

**OF COCONUTS, DECOMPOSITION, AND A  
JACKASS: THE GENEALOGY OF THE  
NATURAL RATE**

Chapter 3 of Surfing Economics.

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## Chapter 3.

# Of coconuts, decomposition, and a jackass: the genealogy of the natural rate

### 3.1 Introduction

The concept of the natural rate of unemployment was formulated in 1968, by Friedman and Phelps. In Friedman, it plays the central role in his theory of the relationship between short-run and long-run Phillips curve. However, in this chapter, I will focus not on its role within the theory of inflation *per se*, but rather on the fundamental notion of equilibrium, the natural rate itself. The natural rate stands in a tradition of ideas that may be loosely called *classical* or *monetarist*. We may well ask, therefore, two questions: first, how does the idea of the natural rate (NR) differ from its predecessors; secondly, how have more recent ideas developed or diverged from it? A full and proper answer to both of these questions would require a degree of scholarship and comprehensive grasp of the broad sweep of the history of economic thought which, alas, eludes me. However, I intend to approach both questions in terms of a series of snapshots and observations which will be drawn together towards the end of the chapter. Without spoiling the story, I conclude that the natural rate as an *equilibrium* concept was largely derivative of Patinkin's concept of full employment, as laid out in his *Money, Interest and Prices* (first published in 1956). However Friedman nowhere ever lays down a specific theory of the natural rate itself, and as such the concept has proven sufficiently loose and vague to fit a variety of subsequent models of equilibrium.

### 3.2 The Classical dichotomy

The origin of the notion of the natural rate lies in the view that (at least in the long run or some 'stationary state') real variables in the economy are determined by 'real things' such as preferences, technology, population and so on. To use Pigou's phrase, money acts as a 'veil', behind which the real economy operates (Pigou, 1941). The notion of the classical dichotomy itself was not formalised much by the classical economists. Perhaps its first

formal statement was by Patinkin (1965), whose ideas I will discuss later. However, in a very revealing essay written by Paul Samuelson in 1968, he defined the notion as a one-time believer. To quote at some length:

“Mine is the great advantage of having been a jackass. From 2 January 1932 until some indeterminate date in 1937, I was a classical monetary theorist. I do not have to look for tracks of the jackass embalmed in old journals and monographs. I merely have to lie down on the couch and recall in tranquility ...what it was that I believed between the ages of 17 and 22 ... We thought that *real* outputs and inputs and price ratios depended essentially in the longest run on real factors such as tastes, technology and endowments. An increase in the stock of money ... would cause a proportional increase in *all* prices and values” (1968, pp. 1-2).

As Samuelson stated, the idea or concept was not formalised. The essential idea was one of *homogeneity* of equilibrium equations in money and prices:

“A. Write down a system of real equations involving *real* outputs and inputs, and *ratios* of prices (values), and depending essentially on real tastes, technologies, market structures and endowments. Its properties are invariant to changes in the stock of money.

Then append a fixed supply of money equation that pins down (or up) the absolute price level, determining the scale factor that was essentially indeterminate in set A ...” (1968, pp. 2-3).

In statement A we have the real equilibrium of the economy in which real factors determine *relative* prices, and in B the monetary side of the economy acts as a scaling factor to determine *absolute* prices. This is stated most simply in the quantity equation: real output  $Q$  is fixed, and the money stock merely acts to determine  $P$  (via the well known equation  $MV = PQ$ ), with a direct proportionality between  $M$  and  $P$  if the velocity is constant.

However, the earliest notion of the dichotomy to my knowledge is in David Hulme (1750):

“Money is nothing but the representation of labour and commodities, and serves only as a method of rating or estimating them. Where coin is in greater plenty – as a greater quantity of it is required to represent the same quantity of goods – it can have no effect, either good or bad, taking a nation within itself; any more than it would make an alteration in a merchant’s books, if instead of the Arabian method of notation, which requires few characters, he should make use of the Roman, which requires a great many.”

Similar statements can be found in a variety of subsequent writers including Walras, Fisher and Cassel, Davenport, James Mill, Hawtrey (see Patinkin, 1965, Note I, pp. 454-62 for a brief history of the idea of the dichotomy).

### **3.3 Patinkin and full employment**

*Money, Interest and Prices* is perhaps as great in its vision as Keynes’ *General Theory*. Whilst the latter has a greater abundance of originality, the former has a greater clarity of insight and formal expression. Don Patinkin states his theory of the labour market and corresponding notion of the full employment equilibrium in just three pages of *Money, Interest and Prices* (in the 1965 edn. pp. 127-30). These pages deserve great attention: they state the labour market model that became the standard foundation for the aggregate supply curve in the aggregate demand/aggregate supply (AD/AS) model. Although Patinkin himself did not formulate the AD/AS representation, it is implicit in his *Money, Interest and Prices*.

Patinkin presents his model of full employment diagrammatically (in his figure 10 on p. 129) as has become standard in macroeconomics textbooks. Labour demand depends on the real wage (and capital which is fixed), as does labour supply. Amending Patinkin’s notation to reflect subsequent usage we have the familiar figure 3.1.

*Figure 3.1 Patinkin’s model of full employment*

Two points need to be made about this model. First, Patinkin equates the notion of full employment with the competitive equilibrium in the labour market. Secondly, Patinkin

suppresses the wealth effect on the labour supply. It is worth quoting at some detail from Patinkin on the suppression of the wealth effect:

“To the extent that an individual operates on the principle of utility maximisation, the amount of labour supplied will depend on the real wage rate ... Thus we write  $N^S = N^S(W/P)$  ... It will be immediately recognised that we have greatly oversimplified the analysis. Both the demand and supply equations should actually be dependent on the real value of bond and money holdings as well as the real wage rate ... Finally, full analysis of individual behaviour would show the supply of labour to depend on the rate of interest. If we have arbitrarily ignored these additional influences, it is because the labour market as such does not interest us in the following analysis; its sole function is to provide the bench mark of full employment.” (1965, pp. 128-9).

The suppression of the wealth effect from the labour supply is crucial, and has proven to be most durable, giving rise as it does to the vertical aggregate supply curve. It has the important feature that although the labour market functions in a system of general equilibrium equations, it can be treated as a partial equilibrium equation. Output, employment and the real wage are all determined in the labour market without reference to the rest of the economy (usually the money and goods markets).

Whereas the classical dichotomy rested on the *homogeneity* of equilibrium equations, Patinkin's model of full employment went further. Patinkin made the system of equilibrium equations *decomposable*, in that the labour market equation could be solved in isolation to the rest of the system of equilibrium equations. Since the level of output, employment and the real wage are determined by the labour market equilibrium alone, changes on the 'demand side' of the economy (the goods and money markets in the IS/LM framework) can have no effect on them. To see that this goes a lot further than the classical dichotomy, it implies not only that money is neutral, but also that changes in *real* demand-side factors will have no effect on output and employment. For example, an increase in real government expenditure will have no effect on the level of output and employment (although it will of course reduce the other components of demand such as consumption and investment – the 'crowding out effect'). If there is a non-zero wealth effect on the labour supply, matters are

rather different. Real balances (and real bond holdings if Ricardian equivalence fails to hold) enter into wealth, and these depend on the *nominal* price level. Hence the position of the labour supply curve depends on the demand-side factors which determine the nominal price level. The labour market equilibrium condition is now given by (1), where for simplicity we assume that real balances are the only form of wealth, and there is no taxation or non-labour income:

$$N^d(W/P) = N^s(W/P, M/P). \quad (1)$$

Note that (1) is still homogeneous to degree zero in  $(W, P, M)$ , so that the homogeneity underlying the classical dichotomy will not be affected.

*Figure 3.2 Aggregate supply with a wealth effect*

However, the labour supply function will shift with  $P$  and  $M$ . Treating  $M$  as constant, if leisure is a normal good, a rise in  $P$  will reduce real balances, and hence increase the labour supply at any given real wage level, shifting the labour supply curve to the right, as in figure 3.2a, thus tracing out the upward sloping AS curve in figure 3.2b.

With the wealth effect on labour supply unsuppressed, the equilibrium system of equations does not decompose, and in fact it is easy to show that an increase in real government expenditure will not have a zero multiplier: the expenditure multiplier will be strictly positive but less than unity. In figures 3.3a and 3.3b we contrast the effect of an increase in the money supply and an increase in government expenditure. In figure 3.3a we can see that the increase in real government expenditure  $\Delta g$  shifts the AD curve to the right, the distance of the shift being  $\Delta g$  if output markets clear.<sup>1</sup> From (1) above, the increase in  $g$  has no direct effect on the AS curve. The equilibrium moves from  $A$  to  $B$ , with some crowding out of the initial stimulus provided by  $\Delta g$  as nominal prices (and wages) rise from  $P_A$  to  $P_B$ . Clearly the increase in government expenditure has a real effect on the level of aggregate output and employment. This stands in contrast to the effect of a proportional increase of the money stock: as depicted in figure 3.3b, a proportionate increase in  $m$  to  $\Delta M$  shifts both the AD and AS curves upwards equally, so that nominal prices rise proportionately to  $\Delta P$ ; the real side of the economy is unaffected.

*Figure 3.3 Macroeconomic policy without decomposition.*

Patinkin's notion of full employment added two things to the classical dichotomy. First, it identified the long-run equilibrium output with the now textbook competitive labour market, depicted in figure 3.2. Second, it added the property of decomposability, so that in addition to monetary neutrality total output, employment and the real wage were all independent of *any* change in the demand side of the economy, whether real or nominal. The vertical aggregate supply curve was born. The notion of decomposability has perhaps been the most crucial and pervasive. The notion that the labour market equilibrium might be non-competitive had always been recognised. However the first *formal* inclusion of imperfect competition in the output market in a Patinkinesque framework was done by Ball and Bodkin (1963). Following Joan Robinson's *Accumulation of Capital*, they introduced the 'degree of monopoly' into the labour demand equation:

We add a profit maximizing condition:  $(1 - \mu)f'(N) = W/P$ , where  $W$  is the money wage,  $P$  is the price level, and  $\mu$  represents the degree of monopoly power existing in the economy.  $\mu$  is equal to  $1/e$  where  $e$  is the elasticity of demand, on an economy wide basis (Ball and Bodkin, 1963, p.61).

In this case, the familiar figure 3.1 becomes as in figure 3.4. Imperfect competition in the output market shifts the 'labour demand curve' to the left (since with imperfectly elastic demand in the output market, the firm's marginal revenue product is less than marginal value product  $P \cdot f'(N)$ ).

*Figure 3.4 Ball and Bodkin's (1963) model of full employment with price-setting firms*

Output, employment and the real wage are less than under perfect competition. However, there is still a unique equilibrium level of employment. Furthermore, the equilibrium satisfies the classical homogeneity property, and also Patinkin's own property of decomposability if the wealth effect on the labour supply is suppressed. Thus Patinkin's notion of full employment was perfectly compatible with imperfect competition.

### 3.4 Friedman and the Natural Rate Hypothesis

Twelve years after Patinkin's *Money, Interest and Prices* had been published, and the same year that Samuelson had called his younger classical self a 'jackass', Friedman's Presidential Address to the American Economic Association (1968) was published. This paper is one of the great classics of economics: it turned out to be both prophetic and seminal. However from the perspective of the study of the natural rate, it is elusive and frustrating. The other papers in which Friedman wrote explicitly about the natural rate are his IEA<sup>1</sup> lecture *Inflation vs Unemployment* (1975), and his subsequent Nobel lecture of the same title (1977). Turning first to the 1968 definition of the natural rate, which has become ingrained in many generations of students, its meaning is more enigmatic than it seems:

“At any moment of time, there is some level of unemployment which has the property that it is consistent with equilibrium in the structure of *real* wages ... The ‘natural rate of unemployment’ ... is the level that would be ground out by the Walrasian system of general equilibrium equations, provided there is imbedded in them the actual structural characteristics of the labour and commodity markets, including market imperfections, stochastic variability in demands and supplies, the costs of gathering information about job vacancies, and labor availabilities, the costs of mobility, and so on.” (1968, p.8).

This ‘definition’ is remarkable for its vagueness. It is not a definition at all, but rather a research programme! Certainly, Friedman himself never attempted to present a formal theory of the natural rate which included the various ‘market imperfections’ he lists. It is rather an assertion of the belief that the real side of the economy possesses a unique (long-run) equilibrium. The belief in the uniqueness of equilibrium is so deep that it is rarely stated as such by Friedman (although its implicit assumption permeates Friedman's work). In Friedman's IEA lecture (1975) we find only a few comments:

“The term ‘the natural rate’ has been much misunderstood ... It refers to that rate of employment which is consistent with the *existing real conditions* in the labour market –

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<sup>1</sup> IES stands for Institute of Economic Affairs, a policy think-tank based in London.

The purpose of the concept separates the monetary from the non-monetary aspects of the employment situation – precisely the same purpose that Wicksell had in using the word ‘natural’ in connection with the interest rate.” (1975, p.25).

The nearest we come to an explicit formulation of the microeconomic theory or the natural rate is also in Friedman’s IEA lecture: turn to p.16 figure 3, and what do we find? We find Patinkin’s model of full employment, the competitive labour market with the labour supply depending only on real wages! Friedman’s discussion of it is prefaced by the qualifier ‘for example’, but his discussion of it demonstrates the continuity with Patinkin in stressing both the homogeneity property of equilibrium and the decomposability of the labour market from the rest of the economy. The homogeneity comes across most clearly from Friedman’s statement that what matters is the actual or anticipated real wage: ‘the real wage can remain constant with  $W$  and  $P$  each rising at the rate of 10% a year, or falling at the rate of 10% a year, or doing anything else, provided both change at the *same* rate’ (1975, p.16). The notion of decomposability is implicit in his use of Patinkin’s model, and the use of the phrase ‘real conditions in the labour market’ in the earlier quote from 1975.

Thus far, Friedman’s natural rate seems to be nothing new: it is solidly in the classical tradition, and more specifically in the footsteps of his erstwhile Chicago colleague Don Patinkin. So what, if anything, was new about the concept of the natural rate as found in Friedman?

1 Friedman’s main contribution was to restate the classical notion of a unique long-run equilibrium in terms of the then contemporary theories of the labour market: namely search models. Although he did not actually formulate any of these himself, he did describe the process of deviations from the natural rate in terms of

‘reservation wages’ and so on. In fact, although partial equilibrium models of search and imperfect information abounded, it was not until 1979 that Salop’s model of the natural rate was published. The real question is whether the notion

of a unique long-run equilibrium unaffected by macroeconomic policy can survive if put in these terms.

- 2 Furthermore, Friedman became explicit about the role of imperfect competition in natural rate. This is clearest in his argument that whilst trade unions cannot cause inflation, they can influence the natural rate. The direct statement of this view is in an answer to a question after the IEA lecture:

“Trade unions play a very important part in determining the position of the natural level of unemployment. They play an important role in denying opportunities to some classes of the community that are open to others. They play a very important role in the structure of the labour force and the structure of *relative* wages. But, despite appearances to the contrary, a *given* amount of trade union power does not play any role in exacerbating inflation. Industrial monopolies do not produce inflation; they produce high relative prices for the products they are monopolising, and low outputs for these products.” (1975, pp. 30-1).

Friedman argued that the only way to have a long-run influence on the level of unemployment was to reform the labour market (in the lecture text he talks of removing ‘obstacles’ and ‘frictions’).

- 3 Friedman *integrated* the classical theory with the Phillips curve, to formulate the vertical ‘long-run Phillips curve’. Essentially, this synthesis rested on restating classical notions of homogeneity in terms of inflationary expectations. Whereas Patinkin had formulated it in terms of rates of *change*. Thus the natural rate becomes the level of employment which is consistent with fully anticipated inflation and constant real wages.
- 4 He also formulated a theory of *deviations* from the natural rate in terms of unanticipated inflation. Employment deviates from the natural rate because of forecast errors.
- 5 On the level of economic *policy* Friedman’s formulation of the natural rate in terms of labour market equilibrium was very influential. In the UK it gave rise to the focus on labour market reform that characterised the Thatcher years (1979-91).

These are all important points, each one deserving as essay to itself. However, we must hurry on to subsequent developments.

### **3.5 Lucas-Rapping and the Lucas archipelago**

Still staying at Chicago we turn to R.E. Lucas, who developed and formalised the natural rate in terms of a competitive market-clearing framework. There are two versions of this enterprise. The first was the Lucas-Rapping paper published in 1969 (written more or less contemporaneously to Friedman's address). This took the basic demand-supply model of the labour market and added to it an *intertemporal*, dynamic model of household labour supply (even if it had only two periods). This introduced the notion of intertemporal substitution in the labour supply: high wages today elicit a higher labour supply in part because it may mean that today's wages are high relative to future wages: the short-run responsiveness of wages is enhanced if the increase is seen as transitory as opposed to permanent.

The second paper was published a decade later (Lucas, 1979), and introduced the 'island' story of the natural rate in terms of a signal extraction problem. Each market is an island, and the aggregate economy is the archipelago. Agents in this economy have good information about their own 'island' market, but not the economy in general (the 'archipelago'). As rational agents, they have to distinguish between increases of nominal prices on their island that represent *real* increases in the price on their island relative to the general price level, and general inflation. Using optimal statistical forecasts based on the relative variances of aggregate economy-wide shocks and island-specific shocks, the agents apportion a certain proportion of any deviation of actual from expected prices to market-specific factors, and hence increase output, giving rise to a short-run Phillips curve.

Both of Lucas' models follow in the spirit of Friedman's definition of the natural rate, in that they put informational problems at the centre of the analysis; uncertainty about the future in the Lucas-Rapping model, and imperfect information about aggregates such as the price level and money stock in the 1979 one. In this sense, Lucas provided the micro foundations, the theory that was lacking in Friedman's notion of the natural rate. However, there was a different agenda as well. This agenda consisted in seeing all markets as

competitive: unlike Friedman, Lucas gives little weight to the notion of non-competitive markets. The Lucas world view puts individual rational choice at the centre of a world of competitive markets. Institutional arrangements and customs are seen as irrelevant to the task of explanation: they are themselves endogenous, being designed ‘precisely in order to aid in matching preferences and opportunities’ (Lucas, 1981, p.4). Fluctuations in economic activity are explained in terms of rational households varying labour supply in response to current and future wages and prices. For Lucas, this is the ‘only account’, there being ‘no serious alternative’ (1981, p.4).

To others there were of course serious problems with Lucas’s story. First, and perhaps most importantly, the two variables which the theory needed to be unknown to individuals on their islands were the aggregate price level and money supply. However, these are two of the variables for which regular (monthly) and reliable data are available in all developed economies. Secondly, with RE the deviations from the natural rate are “white noise”: serially uncorrelated with mean zero. However, as we know there is a *business cycle* with considerable serial correlation of output. This suggests that in order to understand the path of output we need to model the evolution of the equilibrium output itself rather than deviations from equilibrium. This brings us to *RBC* theory.

### 3.6 Real business cycles

Lucas had formalised the notion of the natural rate in a way that rested, at least partly, on imperfect information of forecast errors. However, implicit in his conception of the importance of intertemporal substitution was the notion that even with full information and perfect foresight, fluctuations in economic activity would occur in response to changes in the underlying characteristics of the economy: changes in technology and tastes. The natural rate had been an essentially *static* concept. This is clear in the discussion of the real equilibrium in classical writers such as Pigou and even Patinkin where the adjectives ‘stationary state’ and ‘comparative statics’ are used. This carries over to Friedman’s discussion of the natural rate which is in entirely static terms. In this framework, *dynamics* becomes the discussion of short-run deviations around the long-run static equilibrium.

In contrast *Real business cycle* theory took the notion of competitive equilibrium, and extended it to a fully *dynamic* equilibrium (Prescott 1986). In this view there is an

intertemporal equilibrium that extends through time. Variations in output and employment represent the fluctuations in equilibrium as rational households and firms maximize over a relevant time horizon (usually infinite!). Real wages respond to productivity shocks: the labour supply responds to the profile of real wages over time, hence leading to the business cycle. Thus, if real wages in time  $t$  are relatively high, this may cause households to exploit this fact by supplying more labour in  $t$ . This development makes the concept of the natural rate irrelevant. In this dynamic setting there may exist no real distinction between the actual and the equilibrium level of employment: the equilibrium level of employment is itself fluctuating. In real business cycle theory, then, the concept of the natural rate itself has become largely redundant, although (as the adjective 'real' indicates) the spirit of the classical dichotomy is very much present<sup>2</sup>.

### 3.7 The NAIRU: unions and imperfect competition

Outside Chicago and Minnesota matters were developing rather differently. At the LSE there emerged a framework for modelling the labour market which I shall call the CLE view (CLE being the *Centre for Labour Economics*, a research centre operating at the LSE in the 1980s). Friedman had put the labour market at the centre of his notion of the natural rate. Richard Layard and Steven Nickell developed an empirical model of the UK labour market which put imperfect competition at the centre of the natural rate, in distinct contrast to the Lucas developments. This empirical model became standard in much of European applied macroeconomics.

Two papers provided the basis for this approach (Layard and Nickell, 1985, 1986). One of the key features of the natural rate stressed by Friedman was that it is the only level of unemployment that is consistent with non-accelerating inflation. Layard and Nickell therefore renamed the natural rate the 'non-accelerating inflation rate of unemployment', or NAIRU. The approach reflected an increased interest in imperfectly competitive markets in the early 1980s. The notion of equilibrium in the CLE approach can be represented by a diagram which looks deceptively familiar (figure 3.5).

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<sup>2</sup> Editorial note. At the time of writing this chapter, there were many RBC researchers using real models without any monetary or financial sector. However, the notion that you can model the economy in this way seems largely to have been rejected. Nearly everyone seems to have accepted the notion that

*Figure 3.5 The NAIRU*

The downward sloping curve DD is a familiar ‘labour demand curve’, reflecting the fact that imperfectly competitive firms equate marginal revenue with marginal cost, which is the same thing as saying that the firm employs labour up to the point where the real wage equals the marginal product of labour scaled down by  $(1 - \mu)$  as in Ball and Bodkin (1963). The upward sloping curve WW is, however, rather more innovative. Layard and Nickell modelled the wage determination process as a bargain between the representative firm and union. The bargaining solution adopted was the Nash bargaining solution. The details of this need not concern us here; suffice it to say that the wage depends on the *outside options* (often called ‘fallback positions’) of the firm and union. The nature of the bargaining solution is that the better the outside option of an agent, the better that agent does. Layard and Nickell modelled the outside option of unions as the expected income of union members if they become unemployed. If unemployed, the worker obtains a job at the going wage  $W/P$  with probability  $(1 - u)$ , where  $u$  is the unemployment rate, and stays unemployed with probability  $u$ . Hence the higher is employment in figure 3.5, the better is the outside option facing the union’s members, and the higher the wage which results from the bargain. Thus the upward sloping curve WW represents the fact that unions are able to obtain higher wages when employment is high (unemployment low), rather than labour supply conditions.

The great merit of the NAIRU approach is that it enables the natural rate to be modelled empirically. Nickell and Layard were able to classify factors into those which affected the WW curve (union power, labour mismatch, unemployment benefits, etc.), and those which affected the DD curve (world energy and commodity prices, capital stock, etc), to track the changes in the NAIRU over time. This is an enterprise that Friedman himself never undertook, since he always emphasised the ineffable and unknowable quality of the NR: ‘One problem is that it [the monetary authority] cannot know what the natural rate is. Unfortunately, we have as yet no method to estimate accurately ... the natural rate of unemployment’, (1968, p. 10).

### 3.8 An evaluation of the natural rate hypothesis

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nominal rigidities matter and nominal shocks can effect the economy at least in the short run. For a discussion of this see *New Keynesian Economics, Nominal Rigidities and Involuntary Unemployment*.

I have given a brief sketch of some of the ideas giving rise to, and arising from, the natural rate. The history is by no means comprehensive, but I have given what I believe to be the main salient points (although I must apologise to search theorists for omitting them).

The concept of the natural rate is very solidly rooted in the classical tradition. In its simplest form it consists of two hypotheses:

- (a) There exists a unique equilibrium for the economy determined by real factors in the economy (classical dichotomy).
- (b) Equilibrium output, employment and the real wage are determined in the labour market (decomposability).

Part (b) is perhaps a little injudicious. Friedman himself only ever talked about *monetary* policy in the context of the natural rate: he clearly believed in the neutrality of money, and conceived of it in terms of the homogeneity of the system of equilibrium equations. However, in practice, both Friedman and others have followed Patinkin's approach in locating the real macroeconomic equilibrium primarily in the labour market: output, employment and the real wage are all tied down within the labour market. This notion of decomposability is common to all of the approaches we have explored from Patinkin's notion of full employment to new classical theories and the NAIRU.

The phrase 'natural rate' is itself a masterpiece of marketing, akin to the phrase 'rational expectations (RE)'. In terms of hypotheses (a) and (b) it is a blank space, an invitation for economists to insert their own ideas and fashions in order to define their own notion of the 'real equilibrium'. By not specifying any particular theory of the natural rate, Friedman avoided the problem of obsolescence. I commented that the definition of the natural rate given by Friedman was a research programme rather than a definition: after 25 years no one has yet managed to combine all of the elements identified by Friedman into one coherent model, and probably never will.

The only real difference between the concept of the natural rate and Patinkin's notion of full employment is that the latter is specific (a model of the competitive labour market), and furthermore the only concrete version of the natural rate offered by Friedman himself was

the same as Patinkin. However, the phrase ‘full employment’ has lots of connotations, such as that there should not be much unemployment, and that workers are on their supply curve. One of the reasons that Friedman opted to stress search theory in his Presidential Address was that it focused on the *voluntary* decision of workers to accept or reject job offers. The terminology ‘natural rate’ served to divert attention from the word ‘full’, and hence to accept that in equilibrium there might be unemployment, and indeed that since this unemployment was ‘natural’ it was not necessarily a bad thing. In that sense the change of language Friedman introduced prepared the intellectual ground for the shift of political objectives away from full employment to reducing inflation, and the acceptance of ever-higher levels of unemployment in the ensuing 25 years. Another shift in policy emphasis resulting from this change of language was that unemployment was seen as a primarily *microeconomic* concern. The way to reduce unemployment was not through macroeconomic policy, but through policy towards the functioning of markets – the labour market in particular – in order to remove ‘frictions’ and ‘imperfections’.

Thus far I have tried to clarify the concept of the natural rate, rather than criticise. However, I will not offer a series of critical observations on the natural rate from a theoretical and practical point of view. First and foremost, the notion that there is a unique equilibrium level of output and employment is an extremely strong assumption. Most macroeconomic models are highly stylised in their aggregative structure, using representative markets and agents. These assumptions tend to bias models towards having a unique equilibrium. However, the possibility of multiple equilibria should not be dismissed as merely a curiosity. Friedman cast his 1968 discussion of the natural rate in terms of search theory. However, subsequent research has shown that the possibility of multiple equilibria in search models is endemic. The most notable model here is Peter Diamond’s ‘coconut’ model (1982). Consider an island with coconut trees. Islanders eat coconuts, but there is a taboo against eating coconuts that you have picked yourself. In order to enjoy the succulence of a coconut and sample the delights of coconut milk you need to pick a coconut and then search for someone to swap coconuts with. The cost to you of getting a coconut (finding and climbing a tree) is a fixed production cost: however, the (expected) cost of finding a partner varies with the number of people searching for a partner. If there are many individuals wandering around the island with coconuts, the expected search cost of finding one of them

is low: if there are only a few of you, the search cost will be high. This is a basic *search externality*, in that the incentive to ‘produce’ a coconut depends positively on the proportion of the population similarly engaged. One obtains something like figure 3.6, which follows Diamond more in spirit than detail.

*Figure 3.6 Multiple equilibria in Diamond’s (1982) coconut model*

Let us define the proportion of the islanders engaged in picking coconuts and searching for partners as  $e$ . As an individual, the marginal expected returns to picking a coconut are increasing in the proportion of people likewise engaged. Thus the more people are engaged in producing coconuts, the more individuals will find it in their interest to pick coconuts: this is captured by the function  $e^* = E(e)$ , where  $e^*$  is the proportion of people who want to pick coconuts given that a proportion  $e$  are doing so.

An equilibrium lies on the 45° line: the actual number of coconut pickers equals the number of would-be coconut pickers. Since  $E$  is upward sloping, there may be multiple equilibria, as at points ABC in figure 3.6. Furthermore, these equilibria may be welfare ranked: more people eat coconuts the bigger is  $e$ . As Diamond stated:

“To see the importance of this finding, consider Friedman’s (1968) definition of the natural rate of unemployment as the level occurring once frictions are introduced into the Walrasian economy. This paper argues that the result of actually modeling a competitive economy with trade frictions is to find multiple natural rates of employment. This implies that one of the goals of macroeconomic policy should be to direct the economy towards the best natural rate” (1982, p. 881).

This sort of finding has become known as a *coordination failure* problem (Cooper and John, 1988): the economy may have multiple equilibria which are Pareto ranked, and the free market may fail to ensure that the economy ends up at the best one.

The second issue is that even if there is a natural rate, if it is not perfectly competitive it will not be Pareto optimal (indeed the coconut model shows that even competitive models with externalities might not be so). In this case the *decomposability* property of the natural rate model becomes rather suspect. It rather artificially imposes a unique equilibrium on the

labour market irrespective of the demand side of the economy. Properly modelled, strong assumptions are needed to rule out fiscal policy (or any other real demand ‘shock’) from having an effect on the equilibrium. If we start from an initial position where there is too little output and employment, then there is the possibility that if fiscal policy can raise output, it will have a welfare improving effect. Indeed, if you drop the decomposability assumption, you will not obtain a natural rate model, but rather a *natural range* model: although there may be a unique equilibrium for a given macroeconomic policy (mix of monetary and fiscal policy), there is a *range* of equilibrium levels of output and employment available as policy is varied. If these are welfare ranked, then the government can choose from a range of equilibrium options (see, for example, Dixon, 1988, 1991). Both of the possibilities discussed here: multiple (discrete) natural rates and a continuum (natural range) are both more likely to be of interest in imperfectly competitive economies, since non-competitive equilibria start off being Pareto inefficient.

Thirdly, one has to consider the empirical evidence for the natural rate hypothesis. This is discussed in some detail in Cross (1995), so I shall not dwell on it. It is almost impossible to refute any hypothesis in economics on the basis of econometric evidence. However, the casual empiricist would be able to see huge fluctuations in employment over the past 25 years: these surely point strongly to the presence of strong hysteresis effects, and possibly multiple equilibria (for empirical evidence on the latter, see Manning, 1992).

### 3.9 Conclusion

The natural rate has clearly been a powerful idea. It is a phrase that captured and continues to capture a point of view, a perspective: it views unemployment outcomes as ‘natural’ and unavoidable from the macroeconomic level. Indeed, the phrase ‘full employment’ had much the same ideological force in the preceding quarter of a century: it embodied the notion of abundance and stability as being attainable through sound macroeconomic management. It is interesting to note that the actual theory used to model both full employment and the natural rate may be the same: we find the same demand and supply model of the labour market in Patinkin’s 1956 model of full employment and Friedman’s natural rate in his Nobel lecture. As economics moves on and develops, economists will no doubt continue to

use the label ‘natural rate’ to apply to equilibrium states. The continuity in the label may belie a difference in substance. At some stage in the fullness of time someone will grasp the spirit of the age and think up a new name, a new attitude. I only hope that they do not simply relabel and recycle yet another version of Patinkin’s diagram of the labour market.

## Note

1 For a formal derivation of the effects of fiscal and monetary policy with wealth effects see classic graduate texts of the 1970s (Ott, Ott and Yoo, 1975, ch. 12: Barro and Grossman, 1976, ch. 1).

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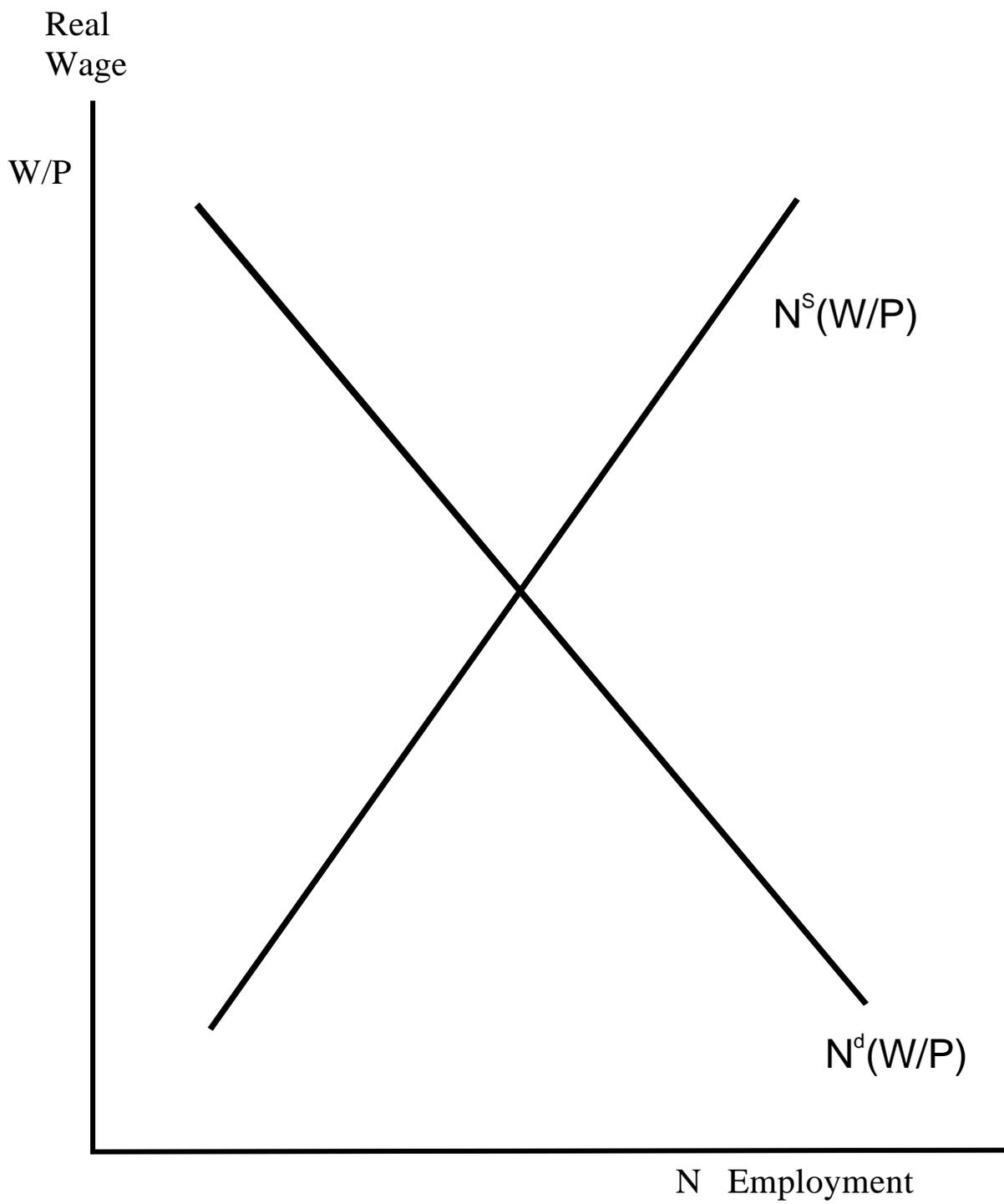


Figure 3.1 Patinkin's model of full employment

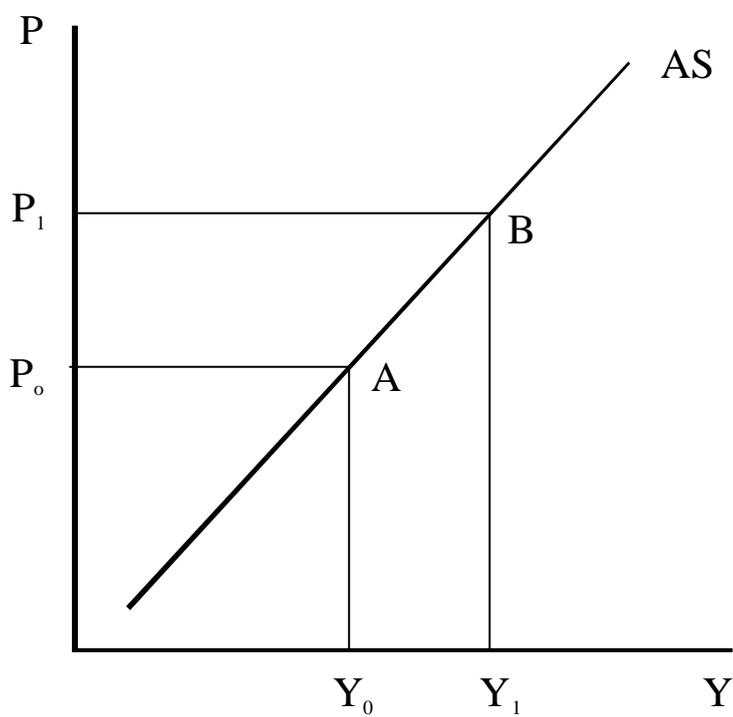
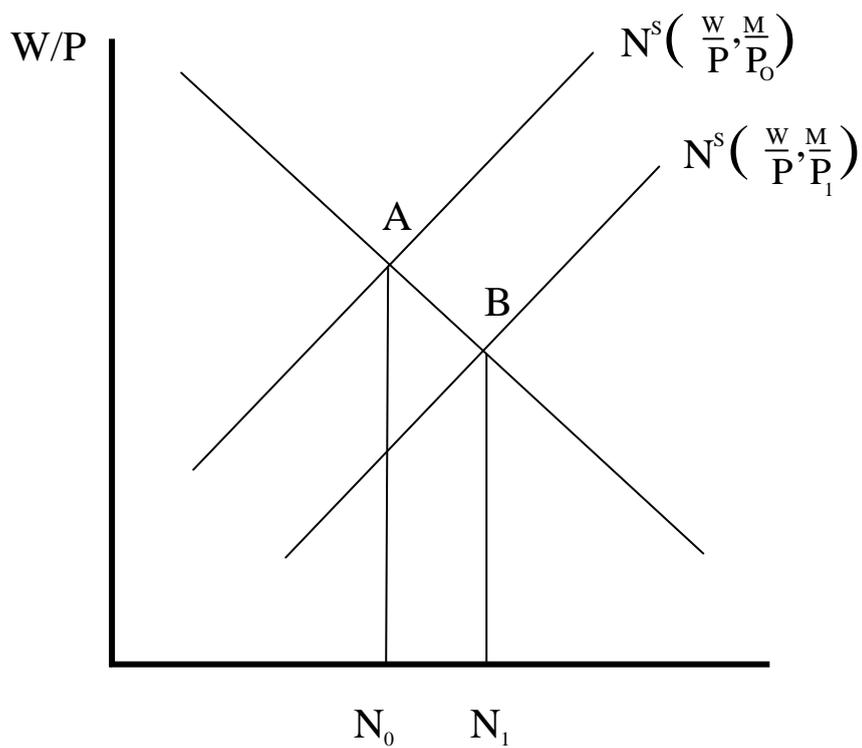
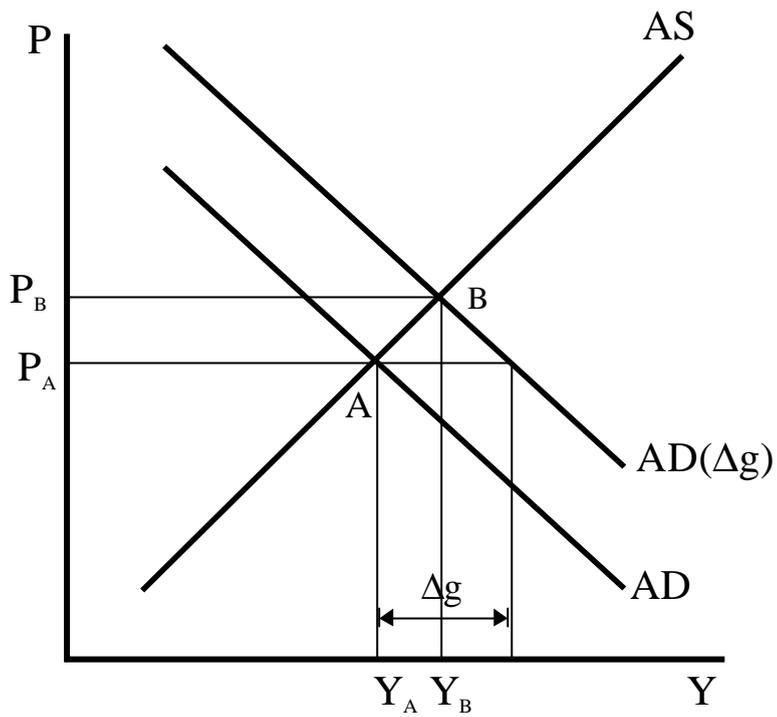
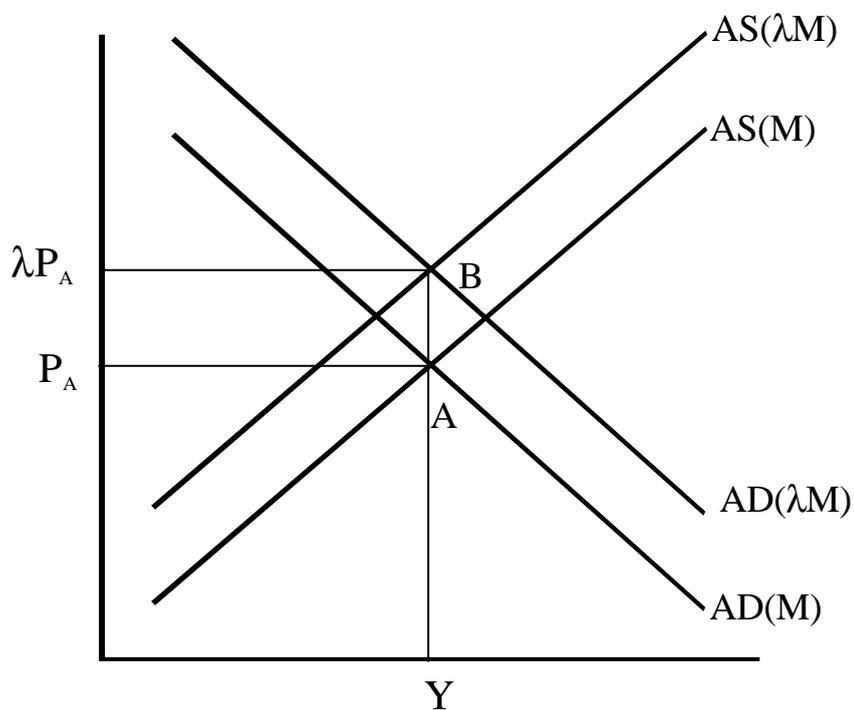


Figure 3.2 Aggregate Supply with a Wealth Effect.



(a) Fiscal Policy



(b) Monetary Policy

Figure 3.3 Macroeconomic policy without decomposition.

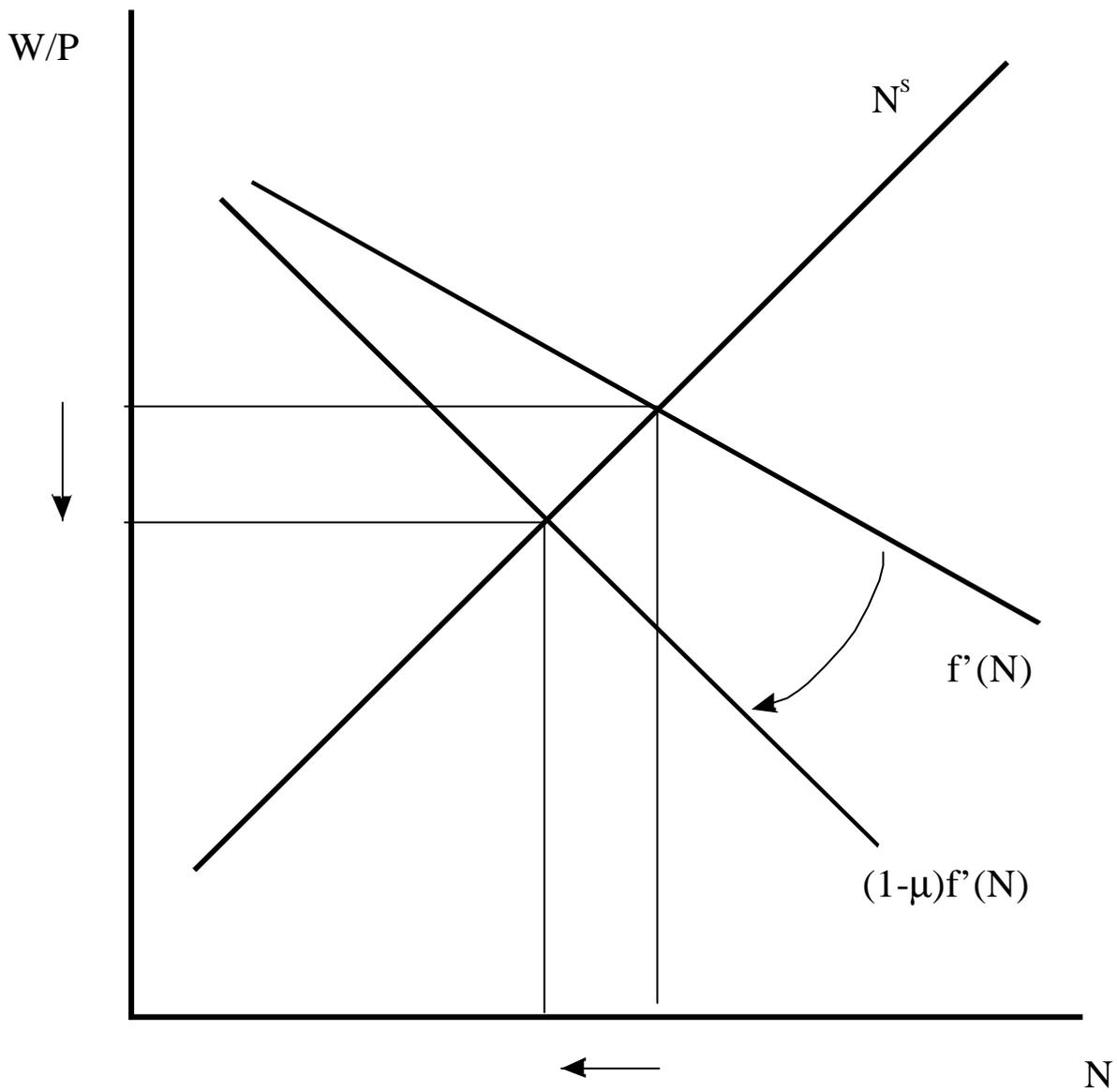


Figure 3.4 Ball and Bodkin's (1963) model of full employment with price-setting firms.

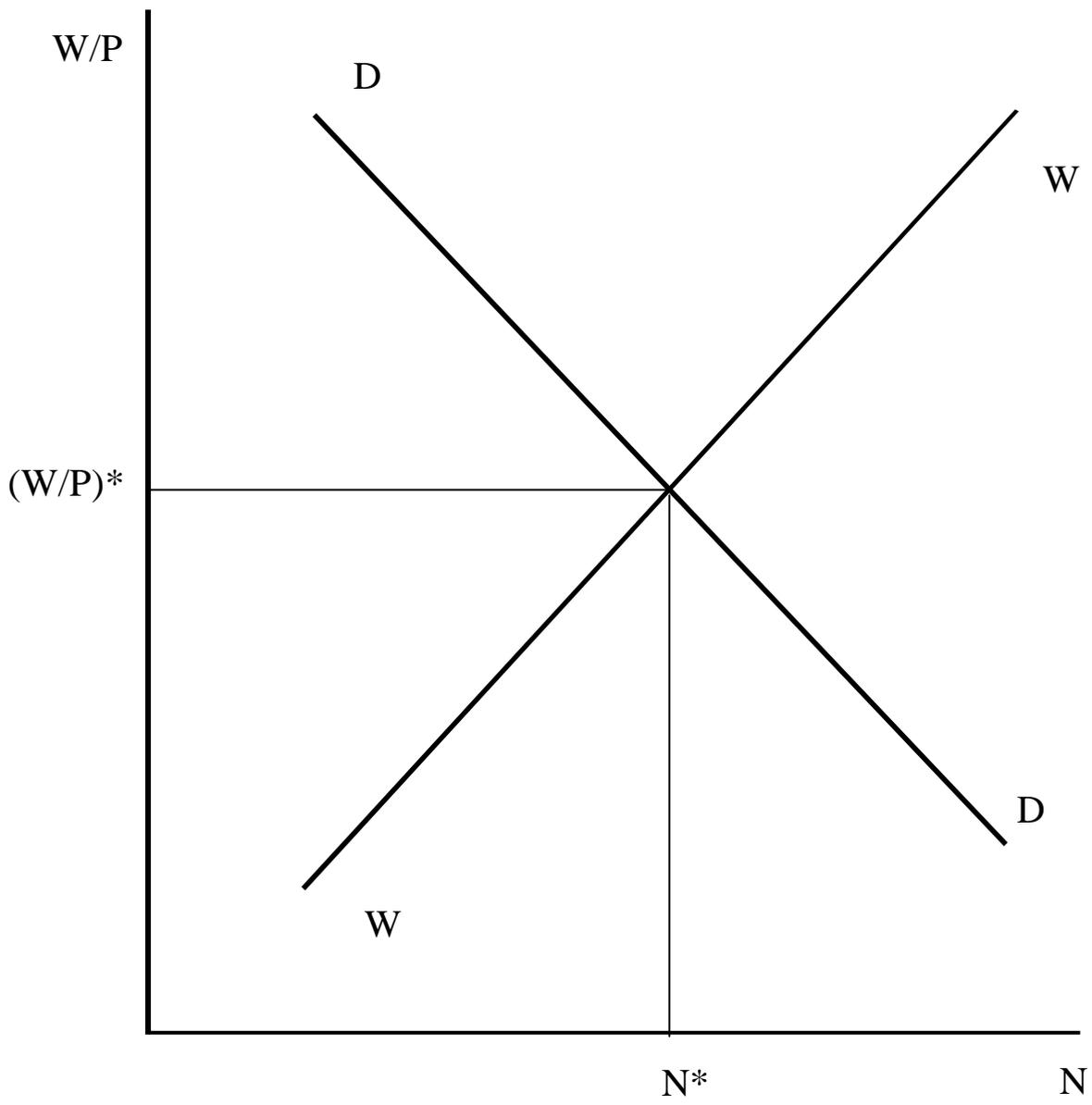


Figure 3.5 The NAIRU

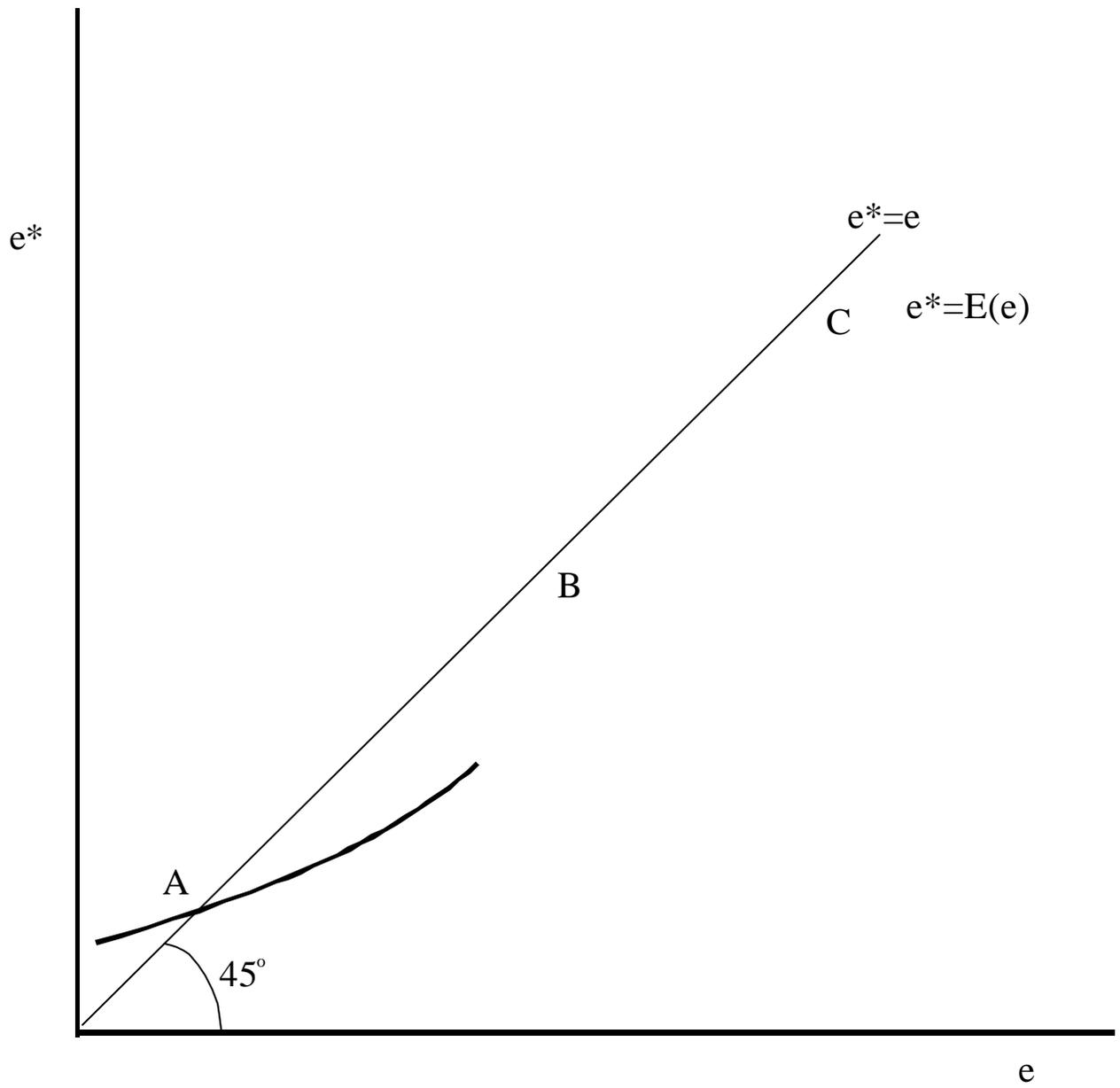


Figure 3.6. Multiple equilibria in Diamond's(1982) Coconut model.