
Hayek's Ricardo Effect: A Second Look

Author(s): Laurence S. Moss and Karen I. Vaughn

Source: *The American Journal of Economics and Sociology*, JANUARY, 2010, Vol. 69, No. 1, Laurence S. Moss 1944-2009: Academic Iconoclast, Economist, and Magician (JANUARY, 2010), pp. 333-358

Published by: American Journal of Economics and Sociology, Inc.

Stable URL: <https://www.jstor.org/stable/40607759>

JSTOR is a not-for-profit service that helps scholars, researchers, and students discover, use, and build upon a wide range of content in a trusted digital archive. We use information technology and tools to increase productivity and facilitate new forms of scholarship. For more information about JSTOR, please contact support@jstor.org.

Your use of the JSTOR archive indicates your acceptance of the Terms & Conditions of Use, available at <https://about.jstor.org/terms>



is collaborating with JSTOR to digitize, preserve and extend access to *The American Journal of Economics and Sociology*

JSTOR

Hayek's Ricardo Effect: A Second Look

By LAURENCE S. MOSS* and KAREN I. VAUGHN

I

Introduction

In this article we review a long-standing controversy in twentieth-century economic thought: the debate over Hayek's Ricardo effect. Hayek developed his interpretation of the Ricardo effect in the context of his theory of business cycles primarily in the late 1930s and early 1940s. At that time Hayek's use of the familiar proposition was held up to close scrutiny by many talented critics, including Nicholas Kaldor, H. D. Dickinson, and R. G. Hawtry, all of whom, according to Hayek, failed to understand what he was saying.¹ In each case Hayek countered their criticism with a restatement of his proposition which in turn failed to satisfy the critics.² Indeed, this apparent miscommunication was still taking place as late as 1969 when Hayek wrote his last piece on the Ricardo effect in answer to a criticism leveled by Sir John Hicks.

The purpose of our article is to discover whether in this debate it was Hayek who was out of step with the profession or the profession that was out of step with Hayek. We shall argue that the reason that Hayek's argument seemed so elusive to his contemporary colleagues (and some later critics) was that his method of analysis was foreign to their way of thinking. While English economists in the 1930s (especially after Keynes published the *General theory*) were concerned primarily with the static problem of balancing income and expenditure flows at acceptable levels of employment, Hayek was attempting to develop a dynamic theory of business cycles that involved tracing out the path of adjustment of the capital stock of an economy from one

This article was first published in *History of Political Economy*, Vol. 18, ps. 545–565. Copyright 1986, Duke University Press. Reprinted by permission of the publisher.

*Correspondence may be addressed to Professor Moss, Dept. of Economics, Babson College, Babson Park (Wellesley) MA 02157-0901; or to Professor Vaughn, Dept. of Economics, George Mason University, 4400 University Drive, Fairfax VA 22030.

American Journal of Economics and Sociology, Vol. 69, No. 1 (January, 2010).

© 2010 American Journal of Economics and Sociology, Inc.

equilibrium state to another. This problem of describing the transitional process only became the subject of serious professional attention long after the debate over the Ricardo effect was concluded.³

In the course of our exposition, we will demonstrate that Hayek's Ricardo effect was not, in Blaug's words, "only another instance of the vice of neoclassical economics: the hasty application of static theorems to the real world."⁴ Indeed, we shall argue that this is the *last* accusation one could logically hurl at Hayek's analysis. The very reason why Hayek encountered so much difficulty in communicating his message was precisely that he was not presenting an exercise in comparative statics but was rather hypothesizing a particular adjustment process where the final equilibrium state depended upon the particular path of adjustment followed in the economy.

In recent years the founders of the 'new classical economics' have praised the broad outlines of Hayek's approach to the business cycle. Robert Lucas pointed out that as early as 1929 Hayek articulated what remains today the single most important theoretical question in business cycle research. Hayek asked, How can cyclical phenomena be incorporated "into the system of economic equilibrium theory?"⁵ Lucas goes on to regret the unfortunate Keynesian diversion of research effort from a thoroughgoing theory of the business cycle to what, in Lucas's words, is the "simpler question of the determination of output at a point in time"⁶ It is well known that Hayek also regretted the unfortunate "Keynesian diversion" and resisted the redirection of research away from what he considered to be one of the most important macroeconomic questions: how production structures adjust to the underlying demand conditions and savings patterns of the community. It was this concern that made him wary of an economic theory that made it appear possible to push an economy into a perpetual state of boom.⁷ He feared that instead of perpetual boom, inflationist policies would only result in short-term, illusory gains followed by a collapse with all of its undesirable macroeconomic effects.

Hayek's approach (much like the modern approach of Lucas and others) was to derive macroeconomic consequences from an analysis of the self-interested behavior of market participants. This was a continuation of the Misesian research program of reducing aggregative relationships to statements about individual action in markets.⁸

Hayek's particular analytic structure combined elements of a Wicksellian cumulative expansion that included Cantillon effects with an 'Austrian' description of production as consisting of a succession of stages that had to be synchronized and coordinated with each other through appropriate price signals.⁹ This framework allowed Hayek to argue that changes in the quantity of money would have non-neutral effects on individual prices and on the allocation of resources. All this led Hayek to admit the stimulative impact of Keynesian monetary policies but severely criticize the Keynesian claim that unemployment could be permanently cured by government-engineered expansions of aggregate demand. If governments try such engineering, they will be thwarted by the Ricardo effect.

We have organized our discussion as follows. In Section II we identify two uses of the Ricardo effect in Ricardo's *Principles*, each of which bears a certain similarity to the mechanism Hayek finally developed. In Section III, we trace the intellectual roots of Hayek's theory to the 'reverse movement' problem in the trade cycle theory of Ludwig von Mises. Mises' theory was itself a variant of the 'cumulative process' analysis first presented by K. Wicksell at the turn of the century. In Section IV, we summarize Hayek's main concern during the 1930s, that economic development required voluntary savings on the part of the economy and that government-created booms would prove to be self-defeating. The Ricardo effect served as the trigger that would bring on the crisis. In Section V we review the substance of the Hayek-Kaldor debate over the micro-foundations of the Ricardo effect. This debate was especially important to the development of Hayek's theory. It was by responding to Kaldor's formidable criticisms of that mechanism that Hayek finally realized why the comparative static approach based on perfect information was totally out of step with the type of phenomena Hayek was trying to model.

II

Ricardo's Ricardo Effect

As a proposition in comparative statics, the Ricardo effect compares two equilibrium states of the economy—before and after a change in relative factor prices has induced a switch in production techniques. As

part of a dynamic theory, the Ricardo effect examines the path by which an economy reestablishes equilibrium after a disequilibrating shock to the system occurs. Both uses of the Ricardo effect appear in Ricardo's *Principles*, and both uses influenced Hayek in naming his own composite mechanism of relative price changes after the work of his English predecessor.¹⁰ It may be helpful to explain the Ricardo effect as it appeared in Ricardo's *Principles* so as to better appreciate the way in which the mechanism functions in Hayek's trade cycle theory.

Comparative Static Statement

In his famous first chapter "On Value" in the *Principles*, Ricardo explained why the labor theory of relative commodity prices breaks down in a capital-using economy. It breaks down because of different durabilities of capital or, as Ricardo noted elsewhere, the varying role of time in the production of commodities.¹¹ More specifically, Ricardo demonstrated why a sudden across-the-board rise in wages must raise the prices of commodities manufactured with labor-saving machinery by a lesser amount than that same wage increase will raise the prices of commodities produced without any machinery at all. His analysis proceeded in two steps.

First, at the 'firm level,' the manager finds himself indifferent between two techniques of production, Technique A and Technique B, each capable of producing a given volume of output at the same identical cost. Technique A, consists of a \$5,000 machine lasting one year and capable of performing 100 man-years of work. Technique B, consists of directly hiring 100 man-years of labor to do the work unaided by any machinery at all. At a supposed wage of \$50 per man-year, both techniques cost \$5,000. Ricardo explained that it is obviously a "matter of indifference" to the manager which of the two techniques is used.¹²

The second step of Ricardo's argument requires that we upset this state of indifference by supposing wages unexpectedly rise from \$50 per man-year to \$55 per man-year—a 10 percent rise in wages. Technique B, the labor-intensive technique, will now cost \$5,500. The machine-intensive technique, Technique A, will also increase in price, but not by as much. The price of the machine cannot increase to \$5,500 because if it was formerly profitable to sell those machines at

\$5,000 (the price of the machine prior to the rise in the price of labor), then each machine had to have contained *less than* 100 man-years of labor to allow for profits to the machine makers. As a general rule, a machine must contain less labor than it displaces; and so a rise in wages will raise its price by *less than* 10 percent.¹³ Faced with a cheaper way of getting the work done, the manager will substitute the machine method for the direct-labor method of production.

Now moving from the firm level of analysis to the economic system as a whole, Ricardo was quite explicit about the role competition plays in keeping machine producers from increasing the prices of their machines by the full 10 percent. Such an effort would elevate profits among machine manufacturers above the going rate established by the productivity of marginal investments in agriculture.¹⁴ This would create a situation in which an "unusual quantity of capital" would flow into machinery manufacture expanding the supply of machines and forcing their prices down.¹⁵ Competitive forces would therefore drive the price of machines down again.

A corollary of Ricardo's argument is that the substitution of machinery for labor causes the prices of commodities produced with machines to decline relative to the prices of commodities produced entirely with direct labor. In other words the adoption of labor-saving machinery by capitalist-managers, in an effort to maximize profits, eventually results in a decline in specific consumer-goods prices.¹⁶ Thus, we can summarize the conclusions of the comparative static version of Ricardo's Ricardo effect as follows:

- (i) A rise in wages will encourage managers to substitute machine-intensive for labor-intensive methods of production; and
- (ii) In the new equilibrium position, the prices of consumer goods made with (labor-saving) machinery will decline relative to the prices of other commodities.¹⁷

The Ricardo Effect in a Dynamic Context

Hayek refers to a second place in Ricardo's *Principles* to support his use of the Ricardo effect: Chapter 31 "On Machinery." In that now famous chapter, Ricardo addressed the problem of whether the introduction of a new technology could ever make workers worse off.

Added only in the third edition, his surprising conclusion was that under certain circumstances, the introduction of a technological innovation could reduce the real wages of labor and lead to unemployment in the short run.¹⁸ He argued that if the introduction of the new technology is sudden and there is no growth in the economy, the fact that labor will have to be diverted from the production of consumer goods to the production of capital will lead to a reduction in the real wage of labor and to reduced employment.¹⁹ That is, during the transition period while new capital goods are being produced, less food can be produced with the same total resources as one had before. Hence in the next time period, workers find that there is less for them to buy with their money, reducing their real wages, and they find that some of the labor that was previously employed has now become 'redundant' because of the increased productivity of the new machinery. Here we have the germ of the idea that later appears in the Austrian theory of the boom—that capital-intensive methods of production cannot be instantly installed; rather, a costly transition period must be financed and this financing requires real savings on the part of the community. It was an idea, however, that Ricardo himself did not explore further.

After raising this extremely interesting problem about the process by which new capital goods are financed, Ricardo assured his readers that the practical significance of his example of an innovation crisis was slight. These conditions could occur only in an economy without net investment, and even then it would only be during the temporary transition period that the workers would experience distress.²⁰ As a practical matter, sudden switches from "circulating to fixed capital" occur concurrently with capital accumulation. This meant that there is typically enough real community savings available to sustain the flow of consumer goods while some labor is being diverted to constructing capital goods. In the context of capital accumulation all that happens is wages rise less quickly than they otherwise would. The financing of the new capital goods does not require that wages fall absolutely. Thus, with net investment, the introduction of new technology during the process of accumulation improves the economic welfare of the workers. The worker's wage is lower than it would otherwise be, but higher than it was in the past.

Hayek's Version

As recently as 1969 Hayek articulated his Ricardo effect theorem that “an increase in the demand for consumer goods will lead (in conditions of full employment) to a decrease in the demand for the kind of investment goods appropriate only to more highly capital-intensive modes of production”²¹ Hayek demonstrated that the Ricardo effect can be presented as a theorem in comparative statics by comparing two equilibrium positions identical in all respects except one—the ratio of product-to-factor prices is higher in one than in the other.²² But as the rest of his 1969 restatement made clear, Hayek’s Ricardo effect was employed to do a great deal more than simply compare the logic of choice under varying patterns of relative prices. The *raison d’être* of the mechanism was to explain why the end of the boom phase of the trade cycle nearly always consists of a depression.

Much as Ricardo had used his proposition to draw out the possible disequilibrium consequences of the attempt to introduce a new technology before adequate savings are available, Hayek used the Ricardo effect as an important component of a dynamic theory of the trade cycle to elucidate the implications of a disequilibrium phenomenon. Drawing on the comparative static proposition in Ricardo’s chapter I, Hayek employed the notion that changing real factor prices induce entrepreneurs to switch from labor-saving methods of production back to labor-intensive methods, thereby ending the boom. But what is it that caused the factor prices to change in the first place? As early as 1931 Hayek elaborated that successfully switching from a labor-intensive to a labor-saving technology requires that there be a diversion of national product from consumption to investment so as to “finance the transition.” According to Hayek it was “voluntary savings” that provided this “diversion” and nothing else could do as well. An inflationary process seldom succeeds, because it relies on “forced savings” rather than voluntary savings, and forced saving is rarely if ever adequate. As we shall explain below the inadequacy of forced savings manifests itself in a change in factor prices ultimately inducing the switch back to labor-intensive methods of production and the crises.

Hayek referred his readers to *both* chapters in Ricardo's writings to support his analysis. Several commentators compare Hayek's mechanism to Ricardo's first version and fail to emphasize the close connection between the argument of Ricardo's chapter "On Machinery" and the central problem of Hayek's theory.²³ In addition to the influence of Ricardo's *Principles* on Hayek, we must also consider the impact of a particular unresolved problem in the so-called Austrian theory of the business cycle on Hayek's thinking about economic problems.

III

The Reverse Movement Problem

During the 1920s Ludwig von Mises' 'circulation-credit' theory of the business cycle (now commonly called the 'Austrian' theory) was widely regarded as the most important of the contributions of the younger generation of Austrian writers to modern, neoclassical economics.²⁴ Mises took issue with the phenomenon Wicksell described in his *Interest and prices* of a steady and evenly accelerating increase in prices so long as the market rate of interest is held below the natural rate and the quantity of money steadily increased.²⁵ According to Mises the injection of new money into the economy has to raise certain prices ahead of others as entrepreneurs try to construct more capital-intensive investment projects. When new money enters the economy through the loan market, after a period of economic expansion consumer-goods prices will rise ahead of wages, and this will encourage entrepreneurs to substitute labor-intensive for capital-intensive techniques of production. This will discourage the sales of capital goods and bring about an economic crisis. The process of capital-goods construction cannot go on indefinitely. Mises insisted that a 'reverse movement' must inevitably set in, ending the boom and ushering in the crisis even if entrepreneurial expectations were to remain optimistic and even if the operation of the international gold exchange standard did not produce contractionary pressures on the banking system.²⁶ Mises' discussion of the reverse movement problem was incredibly terse:

This is one of the ways in which the equilibrium of the loan market is reestablished after it has been disturbed by the intervention of the banks. The increased productive activity that sets in when the banks start the policy of granting loans at less than the natural rate of interest at first causes the prices of production goods to rise while the prices of consumption goods, although they rise also, do so only in a moderate degree, viz., only insofar as they are raised by the rise in wages. Thus the tendency towards a fall in the rate of interest on loans that originates in the policy of the banks is at first strengthened. But soon a counter-movement sets in: the prices of consumption goods rise, those of production goods fall. That is, the rate of interest on loans rises again, it again approaches the natural rate.²⁷

While this analysis set forth a broad outline of a theory of the trade cycle, it left several theoretical questions unanswered. The most important from the Austrian point of view were these: What was the market mechanism that could bring about the counter-movement? How can one explain how each entrepreneur pursuing his own interest can be led to make decisions which, when reconciled with the decisions of other managers, produce the end of the boom and the subsequent crisis? In other words, what are the microeconomic foundations for the "spontaneous *disorder*" that seems to characterize the business cycle?

Shortly after Hayek arrived in London, he was invited to deliver the special university lectures at the London School of Economics (1930–1931). Hayek used this occasion to elaborate on the Mises account of the boom and crisis in a way that made more explicit use of the Austrian description of production as a succession of stages through which resources must pass toward their ultimate destination of becoming consumer goods. This course would enable him to explain, he believed, why a credit-financed boom would necessarily have to end in crisis. The published version of his lectures, *Prices and production* (1931) immediately attracted the interest and commentary of most of the leading economists of his day and led to his appointment to the prestigious Tooke chair at the London School.²⁸

Hayek analyzed the reverse-movement problem in Lecture 3. According to Hayek, a credit-induced boom leads entrepreneurs to bid resources away from consumer-goods industries without any compensating voluntary savings on the part of consumers. This

resulting relative decrease in the supply of final goods and services at a time when wage incomes are rising due to the newly created money causes final goods prices to rise faster than the price of labor. There is a consequent decline in the real wage of labor (where real wage means the ratio of product price to per-unit labor cost). This is most pronounced in the stage of production nearest to the consumer and leads to a surge in profits on short-term investment projects. This surge encourages entrepreneurs to turn away from machine-intensive methods of production in favor of more labor-intensive methods, thereby discouraging sales of capital goods.²⁹ Entrepreneurs, determined to complete their endangered long-term capital projects, turn to the banks for more bank credit, and a tug of war begins. Producers seek new bank loans, the banking system accommodates the new loan demand by creating new money, product prices rise ahead of wage costs. In each market period the process repeats itself, with product prices always rising ahead of wages.³⁰ Hayek argued that any attempt to reduce the flow of bank credit will bring this process of competing errors to a halt, turning the boom into a bust and leading to a readjustment of the capital-goods industry to a new equilibrium consistent with real patterns of consumer demand.³¹

In his 1969 restatement of the Ricardo effect, Hayek objected to Hicks's description of the mechanism presented in *Prices and production* as being predicated on wages "lagging" behind consumer-goods prices.³² Hayek argued that his explanation did not depend upon a lag, if that meant that one incorrect market value is somehow trying to catch up with a correct value with which it must be in harmony. Rather, *both* product prices and wages are incorrect in the sense of being inconsistent with the underlying objective conditions of supply and demand for consumer goods. The fact that consumer expenditures are ultimately used to pay for intermediate goods creates the objective conditions in the market that generate a particular price sequence. As he argued in 1939 and 1942, when capital creation is financed through expanding bank credit, the signals that communicate the objective conditions to entrepreneurs are distorted, and incorrect investment decisions are made. The incorrect decisions are corrected by way of a crisis.

In essence, the Ricardo effect as Hayek described it occurred in the context of a process of genuine macroeconomic disequilibrium in which a crisis could not be averted. The crisis, he argued, was a necessary consequence of a boom brought about by money creation and characterized by a constant incompatibility between relative prices and the growing structure of real capital.

IV

The Inevitability of the Crisis

The first major point Hayek was making during his lectures and in several articles he published in the years immediately following *Prices and production* was simply that any real growth in the capital stock takes time and requires voluntary net savings. There is no way for an expansion of the money supply in the form of bank credit to short-circuit the process of economic growth. His second major point was more difficult. He argued that forced savings can only distort the mix of capital and consumer goods, by generating false relative price signals. These false signals throw the economy into a genuine macroeconomic disequilibrium that cannot be sustained over time. Eventually, the underlying consumer preferences will reassert themselves. All that credit can do is to encourage competition between consumers and producers for the same pool of scarce resources, leading ultimately to a state of affairs in which producers switch from capital-intensive to labor-intensive methods of production. This switch, when carried out by a large number of managers, will choke off investment and bring on a full-scale crisis. But was either the switch or the crisis inevitable? Hayek argued that they are, but most of his early critics disagreed.³³

Suppose the inflation caused by an expansion of bank credit could only last for, say, twenty-two months, but that a larger (i.e., 'more roundabout' or 'deeper') capital structure could be erected in less time. Wouldn't that mean that even when the eventual halt to credit expansion came, the economy would be richer with a larger per capita capital stock that could potentially produce enough income to generate the savings to maintain itself without collapse? If this scenario were possible—say, under conditions of less than full employment of

resources—it would seem that a deliberate policy of credit creation could bootstrap the economy into a permanently larger flow of consumer goods without suffering the consequences of a disruptive crisis.³⁴

At one place Hayek did agree that under certain restricted conditions a credit expansion could occur that did not end in collapse with a misplaced collection of capital goods. He warned, however, that the conditions were so stringent that they were unlikely to have much empirical relevance. This happy state of affairs could only occur in a ‘progressive economy’ where credit expansion did not lead to increased prices, but only managed to keep price levels constant as output grew. In this case, where voluntary saving was already high and the proportion of capital formation financed by forced saving was very low, it was just possible that a crisis could be averted if the credit expansion had been gradual and the contraction equally gradual. However, even in this case, he argued, forced saving did not actually increase the capital stock that can be accumulated in the long run, but only speeded up the process of creating it, since once the credit expansion stopped, “for a time the current voluntary savings will be used to take over, as it were, the capital created by means of forced saving; and current savings would then have to serve, not to make further new investment possible, but merely to maintain capital which has been formed in anticipation of these savings.”³⁵ Under these circumstances, there would still be a relative price change for real wages and real cost of capital that would trigger a switch of techniques. But in this case, the switch would not lead to a crisis. Thus, as a theoretical matter, the crisis need not inevitably follow the boom. The likelihood of such a set of events, however, was extremely limited. As Hayek explained, this was not a scenario upon which to build one’s plans for smooth economic growth, since the conditions under which it might obtain were extremely restrictive. As a practical matter, credit expansions followed by economic crises were the norm, not the exception.

In Hayek’s early book, *Monetary theory and the trade cycle*, he presented a theory of trade cycles that made them endogenous to a monetary economy.³⁶ Cyclical fluctuations were simply the consequences of information problems inherent in an economic system that

relied on credit banking. In *Prices and production* he described a process of economic growth that consisted of a time-consuming transition from one full-employment equilibrium to another. Business cycles were a consequence of attempting to finance this transition process by an expansion of the money supply via bank credit creation. In both these books, Hayek was well on his way to working out a macroeconomic theory that incorporated money and time into a theory of growth from one equilibrium state to another.

However, after the publication of Keynes' *General theory*, the rules of the game changed and professional attention shifted from the problem of economic growth as a transition process from one equilibrium to another, to the problem of the determination of flows of income and expenditure at a moment in time. The limelight shifted from Hayek to Keynes.

In 1939 Hayek produced a restatement of his view of the trade cycle more in line with these contemporary trends. Instead of starting from a position of full-employment equilibrium as he had before, he tried to meet Keynes and his followers on their own ground by making standard Keynesian assumptions of unemployment, rigid wages and interest rates, immobile labor, in order to show how the economic system would nevertheless still find itself unable to sustain a boom.³⁷ It was here that he first used the term the 'Ricardo effect' to underline the venerable pedigree of the mechanism that figured so prominently in his attempt to give a microeconomic account of how individual maximizing decisions on the part of entrepreneurs will lead to the switch of techniques that brings about an economic crisis. In 1939, then, the debate over the Austrian theory of the business cycle focussed explicitly on the choice-theoretic foundations of the turning point in business cycles.

V

Microfoundations of the Ricardo Effect

Let us suppose along with Hayek that during the boom, consumer-product prices do rise ahead of wages, and hence real wages fall. Is this alteration in relative prices by itself sufficient to produce a crisis? As we have shown, Hayek believed that the price effect would induce

entrepreneurs to substitute labor-intensive for labor-saving methods of production. Although each entrepreneur makes the decision to alter investment priorities independently of other entrepreneurs, the aggregative effect of their decisions is to produce a decline in net investment (that is, a decline in the sales of capital goods) and the onset of the crisis. By 1939 Hayek was arguing that the crisis will begin even if the monetary authorities stand ready to continue to supply bank credit at less than the natural rate.³⁸ Indeed, one important corollary of Hayek's Ricardo effect was to show that while a commodity standard (that is, a gold standard) might by itself be sufficient to arrest a boom, it was by no means necessary. A boom would end because of the incentives created by changes in the relationship among wages, prices, and profits.

In order to appreciate the choice-theoretic foundations of Hayek's Ricardo effect, it will be helpful to think of entrepreneurs as managing a number of on-line investment projects. In fact, the firm itself may be construed as a "portfolio of investment projects" rather than, as in standard Marshallian terms, an organization that produces a single product.³⁹ Now each investment project can be identified with a particular product and calculable rate of return. The entrepreneurs are assumed to reshuffle the amount of liquid capital available to them so as to maximize the present value of the firm: they calculate the rate of return on each separate project and then allocate money capital among the projects so as to equalize returns at the margin.⁴⁰

In his 1939, 1942, and 1969 expositions of the Ricardo effect mechanism, Hayek started his analysis (much as Ricardo did) with the firm in "long-period investment equilibrium" earning the same rate of return on the investments in each different project. In some projects capital turns over rapidly (bakery products), while in other projects (selling, rare books) funds are typically tied up for years on end. Offsetting these 'waiting periods' of varying lengths are the actual returns on the different projects which differ in absolute amounts so as to yield an identical internal rate of return among all projects. The internal rate of return (I) is equal to the product of the rate of turnover (T) and the profit margin (M). In equilibrium then, $M = I/T$ for all projects.⁴¹

Now, let us disturb this equilibrium situation by permitting a sudden unexpected rise in product prices (relative to wages) and we discover that the rate of return on quick-turnover projects will have risen relative to the returns on slow-turnover projects. Entrepreneurs would obviously attempt to shift their money capital to quick-turnover projects in which the returns are now relatively greatest. These quick-turnover projects are necessarily more labor-intensive, and hence the demand for capital investment relative to labor will fall. Now it is absolutely vital to keep in mind the following arithmetic facts in order to appreciate the controversy surrounding Hayek's mechanism: (i) the internal return on quick-turnover projects has indeed risen relative to slower-turnover projects but (ii) all rates of return are necessarily higher than they were prior to the rise in product prices.⁴²

The second of the two facts led T. Wilson, Nicholas Kaldor, and the majority of Hayek's critics after 1940 to accuse Hayek's theory of being *logically* inconsistent.⁴³ According to Hayek's critics the rational firm-manager would not simply switch from one kind of project to another, but would try to invest more in each and every project. If before the rise in product prices all returns were equal to the firm's cost of capital, then in the next equilibrium position the scale of the firm must increase because the firm will invest in all its investment projects until each internal rate of return falls back down to equal the cost of capital.⁴⁴ The cost of capital remains fixed throughout the analysis because Hayek has assumed that during the boom the banking authorities are making loanable funds freely available at a rate of interest below the natural rate.

According to Kaldor:

[Hayek committed the same fallacy as those who argue that] a rise in demand for a commodity will cause a rise in its price, and the rise in price causes a restriction in demand (because less is bought at a higher price than a lower price), the increase in demand will lead to a reduction in the amount bought. No doubt the rise in price will make the increase in purchases (following upon the increase in demand) less than it would have been if the price had not risen. But it cannot make it less than before, since the price has only risen because the amount bought has gone up. In the same way, the reduction in capital intensity will make the rise in investment expenditure less than it would have been if capital intensity had remained constant. But it cannot eliminate it

altogether because capital intensity would not have fallen if investment expenditure had not risen.⁴⁵

In short, Kaldor claimed that Hayek had assumed a situation in which the substitution effect outweighed the scale effect, a situation which a comparative static analysis of the Ricardo effect mechanism demonstrated to be impossible.

Hayek responded to Kaldor's criticism by claiming that it missed the point. Kaldor along with other critics seemed unable to understand his mechanism for two basic reasons: (i) their stubborn attachment to the 'perfect competition' model of market structure even when the descriptive realism of that model was at odds with the particular market under study and (ii) their insistence on evaluating his Ricardo effect mechanism solely within a comparative statics framework.

Consider the first charge. If the loanable-funds market were perfect in that the cost of capital facing the firm were to remain constant regardless of the absolute volume of funds the firm wished to borrow, then the rational manager would indeed expand the size of the firm in all directions as Kaldor insisted he would. But, Hayek argued, the market for loanable funds is not and cannot be modeled as 'perfect' under these conditions. Under any real conditions, the cost of capital facing the firm could not remain equal to the external market rate of interest while the firm expanded in size; there is a "limit beyond which [the firm-owner] can raise capital only at higher costs."⁴⁶ Loans to the same borrower will never represent the "same commodity" in the sense in which the term is used in theory of competition. Bankers will not lend infinite amounts of bank credit to any single borrower at a uniform rate because they will perceive an increased risk associated with a higher debt-to-equity ratio.⁴⁷ But are the bankers' perceptions based on an understanding of the real underlying conditions that prevail in the market or are their perceptions based instead on the imperfect and incomplete information available to the creditors at the time the applications for the loans are received?

Hayek later clarified this point. He admitted that creditors "mis-judge" the credit-worthiness of borrowers because they fail to take into consideration the favorable impact inflation will have on the firm's revenues. In the long run, increasing product prices might imply that the credit-worthiness of a firm has increased and therefore should

justify increased loans at no additional risk premium. But long before creditors perceive that this sort of long-run equilibrium adjustment has occurred, the Ricardo effect will have already asserted itself. Hayek's argument then rested on the assumption that increasing product prices increased the firm's demand for loanable funds more quickly than the banks could subjectively reevaluate the credit-worthiness of the firm itself. Under these circumstances, the firm is constrained by the upward sloping portion of the supply curve of credit which acts as a brake on the firm's expansion.⁴⁸ Hence, with incomplete knowledge the scale effect cannot outweigh the substitution effect as Kaldor maintained. In this way Hayek readily admitted what several of his critics had pointed out: the upward sloping supply of credit to the firm acted as a kind of rationing device to constrain the growth of the firm. The manager adjusts by investing his limited capital in short-term (that is, labor-intensive) investment projects.

Hayek's resort to this kind of credit rationing was by no means *ad hoc*. The credit rationing was a rational response to the informational lags that occur during a period of accelerating inflation. The assessment of the credit-worthiness of the firm in one period imposes a "finance constraint" on the amount it can borrow (at the old interest rate) in the next period.⁴⁹

Consider, now, the merits of Hayek's charge that his critics misunderstood his theory because of their preoccupation with perfectly competitive equilibrium conditions and comparative statics. According to Hayek, even if the supply of credit were infinitely elastic to the economy as a whole, the Ricardo effect would still occur because of the finance constraints encountered along the path of business expansion. However, one cannot see that point simply by comparing two equilibrium states. Such a comparison, Hayek argued, would disguise precisely the mechanism he was interested in discussing. As he put it:

The situation which we consider . . . is indeed the classical instance of a cumulative process. . . the perfectly elastic supply of credit at a rate of interest lower than the internal rate of all or most of the firms will be the cause of continuous changes of prices and money incomes where each change makes further changes necessary. There is no point in saying with respect to such a situation that "in equilibrium there must" exist such and such a relationship, because it necessarily follows from the assumptions

that the relationship between at least some prices must be out of equilibrium.⁵⁰

This disequilibrium is a situation in which the different price-determining tendencies in the economy are inconsistent with one another and lead to perpetual change. Hayek tried to explicate his problem by resorting to an imaginative analogy: "The question is rather similar to that whether, by pouring a liquid fast enough into one side of a vessel, we can raise the level at that side above that of the rest to any extent we desire." Of course, we cannot, since this depends upon the viscosity of the liquid itself. Hence, "the speed at which an increase of incomes leads to an increase in the demand for consumers' goods limits the extent to which, by spending more money on factors of production, we can raise their prices relative to those of the products."⁵¹ In the end, real wages will have to fall, if for no other reason than the unavailability of consumer goods to meet the demand; and hence it is inevitable that the Ricardo effect will be triggered.

To throw Hayek's problem into relief, consider the subsequent Hicksian construct of the 'progressive economy.'⁵² In a progressive economy the managers expect the demand for their products to be rising. Based on this expectation they proceed to invest and expand the scales of their firms. They do this over a market period long enough for the net investment that takes place to generate exactly enough extra income and new savings for savings and investment to remain equal to each other. In Hicks's progressive economy, investment generates income without delay—the period of construction of capital goods is assumed to be zero.⁵³ In the new equilibrium position, managers find out that they have constructed exactly the quantity and variety of capital goods they wished to have at the beginning of the market period. Thus, the economy started out in stock equilibrium and ended up in stock equilibrium. In addition, the flow of net investment during the market period was exactly matched by a flow of net savings. Flow and stock equilibrium occur together in the progressive economy. The boom, to return to Hayek's terminology, has proceeded smoothly and without the slightest possibility of ending in crisis.

Now clearly this construction of a progressive economy rules out the Mises-Hayek crisis phenomenon as a matter of definition. If all

plans are coordinated at the beginning of the market period and also at the end, then where is the "cluster of business errors" that constitutes the crisis? In this sense, Hayek was quite correct when he objected to Kaldor's use of comparative static methodology. The methodology of comparing isolated equilibrium states rules out precisely the phenomenon of the crisis.

Suppose on the other hand, that Hayek's entrepreneurs only *believe* they are in a progressive state. The lowering of the interest rate suggests that consumers have provided a larger amount of real savings and the managers eagerly begin the task of constructing the new equipment.⁵⁴ But the entrepreneurs have only been deceived into thinking the flow of new voluntary savings is larger than it really is because (as we know) it is only the money supply that is increasing. Now the flow of actual net savings is brought exactly into balance with the flow of actual net investment through the familiar forced-saving mechanism. Still, at the end of the period the actors come to realize that their stocks of capital goods are inappropriate to satisfy consumer demand. In old-fashioned terminology, there is too much fixed capital and not enough circulating capital—a realization brought on by Hayek's Ricardo effect mechanism. In summary, we have stock equilibrium at the beginning of the market period, flow equilibrium within the period, and stock *disequilibrium* at the end.

Hayek's point is that precisely because the entrepreneurs are mistaken about the true real savings of the consumers, a time must come when they have evidence of their mistakes and take steps to correct them. A comparative static analysis of the economy at two points in time, where the capital structure at T_2 is larger than at T_1 compares two equilibrium situations. Hayek preferred a market period approach over a comparative static analysis because it enabled him to identify the sequence of events by which the entrepreneurs come to realize that the equilibrium toward which they are all heading is no longer economic. They come to that conclusion because the underlying structure of production makes the simultaneous realization of their business plans impossible. This information is transmitted to the entrepreneurs through the price system by way of the internal rates of return on investment projects. Hayek's objection to applying comparative statics to this problem of dynamical change and adjustment

seems to us remarkably cogent. The problem is not to learn about maladjustments by comparing states of equilibrium but rather to ask if the conditions prevailing at T_1 make the transition to T_2 at all possible. Kaldor's approach indeed assumed away the very problem that Hayek's theory was designed to analyze, the problem of the transition an economy undergoes in moving from one coordinated capital structure to another. The revival in the 1970s of interest in modeling this transition process gives Hayek's favorite mechanism a decidedly modern ring.⁵⁵

VI

Conclusion

By emphasizing the inapplicability of the perfectly competitive model especially in the supply of loanable funds, and by insisting on the disequilibrium nature of the cumulative process, Hayek was speaking a different language from his peers in the 1930s, 1940s and, surprisingly, in the late 1960s as well. Hayek challenged the relevance and appropriateness of comparative static analysis to an expanding economy. His struggle to free himself from the precepts of comparative static analysis constitutes, in our view, the elusive element in his thinking and explains why so much miscommunication occurred. Hayek's most formidable opponent, Kaldor, seemed unable to structure the problem except in comparative static terms, and this we believe is what prompted Hayek to focus on their methodological differences.

It is gratifying that by the 1970s Hayek's favorite problem of the process of adjustment from one coordinated state of equilibrium to another was finally recognized and tackled by some of the finest minds in the profession, including one of Hayek's own critics—Hicks.⁵⁶ While the particular solution and the methods of analysis Hayek proposed may be controversial, there is now no longer any question that the problem Hayek raised about the feasibility of reaching one equilibrium based on the conditions prevailing prior to reaching that equilibrium is an important one. The issues Hayek raised during the 1930s have their counterpart in the modern debates about the structural limits placed on short-run macroeconomic policy. This,

of course, remains a central concern of the 'new classical economists,' some of whom have recognized Hayek as a pioneer investigator.⁵⁷ We have taken a second look at Hayek's Ricardo effect in order to illuminate certain novel elements in Hayek's thinking and their relevance to contemporary economic theorizing.

Notes

1. A partial list of English language writers includes, in chronological order, Nicholas Kaldor, 'Capital intensity and the trade cycle,' *Economica*, Feb. 1939, 40–66, reprinted in idem, *Essays on economic stability and growth* (Glencoe, Ill., 120–147; Tom Wilson, 'Capital theory and the trade cycle,' *Review of Economic Studies* 7 (1938–1940): 169–179; H. D. Dickinson, Review of Hayek's *Freedom and the economic system*, in *Economica*, Nov. 1940, 435–437; R. G. Hawtrey, 'The trade cycle and capital intensity,' *Economica*, Feb. 1940, 1–22; Hugh Townshend, Review of Hayek's *Profits, interest and investment*, in *Economic Journal*, March 1940, 99–103; Nicholas Kaldor, 'Professor Hayek and the concertina effect,' *Economica*, Nov. 1942, 359–382, reprinted in idem, *Essays on economic stability*, 148–176; Sho-Chieh Tsiang, *Variations of real wages and profit margins in relation to the trade cycle* (London, 1947), reprinted, W. Germany, 1970; Sho-Chieh Tsiang, 'Rehabilitation of time dimension of investment in macrodynamic analysis,' *Economica*, Aug. 1949, 204–217; William J. Baumol, 'Income effect, substitution effect, Ricardo effect' *Economics*, Feb. 1950, 69–80; Friedrich Lutz and Vera Lutz, *The theory of investment of the firm* (Princeton, 1951), 137–142; R. G. Hawtrey, *Capital and employment* (1937; London, 1952), 248–255; John Hicks, 'The Hayek story,' in idem *Critical essays in monetary theory* (Oxford, 1967), 203–215; Mark Blaug, *Economic theory in retrospect* (Homewood, Ill., 1968), 543–548; Walter Adolf Johr, 'Note on Professor Hayek's "True theory of unemployment,"' *Kyklos* 30 (1977): 713–723; and David H. Howard, Review of Hayek, *Denationalisation of money*, *Journal of Monetary Economics* 3 (1977): 483–485.

2. Hayek adopted the name 'Ricardo effect' toward the end of the 1930s, but the effect itself is discussed in some detail in the following references: F. A. Hayek, *Prices and production* (London, 1935), 69–100 and 148–157; idem, *Profits, interest and investment* (London, 1939), 3–71; idem, 'A comment,' *Economica*, Nov. 1942, 383–385; idem, 'Three elucidations of the Ricardo effect,' *Journal of Political Economy*, 1969, 274–285.

3. E. Burmeister, *Capital theory and dynamics* (Cambridge, 1980).

4. Blaug, 548.

5. F. A. Hayek, *Monetary theory and the trade cycle* (London, 1933), 33 n. The German edition of Hayek's essay appeared in 1929. Cf. Robert E. Lucas, Jr., 'Understanding business cycles,' in K. Brunner and A. Meltzer,

Stabilization of the domestic and international economy (Amsterdam, 1977), reprinted in R. Lucas, Jr., *Studies in business cycle theory* (Cambridge, Mass., 1981), 215.

6. Lucas, 215.

7. See for example the selected passages from Hayek's writings in F. A. Hayek and S. Shenoy, *A tiger by the tail* (London, 1972); idem, *Full employment at any price?* (London, 1975).

8. On the Misesian 'research program' see L. S. Moss and K. I. Vaughn, 'Ludwig von Mises and the Austrian tradition,' paper read at the 1990 meeting of the American Economic Association in Denver, MS; and L. S. Moss, "The monetary economics of Ludwig von Mises," in idem, *The economics of Ludwig von Mises: toward a critical reappraisal* (Kansas City, Mo., 1974), 13–49.

9. G. O'Driscoll, *Economics as a coordination problem* (Kansas City, Mo., 1977), pp. xv–xxi, 1–11, and 153–155.

10. See David Ricardo, *On the principles of political economy and taxation*, in *The works and correspondence of David Ricardo* (Cambridge, 1951) 1:39–43, and 386–397. Hayek cited both places in Ricardo's *Principles* as the location of what he (Hayek) termed the 'Ricardo effect' (see Hayek, 'The Ricardo effect' in idem, *Individuism and economic order* (London, 1949) 220. O'Driscoll, a recent commentator, emphasized the dynamic Wicksellian nature of Hayek's analysis 'The specialization gap and the Ricardo effect: comment on Ferguson,' *History of Political Economy* 7.2 (1975): 268—but did not emphasize the close connection between the argument of Ricardo's machinery chapter and Hayek's Ricardo effect mechanism; cf. O'Driscoll, *Economics as a coordination problem*, 92–128.

11. David Ricardo, Letter to McCulloch, 13 June 1820; cf. P. Sraffa, Introduction to Ricardo, *Principles*, p. xlv.

12. Ricardo, *Principles*, 40.

13. Ibid.

14. On Ricardo's so-called 'agricultural theory of profit' see P. Sraffa, Introduction to Ricardo, *Principles*, pp. xxx–xxxvii. For an application of that theory to how it 'regulates' the overall market rates on competing investments and a summary of the recent doctrinal debate surrounding that application, see L. S. Moss, 'Professor Hollander and Ricardian economics,' *Eastern Economic Journal* 5 (Dec. 1979): 503.

15. Ricardo, *Principles*, 41. Our discussion is entirely consistent with S. Hollander's claim that Ricardo's "intention" was to show that a once-and-for-all rise in wages would not raise the level of prices, but only alter relative commodity prices; cf. L. Moss, 'Professor Hollander and Ricardian economics,' 503–506.

16. Ibid. 37–38.

17. Although Ricardo did not specifically discuss the economic impact of a sudden decline in the wages of labor, we can infer from his comparative-

static framework that a once-and-for-all decline in wages will encourage managers to substitute labor-intensive or direct methods of production (Technique B) for labor-saving (i.e., capital-intensive) methods of production (Technique A). Also, the decline in wages will bring about a decline in the prices of consumer goods made without machinery relative to the prices of consumer goods manufactured with the aid of machinery. This is the form of Ricardo's comparative-static theorem that most closely resembles the one Hayek tried to develop—see the text.

18. On the details of Ricardo's controversial chapter, see P Sraffa, Introduction, pp. lvii–lx; and S. Hollander, 'The development of Ricardo's position on machinery,' *History of Political Economy* 3.1 (1971): 105–135.

19. Ricardo, *Principles*, 390.

20. *Ibid.* 395.

21. F. A. Hayek, 'Three elucidations of the Ricardo effect,' 275–277. See also Hayek, *Profits, interest and investment*, 3–72.

22. Hayek, 'Three elucidations,' 275–276.

23. Except for this omission, see G. P. O'Driscoll's useful critique of Ferguson's remarks about Hayek's version of the Ricardo effect in 'The specialization gap and the Ricardo effect.' Hayek refers to both of Ricardo's versions in 'The Ricardo effect,' *Economica* 34 (May 1942): 127–152 n. 3. One major difference between the two versions has to do with Ricardo's suggestion that technological changes induce the substitution of machines for labor, while Hayek's analysis is restricted to a choice of techniques that is induced by a change in factor prices.

24. G. Haberler, *Prosperity and depression* (Geneva: League of Nations, 1941), 33–35; H. S. Ellis *German monetary theory 1905–1933* (Cambridge, Mass., 1934), 335–374.

25. Knut Wicksell, *Interest and prices* (1898; London, 1936), 102–121.

26. L. v. Mises, *Theory of money and credit* (1912; London, 1934), 362–363. Cf. John S. Mill, *Principles of Political economy with some of their applications to social polity*, 2 vols. (Toronto, 1965), 2:528 n.

27. Mises, *ibid.*

28. According to Abba Lerner, "I had just learned about the average period of production from Professor Friedrich von Hayek's first course at the London School of Economics on capital theory [1931–1932]. At the time, a group of my fellow students (who were avid discussants of economic theory in the third year undergraduate study room) were very excited about my essay and its three-dimensional diagram. We persuaded the editor of the *Clare Market Review*, the LSE student magazine to print it in the magazine." Lerner, shortly before his death, revised the exposition under the title 'Paleo-Austrian capital theory,' and it has been published posthumously in A. Lerner, *Selected economic writings of Abba P. Lerner*, ed. D. Colander (New York, 1983), 563–583. Other responses to the main argument of *Prices and production*

include John R. Hicks, 'Equilibrium and the trade cycle,' *Zeitschrift für Nationalökonomie* 4 (June 1933), reprinted in *Economic Journal* 18 (Oct. 1980): 523–534; Hans Neisser, 'Monetary expansion and the structure of production,' *Social Research* 1 (Nov. 1934): 434–457; and E. F. M. Durbin, *Purchasing power and trade depression: a critique of underconsumption theories* (London, 1933; revised 1934); R. G. Hawtrey, *Capital and employment* (London, 1952), 220–255. Last, but by no means least, was Piero Sraffa's stinging review, 'Dr. Hayek on money and capital,' *Economic Journal*, March 1932, 42–53. Also cf. Hayek's response, 'Money and capital: a reply,' *Economic Journal*, June 1932, 236–249, followed by Sraffa's 'Rejoinder,' *ibid.* 249–251. The Sraffa Hayek debate has only in recent years inspired discussion; see M. Desai, 'The task of monetary theory: the Hayek-Sraffa debate in modern perspective' (working paper at Institut des Sciences Economiques in Belgium); M. Milgate, 'On the origin of the notion of 'Inter-temporal Equilibrium,'" *Economica* 46 (Feb. 1979): 1–10; and L. M. Lachmann, 'Austrian economics under fire: the Hayek-Sraffa duel in retrospect' (MS, 18 pp.).

29. See F. A. Hayek. 'The paradox of savings,' in *idem*, *Profits, interests and investment* (New York, 1939), 199–263. See C. Menger's discussion of the various 'orders' of production in his *Principles of economics* (Glencoe, Ill., 1950), 149–174. Cf. Hayek, *Prices and production*, 32–50; and J. R. Hicks, *Capital and time* (Oxford, 1973), 3–26.

30. Hayek always emphasized that the appropriate measure of real wages was the nominal wage divided by the price of the immediate product that labor helped produce. To distinguish this concept of the real wage from the usual nominal wage divided by the price index, Hayek spoke of the "own-wage" of labor. We have glossed this distinction in the text, since none of our conclusions is affected by it. See Hayek, 'The Ricardo effect' in *idem*, *Individualism and economic order*, 251–253.

31. F. A. Hayek, *Prices and production*, 90–94. On the tug-of-war thesis, see Murray N. Rothbard, *America's great depression* (Princeton; 1963), 17–21.

32. F. A. Hayek, 'Three elucidations,' 278–279. Curiously, Hayek had earlier described his theory as involving "lags"; see *idem*, *Prices and production*, 146.

33. Apparently, consumers must change their *flow* of savings in order to build up a *stock* of capital. Once the stock is built up (i.e., completed), savings can be reduced. H. Neiser, 'Monetary expansion,' 439–442, and also P. Sraffa, 'Dr. Hayek on money and capital,' 46–48. Cf. Haberler, *Prosperity and depression*, 54–56. Cf. L. Laclimann, *Capital and its structure* (London, 1956), 100–127.

34. Hayek, 'The present state and immediate prospects of the study of industrial fluctuating,' trans. from the German, "Der Stand and die nächste . . .," in Hayek, *Profits, interest and investment*, 180.

35. *Ibid.*

36. Hayek, *Monetary theory*, 147.

37. This claim was asserted by Mises in 1912 and restated toward the end of the 1930s by Hayek. See esp. *Profits, interest and investment* where Hayek states: "What I am concerned with is to show how [the rate of profit] would act if the rate of interest failed to act at all" (6–7). At another place in his essay Hayek concludes, "We might get the trade cycle even without changes in the rate of interest" (64). Cf. O'Driscoll, *Economics as a coordination problem*, 94–96.

38. Hayek, *Profits, interest and investment*, 64.

39. Members of the Austrian school were never endorsers of the Marshallian firm/industry distinction. See M. Rothbard, *Man, economy and the state*, 2 vols. (Princeton, 1962), 1:304–308). The modern 'management view' of the firm (similar to the Austrian view) sees the firm as a bundle of investment projects, see B. Henderson. *Henderson on corporate strategy* (Cambridge, Mass., 1972), 145–166. In the example taken from Hayek (to be discussed below) Hayek speaks of three "firms" rather than three investment projects within a single firm. This modification allows us to clarify our exposition considerably.

40. See Tsiang, *Variations of real wages*. 133–134. F. A. Hayek, 'The Ricardo effect,' 227. Hayek's firm-manager tries to maximize the "internal rate of return on investments"; see Lutz and Lutz, 16–26. For a general critique of using the internal rate of return as an index of investment success see Hirshleifer, *Investment, interest and capital* (Princeton, 1970), 51–56, and K. E. Boulding, 'The theory of a single investment,' *Quarterly Journal of Economics* 49 (May 1935).

41. According to Hayek, "the per annum net percentage return on the whole capital of a firm (or on any part of it for which we find it necessary to compute separately), net of 'wages of management' and of risk premium, we shall designate as the "internal rate of return." Initially, the internal rate of return is equal on all projects. Hayek explained: "If we call the internal rate of return I , the rate of turnover T and the profit margin M , the relationship will be presented by $I = TM$ or $M = I/T$. If . . . the internal rate is 6 percent, [then] the profit margin of a firm turning over its capital six times a year will have to be 1 percent, while a firm turning over its capital only once in two years will have to earn 12 percent on all sales, and a firm turning over its capital only once in every ten years will have to earn a profit of 60 percent" (Hayek, 'Ricardo effect,' 227).

42. "For the three [investments] which we have just considered by way of illustration, the first (with an annual rate of turnover $T = 6$) will find its profit margin increased from 1 to 6 percent; the second [with $T = 1/2$] from [12] to [17] percent; and the third (with $T = 1/10$) from 60 to 65 percent. Multiplying these profit margins by the corresponding rates of turnover, we obtain the new internal rates of return of $6 \times 6 = 36$ percent for the first, [$1/2 \times 17 = 8.5$] percent for the second, and $1/10 \times 65 = 6.5$ percent for the third [investment activity]" (Hayek, 'Ricardo effect,' 227).

43. Kaldor, 'Professor Hayek and the concertina effect,' *Economica*, Nov. 1942. Reprinted in Kaldor, *Essays on economic stability and growth* (London 1960), 2:148–176.
44. Ibid. See also Wilson, 'Capital theory and the trade cycle,' 177; Hawtrey, *Capital and employment*, 240–245; and Tsiang, *Variations of real wages*, 141–144.
45. Kaldor, *ibid.*
46. Hayek, 'Ricardo effect,' 237.
47. Ibid. 236. Cf. M. Kalecki, 'The principle of increasing risk,' *Economica*, Nov. 1937.
48. Hayek, 'Ricardo effect,' 235–237.
49. Cf. M. Kohn, 'In defense of the finance constraint,' *Economic Inquiry* 19 (181): 177–195.
50. Hayek, 'Ricardo effect,' 239.
51. Ibid. 241. Cf. *idem*, 'Three elucidations,' 281.
52. I. R. Hicks, *Capital and growth* (Oxford, 1956), 90–93. This is not to be confused with Hayek's use of the term 'progressive economy,' referred to earlier in this article.
53. Ibid. 91.
54. Hayek, *Monetary theory and the trade cycle*, and cf. Rothbard, *America's great depression*, 16–17.
55. Hicks, *Capital and time*. 47–80. See also E. Burmeister, *Capital theory and dynamics*. See, however, Lachmann's 'A reconsideration of the Austrian theory of industrial fluctuations,' *Economics* 7 (May, 1940); in *idem*, *Capital expectations and the market process* (Kansas City, 1977), 267–286.
56. Hicks, *Capital and time*, 81–150. Hicks like Hayek harks back to Ricardo's machinery chapter for doctrinal precedent. See Hicks.
57. Hayek did not reach the same conclusion as certain radical exponents of the "new Classical economics." For one thing, Hayek would not agree that a fully announced set of policy changes will have no effect on real macro-economic variables as has been maintained by T. Sargent and N. Wallace in "Rational expectations," the optimal monetary instrument and the optimal money supply rule,' *Journal of Political Economy* 83 (April 1975): 241–254. Hayek argued that Keynesian stimulative policies would have short-run beneficial effects. Hayek disagreed with Keynes when Hayek insisted these beneficial effects would be at the expense of long-run disruptions.