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Accounting for the business cycle: Nominal rigidities, factor heterogeneity, and Austrian capital theory

Robert F. Mulligan

Abstract An Austrian interpretation of the New Keynesian small menu cost model of the business cycle is proposed. Austrian and New Keynesian business cycle theories share the feature that the cycle is generated by rigidities which prevent the economy from adapting instantaneously to changing conditions. Austrian business cycle theory is capital-based, focusing on credit expansion which artificially lowers interest rates and causes an investment boom and unsustainable business expansion. In contrast, the New Keynesian small menu cost model of the business cycle is based on nominal rigidities which prevent markets from clearing. Small menu costs introduce dichotomous behavior, where firms find it locally optimal to avoid instantaneous output price adjustments in the face of the cost, but this local optimum results in economy-wide output and employment fluctuations which are much greater in relative magnitude. The small menu cost model of the business cycle is extended and reinterpreted in light of Austrian business cycle theory with heterogeneous, multiply-specific capital, thus providing a rigorous formalization of the Austrian business cycle. The Austrian interpretation of this New Keynesian model fortuitously addresses several of its shortcomings.

Keywords Austrian business cycle theory · New Keynesian small menu cost model · Hayekian triangle

JEL classification B53, E12, E23, E32

> SOLOMON: ... *You take this table ... You can't move it. A man sits down to such a table he knows not only he's married, he's got to stay married – there is no more possibilities*.
>
> Arthur Miller (1968) *The Price* Act 1

R. F. Mulligan (✉)
Department of Business Computer Information Systems and Economics, College of Business, Western Carolina University, Cullowhee NC 28723, 828-227-3329
e-mail: mulligan@wcu.edu

1. Introduction

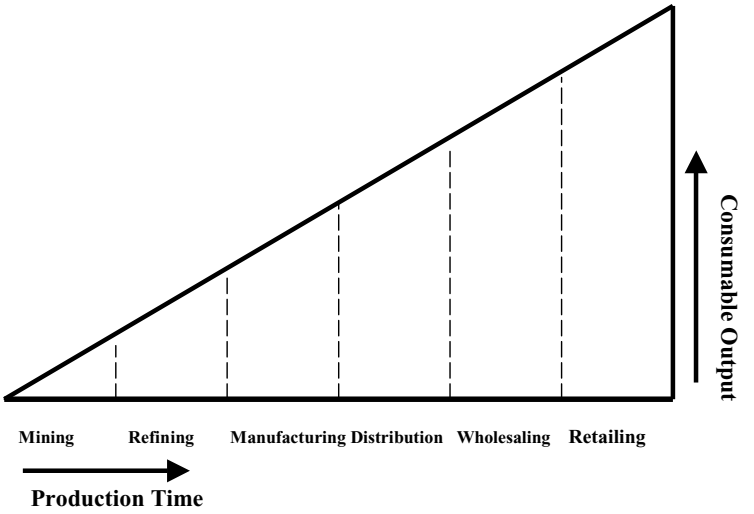
Every economic decision has an opportunity cost, and decisions to invest in long-lived capital equipment have long-lived and especially onerous opportunity costs. As Arthur Miller's appraiser might conclude about capital equipment, "it's furniture and you're married to it." Once entrepreneurs commit to a definite production plan, they surrender many possible future states in return for the opportunity to pursue one; future possibilities are limited by the act of choosing. In effect, "there is no more possibilities. " However, until entrepreneurs commit to a production plan, they are no more than potential entrepreneurs.[1] Austrian business cycle theory is unique in recognizing the role of time preference in coordinating a production structure managed by many independent entrepreneurs with subjective knowledge, information, preferences, and unique abilities.

The Hayekian triangle (Fig. 1; Hayek, 1931:39; subsequently developed by Hayek, 1933, 1939, 1941) illustrates the production structure. In the most stylized case, the interest rate is proportional to the slope of the hypotenuse. The steeper hypotenuse reflects the higher interest rate and consumers' increased time preference – in this higher-interest environment, consumers are less willing to wait for immediate consumption goods. Conversely, when interest rates fall, the structure of production becomes more roundabout, redistributing marginal resources toward productive activities with lower rates of return. These more roundabout production processes produce more final output but require more production time.

The Hayekian triangle is a particularly stylized model of an entrepreneurial plan. In one sense it is a forward looking model, because entrepreneurs should require a return at least equal to their opportunity cost, which is the market rate of interest they could realize by lending funds to others. Lewin (1997:67–71, especially note 7) emphasizes that entrepreneurs' forward-looking behavior and expected internal rates of return are coordinated by the single market interest rate. Once an entrepreneurial plan is implemented in reality, however, things rarely go according to plan and an after-the-fact Hayekian triangle might be expected to be extremely lumpy. But since entrepreneurs should always opt for a higher return in production, in another sense the Hayekian triangle is backward looking, because the returns to different stages of production can only be equalized through arbitrage - if one stage yields an above market return, the value of the resources should be bid up until the yield falls to the market rate. This cannot happen before the fact of realizing temporarily above market returns, however.

Although the Hayekian triangle is a general model of intertemporal resource allocation, it is generally interpreted as a model of how interest rates determine allocation of investment versus consumption spending, and how the production structure is manifested in the capital stock, or more properly, in the capital structure.

[1] Entrepreneurial action is necessarily multifaceted and defies simple quantification. Blaug (1998:227) cites several different historical views of entrepreneurship. Entrepreneurial action includes arbitrage (Cantillon, 1755), coordination (Say, 1803; Kirzner, 1973), innovation (Schumpeter, 1911), uncertainty-bearing (Knight, 1921), and most recently (Casson, 1982, 1985) increasing the range of available judgments on resource allocation.



[1] Source: Garrison 2001, p. 47.

Fig. 1 The Hayekian Triangle.

This paper builds on the insights of Shah (1997) who first developed the contrasts and similarities between the New Keynesian and Austrian business cycle theories, as well as extending the work of Lewin (1997a, 1999) and Horwitz (2000). Because this paper discusses a formal model of a kind which is uncommon among the Austrian school, it attempts to answer Spadaro's (1978) call for selective adoption of rigorous formalism. New Keynesian models of the business cycle emphasize the result that insignificantly suboptimal behavior causes aggregate demand shocks with significant real effects (Akerloff and Yellen, 1985). Resistance to changing prices or wages plays the same role in the New Keynesian models as resistance to adjusting the capital structure plays in Austrian business cycle theory: both rigidities or inertial properties keep the macroeconomy from full general equilibrium, and introduce large fluctuations in aggregate output and employment. Because this paper generalizes two competing models, arguing that the New Keynesian models are special cases of the Austrian business cycle, the methodological approach owes much to John Dewey's theory of knowledge, especially as presented in Dewey and Bentley (1949), Palmer (2004), and Boettke, Storr, and Lavoie (2004).

The paper is organized as follows: section 2. The Austrian Theory of the Business Cycle, summarizes the theory; section 3. Qualitative Applications and Earlier Empirics, reviews applications of the theory to historical data; section 4. The New Keynesian Small Menu Cost Theory of the Business Cycle summarizes that theory; section 5. An Austrian Critique of the Small Menu Cost Model, develops some Austrian objections to the small menu cost model; section 6. An Austrian Model of Inertia in the Production Structure, reinterprets the small menu cost model in light of Austrian business cycle theory; and finally section 7. Conclusion, provides concluding comments.

2. The Austrian theory of the business cycle

This section briefly summarizes the Austrian capital theory on which the reinterpretation of the small menu cost model is based. Hayek (1935:136–139), Mises (1949:550–566), and Garrison (1986:440; 1988; 2001:71–73) draw a fundamental distinction between ordinary changes in time preference and policy-induced changes in interest rates. Only a decrease in interest rates caused by credit expansion can drive the business cycle. According to Austrian business cycle theory, there should be no cycle if the decrease in interest rates is due to a general lowering of time preference. Because production takes place over time, time preference assures outputs from each stage have greater expected value than the sum of inputs (Mises, 1949:483–488; Rothbard, 1962:323–332; Garrison, 1985:169; 2001:46).

The interest rate is the rate of time discount implicit in the pattern of prices of productive resources, including capital goods. Garrison cautions (1985:169–170; 2001:50) this is not necessarily the same as the loan rate determined in the loanable funds market, though he also acknowledges the market process eventually adjusts the loan rate to the broader market rate of interest. In the Austrian view, determinants of the broader market interest rate are not exhausted by the determinants of the loan rate in the loanable funds market (Rothbard, 1970:321–323), although the slope of the hypotenuse of the Hayekian triangle reflects the interest rate determined in the loanable funds market (Garrison, 2001:50). The value of inputs is a derived demand determined by the price an entrepreneur expects to command for output at the end of a production stage.[2] This expected price is discounted over the duration of the production stage (Garrison, 1985:170; 2001:46).

Productive resources have differing degrees of substitutability and complementarity (Garrison, 1985:168; 2001:49). Austrian business cycle theory emphasizes the inflexibility imposed by the high cost of reallocating installed physical capital. It is important to realize that similar kinds of inflexibility and high adjustment costs can come from other resources, particularly labor (Lachmann, 1956:79–78; Lewin, 1999:130–132). Workers often resist seeking employment outside preferred venues. Lewin (1999:178–199) argues that human capital has many of the same characteristics of physical capital and thus imposes many of the same inflexibilities. Because this source of high unemployment results from high adjustment costs which frustrate resource allocation and adjustment of the production structure, rather than from real or nominal wage or price stickiness, this potential cause of recession, though labor-based, should be recognized as Austrian rather than Keynesian. Mulligan (2002) presents evidence that labor employment is reallocated over the business cycle in a manner similar to that predicted by Austrian business cycle theory for the physical capital it complements.

Furthermore, in the distinctive Austrian view, what makes something capital equipment is not any objective physical property it may possess, but the subjective value conferred by an entrepreneurial planner who envisions using the thing in the context of a definite production plan or capital structure (Lewin, 1999:5–6, 68–71). Though actual production activities can be objectively observed, the underlying entrepreneurial valuation and expectations can only be inferred and subjective. When changing conditions

[2] Batra (1974), Britto (1980), Mills (1983), and Schmitz (2004) present models analyzing the impact of uncertainty on production.

call for entrepreneurial managers to revise their production plans, altering the capital structure, they face the constraint imposed by the pre-existing capital structure.[3] Future entrepreneurial plans are always potentially constrained by the desirability of making some use of the existing capital and goods in process, though in extreme cases it may be abandoned completely. This is more likely to be the case the closer capital equipment is to the end of its usable life, but then the adjustment cost is the whole value of the discarded equipment. Much production which occurs during business expansions is simply wasted, because given people's time preference, this output was never desired anyway (Hülsmann, 2001).

In the Austrian theory of the business cycle, policy-induced monetary or credit expansion discoordinates the Hayekian production structure in an unsustainable manner, creating the boom before the bust. Expansion is manifested in an artificial oversupply of investable resources (often called loanable funds, see Garrison, 2001:36), signaled by a below-market interest rate. As a practical matter, it is much easier to conclude either that (a) money or credit supplies have increased, or that (b) commercial and industrial lending or private domestic investment spending have increased, than to assert that a particular prevailing interest rate is lower than what the market would dictate in the absence of the overexpansion. Austrian capital theory does not rely on Fisher's (1896) distinction between real and nominal interest rates or Frydman and Rappoport's (1987) distinction between anticipated and unanticipated changes in the general price level, instead emphasizing a distinction between preference-based changes in interest rates and policy-induced changes.

The unsustainable expansion is most often considered in terms of an overabundance of physical capital which is installed in increasingly earlier stages of production. As the expansionary intervention supplies more investable resources, and does so at a depressed interest rate, entrepreneurial managers fund lower and lower yielding investment projects in earlier production stages more remote in time from final users, simultaneously taking advantage of the lower loan interest rate and the newly more abundant supply of investable resources.

However, the business cycle can also be described in terms of how expansionary policy forces an overcommitment on the part of entrepreneurial planners to activities which are both more capital-intensive and time-intensive, and thus, lower-yielding. Such production plans cannot be expanded or sustained indefinitely, even if the interest rate continues to fall, because the nominal interest rate cannot fall below zero (Mises, 1949:552, Sechrest, 1997:20). Planners surrender flexibility whenever they commit liquid financial capital to a particular production plan. If business conditions change, production plans can not be completed as originally anticipated. The removal of flexibility on the part of the entrepreneurs can be though of as the proximate cause of the business cycle.

In adjusting to an inflationary environment, the production structure simultaneously extends average production time, and attempts to increase the amount of output supplied to consumers, who save less in response to the lower interest rate. Hayek (1935:137) describes this concave "triangle" as curvilinear. In earlier stages of production, more productive activity occurs, but with a lower rate of return to compete

[3] This is not a sunk cost, but the value of the capital remaining at any point in time, minus its salvage value.

with the low interest rate. In the latest stages of production, high rates of return are necessary in spite of the low interest rate, because the low interest rate influences consumers to demand more final output. Resources are allocated out of middle stages of production into earlier and later stages, forming the "curvilinear" triangle. But middle stages of production serve the essential function of connecting the early and late stages. Because the early and late stages overexpand while middle stages atrophy, there is no way to move the full volume of early stage goods-in-process through the middle-stage bottleneck, to the late stages where consumers are clamoring for more output and saving less in response to the unattractively low interest rate.

Expansionary policy locks entrepreneurs into production plans which are specific courses of action the same policy renders unfeasible. Horwitz (2000:82) notes that entrepreneurs typically fail to effect perfect coordination of the production structure, but in the absence of monetary expansion which creates investment spending over and above the savings consistent with agents' time preferences, these coordination failures will be random and non-systematic. Expansionary monetary policy results in what Horwitz terms a systematic unsustainability in both the capital structure and the price vector. Hülsmann (2001) particularly emphasizes that this overinvestment-overconsumption boom, which everyone applauds as an era of blessed prosperity, is better understood as a period of waste. Scarce resources are committed to a production structure which cannot supply as much output over the long run as the sustainable preinflation, preexpansion production structure.

Lower interest rates reward entrepreneurs and firms which exploit most fully the most roundabout, capital-intensive production activities. These plans can not prove profitable in the long run, unless the low interest rate persists indefinitely, that is, unless the lower interest rate is due to a permanent lowering of the general rate of time preference. Even if expansionary policy attempts to keep the interest rate artificially low, the later stages of production cannot be completed. Artificially low interest rates increase early-stage production, late-stage production, and consumption, and at the same time depress saving.

The Austrian business cycle focuses on intertemporal production plans because heterogeneous, multiply-specific factors must be coordinated in an intricate and deterministic way to yield consumable output (Lewin, 1999:121–125). All factors of production should be regarded as inherently heterogeneous and multiply specific. Even two otherwise identical piles of coal of the same type and grade, take on a heterogeneous character if one is located in North Carolina and the other in Korea. Transportation costs must be expended to render the two resources more truly homogeneous. Even if the two piles were located contiguously, their consumption or use in production must necessarily be separated temporally, if not spatially. Coal located in the interior of a pile can not be used as soon as coal located on top.

a. Say's law and the Austrian business cycle

Conventionally rendered as "supply creates its own demand," Say's Law asserts that satisfying the wants of others enables us to earn the income we need to satisfy our own wants. Prior to Keynes (1936), Say's Law was interpreted as asserting the impossibility of a general overproduction. If producers supplied more than what consumers desired, or if they produced the wrong items, produced output would go unbought,

signaling to the producers to produce less. Keynes (1936:26) argued that Say's Law systematically broke down during the Great Depression. More had been produced than people were willing to buy. Aggregate demand had collapsed, lowering prices, and making it impossible for private industry to employ enough of the work force at reasonable pre-depression wages. With so many people out of work, there was a significant decrease in demand for output, preventing business firms from employing enough people in a vicious cycle.

In Keynes's view, private industry had supplied too much, and it could no longer sustain enough demand for this much output. It is significant that Keynes was unable to explain why the economy should ever overproduce, beyond claiming it was just an inevitable shortcoming of capitalist organization. His argument was that this was a natural instability of private economies, and he felt government intervention was warranted to counter it. As Keynes saw it, the only alternative to intervention was outright socialism.

From the perspective of Austrian business cycle theory, it is easy to see that overproduction did occur in the late twenties, and also easy to see why. Government and Federal Reserve System policy was to expand the money supply, getting commercial banks to loan out more than they held in deposits. This expanded the supply of goods and services, increasing the demand for labor and other resources, and lowering the unemployment rate. The expansion was unsustainable because it was unsupported by real savings. When the Federal Reserve System finally tightened the money supply in the late 1920s, the economy collapsed as banks called in business loans. Businesses were forced to cancel planned expansion activities. Throughout the depression, supply of and demand for output were both lower than their pre-depression levels (Rothbard, 1962).

Austrian business cycle theory can be understood as an explication of Say's Law. This is most obvious in a barter economy where the demand for any commodity is identical to the supply of all other commodities. In a monetary economy, when consumers demand a good, they are supplying money, which they receive from other demanders in exchange for the supply of other goods or resources (Hutt, 1974, Johnson, 2001, Salerno, 2001). Entrepreneurs compete to best satisfy consumer wants and gain cost advantage by making the best use of available resources. Recessions occur when entrepreneurs are given too cheap access to too plentiful credit facilities. Entrepreneurs respond by expanding production and employing more capital in more roundabout and time-consuming, and thus lower-yielding, productive activities. Entrepreneurs demand more producer goods in early stages of production, even as they attempt to supply more consumer goods in later stages. Consumer demand rises because saving falls with the lower interest rate. The derived demand for labor is discounted based on how remote the labor is from final output (Van den Hauwe, 2001). Unless the production possibilities set expands, the economy cannot simultaneously produce more producers' goods and more consumers' goods. Supply cannot create its own demand when credit expansion results in too much being supplied in too inefficient a manner. Correction becomes inevitable.

b. Installed v. Financial capital in entrepreneurial plans: Bischoff's putty-clay model

Bischoff (1970) presents a valuable distinction between uninvested financial capital and installed physical capital: the "putty-clay" model. In his formulation, "putty" capital is uninvested saving which helps clear the loanable funds market. "Clay" capital has already been installed, and is expected to yield a definite return in currently-operating entrepreneurial plans.[4] This expected return must be at least as high as the return on financial assets, such as government bonds, available to entrepreneurs when they formed their production plans. The actual return on installed capital may be lower, as expectations may be disappointed.

When interest rates change, this impacts entrepreneurial decisions about whether and where to invest "putty" capital. "Clay" capital, which is already installed, may be abandoned completely, or may be used exactly as called for in the original production plan. Most commonly, however, "clay" capital is used in modified production plans, which attempt to extract as high a return as possible (Garrison, 2001:74). The available "clay" capital was intended for a different production plan, predicated on a different interest rate, for a given maturity corresponding to the useful life of the installed capital.

In Keynesian terms, there is a liquidity constraint on "clay" capital, in contrast to uninvested "putty" capital. Investors would take funds directly out of installed capital and invest these funds in higher-yielding government bonds or other financial assets if they could, but these funds are tied up in illiquid physical assets, or in term leases on physical assets. These physical assets may be sold but cannot command as high a price once their productive yield becomes less competitive. Lachmann (1947, 1956) recognized that installed "clay" capital is inherently multispecific and heterogeneous.

It is less obvious that multispecificity and heterogeneity are also shared to some extent by uninstalled financial or "putty" capital. This insight is the basis for the segmented markets (Culbertson, 1957) and preferred habitat (Modigliani and Sutch, 1966) theories of term structure, the relationship between average annual return and the time to maturity at any point in time (Thomas, 1997:138–154; Van Horne, 1998:83–100). In the more basic pure expectations theory (Fisher, 1896; Lutz, 1940) and liquidity premium theory (Hicks, 1946:146–147) different maturities are perfect substitutes, thus supply of and demand for different maturities of investable assets-loanable funds have infinite elasticity of substitution.

Under the pure expectations theory, arbitrage ensures that only expectations about future interest rates enable financial assets of different maturities to have different yields. Under the liquidity premium theory, in addition to expectations, it is recognized that individual's desire for liquidity means lenders will demand, and borrowers be willing to pay, a liquidity premium for longer maturities, partly to offset higher default risk (Fisher, 1959). The segmented markets theory treats different maturities as having

[4] Keynes (1936) and Garrison (2001) both attempt to address the role of entrepreneurial and consumer expectations. Garrison's approach is narrower, but also more modern, technical, and systematic. Butos (2001:11–15) criticizes Garrison's approach. Lewin (1999:30–44) discusses the activity of adapting production plans to revised expectations.

zero elasticities of substitution, and the more realistic preferred habitat theory assumes substitution elasticities across maturities are low, but that if one maturity offers a higher yield than others, arbitrage across maturities would drive away savings and attract investment demand, until the yield inequality was minimized. The market process consists of entrepreneurial planners effecting adjustment toward a dynamic equilibrium they continuously redefine. The prevailing term structure of interest rates determines resource allocation among early, middle, or late stages of production, in accordance with consumers' time preference and available investment alternatives.

c. Entrepreneurial behavior in business firms

Market order evolves spontaneously (Hayek, 1973:39) and because firms are intelligently-designed entities, it is difficult to place the firm within the market order (Khalil, 1995, 1997a, 1997b). Coase (1937, 1988) advanced the thesis that production is generally organized in firms to minimize transactions costs which would otherwise prevent many exchanges and productive activities. This assertion cannot be attacked on its face, but this is not all firms accomplish. An extensive management literature has emerged on entrepreneurial planning within firms (Pondy, 1970; Pfeffer and Salancik, 1978; Hannan and Freeman, 1984; Levinthal, 1994; Lombardo and Mulligan, 2003). It seems clear that the Austrian school also offers additional insight into why production is organized in firms. Firms provide an institutional context for entrepreneurial discovery (Kirzner, 1973, 1979, 1985), facilitating the use of relevant knowledge and information (Potts, 2001) and the coordination of the production process (Yu, 1999).

Because Austrian business cycle theory is built on the concept of production or capital structure, the role entrepreneurial managers play in adjusting and maintaining the production structure connects Austrian macroeconomics with Austrian microeconomics. Production structure is central to the Austrian theory of the firm (Dulbecco and Garrouste, 1999), thus grounding Austrian business cycle theory firmly on microeconomic foundations. Baetjer (1997, 2000) notes that the need to coordinate production through the capital structure is ongoing and omnipresent due to the frequent arrival of new knowledge, which generally requires modifying the production structure.

Baetjer emphasizes that capital equipment is useless if workers do not know how to use it, and if complementary capital is not available, e.g., a locomotive cannot be operated by a lay person, and cannot run without tracks. Lachmann (1947:199), Lewin (1999:123–125), and Cochran (2001:22) make a similar point. Maintaining the production structure is a dynamic, disequilibrium process (Lewin, 1999:22–25; Lewin and Phelan, 2000:68). Augier and Augier (2003) develop a set of formal models to explore the implications of regarding stages of the production the production process as endogenous, that is, determined by entrepreneurs responding to incentives within the economy.

3. Qualitative applications and earlier empirics

Austrian business cycle theory has contributed a series of qualitative explanations of historic business cycles. Curiously, though today often dismissed uncritically, the

Austrian business cycle was once the leading theory (Haberler, 1937). More recently Austrian theory is often dismissed (Friedman, 1969:261–284, 1993; Hummel, 1979; Yeager, 1986:378; Tullock, 1987, 1989; Cowen, 1997; Wagner, 2000) or simply ignored. In response, an Austrian literature of defense, apology, and counterattack has developed (Salerno, 1989; Garrison, 1996, 2001; Cwik, 1998; Block, 2001). Although their analysis of investment as a driver of recession owes little to the Austrian school, Chari, Kehoe, and McGrattan (2002) conclude the Great Depression was caused by labor market rigidities, and that investment frictions played a minor role. Holcombe (2001) discusses some reasons why Austrian macroeconomics is undervalued by the neoclassical and Keynesian mainstream.

Rothbard's (1963) study of the inflationary roots of the Great Depression persuasively argues that credit expansion created an unsustainable boom in the 1920s, and that government policy frustrated the efforts of economic agents to liquidate inefficient capital, resulting in a protracted secondary contraction, thus transforming what would have been a routine recession into the Great Depression by preventing prompt liquidation of overinvestment. Valuable resources which could have been used for more productive purposes, and for output more urgently desired by consumers, instead were tied up in fruitless and counterproductive attempts to maintain labor employment in the same industries which had already overexpanded through the malinvestment boom. Focusing on unorthodox and rarely examined monetary aggregates, Rothbard shows that inflation and credit expansion continued sporadically well into the 1930s, effectively preventing any general liquidation of malinvested capital. Rather than facilitate liquidating malinvestment, easy credit policies generated further opportunities for malinvestment. The misallocation of productive resources was further exacerbated by governmental efforts to restore and maintain artificially high prices through cartelization and price controls.

This view contrasts markedly with Friedman and Schwartz's (1963) conclusion that the secondary contraction was caused by the Federal Reserve System's failure to provide *enough* liquidity (Table 1). Using the standard monetary aggregate that ultimately emerged as M1, Friedman and Schwartz find that the main problem during the depression was that the money supply shrank, even though the monetary base grew. Table 1 summarizes some of the evidence cited by Keynesian, monetarist, and Austrian authors. It is difficult to avoid the conclusion that the Austrian explanation is the most encompassing, even though Austrian business cycle theory focuses on the unsustainable expansion which precedes a recession.[5] The monetarists are simultaneously to

[5] The author is much indebted to Sudha Shenoy for a highly enlightening conversation on the state of understanding of the causes of the Great Depression prior to the publication of Friedman and Schwartz's *Monetary History of the United States* (1963). It simply was not clear whether monetary policy had been expansionary or contractionary during the thirties until this definitive study was published with its huge volume of previously unavailable monetary data. Until then, armchair Keynesians were free to presume facts supported their conclusions. Rothbard's (1963) reliance on subsequently ignored monetary aggregates and proxies was largely necessitated by the unavailability of more widely accepted data prior to the publication of the *Monetary History*. Rothbard (1978) explains and justifies his choice of data, but see also Anderson (1949:125–502) for a contemporary account of the Great Depression. Responding to Keynesian assertions largely unsupported by data that monetary policy had been unambiguously and ineffectively expansionary, Friedman and Schwartz concluded that policy had been almost unambiguously contractionary. Their conclusion does not square entirely with the facts, many of which Friedman and Schwartz were the first to document. Policy was inconsistent, as Rothbard shows, providing some support for Keynesian claims,

Table 1 Competing Views of the Great Depression

Keynesian	Monetarist	Austrian
Liquidity trap created once nominal interest rates became low enough; bank demand for excess reserves became perfectly elastic. Monetary base doubled between 1929–38: monetary policy was expansionary, but excess reserves accumulated in banks. Demand for loans depressed due to unfavorable business outlook. Banks did not buy any but the shortest-term securities because nominal yields were so low.	Real interest rates extremely high due to price deflation: e.g., CPI fell 10% in 1931 and 1932, indicating contractionary policy. Growth in monetary base mostly attributable to currency held by public, unavailable for lending, rather than bank reserves. "Flight to quality" greatly increased demand for short-term Treasury securities, depressing their yield. Fed tightened discount lending policy in 1931, and doubled the reserve requirement between 1936–37, triggering a secondary recession.	Expansionary monetary policy depressed interest rates and created an unsustainable investment boom throughout the late 1920s. Monetary policy was intermittently expansionary and contractionary throughout the 1930s. Government intervention initiated under the Hoover administration between 1930–32 delayed liquidation of malinvested capital. Price fixing, fiscal stimulus, and monetary activism (intermittently expansionary and contractionary), continued and extended under the Roosevelt administration, delayed liquidation of malinvested capital, prolonging the Depression.
Keynes, 1936, Hicks, 1939, Modigliani, 1944	Friedman and Schwartz, 1963: 411–419	Rothbard, 1962, Garrison, 2001

be applauded for introducing the first evidence of contractionary policy over three decades after the start of the recession, as well as to be scolded for selectively ignoring very real evidence of expansionary policy, which remains irrefutable.

The Austrian perspective can be interpreted as intermediate between the Keynesian, emphasizing a liquidity trap which made expansionary monetary policy ineffective, and the monetarist, which criticizes the Fed for unwittingly implementing a contractionary policy. The Austrian school blames the expansionary policy of the 1920s for the onset of the Depression, and active government and central bank policy for transforming what would have been a routine recession into a decade-long ordeal. The Austrian school goes beyond the monetarist school in emphasizing the real discoordination and resource misallocation forced by government and central bank activism, resulting in persistent and abnormally high unemployment.

Because he was not an academic, Harwood (1932) focused only on the unsustainable aspects of inflation, not on how it created an overextended production structure. Economic historian William Graham Sumner (1891) also recognized that inflation precipitated economic downturns. Harwood's theory of the business cycle was that

and this inconsistent expansionary-contractionary policy provided an especially difficulty environment for entrepreneurs' liquidation of malinvested capital, delaying recovery for nearly ten years. In an important sense, both Keynesians and monetarists failed to see the forest for the trees.

the root cause was any excess of investment spending over saving. Such an imbalance can only be introduced through systematic expansion of the money supply, which allows banks to lend funds for business investment in excess of the savings they hold on deposit. He argued that the amount might be small initially, but would necessarily grow over time, as producers' goods face increased demand, bidding up their price.

Harwood agreed with Mises and Hayek that unsustainable expansion comes about primarily because the interest rate is kept artificially low due to the oversupply of cheap credit, and businesses take advantage of the attractive low borrowing rate to finance expansion of production facilities. He largely disregarded the impact of localized distortions, recognizing that they occur, but arguing that their impact distorting the allocation of productive resources must be negligible. This is a major difference between Harwood and Mises and Hayek.

In Harwood's view, as soon as investment spending exceeds saving, businesses that sell producer's goods start expanding to satisfy increased demand for productive assets. The increased spending results in increased income to households and workers, meaning that the increased demand is for consumption goods as well as investment goods. Harwood's point is that this leads to a general increase in business activity to satisfy what businesspeople perceive as increased demand for goods and services. Though he accepted the Mises's and Hayek's views that investment and employment expand fastest and farthest in the industries most directly affected by the additional investment spending, he felt this was generally less important than the fact the increase in spending is quickly diffused throughout the consumption-goods-producing sector.

O'Driscoll and Shenoy (1976) present an account of the stagflation of the 1970s. They note that credit expansion increases nominal demand at the point the newly-created money is injected, distorting the price vector and the allocation of resources, especially of capital which cannot be easily reallocated. Credit expansion always increases consumption expenditures because any new money results in increased nominal income to some households. Firms engaging in production most remote from consumption find resource prices bid up, and resources bid away, by firms selling directly to consumers. Unemployment starts in these firms remote from final consumption even as prices continue to be bid up by continued injections of cheap credit. Garrison (2001:145–164), in the most important contribution to Austrian macroeconomics since 1949, also provides convincing accounts of both the Great Depression and the stagflation of the 1970s using the Austrian model.

Sechrest (1997) suggested certain relationships and similarities between Austrian and monetarist business cycle theories. He also points out several fundamental differences. Garrison (2001) also emphasizes the similarities between Austrian and monetarist business cycle theories. Shah (1997) pointed out similarities between New Keynesian and Austrian business cycle theories, particularly with the small menu cost theory, which are further developed here.

Cwik (1998) uses the Austrian theory to analyze the Gulf crisis recession of 1990. Carilli and Dempster (2001) argue that Austrian business cycle theory places undue reliance on economic agents misperceiving credit expansion as a real increase in loanable funds. They suggest that even if rational agents correctly anticipate inflation, agents maximize profits under uncertainty by taking advantage of the market interest rate whenever it falls below the underlying rate of time preference. Keeler (2001) used standardized quarterly data for eight U.S. business cycles, finding monetary shocks

did cause cycles which were propagated through relative price changes, including nominal interest rates.

Powell's (2002) account of the Japanese recession of the 1990s is especially noteworthy because he focuses on exactly how expansionary monetary and fiscal policy recommended to spur recovery, actually lengthened and deepened Japan's recession. His conclusion is that monetarist policy prescriptions proved only marginally less ineffective than Keynesian ones. As with the Great Depression, poor policy prescriptions transformed what should have been a routine recession into a decade-long ordeal. Mulligan (2002) uses sectoral labor data as indicators of resource allocation among industrial sectors. Resources are reallocated among early, middle, and late stages of production in response to changes in nominal interest rates, as Austrian business cycle theory predicts.

Callahan and Garrison (2003) explain the 1990 technology boom and subsequent recession of 2001–2002 in terms of Austrian business cycle theory. They are able to point to specific Cantillon effects created when excess liquidity was injected into localized markets, showing how markets temporarily inflated prices for computer programmers and web developers, real estate in certain cities, and technology stocks. Cochrane, Call, and Glahe (2003) argue that the location and timing of credit injection are especially critical in determining where and how far the production structure will overexpand, and what will be the nature and timing of the inevitable collapse. Sechrest (2003) also finds substantial support for the Austrian business cycle model in regression analysis of conventional macroeconomic data. Mulligan (2003, 2004) also finds support for Austrian business cycle using error-correction models estimated with macroeconomic data.

In marked contrast to orthodox neoclassical and Keynesian accounts of the business cycle, Austrian business cycle theory presents a consistent and coherent explanation of the causes and propagation mechanisms of the business cycle. Though more typically qualitative than quantitative, the explanatory successes of Austrian business cycle theory have proved robust over an impressive time period and range of specific applications. This success makes it puzzling that Austrian business cycle theory has not been enthusiastically embraced by non-Austrians, and that it has yet to reemerge as the dominant macroeconomic policy paradigm.

4. The New Keynesian small menu cost theory of the business cycle

The New Keynesian small menu cost model of the business cycle is an attempt to explain the business cycle in terms of resistance to small changes in prices. Price stickiness results in large changes in real output, employment, and consumer welfare. When all resources are considered heterogeneous, the critical contribution of the entrepreneurial planner can be appreciated. Entrepreneurs are not resistant to changing small menu prices merely because of the accounting cost of doing so, but because of the cost of marshalling information against the uncertainty of future market conditions and the cost incurred when their decision goes wrong.

The small menu cost model attributes the inability of entrepreneurs to reallocate resources to the false signals given by market prices which are temporarily slightly out of equilibrium due to price-setters' desire to avoid costs associated with changing

prices. Thus the allocation realized by the market is necessarily suboptimal, resulting in large swings in real output and employment.

It seems much more satisfactory to view the underlying inflexibility in resource allocation to a more general resistance on the part of entrepreneurs to altering their production plans, an activity which occasionally becomes imperative, but often can be avoided as particularly risky, costly, and undesirable. It seems more promising to incorporate behavioral inertia into models of entrepreneurial action, an element of resistance to revising production plans. Entrepreneurs hope for an environment where their plans can be left in place as long as possible, an entirely natural response to uncertainty.

Thus a reformulated Austrian business cycle theory emphasizes costs associated with changing production plans, rather than merely with costs associated with changing prices or capital allocation alone. The production plan formulated by an entrepreneur specifies the quantity and types of resources to be combined, in a definite manner, given expected resource and output prices, to yield a certain amount of a definite output of a certain expected value. Many characteristics of such a plan would frustrate attempts at too-frequent revision, not only resource prices. Each characteristic of such a plan imposes certain difficulties and costs, and thus contributes to large fluctuations in output and employment, along with small menu costs. The small menu cost model serves as one example of how these fluctuations can arise, but it seems clear that it is only one cause among many and that Austrian capital theory offers a more general, and consequently more satisfactory, explanation of the business cycle.

The small menu cost model (Rotemberg, 1987; but see also Rotemberg, 1982; Akerloff and Yellen, 1985; Mankiw, 1985; Ball and Romer, 1987, 1990; Ball, Mankiw, and Romer, 1988; McCafferty, 1990:453–463) is based on the Taylor series expansion[6] of the profit function for a representative firm in a monopolistically competitive market. Firm i should refrain from changing output prices as long as the (economy-wide with J identical firms) difference in profits gained through changing prices is smaller than the cost of changing prices, the menu cost c,

$$\Delta \equiv J\pi_i^1 - J\pi_i^0 < c,$$

where π_i^1 is firm i's profit if it charges the new price and all other firms continue to charge the old output price P^0, and π_i^0 is firm i's profit if it refrains from changing price, along with all its competitors who continue to charge P^0. The result

$$\frac{\Delta}{P^*} \cong \theta^{1/(1-\beta)} \frac{1-(1-\theta)^2}{2(1-\theta)} \frac{(P^0-P^*)^2}{(P^*)^2},$$

an expression for the difference in profits divided by the flexible-price equilibrium price level P^*, contains no first-order expressions in $(P^0 - P^*)$, the change in prices. It is observed that if $\Delta < c$, then not changing output prices will be optimal for all

[6] For applications of the Taylor series expansion in economics, see Henderson and Quandt, 1956:375–376; Chiang, 1967:256–258; Takayama, 1974:399–400, 428; Silberberg, 1978:48–51, 118–121; Varian, 1978:313. For non-economic applications see Gellert et al., 1975:488–496 or nearly any calculus text.

firms, and since Δ is proportional to $(P^0 - P^*)^2$, very low menu costs may still be compatible with the condition $\Delta < c$.

It is also demonstrated that output levels $Y_i = C_i$ always lie on the demand curves

$$JC_i = (P_i/P)^{1/(1-\beta)}(M/P)$$

in this monopolistically competitive market.[7] Since $P_i = P^*$ for all i, and P^* solves $M = P^*\theta^{1/(1-\beta)}$, the fixed-price equilibrium output level is

$$Y^0 = \theta^{1/(1-\beta)}(P^*/P^0),$$

and the difference between the fixed-price and flexible-price equilibrium output levels is given by

$$Y^0 - Y^* = \frac{\theta^{1/(1-\beta)}}{P^0}(P^* - P^0).$$

This expression demonstrates that changes in output levels due to nominal price rigidity, and therefore in employment levels, can be *first order* in $(P^* - P^0)$ while the underlying menu costs may only be *second order* (proportional to $(P^* - P^0)^2$). Rotemberg's conclusion was that his argument demonstrated the possibility that small menu costs, which plausibly delay producers from adjusting prices toward equilibrium and prevent markets from clearing, result in much larger swings in real output and employment.

Evidence for small menu costs has not been overwhelming. As Shah (1997: 43–47) points out, this may be inevitable in the absence of a consensus on how often price adjustment should occur and how efficient markets can be. The key result is that nominal rigidities may be small and still cause business cycles; it may well be that the rigidities are too small to perceive. It is important to realize that none of these findings could prove or disprove the importance of price or wage stickiness. Cecchetti (1986) found evidence of rigid newsstand prices for magazines. Kashyap (1995) found mail order catalog prices were only adjusted about once every six months. Blinder (1991) interviewed business executives, finding frequent non-price adjustments made in response to changes in supply and demand conditions. Changes at these non-price margins would overwhelm price rigidity even if it could be observed generally. Blinder found a mean lag of three to four months between changes in underlying market conditions and changes in prices. McLaughlin's (1994) analysis of Panel Study of Income Dynamics (PSID) data found annual real wage cuts and very small changes in nominal wages, in both directions, were common.

[7] From an Austrian perspective, it can hardly be satisfactory to assume a market structure which in fact evolves spontaneously from the choices made by uncoordinated market participants. Lewin and Phelan (2000) describe the implications of factor and expectational heterogeneity. In their view, firms are necessarily heterogeneous. This is not, however, a major shortcoming of Rotemberg's model. Of the several formalizations of market structure, monopolistic competition is widely regarded as offering the broadest applicability and most realism. It is noteworthy the Austrian school views both market structure and capital or production structure as spontaneously-evolved processes.

Rotemberg (1982) suggests firms that change prices too frequently may be viewed by their customers as erratic and face reduced sales. Rotemberg's small menu cost model is closely related to Akerloff and Yellen's (1985) model demonstrating second-order departures from optimal equilibria at the individual level can result in first-order fluctuations in macroeconomic aggregates. A closely related class of New Keynesian business cycle models, the efficiency wage models, base their results on wage rigidities rather than output price rigidities, exemplified by Yellen (1984).

5. An Austrian critique of the small menu cost model

Rotemberg's implicit assumption is that menu costs are the *only* barrier, or at least the most important barrier, to perfect and instantaneous market clearing. This is not so much an underlying assumption of Rotemberg's model as a basis for the New Keynesian interpretation of Rotemberg's result. The contrasting Austrian view is that all prices, or nearly all prices, are nearly always disequilibrium prices.[8] Prices are either held steady in between experimental entrepreneurial adjustments, or are in the process of being adjusted experimentally. Production plan adjustments aim at increasing profits but are not necessarily always successful. In between experiments, entrepreneurs are resistant to changing prices because they are deterred by the cost of getting the decision wrong, although they also understand that the current price is also wrong in some sense, and higher profits could nearly always be earned by changing to the currently unknown, currently correct price. This Austrian understanding accords very well with the New Keynesian concept of small menu costs. The justification for nominal rigidities is less important than the conclusion they are justified.

However, the Austrian view of the entrepreneur's price setting decision is that it is only one element the entrepreneur carries out in managing a production plan. The Hayekian production plan, which is subject to constant revision, includes current and expected future output and input prices, selection of technology, input and output quantities, and resource bills. Because production takes place over time, inevitable changes in market data change the most desirable outcome of the production process, even as output is being produced. Whenever the interest rate changes, optimal allocations of capital in each stage of production change, but production plans which have already been put in operation are less flexible. Each stage of production is filled with half-baked cakes (Kirzner, 1996:37–41). If there were no adjustment costs to be borne, the production structure could instantaneously adapt to changed market conditions, but usually it is too wasteful to completely abandon unfinished goods-in-process and already-installed capital equipment. However, as the New Keynesian small menu cost model emphasizes, resistance to making small price changes results in larger-order fluctuations in employment and output.

[8] It is interesting that Lachmann and Kirzner held contrasting views on the significance of disequilbrium prices. To Lachmann (1976a, 1976b), entrepreneurs change market conditions, often introducing new disequilibria, and guaranteeing that existing equilibria or near equilibria cannot long persist. In Kirzner's (1976) view, entrepreneurs discover disequilibria and profit from their removal. On this important distinction, see especially Lewin (1999:22–25). It seems especially promising to subsume these contrasting views as two species of entrepreneurial behavior; nevertheless, the two kinds of entrepreneurial activity –Lachmannian and Kirznerian entrepreneurship – exhibit marked formal differences.

Because capital equipment is long-lived and its cost must be amortized, the relevant choice an entrepreneur faces when new market information is revealed is best understood not so much in terms of what is the best production structure newly installed from scratch, but what is the best use of already-installed capital. Thus, the use of capital equipment, and other difficult to reallocate resources, such as human capital, imposes an additional set of inflexibilities on the market beyond nominal rigidities. Although nominal rigidities clearly impose inflexibility on entrepreneurial attempts to respond to changing conditions, nominal rigidities are nested within a given production structure. Thus Austrian business cycle theory can be considered as subsuming the New Keynesian small menu cost theory of the business cycle, although there should be a substantial debate between Austrians and New Keynesians over which plays a more important role in driving the business cycle, nominal rigidities or rigidities in intertemporal resource allocation, that is, capital structure rigidities.

The greatest shortcoming of the small menu cost model seems to be the lack of compelling justification for connecting nominal rigidities in clusters of errors, which must occur randomly fairly frequently, with the non-periodic business cycle. Individual entrepreneurial errors are common, occurring both frequently and randomly (Rothbard, 1997:73; Mueller, 2001:13), although in the small menu cost model, nominal rigidities are not errors in the local sense, only in the global sense. Since postwar recessions have occurred approximately every ten years on average, it seems fair to ask, that if recessions are due to nominal rigidities, why recessions are not more frequent. If the economy experiences a recession simply because it is optimal for firms to keep using old menus since it costs a non-negligible sum to replace them, it seems reasonable to ask why recessions occur less frequently than once every two weeks to six months.

Apart from the issue of how frequently the models predict recessions, is the issue of what coordinates the discoordination throughout the economy. Schumpeter's (1911, 1939) technology-based business cycle model faces the same difficulty. In the small menu cost model, firms face nominal rigidities, and periodically overcome them, seemingly at random. It may be that the business cycles are in fact due to nominal rigidities, but do not occur more frequently, because it calls for a fairly extraordinary confluence of random events to ensure a sizable number of firms are simultaneously failing to adjust prices, and perhaps this only happens randomly about once every ten years. Hülsmann (2001:36–39), in recognizing the importance error clusters, criticizes Garrison's (2001) modeling of them. Hülsmann emphasizes that the boom, which appears to be a period of growth and prosperity, is actually a period of wasting scarce resources. People's belief in the reality of their prosperity was as erroneous in 1999 as it was 1929.

In the New Keynesian view, recessions are inevitable and occur at random. Sechrest (2001:73–75) argues that monetarism provides a more plausible explanation of the timing of recessions than the small menu cost theory, but it also fails to explain why it takes so long for the economy to recover. In Austrian business cycle theory it is clear that the interest rate coordinates the economy's production structure, and credit expansion causes a general overexpansion of production and economic activity. Recessions are not inevitable, but result from poor monetary policy. Recessions last six months to two years because that is how long it takes for entrepreneurs to reallocate resources in a sustainable production structure, in the absence of continued central

bank intervention delaying or preventing liquidation of capital misallocated during the wasteful expansion.[9]

6. An Austrian model of inertia in the production structure

An Austrian reinterpretation of the Rotemberg (1987) model is developed below. Entrepreneurs seek to maximize the profit function incorporating a heterogeneous-capital-using technology (Lachmann, 1956), which might be represented in Cobb-Douglas form[10] as

$$Y_i = AL^{\alpha} \prod_{i=1}^{n} K_i^{\beta i}.$$

Each entrepreneur seeks to maximize the subjective profit function

$$\pi_{jt} = p_{jt} Y_{jt} - \sum_{i,j=1}^{n} p_{jit} k_{jit} - \sum_{i,j=1}^{n} p_{jit} l_{jit},$$

subject to the technology selected by the entrepreneur and the expected vector of prices, potentially revised even during the production process. In each period t, entrepreneurs purchase basic and intermediate inputs to transform into lower-order intermediate inputs and final output in period $t + 1$.

Rotemberg's profit-differential function now takes on a new and broader interpretation. Firm i should refrain from changing its production plan as long as the difference in profits expected to be gained through changing the plan is smaller than the adjustment cost a, analogous to, and including, the menu cost c,

$$\Delta \equiv \pi_i^1 - \pi_i^0 < c < a.$$

Clearly this adjustment cost a, since it includes the menu cost c, must always be at least as great as c, and often will be much greater. Thus the Austrian interpretation of the small menu cost model automatically imposes a higher threshold which must be exceeded before entrepreneurs react, suggesting a less flexible, less adaptive economy,

[9] The Austrian view, especially given by Rothbard (1962), is that the economy, once placed in a recession by the collapse of ill-considered expansionary policy, can recover very rapidly on its own unless prevented by continued policy intervention, aimed at maintaining production and employment at the pre-collapse levels of the unsustainable boom. According to Rothbard, this continuation of activist policy accounted for the severity and length of the Great Depression.

[10] This functional form is used only for illustrative purposes. No assumption is made about returns to factors. The Cobb-Douglas function is additive in logarithms. Note that though this production function incorporates multispecific capital, it follows the established practice of modeling labor as homogeneous. Given the Hayekian theory of the production structure, it is especially attractive to consider an additive production function of the form $Y_t = \sum_{(i=0)} q_{i(t-i)}$, where the q_is are the value added in each stage of production. The q_is can be considered sums of the value added by each factor used in a particular stage. Henderson and Quandt (1959:39-40) describe additive utility functions, though not production functions, discussing some of their mathematical properties.

an important advantage to the Austrian interpretation. The *J*s drop out because each entrepreneur's profit function is unique and while there might be a typical entrepreneur, there are no identical representative agents. The production plan at any time t is predicated on an information set[11] Φ in the sense of Alchian (1969), which in this case incorporates the production plan itself. In a zero-adjustment-cost environment, it would always be optimal and costless to adjust the production structure whenever new information becomes available. In the real world, however, entrepreneurs face information costs whenever they confront, develop, evaluate, and respond to new information.

In addition, entrepreneurs face the cost of discarding old installed physical capital, human capital, and goods-in-process embodied in the old production structure, as well as discarding outdated menus. Because the production structure cannot be constantly readjusted without incurring significant cost, once entrepreneurs have implemented a production plan, they may resist revising it, and may even resist alertness to new information which calls for revising a production plan once it has been implemented (Kirzner, 1973:35, 64–68, 1992:26–28; Hannan and Freeman, 1984). It seems to be in the nature of production planning that entrepreneurs are always engaged in adjusting them and reallocating resources, but adjustment costs and the desire to make use of already-installed physical capital and already-produced goods-in-process, ensure the production plan is never fully adjusted to the optimal, zero-adjustment-cost production structure.

It is attractive to think of the individual profit states and the difference in expected future profits which can be realized by adjusting the production structure as being a function of the generic information set Φ which includes the production technology relating inputs to outputs in each stage of production, and input and output prices, both present and those expected to prevail in the future. One essential component of the information set is the current interest rate, and expected future interest rates. This will be a key element in coordinating the behavior of disparate firms which are otherwise unlikely to act in concert.

In each decision period, entrepreneurs assess whether to revise the production structure. To obtain Rotemberg's result, expand a generalized expression for Δ around $\Phi^0 = \Phi^*$, where Φ^0 represents the original information set which was the basis for the prevailing production structure, and Φ^* represents a new information set implying a new and different zero-adjustment-cost profit-maximizing production structure. The second-order Taylor series expansion of Δ around $\Phi^0 = \Phi^*$ is given by

$$\Delta(\Phi^0) \cong \Delta(\Phi^*) + \left.\frac{d\Delta}{d\Phi^0}\right|_{\Phi^0=\Phi^*} (\Phi^0 - \Phi^*) + \frac{1}{2}\left.\frac{d^2\Delta}{d(\Phi^0)^2}\right|_{\Phi^0-\Phi^*} (\Phi^0 - \Phi^*)^2$$

[11] The information set must either be capable of being characterized by some unique cardinal measure, e.g., such as Gödelization with prime numbers (Gödel, 1931; Nagel and Newman, 1958; Gellert et al., 1975:720–723), or less restrictively, differences in the information set can be unambiguously characterized as greater, less, or indeterminate, at least hypothetically. This determination is, in reality, always subjective. The ordering must be homothetic but need not be additive over individuals. Indeterminate differences, where an individual is aware the information set has changed, but cannot decide how the existing production plan should be modified in response, result in no change to the production plan.

The first derivative of Δ with respect to Φ^0 can be written as

$$\frac{d\Delta}{d\Phi^0} = \frac{d\pi_i^1}{d\Phi^0} - \frac{d\pi_i^0}{d\Phi^0}$$

or equivalently in terms of partial derivatives as

$$\frac{d\Delta}{d\Phi^0} = \frac{\partial\pi_i^1}{\partial\Phi_i}\frac{d\Phi_i}{d\Phi^0} + \frac{\partial\pi_i^1}{\partial\Phi^0} - \frac{\partial\pi_i^0}{\partial\Phi^0}$$

in which it can be seen that the first right-hand-side term is identically equal to zero. This is because under the general assumption of expanding the Taylor series around $\Phi^0 = \Phi^*$, the partial derivative of each firm's (or each entrepreneur's) information set Φ_i is identical to the original starting information set $\Phi^0 = \Phi^*$, thus the first derivative $d\Phi_i/d\Phi^0$, is identically equal to zero, essentially by assumption.

The analogous expression for the second-order Taylor-series expansion, here for changes in the basic information set, can now be expressed as

$$\Delta \cong \theta^{1/\{1-\beta\)} \frac{1-(1-\theta)^2}{2(1-\theta)} \frac{(\Phi^0 - \Phi^*)^2}{\Phi^*}.$$

This expression for the minimum change in the production structure, or for production plan revision, contains no first-order expressions in $(\Phi^0 - \Phi^*)$, the information set revision. It is observed that if $\Delta < a$, then not changing production plans will be optimal for all entrepreneurs, and since Δ is proportional to $(\Phi^0 - \Phi^*)^2$, very low adjustment costs may still be compatible with the condition $\Delta < a$. Since output price is one component of the information set Φ, Rotemberg's original conclusion still holds. Entrepreneurial hesitancy against instantaneous and error-free adjustment in response to new information can prevent markets from clearing, and can result in much larger swings in real output and employment.

Including economy-wide interest rates in the information set Φ enables Rotemberg's model to plausibly face an economy-wide shock, general policy-induced credit expansion including a lowered real interest rate, resulting in an economy-wide unsustainable expansion, and consequent correction. Embodying past information sets in a production structure characterized by inertia, an essential feature contributed by Austrian business cycle theory, enables the Rotemberg model to plausibly explain why recessions occur approximately once every ten years rather than once every two weeks.

Comparing the two theories in this way demonstrates Austrian theory is at least as good as small menu cost theory, if not better, perhaps more importantly, that it is encompasses the New Keynesian theory, and that it more plausibly explains why recessions occur when they do. The biggest difference between the two theories is that in the small menu cost model, recessions are inevitable and occur at random. In the Austrian model, recessions are avoidable and are caused by expansionary monetary or fiscal policy.

7. Conclusion

Interest rates facilitate intertemporal coordination of productive resources by clearing the loanable funds market (Garrison, 1986:440; 2001:39). In this regard disequilibrium interest rates play the same role as prices in signaling opportunities for entrepreneurial discovery (Lachmann, 1976a; 1976b; Kirzner, 1984a:146; 1984b:160–161; 1997), and individual entrepreneurs respond by maintaining the production structure, that is, they adjust it by reallocating resources.

This paper proposes viewing capital not so much as a set of physical artifacts, but as embodied in forward-looking production plans aiming at transforming higher-order into lower-order goods of greater market value. The production process and its evolution through time, though employing labor and raw materials as much as more narrowly defined physical capital, are the essence of the capital structure.

An Austrian critique and interpretation of the New Keynesian small menu cost model of the business cycle has been presented and discussed. The Austrian generalization of the small menu cost model reveals that Austrian capital theory's multispecific-capital-using economy reduces to a nominal rigidities model when capital is removed. Austrian business cycle theory is proposed as an encompassing model of the business cycle, in which cycles arise due to resistances to instantaneous change, which can arise from many sources. The Austrian interpretation of the small menu cost model addresses several problems, including how rigidities are coordinated across heterogeneous agents.

The present paper proposes generalizing and reinterpreting Austrian capital theory to view investment and production planning within the context of a broader entrepreneurial plan, which includes setting current prices and forming expectations about future prices, as well as the decision to forgo current consumption by saving. Rigidities imposed by the structure of existing capital are likely to be more important than price rigidities in generating large fluctuations in output and employment. The capital structure inherited from a succession of past investment decisions is likely to impose the greatest constraint on future entrepreneurial plans, especially if policy-induced credit expansion has encouraged too much wasteful investment by making investable resources artificially cheap.

This proposed generalization of Austrian capital theory is grounded firmly in the literature of the Austrian school, particularly Shah's (1997) discussion of the relationship between the New Keynesian and Austrian business cycle theories, as well as the work of Lewin (1997a, 1999) and Horwitz (2000). As in the New Keynesian models, insignificantly suboptimal behavior causes aggregate demand shocks with significant real effects. Resistance to changing prices or wages plays the same role in the New Keynesian models as resistance to adjusting the capital structure or production plan plays in Austrian business cycle theory: both rigidities or inertial properties keep the macroeconomy from full general equilibrium, and introduce large fluctuations in aggregate output and employment.

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