machine producing industries leads to the "scarcity of capital." This means to visualize the Ricardo Effect not as an economy-wide shift of workers from the machine producing industries towards the consumer goods industries,

but as a re-allocation of productive capacity within the machine producing industries itself. Instead of the “acceleration effect” becoming dominated by the “Ricardo effect” in the second half of the upswing, I will twist Hayek’s argumentation a bit. I will argue that the “acceleration effect,” which emanates from one half of the economy (the consumer goods industries), gives rise to the “Ricardo effect” in the other half of the economy (the machine producing industries). I will also attempt to demonstrate a secondary thesis on top of this primary thesis. This secondary thesis is that, because the “acceleration effect” causes the machine producing industries’ capacity to become fully employed, continued credit expansion will lead, somewhere halfway the boom, to increasing operating expenditure by all industries. This increasing operating expenditure will drive towards a Ricardo Effect in the raw materials industries, causing an increasing scarcity of “circulating capital,” and finally flipping over the upswing into the downswing.

The rest of this paper is organized as follows. In the following section I will summarize Hayek’s theory of the Ricardo Effect with more detail than in this introduction. Here I will also highlight the main points of the debate over the Ricardo Effect in the early 1940’s, and I will highlight the main capital-theoretic problem that Hayek deals with in his theory of the Ricardo Effect. In the third section following that, I provide a list of points on which my development of the theory of the Ricardo Effect originates in Hayek’s theory. The fourth section can be seen as the core of this paper. It deals with a conceptual difficulty of the stages-of-production model that Hayek recognized in his theory of the Ricardo Effect ([1935] 2012, pp. 223–226). The difficulty is that of so-called “circularities” in the structure of production, in particular how to model these circularities verbally or graphically. Hayek did not really resolve this difficulty and I will attempt to do so by re-examining the capital-theoretic issue of combining the intertemporal stages-of-production viewpoint with the cross-sectional viewpoint that divides the economy into a consumer goods industries and a machine producing industries. Here I propose a new type of cross-sectional model that should better help understand the near-future/distant-future trade-offs. In section five I will argue in detail for my primary thesis and therefore go into the reasons why a Ricardo Effect (i.e. a decline

of investment) would occur within the machine producing industries during the boom. In the sixth section I will come to my secondary thesis, and I will argue that the increased capital utilization that appears during the boom leads to a Ricardo Effect in the raw materials industry. Hereto I will extend the cross-sectional viewpoint that divides the economy into a consumer goods industries and a machine producing industries with the raw materials industries as a third sector.

2. A SUMMARY OF HAYEK'S THEORY OF THE RICARDO EFFECT AND ITS PROBLEMS

2.1 Hayek's Revised Business Cycle Theory

In *Profits, Interest and Investment* ([1939] 2012) and "The Ricardo Effect" ([1942a] 2012) Hayek published what may be called his "theory of the Ricardo Effect" (Wilson, 1940, p.171).¹ *Profits, Interest and Investment* was partly a revision of his business cycle theory of *Prices and Production* ([1935] 2008) in order to provide a more detailed explanation of the upper turning point of the business cycle. Hayek identified as a main difference with his earlier explanation of crises that in his "revised version" he believes that "a rate of profit rather than a rate of interest is the dominating factor in this connection" ([1939] 2012, p. 212). Hayek would initially assume the rate of interest as given, which apparently implies that the supply of credit is simply "elastic" and that there is a credit expansion going on throughout the upswing (*ibid.*, p. 230). Hayek attempts to demonstrate that "the turn of affairs will be brought about in the end by a "scarcity of capital" independently of whether the money rate of interest rises or not" (*ibid.*). Professor Klausinger has explained the importance of these revised aspects:

The new features of the model—in comparison to *Prices and Production*—are crucial for the novel explanation of the upper turning point. For

¹ Apart from these two essays Hayek's theory of the Ricardo Effect can also be seen to be restated in two short replies to Kaldor ([1942b] 2012). Also, without using the term "Ricardo Effect," Hayek raised similar points in chapter XXVII of *The Pure Theory of Capital* ([1941] 2009) and in "Full Employment Illusions" ([1946] 2009). Then he returned to the issue roughly a quarter of a century later in "Three Elucidations of the Ricardo Effect" ([1969] 2012).

without an elastic supply of credit and with the circulation of money limited, eventually the rate of interest would rise sufficiently to choke off investment demand [...] what Hayek is now attempting to demonstrate is the inevitability of the breakdown of an inflationary boom, even [...] with unlimited credit creation and with less than full employment. (2012, p. 17, footnote omitted.)

Because Hayek would concentrate on the latter half of the upswing, he was brief about the first half. He simply asserted that in the first half of the upswing, credit expansion and increasing consumer spending would give incentives to the consumer goods industries to order more machinery. This more or less exaggerated 'derived demand for machines' Hayek called the "acceleration effect," following the terminology of "a well known doctrine, the so-called 'acceleration principle of derived demand...'" (Hayek, [1939] 2012, pp. 222–223). However, Hayek did not quite follow that doctrine itself till the end.

Hayek assumed that "at a point somewhere half-way through a cyclical upswing [...] prices of consumers' goods do as a rule rise and real wages fall" (ibid., p. 217). On this Hayek builds his concrete thesis: At this halfway point the incentives for entrepreneurs are strong enough to:

...make the tendency to change to less durable and expensive types of machinery dominant over the tendency to provide capacity for larger output. Or, in other words, in the end "the acceleration principle of derived demand" becomes inverted into a "deceleration principle..." (ibid., p. 231)

Besides calling this weakening 'derived demand for machines' simply a "decline of investment" (ibid., p. 230), Hayek also calls this tendency the "Ricardo effect." In short, the "acceleration effect" dominates the first half of the upswing, the "Ricardo effect" the second half.

Hayek's visualization of this Ricardo Effect is that while the consumer goods industry decreases its capital expenditure, it will start to increase its operating expenditure. Workers are then re-allocated from the machine producing industries towards the consumer goods industries. Fewer machines, or "less durable and expensive types of machinery," are manufactured in the machine

producing industries, while machine-utilization in the consumer goods industries goes up ([1942a] 2012, pp. 275–276). However—this seems to be Hayek’s point—higher machine-utilization can only sustain higher output for as long as those machines are not yet worn out. Since less machines are manufactured to replace worn-out machinery, there must come a point at which that higher output cannot be maintained. The decline of investment results in a decreased productive capacity, and “the classical maxims that a scarcity of capital means a scarcity of consumers’ goods [...] assert their fundamental truth” ([1939] 2012, p. 231). The relationship to the business cycle of this theory of the Ricardo Effect is that this “scarcity of capital” becomes the *real* reason why the high level of output during the boom-phase cannot be sustained (*ibid.*, pp. 230–232). The upswing must reach a “turn of affairs” (*ibid.*). Besides this, the decline of investment by the consumer goods industries would, of course, also lead to a slump in the machine producing industries.

2.2 The Debate on the Theory of the Ricardo Effect

The debate² that followed, between Wilson (1940), Hayek ([1942a] 2012) and Kaldor ([1942] 2012), centered around the rather micro-economic question of what firms in the consumer goods industries would do under the circumstances that Hayek described. Wilson compared Hayek’s thesis, that “with a perfectly elastic supply of credit, a fall in real wages will lead to the adoption of less roundabout methods of production,” to a treatment of a similar case by Kaldor (Wilson, 1940, p. 173). To Kaldor, a representative firm would combine, in the words of Wilson, “direct labour and indirect labour [...] in the same proportion as before; the change in prices will change the scale of output but leave the degree of capital intensity unchanged” (*ibid.*, p. 174; cf. Kaldor, 1939, pp. 49–50). Kaldor’s conclusion was that the method of production (i.e. the ratio of direct to indirect labor) at which profits are maximized, in the case of elastic

² Other summaries of the debate can be found in Haberler (1943), Blaug (1997) and Klausinger (2012). Klausinger (2012) is the introduction to the 8th volume of Hayek’s *Collected Works* in which most of the theory of the Ricardo Effect can be found. Klausinger (2011) provides some more background to the debate. For example, Wilson, Kaldor, and Hayek were all attached to the London School of Economics during the debate, Kaldor being Wilson’s thesis supervisor.

credit, will be entirely determined by the interest rate. The real wage rate has no influence. The reason is that falling real wages (selling prices that go up relative to money wages) do not affect the initial costs (expenses on wages for indirect labor plus interest charges) of each different method of production (Wilson, 1940, p. 177). Hence, under elastic credit and falling real wages, such a representative firm would not change its “ratio of indirect to direct labour” (ibid., p. 176). But it would hire more indirect labor and direct labor in the same proportion as it did before. In other words, it would purchase more machines similar to what it already has, and also hire more workers to man those machines. The representative firm enlarges its scale of operations by “capital widening.” With respect to the consumer goods industries as a whole, this means that maximum aggregate profits are achieved when each consumer goods firm enlarges the scale of operations on its particular profit-maximizing “ratio of indirect to direct labour” until for each firm marginal revenue will have equaled marginal costs (ibid.; cf. Klausinger, 2012, p. 19). In the aggregate of the consumer goods industries this means, as Professor Klausinger has explained, that “the increased demand for consumers’ goods will bring forward ‘capital widening’ but no ‘capital enshallowing’...” (Klausinger, 2012, p. 19). Wilson pointed to the crucial role of Hayek’s assumption of a perfectly elastic supply of credit, which would play an important role in the rest of the debate. Even if that assumption is dropped, Hayek’s thesis would not stand, according to Wilson. Under a rising supply schedule of credit, he argued, an increase in consumption may diminish capital intensity (there will be less use of indirect labor relative to direct labor), but it will not lead to a fall in investment (less use of indirect labor in the absolute) (ibid.).

Hayek subsequently defended his case in “The Ricardo Effect” ([1942a] 2012). Instead of discussing a choice among a number of different ratios of indirect to direct labor, Hayek now built his argument on the more practical idea that entrepreneurs must choose between “expenditure on wages (or investment in ‘circulating capital’) and expenditure on machinery (investment in ‘fixed capital’)” (ibid., p. 262).³ Hayek maintains that in the upswing at

³ Increasing capital utilization is not exactly the the same as increasing the ratio of direct to indirect labor (i.e., decreasing the “ratio of indirect to direct labour”). The former means that existing machines will be utilized more intensely, the latter

some point entrepreneurs prefer to use their funds to increase output by increasing the utilization of their existing capacity rather than by purchasing more capacity. The obvious objection against Hayek's line of argumentation was raised by Hayek himself: "To this it will no doubt be answered that there is no reason why the entrepreneurs should not do both: provide for the output in the near future by the quick but expensive methods *and* provide for the more distant future by ordering more machinery" (*ibid.*, p. 278). Kaldor indeed responded in such a way:

When the price of a product rises (or strictly: the *expected* price of the product rises) it becomes profitable to increase output, and to extend output-capacity, until the expected price, or the marginal revenue, is back again to conformity with cost. As Ricardo said: "an unusual quantity of capital would be employed till their price afforded only the common rate of profit" ([1942] 2012, p. 296)

Hayek must show what is precisely that thing that propels entrepreneurs in the consumer goods industries to *only* increase operating expenditure when demand for their product rises. Increasing output by increasing capital utilization can only go so far. There are capacity constraints in the consumer goods industries which can only be lifted by purchasing additional machinery. Under the circumstances that Hayek initially stipulated—an "elastic" availability of credit and increasing consumer spending—there should be ample room to *also* increase capital expenditure and install more capacity. Output would be increased by a combination of operating expenditure *and* capital expenditure, contrary to Hayek's claim that there is a tendency to shift to operating expenditure only (Haberler, 1943, p. 490).

This brings us to the one point on which Hayek is seen as having admitted defeat (Klausinger, 2012, pp. 21–22). For in "The Ricardo Effect," Hayek retreated from his assumption

that replacement machines which are to be built will be "less automatic" than the machines they will replace. These two concepts are intertwined in the theory and debate on the Ricardo Effect. Of course, they may have something to do with each other if increased capital utilization of the consumer goods industries is made possible by shifting labor away from the machine producing industries, leaving the latter with less manpower to build more automatic machines. This was precisely Hayek's thesis.

of an elastic supply of credit during the upswing, towards the assumption that “every prospective borrower will have to face an upward sloping supply curve of credit” ([1942a] 2012, p. 270). Hayek argues that the funds in the hands of entrepreneurs are limited and that therefore operating expenditure will at some point in the upswing be increasingly preferred above capital expenditure. This change of assumption implies that a decline of capital expenditure by the consumer goods industries—if that indeed happens during the upswing—occurs mainly because the supply of credit is drying up, rather than that the rate of profit on investment in fixed capital is declining vis-à-vis investment in working capital⁴ (Hayek, [1939] 2012, pp. 215–217; Kaldor [1942] 2012, p. 302). Professor Klausinger has interestingly commented that “in the end the Ricardo effect was salvaged by giving up most of what had distinguished it from alternative explanations of the upper turning point” (ibid., p. 22; cf. Blaug, 1997, p. 526). Indeed, because Hayek now made the increasingly limited availability of credit the “dominating factor” in bringing about the decline of investment, the superior profitability of investing in more labor-intensive methods of production no longer plays that role of the “dominating factor” that Hayek initially had assumed for it ([1939] 2012, p. 212).

Hayek himself did not admit defeat ([1942b] 2012). His stubborn resistance comes from relying on another argument he brings to the table:⁵ Investment must also be constrained because of the scarcity of real capital. An individual firm may be so lucky that the machine it wants to acquire stands “waiting in the shops,” but what “might be true for any one firm [...] will not be true when

⁴ Note that Hayek used the phrase “investment in working capital” in the sense of what nowadays would be called *operating expenditure*. It does not necessarily mean “investment in *net* working capital” (i.e. the cash buffer between receipts and expenditures) although increasing operating expenditure may very well imply that an increase in net working capital is needed since expenses on wages and raw materials would increase.

⁵ Hayek, in “The Ricardo Effect” ([1942a] 2012), interweaves the “scarcity of money capital” argument (based on changing the assumption towards an upwards sloping supply curve of credit” with the “scarcity of real capital” argument. As does Kaldor ([1942] 2012), I treat them separately.

all firms are simultaneously in the same position" (ibid., p. 278).⁶ Hayek uses the limited availability of real capital as evidence that "additional equipment and still more the output produced by it will be available only after considerable delay. And in the interval till this output is available profits which might have been made by quicker methods will be lost and ought to be counted as part of the cost of the production for the most distant future" (ibid.). Besides arguing that realizing profits in the near future will take precedence, Hayek also argues that the decline of investment comes about for two other reasons. One is that the price of machinery would go up because of an increasing scarcity of labor in the machine producing industries, as labor is being reallocated to the consumer goods industries. The other is that, in so far as new machines are ordered, these will be the cheaper (less labor-saving) types of machines which can be installed more quickly (ibid., p. 281).

Kaldor responded that a rise in prices of machines has nothing to do with what Hayek is trying to prove. A rise in the price of machinery will not lead to a decline in investment from the consumer goods industries:

[Hayek] confuses influences coming from the side of demand with influences coming from the side of supply. If the price of machinery rises, the demand for machines will be less than if it did not rise. But the price of machinery has only risen, on his assumptions, *because* demand has risen; how does this explain then the emergence of unemployment [in the machine producing industries]? His business is to prove that demand will fall; not that a rise in demand will be checked by a rise in price. ([1942] 2012, p. 307, footnote omitted; cf. Wilson, 1940, p. 176)

There is one part of Hayek's main thesis that Kaldor cannot put aside completely. This is that entrepreneurs in the consumer goods industries will prefer cheaper but less labor-saving machinery (which can be installed more quickly) over more labor-saving equipment (which will take longer to put in place). But to Kaldor even this does not prove much:

It is only if the entrepreneur expects higher prices for his products in the near future than in the more distant future that it might become more

⁶ This argument was probably directed against called Kaldor's "representative firm subterfuge" (Desai, 1991, p. 67; cf. Kaldor, 1939, p. 44).

profitable to install the machine with the shorter construction period, even though the rate of interest is the same [...] assuming that the latter is the case, what does it prove? [...] Professor Hayek has taken on himself to prove that this will cause a fall in demand for capital goods, and thus unemployment in the capital goods trades; and to the latter contention the argument contributes nothing at all." ([1942] 2012, p. 308)⁷

2.3 Hayek's Visualizing Problem

One problem that Hayek himself identified with his theory was that he admitted to "find it difficult to visualise precisely how [the Ricardo effect] will be brought about" (Hayek [1942a] 2012, p. 280). That Hayek did not really have a precise visualization how the Ricardo Effect would occur may also be evident from his description of that effect:

the [Ricardo] effect [...] will be twofold. On the one hand it will cause a tendency to use more labour with existing machinery, by working over-time and double shifts, by using outworn and obsolete machinery, etc. On the other hand, in so far as new machinery is being installed, either by way of replacement or in order to increase capacity, this, so long as real wages remain low compared with the marginal productivity of labour, will be of a less expensive, less labour-saving, and less durable type." ([1939] 2012, p. 219)

In fact we find here three different effects. The first is increased capital utilization ("over-time and double shifts") The second is an asset replacement delay ("using outworn and obsolete machinery"). Only the third is the narrow interpretation of the Ricardo Effect as factor substitution (changing to "less labour-saving" machinery). There is not one concrete manifestation of the Ricardo Effect. The common aspect is simply that they all help produce output in the near future at the expense of output in the distant future. A Ricardo

⁷ Hayek did not use the phrase "construction period" in his theory of the Ricardo Effect. Kaldor's use of this term, which was used by a number of authors in the 1930's capital debates, is a good indication that this point has more to do with the capital-theoretic questions that form part of the background of the debate. The idea behind both Hayek's and Kaldor's reasoning is the law of roundabout production, i.e that longer construction periods (given "wisely chosen" methods) result in more labor-saving machinery (Hayek, [1941] 2009, p. 77).

Effect could thus be defined more broadly than just a decline of investment on the part of the consumer goods industries. In Hayek's intertemporal framework a Ricardo Effect can simply mean *any* shift of resources, a "redistribution of production factors in time as a consequence of a change in the rate of profit" (Birner, 1999, p. 805). This may also suggest that the thesis of the decline of investment on part of the consumer goods industries might only have been an initial rough sketch to visualize what is going on during the latter half of the upswing. In other words, that it is an attempt to concretely visualize a more abstract thesis behind it, namely that towards the end of the upswing resources are shifted towards near future output.

What might Hayek's visualizing problem be? A clue lies in section 7 of *Profits, Interest and Investment* ([1939] 2012, pp. 223–226) in which Hayek raises problems with his own visualizing tool, the stages-of-production concept. It involves the capital-theoretic question of combining two different points of view (cf. Birner, 1999, p. 805). On the one hand there is the viewpoint of the Austrian theory of capital, which is intertemporal. It makes a "longitudinal section" of the economy. It considers what happens over a stretch of time and looks upon production as going on in stages through time. On the other hand there is the view of an economy as a dichotomy of a consumer goods industry and a machine producing industry. It is a viewpoint often encountered in the theory of the Ricardo Effect, and it is usually considered a "cross section" viewpoint of production. It considers what happens at a moment or a single interval of time (Wicksell, 1934, pp. 236–237; cf. Garrison, 2001, p. 47; cf. White, 2007, p. xxiv).

Hayek makes use of both the cross-sectional and the intertemporal viewpoints, although as an Austrian capital theoretician, it seems to me, he is principally thinking in intertemporal terms. Therefore Hayek has to translate the meaning of the "lengthening and shortening of roundabout production"—which is going on in multiple "stages"—into the cross-sectional scheme of a division of just two "industries." When we lay the intertemporal stages-of-production concept over the cross-sectional concept, we can say that the machine producing industries is the preceding stage of the consumer goods industries, while the consumer

goods industries is the following stage. The words “stage” and “industry” seem to have roughly the same meaning.

There is a complication, however, in laying the stages-of-production concept over the cross-sectional scheme of two industries. The consumer goods industry is the last stage; the machine producing industries comprise the one before that. But which industry is the preceding stage of the machine producing industries? The straight answer is that the machine producing industries are their own suppliers of capital goods—the industries are their own preceding stage. This phenomenon was called the “circularity” of the “partial self-reproduction of real capital” in the 1930’s capital debates (Kaldor, 1937; Eucken, 1940). In this lies Hayek’s visualization problem. The complication is the question how to fit such a “circularity” into the linear stages-of-production concept (Hayek, [1935] 2012, pp. 224–225).

Hayek recognizes this difficulty, but he also avoided exploring in which way he could come to a model that would include such circularities. The only clue he left was a reference to a study by Burchardt (1931) which commenced the German 1930’s capital debates ([1939] 2012, p. 225). This issue of “circularities” was also not drawn into discussion in the debates on Hayek’s theory of the Ricardo Effect in the early 1940’s (Wilson, 1940; Hayek, [1942a] 2012; Kaldor [1942] 2012). Nor has a discussion of its possible significance for “Ricardo Effects” appeared in the secondary literature since then (Lachmann, 1940; Lutz and Lutz, 1951; Gilbert, 1955; O’Driscoll, 1977; Haberler, 1986; Moss and Vaughn, [1986] 2010; Steele, 1988; Hagemann and Trautwein, 1998; Birner, 1999; Gehrke, 2003; Klausinger, 2012).

3. POINTS OF DEVELOPMENT OF HAYEK’S THEORY OF THE RICARDO EFFECT

In what follows is a list of points on which my development of the theory of the Ricardo Effect originates in Hayek’s theory of the Ricardo Effect. In my development I will deviate at various points from the importance that Hayek gives to certain aspects of his theory, such as his concrete thesis and his conclusions. I believe I can still call my theory a “development of the theory of the Ricardo Effect,” since almost all of these deviations are the result

of re-evaluating or developing the ideas and concepts of Hayek's original theory of the Ricardo Effect.

(1) I follow Hayek in believing that "a rate of profit rather than a rate of interest is the dominating factor in this connection" (ibid., p. 212). It means, I think, that the lead role in bringing about the crisis, at least in the second half of the upswing, lies not with capitalists that have malinvested their expenditure on fixed capital because of misguidance by the rate of interest (Hayek [1935], 2008, p. 272). On the contrary, it has to do with capitalists that unmisguidedly reap profits by decreasing their capital expenditure and increasing their operating expenditure (cf. Kaldor, 1939, p. 64; [1942] 2012, pp. 286–290; cf. Huerta de Soto, 2006, pp. 368–370).⁸

(2) I will stick to Hayek's initial assumption of a continuing credit expansion throughout the upswing, which was more or less tied to the rate of profit as the "dominating factor." I believe Hayek's 'retreat,' by changing his assumptions on the supply of credit during the upswing in "The Ricardo Effect" ([1942a] 2012), and so giving up most of what was original in his approach in *Profits, Interest and Investment* ([1939] 2012), has everything to do with his sticking to his concrete thesis that during the upswing the capitalists of the consumer goods industries decrease their capital expenditure.

(3) In terms of understanding the structure of production through theoretical concepts, section 7 of *Profits, Interest and Investment* ([1939] 2008, pp. 223–226) offers some very interesting suggestions for developing the "stages of production" concept from *Prices and Production* ([1935] 2008, pp. 223–252). Hayek left here much room for development, especially in incorporating the role of fixed capital and "circularities" into the concept of the stages of production.

(4) Comparing Hayek's theory of the Ricardo effect ([1939] 2012; [1942a] 2012), with Mises's chapter on the business cycle in *Human*

⁸ This thematic difference perhaps accounts for the fact that Hayek's theory of the Ricardo Effect is hardly integrated into modern versions of the Austrian Business Cycle Theory (ABCT). Modern versions of ABCT often build on Hayek's *Prices and Production* (e.g. Garrison, 2001, p. 11) and are largely occupied by explaining the malinvestment of capital expenditure during the business cycle through analyzing the circumstances of committing capital expenditure (ibid., p. 81).

Action ([1949] 1998, pp. 535–583), there is an interesting difference between these two originators of the Austrian business cycle theory. To Mises, the “very well known fact” is that the machine producing industries are “overloaded with orders” when the business cycle is approaching the upper turning point (*ibid.*, p. 583). This ‘stylized fact’ suggests that only in the downswing the machine producing industries will start to experience idle capacity. Hayek’s theory of the Ricardo Effect, however, posits the thesis that somewhere half-way the upswing of the business cycle, the consumer goods industries increasingly do *not* replace their worn-out machines and do *not* invest in modernizing their machinery ([1939] 2012, p. 219; [1942a] 2012, pp. 267–268). This suggests that the ‘stylized fact’ should be that there is already a fair amount of idle capacity in the machine producing industries when the business cycle approaches the upper turning point.

The interesting difference between Mises and Hayek is thus a difference in what is (according to Mises) and what theoretically ought to be (according to Hayek) the ‘stylized fact’ concerning the level of idleness in the machine producing industries as the business cycle approaches the upper turning point. I believe Mises is right about his stylized fact, which partly accounts for the main deviations between Hayek’s theory of the Ricardo Effect and my development of it. However, the connection with Hayek’s original theory is that I believe that Hayek was right in principle about the occurrence of a Ricardo Effect.

(5) Hayek relies in his theory of the Ricardo Effect on the wage rate as the major element in the profit mechanism, for capitalists will compare the “profit earned on the turnover of any amount of labor” invested for different periods ([1939] 2012, p. 215). The role of the wage rate seems therefore crucial in the theory of the Ricardo Effect, as Hayek clearly says that the “substance [of the Ricardo Effect] is contained in the familiar Ricardian proposition that a rise in wages will encourage capitalists to substitute machinery for labor and vice versa” (*ibid.*). However, Hayek subsequently also argued that “it is through this [Ricardo] effect that the scarcity of real capital will make itself ultimately felt” ([1942a] 2012, p. 259). In my development of the theory of the Ricardo Effect, I will deviate from Hayek’s original theory by taking the profit earned on the turnover of versatile fixed capital

as the major element determining “the rate of profit.” This is also consistent with point (3) above.

(6) In his theory of the Ricardo Effect, Hayek argues that a shift from capital expenditure towards operating expenditure takes place ([1939] 2012, p. 219; [1942a] 2012, p. 262; [1946] 2009, p. 149). Hayek’s suggestion that this increase in operating expenditure would occur “at a point somewhere half-way through a cyclical upswing” (Hayek [1939] 2012, p. 217) seems almost identical to Keynes’s finding that “the characteristic secondary phase of a credit cycle” was “due to the growth of investment in working capital” (Keynes, 1930, p. 252). Much earlier Lord Overstone, a leading member of the Currency School, had pointed towards widespread “overtrading” ([1857] 1972, p. 31)—pushing operating expenditure to or beyond the sustainable margin—in the excited last phase before the upper turning point. Now, whether increasing operating expenditure is the result of a shift from capital expenditure or not, it remains a ‘stylized fact’ of cyclical upswings that workers are employed in “over-time and double shifts.” Hayek’s theory of the Ricardo Effect can be seen as an attempt to explore this aspect of the business cycle, and its possible link to overconsumption (cf. Salerno, 2012). Although I will attempt to demonstrate a slightly different thesis than Hayek’s, the task remains to explain this increase in operating expenditure.

(7) In discussing the role of rising costs, and especially rising prices of raw materials, during the upswing, Hayek expands the model of a “crude dichotomy of industry into consumers’ goods industries and capital goods industries” into a trichotomy that also includes a raw materials industry ([1939] 2012, pp. 229–230). With Hayek this trichotomy remains a short verbal sketch, which I will attempt to develop.

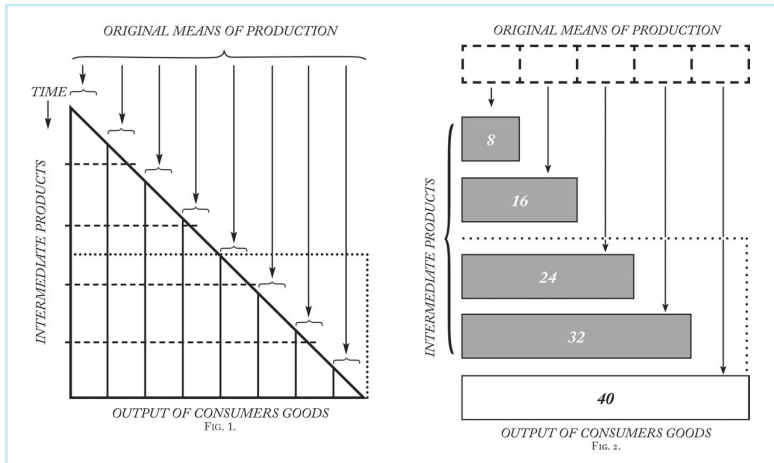
4. THE STRUCTURE OF PRODUCTION

4.1 The Difficulties of the Stages-of-Production Model

In *Prices and Production* ([1935] 2008) Hayek introduced his famous triangles of the structure of production, what he called the “stages of production.” What is important to mention about his triangles in that book, is that the first triangle he provides is a *longitudinal* or *intertemporal* triangle, reproduced as Figure 1 below (ibid., p. 228).

The second to sixth figures of triangles (such as Figure 2 below) are *cross-sections* of the first figure (ibid., pp. 232–247).

Figures 1 and 2



The difference between them is that Hayek’s cross-sectional triangles deal with the *current* distribution of inputs (and spending) among stages that are performed simultaneously “in a given period” ([1935] 2008, p. 232). A cross-section can be likened to a snapshot of a situation at a moment in time. The intertemporal understanding of the economic process follows from imagining the sequence of such cross-sections, much like a moving picture is actually a sequence of snapshots. Hayek moves from one cross-section to another in order to portray the changes in the structure of production due to either increased (voluntary) savings or (fiduciary) credit expansion (ibid., pp. 232–247). However, only the first figure is really intertemporal in itself (or “longitudinal,” as Wicksell would say). It not only represents *current* output of consumer goods and intermediate goods on the one hand, it also serves as a picture of *future* output due to the present allocation of resources. Hayek’s particular intertemporal triangle deals with the output due to the average length of production in a “stationary society” (ibid., p. 229). In a stationary society *future output* of consumer goods and intermediate goods is as high as the *current output* of those goods. The intertemporal function of this triangle may seem somewhat purposeless therefore, because there are no intertemporal differences of output in a stationary society. The point

is that if such a stationary society would be transformed into another stationary society with a longer average period of production, then after a period of transition in which the output of consumer goods is lowered, the current production of both intermediate goods and consumer goods will have increased. During the “traverse” between two stationary societies, some stages are partly abandoned, in order to perform stages not previously engaged in. After the traverse, the intertemporal triangle has become wider and longer.

As mentioned before, in *Profits, Interest and Investment* ([1939] 2012) Hayek reflects on the question of how the demand for capital goods plays out in the “structure of capitalistic production.” He argues that “a crude dichotomy of industry into consumers’ goods industries and capital goods industries is wholly insufficient to reproduce the essential features of the complicated interdependency between the various industries in real life” (ibid., p. 224). Certainly, this dismissal of the “crude dichotomy” is rather incompatible with the fact that he uses such a dichotomy in various parts of his theory of the Ricardo Effect. A telling example is Hayek employing a verbal model of “integrated firms” which consist of two departments; one department that produces commodities, another department that produces machines ([1942a] 2012, pp. 279–280).⁹ Hayek also extensively uses the closely related distinction between “expenditure on wages (or investment in ‘circulating capital’) and expenditure on machinery (investment in ‘fixed capital’)” (ibid., p. 262).

Besides commenting on the insufficiency of the “crude dichotomy,” Hayek also addresses the insufficiencies of his own stages-of-production model, which consists of more steps in the production process than just two.¹⁰ To Hayek, the stages-of-production model “is not quite adequate for the purpose” either ([1939] 2012, p. 224). He points out that it “gives the impression of a simple linearity of the dependency of the various stages of production which does not apply in a world where durable goods are the most important form

⁹ The (Marxian) dichotomy of consumers goods industries and machine producing industries was called the *Abteilungsschemen* in German (Eucken, 1940, p. 118), which literally stands for “departmental scheme” (Nurkse, 1935).

¹⁰ Hayek does not make explicit whether his doubts concern the longitudinal or the cross-sectional stages-of-production concept. I believe it refers to the cross-sectional stages-of-production concept.

of capital" (ibid.). This is because, as he admits, it was based on the "assumption that all capital used was of the nature of circulating capital" (ibid., p. 224). Hayek then speculates on a modification of his stages-of-production concept, by designating some stages as responsible for producing fixed capital:

If we designate the production of consumers' goods as stage I we can then classify the various industries which directly supply the consumers' goods industries with capital goods of various kinds as stages II, III, IV, etc., according to the more or less "capitalistic" character of the equipment which they supply. Stage II would supply the consumers' goods industries with the least capitalistic type of requirements, such as the raw materials and their simplest tools. Stage III would supply them with equipment of little durability and machinery of the least automatic type. Stage IV would supply a somewhat more capitalistic (more durable or more labour-saving) type of machinery, and so on to stage V, VI, etc., in ascending order. (ibid., p. 224)

Through this modification, a machine from stage IV could be delivered immediately to the consumer goods producers at stage I. That machine does not have to pass a number of stages in between. It is in the nature of circulating capital that it often does pass a number of stages when it is processed from raw materials into consumer goods. In this respect, Hayek certainly revises his expository device of *Prices and Production* ([1935] 2008).

But Hayek still feels that such an adaption of the stages-of-production concept "gives an undue impression of linearity of these relationships while in fact they may in many respects be rather circular in character" (ibid., pp. 224–225). What Hayek means must be something like this: The more labor-saving equipment provided by stage IV would be used to help produce the "simplest tools" that will be put out by stage II, while at the same time the "simplest tools" provided by stage II could also help to produce the "more labor-saving equipment" at stage IV. So for fixed capital, it is not only the case that a number of stages could be passed over when it travels from a higher to a lower stage. Its services may also be "put back" to a higher stage (Eucken, 1937, p. 541 *et passim*). This phenomenon of "circularities"¹¹ in the structure of production

¹¹ The phenomenon of "circularities" has also been described as "whirlpools" (Dorfman, Samuelson, and Solow, [1958] 1986, p. 205) and recently as "looping"

played an important role in the 1930s capital debates as it formed a challenging aspect to the ‘Austrian’ stages-of-production concept (Kaldor, 1937). Hayek alludes to this phenomenon by referring in a footnote to a study by Burchardt that started the 1930s capital debates in Germany (*ibid.*, 225). Hayek even notes Burchardt as having given “the most fruitful of all the recent criticisms of the ‘Austrian’ theory of capital” (*ibid.*).

This is the point in the original theory of the Ricardo Effect where Hayek practically invites it to be developed. Hayek offers a few pages of doubts and ideas about the stages-of-production model, but it does not lead up to a systematically elaborated improvement over *Prices and Production* ([1935] 2008). In what follows I will treat the relation of cross-sections to intertemporal output first, before addressing the “circular” relationships in the cross-section itself.

4.2 Sequences of Cross-Sections to Picture Intertemporal Changes

The longitudinal and cross-sectional aspects of the Hayekian triangle may easily get confused because the first figure on the one hand, and second to sixth figures on the other hand, are all triangular. In fact, Professor Garrison argues that “the Hayekian triangle has a double interpretation” (2001, p. 47). This double interpretation has resulted from fusing the two different kinds of triangles into one. For the further discussion, I propose to disentangle these purposes by keeping the cross-sectional and longitudinal aspects apart by not fusing them into a single stages-of-production concept. As far as the question of understanding the relationship between the intertemporal aspects of production and the interdependencies of industries, I find it useful to employ a cross-sectional model (not necessarily a triangular model) that pictures the *current* distribution of input, and then think of the future consequences of that current distribution in order to draw a subsequent cross-section.

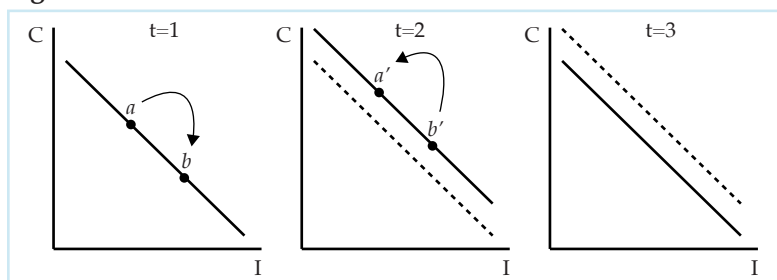
As a simple cross-section of an economy, we can take Professor Garrison’s *production possibilities frontier* or “PPF.” The PPF depicts

(Cachanosky and Lewin, 2016, p. 17). While Dorfman et al. and Cachanosky and Lewin seem to use these phenomena *against* the determinability of a structure of production, Lowe (1976, p. 34) uses it as evidence *for* such a determinability.

the current distribution between consumption-spending C and investment-spending I , as depicted in the three PPFs in Figure 3. Therefore, it could be said that “a crude dichotomy of industry into consumers’ goods industries and capital goods industries” is implied in Professor Garrison’s PPF, simply because it crudely divides the economies’ output into consumer goods and capital goods (ibid., p. 46). The underlying thought of Professor Garrison’s PPF is intertemporal, because “the economy grows to the extent that it uses its resources to the production of capital goods rather than the production of consumer goods” (ibid., p. 41). However, the PPF does not depict future output or future output capacity. But if we imagine a sequence of PPFs we could say that any PPF at time t is the result of the distribution between consumption-spending (C) and investment-spending (I) along the PPF at time $t-1$.

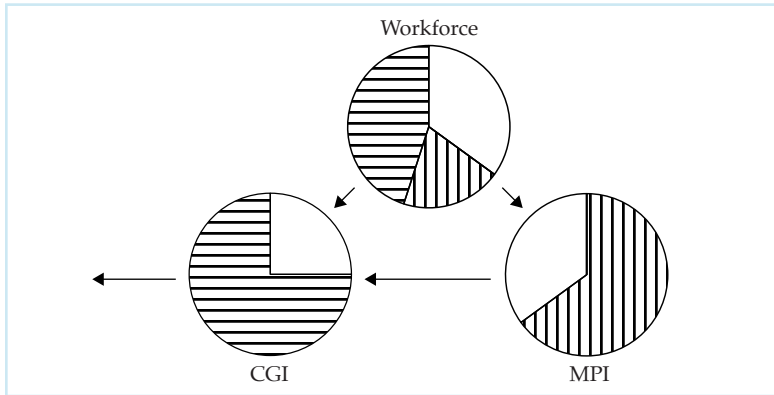
Such a sequence is actually depicted in Figure 3: Suppose a movement along the PPF towards more investment (a to b) takes place at $t=1$. This would imply that the economy has more resources at the next cross-section at $t=2$. In other words, it will have more resources at $t=2$ as the result of more resources being devoted to producing capital goods rather than consumer goods at $t=1$. The PPF shifts outwards from $t=1$ to $t=2$ (the dotted line at $t=2$ representing the PPF at $t=1$). Then at $t=2$ a new allocation would have to be made among consumption-spending and investment-spending. Suppose that this choice involves an allocation of such a small amount of investment-spending that the capital stock of the economy cannot be maintained intact (from b' to a'). This will mean that the PPF will shift inwards from $t=2$ to $t=3$.

Figure 3



In the above-pictured sequence of PPFs, all current allocations between consumption-spending and investment-spending involve a near-future/distant-future trade-off. But this PPF does not discriminate between the resources that are generally versatile, partially versatile, or completely specific. In reality, of course, some resources are capable of being “put back” to higher stages of production, but some are not. In order to make the cross-sectional model better adaptable to handling this problem, we can first convert Professor Garrison’s PPF into three related pie-charts (Figure 4 below). On top we have a pie—the *workforce*—which represent the allocation of a generally versatile resource, labor. Part of this pie will be allocated to the consumer goods industries (*CGI*, on the left below), part of it will be allocated to the machine producing industries (*MPI*, on the right below), and another part will represent the unemployed workforce.¹² Both pie-charts beneath the workforce-chart represent the level of capital utilization in each industry. The amount of workers allocated to an industry is correlated to the level of capital utilization, which is represented by the same pattern to illustrate each piece of the pie. For example, in the “workforce” pie-chart on top, the horizontal lines represent the number of workers allocated to the consumer goods industries, while in the *CGI* pie-chart the horizontal lines represent its level of capital utilization. The arrows pointing to the left represent an outflow of goods. Specifically, the output of consumer goods (the arrow left of the *CGI*) and the output of machines destined for the consumer goods industries (the arrow between the *CGI* and the *MPI* pie-charts). The arrows pointing downwards simply indicate that labor has to be allocated to each of the two industries.

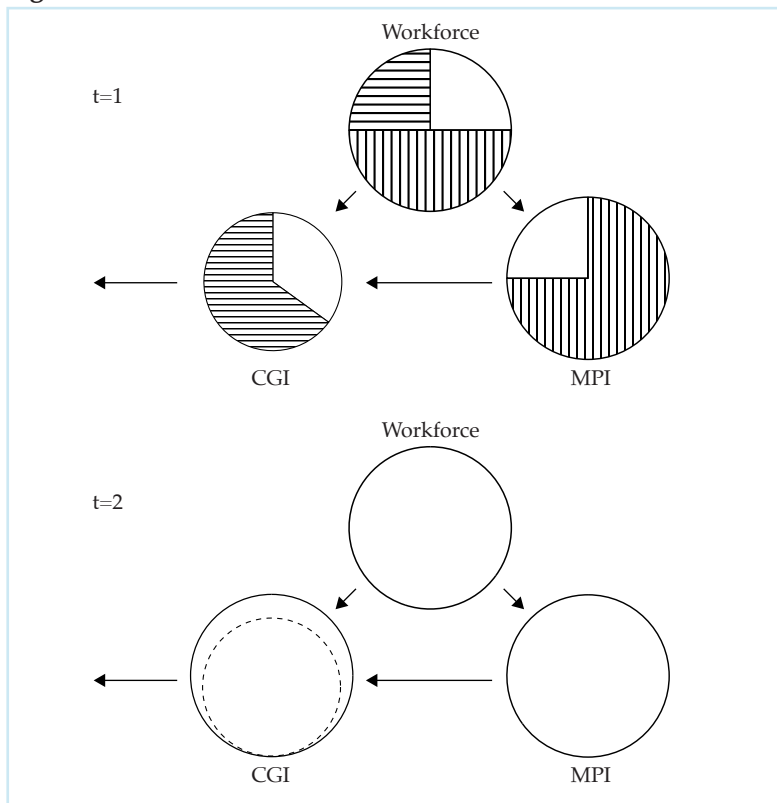
¹² The measure of unemployment can here be likened to the measure in which an economy operates within the bounds of the PPF.

Figure 4

Just as Hayek presented a series of subsequent triangles in *Prices and Production*, we could also present a sequence of these pie-chart models in order to follow the consequences to productive capacity by changing the current allocation of labor. An example is provided in figure 5 below. In this figure we will now also assume that the size of the consumer goods industries' pie-chart will represent its productive capacity. In other words, a larger pie means a higher productive capacity, and vice versa. This productive capacity must be maintained by the output of the workers allocated to the machine producing industries. In figure 5 it may be, for example, that 40 percent of the workforce must be allocated to the machine producing industries at $t=1$ in order to provide enough replacement machinery (over the next interval) so that the capacity of the consumer goods industries will be maintained intact at $t=2$. Now suppose that at $t=1$ some labor is re-allocated from the consumer goods industries towards the machine producing industries, so that 50 percent of the workforce will make machines. The cost of this re-allocation is that in the period between $t=1$ and $t=2$ less consumer goods will be made had the re-allocation not been made. The benefit will be that at $t=2$ more machines will have been delivered to the consumer goods industries than was necessary to maintain its capacity. Its capacity must have grown. In the next cross-section at $t=2$ this is represented by a larger circle for the consumer goods industries. The inner dotted circle represents the former capacity at $t=1$, in order to emphasize that capacity has changed. The way in which labor is allocated

among the pies of *CGI* and *MPI* at $t=2$ will, in turn, determine output of consumers goods during the next interval, as well as the new capacity of the *CGI* at $t=3$, etcetera. This allocation at $t=2$ is intentionally left blank in order to emphasize that the allocation at $t=1$ determines the capacity of the consumer goods industries available at $t=2$, but the allocation at $t=1$ certainly does not determine the way the workforce will be allocated in going from $t=2$ towards $t=3$.

Figure 5



4.3 Circularities in the Cross-Section

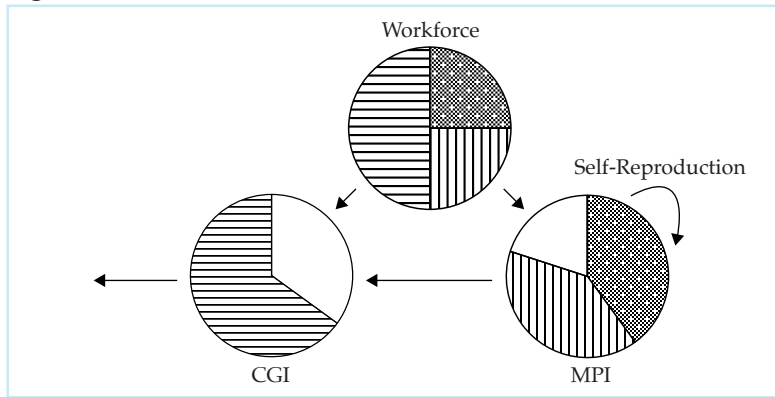
Let us now follow up on Hayek's reference to the "the most fruitful of all the recent criticisms of the 'Austrian' theory of capital" by Burchardt (1931).¹³ Burchardt's complaint against the Austrian theory of capital was that in its stages-of-production concept there is the assumption that in all contemporary production an initial stage of production exists that produces intermediate products without the help of intermediate products (*ibid.*, p. 540). Applied to Hayek's stages-of-production triangle, we can in fact see that in its highest stage only original means of production are applied, while in all other stages below that original means of production co-operate with intermediate means of production. In actual economies, Burchardt argued, there are no stages of production going on that work without the aid of intermediate products or "real capital." Burchardt, who preferred to theorize in terms of the "crude dichotomy" of consumer goods industries and machine producing industries, offers a simple example to support his claim. He notices that the machine producing industries, "next to machines for the consumers' goods industries also build the machines, that are applied for reproduction of themselves" (*ibid.*, p. 546). If the machine producing industries is looked upon as a stage, it would partly be its own higher stage of production. This was also called the "circularity" of the "partial self-reproduction of capital goods" by Burchardt (*ibid.*, p. 547).

Let us now incorporate into our pie-chart scheme this "circularity" of the "partial-self reproduction of real capital." We can picture this by drawing a circular arrow—representing "self-reproduction"—back to the machine producing industries. Also, we can now divide the pie-chart of the machine producing industries into three pieces: (1) Production for the consumer goods industries, illustrated by vertical lines; (2) the "self-reproduction," illustrated by the "+" marks; and (3) idle capacity, in white. This is also reflected in the allocation of the "workforce." Within the

¹³ In Hayek's original publication of *Profits, Interest and Investment*, he referred to Burchardt (1932), but as Professor Klausinger points out in his editing remark in Hayek ([1939] 2012, p. 225), there was also a first part published in 1931. As Burchardt (1931) focuses on the capital theory of Böhm-Bawerk and Burchardt (1932) on that of Marx, the first part is likely the one that Hayek meant (Hayek, [1939] 2012, p. 225).

machine producing industries, output capacity must be divided between providing the consumers goods industries with machines, and providing itself with replacement-machinery and additional machinery. In doing so we are also letting go of the assumption of a given productive capacity for the machine producing industries.

Figure 6



Again we could imagine a sequence of pie-chart models, a moving picture, that shows the intertemporal consequences of the current distribution of resources. Suppose, for example, that at $t=1$ more capacity of the machine producing industries is allocated towards “self-reproduction,” at the expense of production for the consumer goods industries. This will have the consequence that at $t=2$ the consumer goods industries will have lost some capacity due to worn-out machines for which the machine producing industries have not provided a replacement. However, the capacity of the machine producing industries must have grown from $t=1$ to $t=2$. This will give rise for new possibilities for the period between $t=2$ and $t=3$, because the additional capacity in the machine producing industries can now help rebuild the lost capacity of the consumers goods industries to a level higher than before (cf. Lowe, 1976, p. 110).¹⁴

¹⁴ Apart from adding the “circularity” I have also assumed full employment of the workforce. This is done to illustrate one of Hayek’s points regarding capital utilization: Idle capacity can exist in both the consumer goods industries and the machine producing industries despite all workers being fully employed. Idle capacity is not necessarily a sign that an economy operates within its production

In order to facilitate the understanding of the time-structure of production vis-à-vis the linear-and-circular relationships of industries, I think it is advisable to reserve the word “industry” to the cross-sectional model, and to reserve the word “stage” (and “stage of production”) to the intertemporal considerations. The word “industry” refers then not to the type of output, but to the type of current fixed capital input. The consumer goods industries are the industry with the specific equipment, the machine producing industries are the industry with the versatile equipment. The word “stage” refers then to the time-distance of the contribution of the output of an industry for final consumption (cf. Eucken, 1940). The consumer goods industries always perform a last stage, it is an industry that processes raw materials into consumer goods. However, the machine producing industries can perform any number of stages: A short time-distance towards contributing to consumption would be to use the currently available capacity of the machine producing industries towards building machines for the consumer goods industry directly. A more roundabout approach would be to first perform the stage to build additional, but similar, equipment for the machine producing industries itself. With more capacity in hand, it could then perform a second stage of building more machines for the consumer goods industries than with the aforementioned “direct” method. A still more roundabout approach would be to first perform two or more stages of developing more elaborate machine-tools than are now in existence. This will undoubtedly take a longer time than to manufacture equipment similar to a type already in existence. Again a next stage would be to manufacture machines for the consumer goods industries, which could be of a more labor-saving type.

5. THE RICARDO EFFECT IN THE MACHINE PRODUCING INDUSTRIES

The key difference between the consumer goods industries and the machine producing industries is that the former can utilize its current capacity to fulfill the orders of its customers *and* let

possibilities frontier. A lot of factories will be left idle during evenings, nights and weekends, and this does not necessarily mean an inefficiency in the economy (Hayek, [1936] 1984, p. 175 *et passim*).

additional capacity be installed by an outside industry. There need be no choice between operating expenditure and capital expenditure when credit is elastic. Operating expenditure can be increased until full capacity is reached; capital expenditure can be increased to get more capacity.¹⁵ Contrary to the consumer goods industries, the machine producing industries cannot outsource the task of building their own capacity to another industry. So even under elastic credit the machine producing industries do have to shift between operating expenditure (producing for the consumer goods industries) and capital expenditure (producing for itself). If the Ricardo Effect is a creature, the machine producing industries could be its natural habitat.

From the perspective of the consumer goods industries we can say that voluntary saving would mean a relative decline in consumer spending. The consumer goods industries would need to order more labor-saving machinery to be able to reduce their operating costs and so still make profits. With fiduciary credit expansion there would not be a similar reduction in consumer spending. It seems that it is likely that this encourages entrepreneurs in the consumer goods industries to enlarge the scope of their activities, to invest in more productive capacity. At the same time, they have less incentives for cost-saving equipment than in the case of voluntary savings.

When we turn to the point of view of those that build the machines, it is also likely that an increased demand from the consumer goods industries for machines, fueled by inflationary credit, makes the prices of machines rise relative to wages and materials. What will the machine producing firms do under such an "acceleration effect"? These firms must either (1) allocate capacity to provide the consumer goods industries, or (2) invest in their own output capacity by declining to fulfill orders from the consumer goods industries. The second option, investing, means machine producing firms buy their own output at higher shadow prices than they did before the credit expansion. They would do this if they expect that, with increased capacity in the next period,

¹⁵ Under elastic credit and increasing consumer spending, operating expenditure would only be increased until marginal operating revenue equals marginal operating costs, which may or may not be achieved before full capacity utilization.

demand will still be as high as to compensate the opportunity cost of not serving customers in the present period. The first option simply means not to invest, but to manufacture and sell more machines for the consumer goods industries and reap 'windfall profits.' This option means higher profits than before, because credit expansion has inflated the prices of machines.

When we are at the beginning of what is expected to be an upswing, machine producing entrepreneurs may perhaps decline orders so they can increase capacity somewhat later. But concerning the latter half of the upswing, the Hayekian answer would, with a little speculation, be not much different than what Hayek said about his own, roughly similar question in "The Ricardo Effect":

The answer, I think, is to be sought *firstly* in the fact that the provision for the near future will necessarily have the first attention of the entrepreneur, because if the profits which might be made in the near future are not obtained, they (and perhaps a certain amount of permanent business) will be lost to a competitor. ([1942a] 2012, p. 281)

Obviously it depends on the individual entrepreneur in question in how far he will not fulfill current demand in order to have a greater capacity to fulfill future demand. In any case, current demand is a more or less measurable thing for the entrepreneur, while future demand is partly guesswork. When profit potential on current business rises, each entrepreneur must have some point at which he will tap into that current profit potential at the expense of a possibly greater—but more uncertain—profit potential somewhat further in time. The argument here is that there *must be* such a point at which the entrepreneurs in the machine producing industries tap into current profit potential at the expense of enlarging the productive capacity of their own industries. To deny this would mean that there is never any provision for the present or the near future at all, all resources being devoted to a never fulfilled future demand. The thesis here is thus that a credit-accelerated 'derived demand for machines' emanating from the consumer goods industries will—sooner or later during the upswing—result in reaching that point at which resources in the machine producing industries are allocated towards near future output.

If this thesis is admitted as correct, it explains an important fact. Mises pointed to this fact in his chapter on the business cycle in

Human Action ([1949] 1998), actually while discussing the “acceleration principle.” Here Mises indicates that:

[i]t is a very well known fact that the more the boom progresses, the harder it becomes to buy machines and other equipment. The plants producing these things are overloaded with orders. Their customers must wait a long time until the machines ordered are delivered. This clearly shows that the producers’ goods industries are not so quick in the expansion of their own production facilities as the acceleration principle assumes. (*ibid.*, p. 583).

The consumer goods industries can outsource the production of the machinery they need to the machine producing industries; they can emanate a ‘derived demand for machines’ to this other industry. However, this is not so for the machine producing industries. Its derived demand for machines emanates in a circle back to itself. Therefore, the acceleration effect goes, as an American phrase says, only “as far as it goes.” Where this ‘derived demand for machines’ can get no further, because it has reached the highest stage of production for fixed capital, so to speak, the sober realization comes that the machine producing industries cannot magically expand. An allocative choice must be made, and it will be made on a profitability calculation. The “producers’ goods industries” that Mises wrote about may simply find it profitable—sooner or later during the upswing—to be not so quick in the expansion of their own production facilities, but rather collect windfall profits on a credit induced ‘capex boom’ (cf. Brown, 1957, p. 424; cf. Floud, 1976, pp. 61–67). The fact that the machine producing industries are overloaded with orders—rather than rejecting these orders so that the machine producing industries can expand—seems ample proof that a Ricardo Effect is happening there as the boom progresses towards the upper turning point.

7. THE RICARDO EFFECT IN THE RAW MATERIALS INDUSTRY

The Ricardo Effect in the machine producing industries still does not provide a complete explanation of “the partial scarcity of capital,” and with that, of the upper turning point. But it can serve as a stepping stone towards a second thesis. This thesis is

that a Ricardo Effect in the raw material industries is the reason for an increasing ‘scarcity of circulating capital’ as the upswing progresses (Lachmann and Snapper, 1938; cf. Hayek [1939] 2012, pp. 229–230; cf. Mises, [1949] 1998, p. 561). This increasing scarcity of circulating capital may be the proximate cause of the upper turning point, because the rising operating costs due to the relatively rapid rise in raw materials prices must start to put some marginal producers out of business as the upswing progresses. In order to provide some support for this thesis we must now return to the scheme of the structure of production.

In *Profits, Interest and Investment* ([1939] 2012), while discussing the rising prices of raw materials during the upswing, Hayek sketches a ‘verbal model’ of a three-sector economy containing a consumer goods industry, a machine producing industry and a raw materials producing industry (cf. Lachmann, 1940). Apart from the consumer goods industries, Hayek tries to reconcile the stages-of-production concept with the existence of the capital goods industries by distinguishing the latter further into “industries [...] which specialise in the production of [...] durable equipment” (Hayek, [1939] 2012, p. 226) or “producers of machinery” (ibid., 229) on the one hand and “raw material industries” (ibid., p. 231) on the other. These three sectors have peculiar functional relations among each other: The principle of derived demand is fully applicable to the relation between the consumer goods industries and their suppliers of raw materials. The reason is that: “raw materials are required in practically fixed amounts per unit of output of any particular commodity” (ibid.). But this is not so between the consumer goods industries and the machine producing industries, Hayek points out: An increase in demand for consumer goods may or may not increase the demand for machines, because increases in demand can often be met by a higher degree of capital utilization (“over-time and double shifts”). So the level of demand for consumer goods and the level of ‘derived demand for machines’ cannot be as correlated as the level of demand for consumer goods and the ‘derived demand for raw materials’ must be.¹⁶

¹⁶ Hayek gives the *acceleration principle* therefore a “multiplier”: Suppose a firm has ten machines that each help produce a thousand products a day per 10-hour shift. Suppose also that demand increases by a thousand products a day. This firm can

Building on Hayek's idea of a trichotomy, the pie-chart scheme of a dichotomy between a consumer goods industry and a machine producing industry can be ameliorated with the raw materials industries. For this we will move the machine producing industries to the top of the scheme to symbolize its "strategic position in any industrial system" because of its self-reproducing capabilities (Lowe, 1976, p. 30). Labor, the generally versatile factor in Hayekian capital theory, takes center stage. The raw materials industries will form a separate sector that supplies both the consumer goods industries and the machine producing industries (cf. Weitzman, 1971, p. 513).

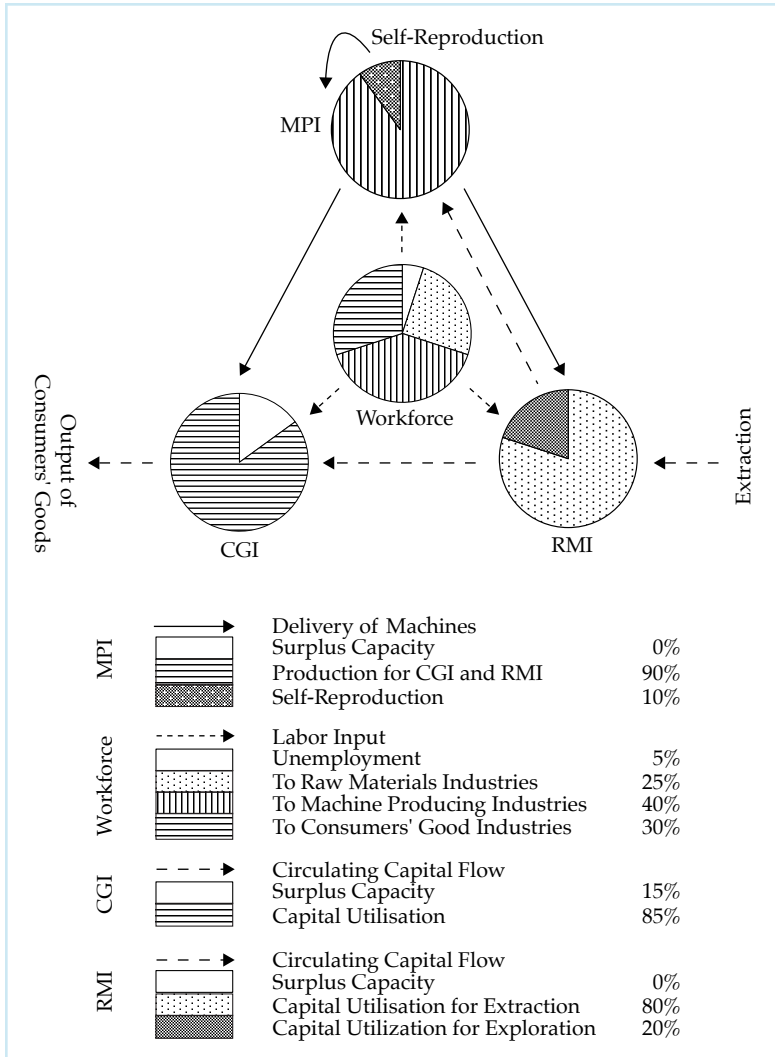
A 'circulating capital flow' leaves the raw materials industries and becomes 'goods-in-process' when it travels to the consumer goods industries. However, the circulating capital flow can also be diverted from that industry towards the machine producing industry. By this we visualize the idea that "iron may build machinery instead of park railings," that is, the possibility that raw materials can be "put back" to an earlier stage of production (Böhm-Bawerk, 1891, p. 112; Eucken, 1940).

Besides this choice in allocating its output, the raw materials industries must also make an allocative choice of its inputs (cf. Hayek, [1939] 2012, p. 230). The equipment it owns is to a certain extent versatile enough to either extract from currently operable natural resources¹⁷ (operating expenditure) or to explore for new natural resources and put them into operation (capital expenditure). The capacity of the raw materials industries is, as such, partly determined by the amount of machinery it receives from the machine producing industries and partly by the way it allocates its machinery. In other words, the raw materials industries cannot fully outsource the maintenance and extension of its productive capacity towards another industry. The raw material industries may therefore also be a habitat of the Ricardo Effect (ibid.).

either order another machine (a multiplier of one); it can order two machines if it expects demand to increase to 2000 products extra a day (a multiplier of 2); or it orders no machines at all if it increases its capital utilization by working each current machine an extra hour a day. Hayek's "multiplier" thus measures the correlation between increase in demand for consumer goods and the related demand for machines.

¹⁷ An oil field under the sea is a natural resource. The oil field becomes an *operable* natural resource if there is an oil platform on top of it that is able to extract the oil.

Figure 7



If we stick to the assumption of elastic credit, we must ask how and where additional credit will be spent once credit has subsidized the machine producing industries into full employment. As credit cannot procure any additional machines, output can only be increased by additional operating expenditure

(cf. Machlup, [1940] 2007, pp. 207–230; cf. O’Driscoll, 1977, p. 98). This implies not only higher employment, but also higher consumption of raw materials. Are the raw material industries, in such a boom, willing and able to increase their own productive capacity to such an extent that they can keep up with such a rising demand? If not, this would imply that an increasing scarcity of circulating capital is the phenomenon that could choke off the upswing. First, I think we could question the ability of the raw material industries to obtain enough equipment in time from the machine producing industries when the latter are already overloaded with orders. Second, the profit incentives to allocate those versatile resources which are capable of both exploration and exploitation will, in a way much similar to the profit incentives of the machine producing industries during the boom, shift in favor of providing for the near future at the expense of the more distant future.

In his original theory of the Ricardo Effect, Hayek sought an explanation for the fact that during booms raw materials rise faster in price than consumer goods ([1939] 2012, p. 229). If this is indeed a ‘stylized fact,’ it may explain that at some point during the upswing, marginal producers will be going out of business, as their operating revenue will no longer cover their operating expenditure (Mises, [1949] 1998, p. 561). It will also cause downsizing in the scale of operations with other producers.

Such an explanation of the proximate cause of the upper turning point may not seem incompatible with a purely monetary explanation of the crisis, as it could be argued that the rise of raw materials prices is due to a lack of credit for building additional productive capacity in the raw materials industries. In other words, one could argue that a credit rationing is behind the rise of raw materials prices.

I hope that the above development of the theory of the Ricardo Effect helps to explain why it is not a lack of credit, but rather the expansion of credit that helps to drive raw materials prices up. The credit contractions which are typical of upper turning points may very well be explained as a reaction of the banks to the revealing of malinvestments—i.e. to losses and bankruptcies—which themselves are caused by the rise in the prices of raw materials.

CONCLUSION

The Ricardo Effect has too often been interpreted too narrowly as a “substitution of capital by labor.” By taking a broader perspective, it has been possible to rebuild Hayek’s theory of the Ricardo Effect around a different thesis than Hayek’s own. Hayek could not win the debate over his original thesis, namely the thesis that, under elastic credit, a decline of investment by the consumer goods industries would occur during the upswing. The reason for this is simply that the consumer goods industries can outsource the production for additional productive capacity to an outside industry. This being the case, the consumer goods industries can increase both operating expenditure (increase capital utilization) and capital expenditure (order more capacity) at the same time. When I investigated the main capital-theoretic issue of the original theory of the Ricardo Effect, namely the “circularity” of the “partial self-reproduction of capital goods”—to which Hayek pointed—I have concluded that the machine producing industries cannot outsource their need for additional capacity to another industry. This realization is crucially important for the theory of the Ricardo Effect, as it helps identify the machine producing industries as the perfect habitat for the Ricardo Effect. I have also concluded that there is indeed enough reason to assume that elastic credit drives up the prices of machines in such a way that it can indeed give rise to a Ricardo Effect in the machine producing industries as a credit-induced upswing progresses. Following important clues that Hayek left, I have also been able to argue for a second thesis, by considering that after the Ricardo Effect occurs in the machine producing industries, and credit remains elastic, overall operating expenditure must increase. The second thesis was that as the boom progresses further, also a Ricardo Effect in the raw materials industries will occur, because also the raw materials industries cannot fully outsource the production of additional productive capacity to an outside industry.

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