A Theory of Slack

How Economic Slack Shapes Markets, Business Cycles, and Policies

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Draft version: April 2026
Draft URL: pascalmichaillat.org/18/

CHAPTER 22.

Connections to other business cycle models

This chapter uses the Kuhnian perspective to understand how, over the past century, business cycle macroeconomics evolved from the Old Keynesian model to the Real Business Cycle model and finally to the New Keynesian model, and how the slackish model fits in that context. We review how models improved over time by improving along the three dimensions that Kuhn emphasizes: being descriptive, being economical, and being fruitful. Finally, we see how the slackish model proposed in this book borrows from the various models to try to deliver a business cycle model that is more descriptive, more economical, and more fruitful.

People have been developing models of business cycles since the Great Depression and for outsiders it looks like a big mess. These models make strikingly different assumptions, and it isn't clear why. They also take very different approaches, which each seem to have advantages and disadvantages. And of course the models have diametrically different policy implications. It can be hard to understand why researchers made these choices and what the common thread is across the models. What's particularly frustrating is that a lot of the assumptions seem fairly arbitrary and, yet, people really firmly adhere to them. Different researchers also focus on different questions and problems, which makes it hard to see what the debate is all about.

That's why it's important to think about the structure of science. After a general overview, we apply the Kuhnian model of science to business cycle research. This allows us to understand the strengths and weaknesses of different business cycle models and the evolution from model to model.

22.1. The Kuhnian model of science

We begin by summarizing Kuhn's model of science, which was developed in two books. The first book is *The Copernican Revolution*, in which Kuhn (1957) explains the evolution of planetary astronomy from Antiquity to today. The second is *The Structure of Scientific Revolutions*, in which Kuhn (1996) generalizes the model of science developed in the context of astronomy and applies it to other sciences. That model of science will help us understand what has been happening in the world of macroeconomics, and how the slackish model fits in.

22.1.1. Organization of scientific knowledge in paradigms

The core building block of Kuhn's model of science is a paradigm, which is a way that scientists organize a whole body of knowledge. They then use that paradigm to interpret what they observe in nature. It is a lens through which scientists of a particular era look at the world. And at the core of a paradigm, there is a model that all the scientists that belong to that paradigm use.

But a paradigm is not only a model—there are a lot of other things that are attached to it. A paradigm also encompasses the facts that scientists are particularly interested in. Indeed, scientists who belong to different paradigms focus on different facts and look at different objects. Paradigms also include acceptable research practices and methodologies.

Overall, a paradigm is a model and shared norms and standards that are universally accepted by the people in the field. The way that you can identify paradigms is that, often, you have a textbook or several textbooks that summarize everything that the paradigm stands for. These textbooks are used to educate students to pass along theory, facts, methods, and norms.

22.1.2. Cycling through paradigms

The question now is: How do we get to the current paradigm? Science is often described as a cumulative exercise where, over time, we learn and discover more and more. People think of scientific progress as continuous improvement—like adding bricks to a wall, making it higher and higher. However, this is quite an inaccurate picture. In practice, science doesn't evolve linearly at all—it's not really a cumulative exercise at all. Science is much more cyclical: periods of creation and improvement are followed by times of destruction, when scientists scratch what they knew and start afresh.

What does this scientific cycle look like? The cycle starts with normal science. In a period of normal science, a paradigm is well established and accepted by everyone in the community. All the researchers look at the facts that the paradigm is interested in and use the research methods that the paradigm recommends. Often, at the center of the paradigm are several parameters or constants that need to be measured or estimated. A lot of time is spent trying to measure these things using the data. Sometimes, the paradigm makes predictions about how the world is supposed to work, so scientists spend time testing these predictions and assessing whether the world is in line with the predictions of the model. If the facts are not exactly consistent with the predictions, scientists go back and further articulate and refine the model to describe these new observations properly.

At some point during the normal-science process, as scientists keep looking at the world through the lens of the paradigm, they start to discover anomalies, which are empirical regularities or observations that cannot be easily reconciled with the model. Once there are too many anomalies that cannot be explained properly with the paradigm, some people start looking for different paradigms, or a different way to explain the world.

When we reach that stage, we move away from normal science and into revolutionary science. During these episodes, the existing paradigm has to compete with new paradigms that have been created to explain the anomalies that have been observed. Revolutionary science takes time: the battle between the paradigms is generally not resolved overnight.[1] People come up with one or many alternative paradigms, and there's a big fight within the community to decide who is going to take over. After a while, one paradigm emerges as victor and replaces the old paradigm. In the case of astronomy, this period of revolutionary science occurred during the Renaissance. It involved Copernicus, Giordano Bruno, Tycho Brahe, Kepler, and Galileo, and was a battle between the old geocentric model and the new heliocentric model.

Once the new paradigm is adopted, there is a new period of normal science during which people refine the new paradigm and use it to look at new research questions and isolate new anomalies until it's time for a new period of revolutionary science where new paradigms are proposed and possibly take over.

22.1.3. A good paradigm is descriptive

Science evolves and improves by cycling through paradigms. To understand how new paradigms are created, and how a new paradigm might emerge victorious from the period of revolutionary science, we must understand what the qualities of a good paradigm and its underlying model are.

The first quality that Kuhn (1957, pp. 38–39) talks about is being descriptive. A model should be able to accurately describe and explain all the facts that have been collected by scientists. Indeed, the emphasis is usually only on this quality. When we are taught about science in school, we learn that models are fundamental truths that explain the world. But, of course, no model is true—models are just an articulation of the knowledge that has

[1] Akerlof and Michaillat (2018) explain why better paradigms might take a long time to be accepted, or might not be accepted at all.

been collected. A quality of a good model is that it can explain a lot of that accumulated knowledge. If a model is unable to describe the basic phenomena that are observed in the real world, it is not going to be useful. In the case of astronomy, these facts have to do with the movement of the Sun and the stars during the day and over the seasons in different locations on Earth.

22.1.4. A good paradigm is economical

The second quality of a good paradigm is to be economical. It should be a simple, logical explanation for a long list of facts. An economical model provides assistance to a scientist's memory because by memorizing a few relationships that are easy to manipulate, the scientist can recover a large number of observations (Kuhn 1957, p. 37). This means that the model has to be simple enough that you can keep it in your head and always articulate what you see in the real world through the lens of the model. It has to be simple enough to explain existing facts and analyze new problems.

Being economical is a logical quality of the model, so it can hold even if a model is not descriptive. For instance, the geocentric view of the universe is not a good description of the universe. Nevertheless, that paradigm is very economical. In fact it is possible to recover all the facts that were known to astronomers from the Antiquity to Middle Ages from a two-sphere model—with the earth as a small stationary sphere whose center coincides with that of a much larger rotating stellar sphere (Kuhn 1957, figure 11). This is why, even today, the geocentric two-sphere model continues to be used in surveying and navigation (Kuhn 1957, p. 38). Even though the model is not as accurate as the heliocentric model, it can explain a number of things well enough and is especially simple to remember.

22.1.5. A good paradigm is fruitful

The third quality of a good paradigm is to be fruitful: the paradigm must be a good guide to the unknown (Kuhn 1957, pp. 39–41). It should make useful predictions about things that we haven't seen yet. The paradigm is a tool for scientists exploring the unknown because it tells them where to look and what they may expect to find. A good paradigm must describe all the things that have been observed, but there are also many things that scientists haven't looked at yet—either because they never thought about looking at certain things or because they didn't have the right instruments to do so. A good paradigm makes predictions about what these unobserved, unknown things might look like and how they might behave.[2]

[2] By making predictions about the unknown that may be wrong, a model makes what Popper (1963) calls risky predictions—which he sees as necessary to validate or falsify a model. Economists are Popperian at heart: they enjoy examining the testable predictions of models, and use those to reject models. The Kuhnian view of models is more constructive: rather than simply offering up predictions to be shot down, models

Planetary astronomy offers a striking example of this function of models as guides to empirical exploration. Before it was ever observed, Neptune was predicted to exist from Newtonian mechanics and the observation of disturbances in the orbit of Uranus. This prediction led astronomers to explore the space around Uranus with telescopes and ultimately to discover Neptune (Kuhn 1957, pp. 261–262).

22.2. Applying the Kuhnian model to business cycle research

We now apply the Kuhnian model of science to business cycle research. We first identify the paradigms of business cycle research: Old Keynesian paradigm, Real Business Cycle paradigm, and New Keynesian paradigm. We describe the different elements that make up these paradigms: the core model used by the adherents to the paradigm, the set of facts that are considered relevant, the set of methodologies that are acceptable, and the research problems that are considered interesting. We then discuss why business cycle research evolved as it did, cycling from paradigm to paradigm.

22.2.1. The structure of business cycle models

Let us first briefly discuss the structure of business cycle models. Indeed, all the main business cycle models share a common structure.

All the models are composed of households—these are the people that make up the economy. The households do two things: they consume and produce. Household members are therefore both workers and consumers: the goods and services produced by one household are consumed by other households.

These models describe market economies: producers trade their goods and services and use the income to buy the goods and services that they want to consume. The models do not describe more primitive economies in which all production is done at home by self-sufficient households.

Typically, people are not self-employed but are instead employed by firms—although the presence of firms is not as important as it might seem. The production takes place in the firms through a production function, using labor that firms hire from households. The firms then sell the produced goods and services back to households. So these models have two markets: a labor market and a product market. Furthermore, the models are symmetric in that the product and labor markets have the same structure.

We now describe the different business cycle paradigms based on how they model the labor and product markets and how they model prices and wages. Hence we also discuss

open new avenues for research, new domains of exploration. Of course, Kuhn does recognize that if too many risky predictions are wrong—if there are too many anomalies—models are eventually replaced. This is what occurs during scientific revolutions.

the other elements of each paradigm: norms, methods, parameters of interest, questions of interest, and so on.

22.2.2. The Old Keynesian model

We start with the oldest fully developed business-cycle model: the Old Keynesian model. With respect to the labor and product markets, the Old Keynesian model assumes non-clearing Walrasian markets. This means that firms and households are price takers, but prices and wages are fixed at levels that may not clear the markets. As a result, when shocks hit the economy, demand is no longer equal to supply, generating either excess demand or excess supply.

That paradigm's decisive paper is Barro and Grossman (1971), which developed a fully fledged Old Keynesian model of the business cycle.[3] An early textbook that inspired the Old Keynesian paradigm is *Money, Interest, and Prices* by Patinkin (1965). The main textbooks of this paradigm are *Money, Employment and Inflation*, written by Barro and Grossman (1976), and *The Theory of Unemployment Reconsidered*, written by Malinvaud (1977). These books present the whole paradigm and articulate its implications.

We saw above that a paradigm is not just a model: it also comes with a shared set of concepts. A concept specific to the Old Keynesian paradigm is the set of regimes that appear depending on whether the product and labor markets are in excess supply or demand. Malinvaud (1977, figure 1.2) refers to these regimes as Keynesian unemployment (excess supply on the labor and product markets), classical unemployment (excess supply on the labor market, excess demand on the product market), repressed inflation (excess demand on the labor and product markets), and underconsumption (excess demand on the labor market, excess supply on the product market).

Another specificity of the Old Keynesian model is having separate notional and effective demand and supply curves. The notional curves are derived by assuming that the market would clear. The effective curves are derived under the realization that, in fact, prices are fixed and so the market might not clear after all.

22.2.3. The Real Business Cycle model

The Real Business Cycle paradigm followed the Old Keynesian paradigm. It also assumes Walrasian labor and product markets, but unlike in the Old Keynesian model, it assumes

[3] This model was initially known as the General Disequilibrium model—the title of the paper by Barro and Grossman (1971) is "A General Disequilibrium Model of Income and Employment". But the model is now referred to as the Old Keynesian model, in contrast to the New Keynesian model—the title of Barro (2025)'s literature review is "The Old Keynesian Model." As the literature evolved and became more sophisticated, it incorporated the adjustment process from the initial non-Walrasian situation to the Walrasian equilibrium. The models then moved from situations of "disequilibrium" to "non-Walrasian equilibrium," and the notion of "disequilibrium" was discarded (Benassy 1993).

that prices and wages are always at the market-clearing levels. Thus, the labor and product markets always clear, as prices and wages move flexibly.

The seminal paper for the Real Business Cycle paradigm was written by Kydland and Prescott (1982). The Real Business Cycle paradigm's textbook is *Frontiers of Business Cycle Research*, edited by Cooley (1995), with contributions from the main researchers in the field. The book summarizes everything that the Real Business Cycle paradigm stands for. It includes chapters about models and many chapters that describe the methodologies that are acceptable for the paradigm, including for instance recursive methods to compute equilibria.

We saw above that a paradigm is not just a model: it also comes with a shared set of norms and methods. A norm specific to the Real Business Cycle paradigm is that technology shocks play a very important role: they are the main drivers of the business cycle. So researchers in the Real Business Cycle paradigm pay a lot of attention to technology and technology shocks. This is not true in all paradigms: in the Old Keynesian model, technology isn't even mentioned.

There is a very clear procedure about how to do things in the Real Business Cycle paradigm: build a model; calibrate that model; simulate the dynamics of the model under stochastic shocks; and finally compare what happens in the simulated model to the real world—typically compare the moments of simulated variables to the same moments in the data.

Another methodology that is associated with the Real Business Cycle paradigm is to detrend the data with a Hodrick and Prescott (1997) filter, and to define business cycle fluctuations as the deviation from that trend. Under the typical calibration, the procedure produces small fluctuations, because the HP trend absorbs a good amount of the business cycle movements.[4] Hence the model is left with less to explain.

A last methodological norm attached to the Real Business Cycle paradigm is that it is utterly unacceptable to use diagrams and graphs. There is a saying that "a picture is worth a thousand words", but members of the Real Business Cycle paradigm say that "an equation is worth a thousand pictures." That may seem silly, since diagrams are representations of equations, and often allow us to uncover interesting and hidden properties of equations. Famously, the Feynman diagrams changed how postwar theorists did and thought about physics (Kaiser 2005). Nevertheless, this is the research methodology embraced by that paradigm.

A paradigm also comes with a set of research questions that are deemed interesting and that are studied in depth. At the core of the Real Business Cycle paradigm is a business cycle model with Walrasian markets, so the model is always efficient. Hence, policy questions regarding the stabilization of business cycles are not considered interesting in

[4]This is obvious by looking at labor market data detrended by HP filter (Shimer 2012, footnote 10).

that paradigm. In fact, business cycles are considered virtually costless and therefore not worth worrying about (Lucas 2003).

And since prices are flexible, money is neutral in the Real Business Cycle paradigm, so there is no room for monetary policy. Any question related to the effectiveness of monetary policy, or the optimal conduct of monetary policy, is absent from that paradigm.

22.2.4. The New Keynesian model

After the Real Business Cycle paradigm came the New Keynesian paradigm. The New Keynesian model replaces the Walrasian markets of previous paradigms with monopolistic markets. Moreover, the paradigm assumes that prices and wages are rigid, in that they adjust slowly over time, in a staggered fashion: each period only a fraction of prices and wages are changed, as proposed by Calvo (1983).[5]

The foundational papers of the New Keynesian paradigm include Blanchard and Kiyotaki (1987) and Kimball (1995). Its main textbooks are *Interest and Prices* by Woodford (2003) and *Monetary Policy, Inflation, and the Business Cycle* by Gali (2008). These textbooks are widely used today in graduate programs all over the world.

A paradigm is not only a model but also a set of parameters of interest that scientists in the paradigm attempt to measure as well as possible. In the New Keynesian paradigm, one of these parameters is the frequency of price changes (Klenow and Malin 2010). Indeed, that frequency is a preeminent parameter of interest in the New Keynesian model: it corresponds to the frequency at which the Calvo fairy operates, which in turn determines the shape of the Phillips curve.

Another central empirical object is the price markup, which people have spent a lot of time measuring and estimating (Rotemberg and Woodford 1999). This is because of the monopolistic nature of competition in the model. Markups were not interesting in previous paradigms, but they attract a lot of attention in the New Keynesian paradigm.

Of course, because prices are rigid in the New Keynesian model, monetary policy is nonneutral. Therefore, many researchers in the paradigm investigate what is the best way to conduct monetary policy (Woodford 2010). And many others investigate what is the effectiveness of monetary policy in the real world, using a range of empirical strategies (Christiano, Eichenbaum, and Evans 1999). Another monetary concept that plays an important role in the New Keynesian paradigm is the Taylor (1993) rule for monetary policy. This is an important building block of the New Keynesian model because it ensures its determinacy. The Taylor rule had not appeared in previous paradigms, but it is a central object of research for New Keynesian researchers (Taylor and Williams 2010).

[5] The simplest version of the New Keynesian model assumes rigid prices but flexible wages, but for quantitative applications, researchers typically assume both rigid prices and rigid wages, as in the model by Erceg, Henderson, and Levin (2000). Whether wages are flexible or rigid is not pertinent to our discussion.

A last object that is very specific to the New Keynesian paradigm and generated a tremendous amount of research is inflation expectation. Gali (2008, p. 185) concludes his textbook by emphasizing that one of the two main implications of the New Keynesian model is the importance of expectations about future short-term interest rates and inflation. Indeed, these expectations play a key role in the New Keynesian model's Phillips curve (Coibion, Gorodnichenko, and Kamdar 2018). The importance of expectations in the model has pushed central banks toward more communication and transparency to anchor expectations at the appropriate level (Coibion, Gorodnichenko, and Weber 2022). Their importance has also led researchers to design specific surveys to measure inflation expectations of households and firms (Weber et al. 2022). It is interesting that New Keynesian researchers talk about expectations so much, while people in the previous paradigms didn't care about these expectations much. This shows that it's not just the models that are different across paradigms—the facts that people look at are different.

22.2.5. From the Old Keynesians to the New Keynesians

We've covered the three existing paradigms of business cycle research: Old Keynesian, Real Business Cycle, and New Keynesian. Now, let's place them in time and see how the macroeconomic community moved from one to the other.

The Great Depression prompted Keynes (1936) to write the *General Theory*. Because the *General Theory* was not mathematical, Hicks (1937) was prompted to formalize it—introducing the IS-LM framework. The IS-LM framework was developed before the mathematical revolution in economics. Although it is somewhat mathematical in that it is built on some equations and diagrams, it is not microfounded: it does not describe what workers and firms do, how markets operate, how prices and wages are set, and so on. As a result, for instance, it cannot be used for welfare analysis and optimal policy design.

These limitations of the IS-LM model prompted the appearance of the Old Keynesian paradigm in the 1960s. In *Money, Employment, and Inflation*, Barro and Grossman (1976) explain why they build the Old Keynesian model. They were worried about the weak foundations of the IS-LM framework. They wanted to provide a strong microfoundation to Keynesian ideas. For instance, they wanted to understand the interrelation between the behavior of individual economic agents and the realization of macroeconomic phenomena. The Old Keynesian model did not aim to address empirical anomalies associated with the IS-LM model: it was touted as a methodological improvement. Thus, the community joined the Old Keynesian paradigm because it was providing a better methodology, with microfoundations, not because it described the world better. It managed to describe the ideas and mechanisms in the *General Theory* with a consistent mathematical framework consisting of firms and households maximizing utility and profit in a modern way.

The Old Keynesian paradigm was very active in the 1970s, but was rapidly displaced by the Real Business Cycle paradigm in the 1980s. Very quickly after Kydland and Prescott (1982) wrote their paper, the Real Business Cycle paradigm took over and was adopted by the macroeconomic community until the late 2000s.

The motivation for moving from the Old Keynesian paradigm to the Real Business Cycle paradigm is a little harder to see, but appears again to be solely methodological. A common view is that the US stagflation in the 1970s led to drastic changes in macroeconomics, as a result of which the Old Keynesian model perished. At the time, however, Real Business Cycle researchers sold their contribution differently. In *Frontiers of Business Cycle Research*, Cooley and Prescott (1995) provide a very simple explanation for what they were trying to do. They started with the view that growth and fluctuations are not distinct phenomena to be studied with separate data and analytical tools. They wanted to build a model that captures both short-term economic fluctuations, and long-term economic growth. In fact, the abstract of Kydland and Prescott (1982) starts with "The equilibrium growth model is modified and used to explain the cyclical variances of a set of economic time series, the covariances between real output and the other series, and the autocovariance of output." So, the stated goal was to have a unified treatment of growth and fluctuations. This motivation explains where all the assumptions of the Real Business Cycle model come from: why it starts from a growth model, why prices are flexible (they ought to be in the long run), and why technology plays a crucial role (it is a key driver of economic growth).

A secondary factor that might have contributed to the demise of the Old Keynesian paradigm and accelerated the transition to the Real Business Cycle paradigm is an emerging reluctance to assume rigid prices and wages. One possible source of this reluctance is a famous argument by Barro (1977), in which he criticized the Old Keynesian assumption of wage rigidity made because firing workers due to wage rigidity violates bilateral efficiency. Firms and workers forego Pareto improvements: they could both be better off by renegotiating a lower wage and continuing to work together. Barro deemed such level of inefficiency too implausible to be included in the models.

Real Business Cycle literature was very active for two or three decades, after which the New Keynesian paradigm rose to prominence. The New Keynesian paradigm became very active in the late 1990s and is still dominant today. So, the 1990s and 2000s were a period of revolutionary science because there was a fierce competition between the two paradigms—Real Business Cycle and New Keynesian—and, eventually, the New Keynesian paradigm took over.

Again, it's interesting to understand the motivations for building the New Keynesian model. In this case, however, the motivation was very much empirical: the goal was to describe the world better than the Real Business Cycle model. In the preface of *Interest and Prices*, Woodford (2003) explains that the goal was to improve on two things. First, the model was designed to understand the inefficient fluctuations that result from rigid wages and prices. In fact, early on, Summers (1986) criticized the Real Business Cycle model for being unable to account for the Great Depression: to account for market failure on a grand scale. Second, the framework was designed to help understand why monetary policy is effective, what central bankers do, how they could conduct monetary policy better. So, a big motivation was understanding cyclical inefficiencies and thinking about monetary policy. People wanted to have a model that could explain market failures in recessions and that could guide monetary policy, which the Real Business Cycle model couldn't do. That is why the New Keynesian paradigm took over.

22.3. Connecting the slackish model to previous business cycle models

In this section, we draw connections between the slackish business cycle model and its predecessors. We explain the elements that the slackish model borrows from these previous models, and we discuss what the slackish model aimed to improve upon. We have seen in the previous section what are the main assets and liabilities of existing business cycle models. Given this assessment, the construction of the slackish model is quite natural: it aimed to preserve as many assets as possible and move away from the liabilities. Here we consider the two-market version of the slackish business cycle model, presented in chapter 15. That model has separate product and labor markets and firms, so it shares the same structure as the core models in the other paradigms.

22.3.1. Connections to the Old Keynesian model

The slackish business cycle model shares several similarities with the Old Keynesian model. A first similarity is that both models feature slack. In the Old Keynesian model, the model features slack in any situation of excess supply. For instance, there is slack on the product market in the Keynesian unemployment and underconsumption regimes, and slack on the labor market in the Keynesian unemployment and classical unemployment regimes. However, in the classical-unemployment and repressed-inflation regime, there is no slack on the product market: there is excess demand so firms can sell all their production. And in the repressed-inflation and underconsumption regimes, there is no unemployment on the labor market. This is all a bit unrealistic. In a slackish model, just as in the real world, there is always some slack and some unemployment—goods that cannot be sold and workers who cannot find jobs.

A second similarity is that both models are generally inefficient. The Old Keynesian model operates efficiently only when the fixed prices and wages happen to be at the market-clearing levels. The slackish model operates efficiently only when the price and wage norm coincide with the efficient price and wage levels.

The Old Keynesian model has several limitations, however, and the slackish model attempts to improve on them. A first limitation of the Old Keynesian model is that it is a little cumbersome to analyze: the model is described by four different systems of equations, one for each possible regime. These four systems are required to describe all the possible cases as either supply or demand can be rationed on each market. Studying the model is therefore difficult because each regime requires a different analysis. By contrast, the slackish model is described by the one system of smooth equations, irrespective of the slackness or tightness of the product and labor markets. A case-by-case analysis is not required.

A secondary, related limitation is that the Old Keynesian model is quite binary. Its behavior is determined either by the market supply (in excess demand) or by the market demand (in excess supply) on any market. Demand and supply never matter at the same time. The slackish market offers a more balanced perspective. Market demand and supply both matter at all times, although because the market is highly nonlinear, demand takes a much more important role in slack times and supply in tight times. But the relative importance of supply and demand evolves continuously with the state of the market, instead of jumping from all demand to all supply when the nonclearing Walrasian market moves from excess supply to excess demand.

This is visible when we look at unemployment. The slackish framework borrows the concepts of Keynesian and classical unemployment from the Old Keynesian model but the beauty of the framework is that they all occur at the same time and at all times with different relative importance. In the Old Keynesian model, classical and Keynesian unemployment cannot coexist (Malinvaud 1977, figure 3).

In addition, the Old Keynesian model faces tricky theoretical challenges to deal with the rationing that sellers or buyers face. Consider a situation of excess demand: the buyers expect to be able to buy anything they want at the market price, they plan accordingly, but when they get to the market they face rationing and are actually unable to buy what they planned to buy. The model must then explain how goods are rationed: by a lottery, by willingness to pay, or in some other way? The model must also explain how buyers might anticipate this situation in the first place, and how they may alter their behavior. A buyer who anticipates being rationed does not behave like someone who does not anticipate it.

In effect, the slackish model resolves this situation by introducing matching functions that mediate trades on the product and labor market, so there is always slack but no theoretical challenges. The matching function is the device that resolves the theoretical issues that plagued the Old Keynesian model. The matching function dictates what the trading probabilities are, and everyone takes them as given when they make decisions. So nobody is surprised at any point, and everyone anticipates the market conditions that are realized.

22.3.2. Connections to the Real Business Cycle model

The Real Business Cycle and slackish models are diametrically different. The Real Business Cycle model has never any slack or unemployment while the slackish model always has some slack and unemployment. The Real Business Cycle model generates business cycles from technology shocks while the slackish model generates business cycles from aggregate demand shocks. The Real Business Cycle model is generically efficient while the slackish model is generically inefficient. Prices are flexible and monetary policy is neutral in the Real Business Cycle while prices are rigid and monetary policy is nonneutral in the slackish model. In fact, prices are the main equilibrating variables in the Real Business Cycle model, while tightnesses are the main equilibrating variables in the slackish model. The Real Business Cycle paradigm emphasizes dynamic programming while we learn a lot about the slackish model through comparative-static analysis. The Real Business Cycle literature only uses stochastic models; we presented models that are deterministic and yet appear insightful. And we made almost all our arguments using graphs and diagrams, which would be heretical in the Real Business Cycle literature.

Nevertheless, the two models Real Business Cycle and slackish do share some commonalities. Both feature price-taking households and firms. In both, all exchanges are always bilaterally efficient. Both aim to be as economical as possible, and favor theoretical cleanliness. The slackish model also shares with the Real Business Cycle model a desire for a unified framework, but over slack and tight states, or slumps and booms, rather than over economic growth and economic fluctuations.

22.3.3. Connections to the New Keynesian model

The slackish business cycle model also shares several commonalities with the New Keynesian model.

First, in both models, aggregate demand arises from the households' consumption and saving decisions, described by an Euler equation. However, we modify the Euler equation by introducing wealth in the utility function. In the New Keynesian model, the equilibrium aggregate demand is degenerate in that it does not involve any quantities—it just pins down a real interest rate. With wealth in the utility function, the equilibrium aggregate demand is nondegenerate: it describes output as a decreasing function of the real interest rate. As a result, the model behaves better, especially at the zero lower bound or under an interest-rate peg.

Second, monetary policy is nonneutral in the slackish model, just as in the New Keynesian model, and monetary policy continues to operate through the Euler equation. By adjusting the policy rate, the central bank influences households' consumption and saving decisions and, consequently, aggregate demand, just as in the New Keynesian model.

Third, just as in the New Keynesian model, monetary policy is nonneutral in the slackish model because prices are rigid. But pricing in the slackish model is very different from pricing in the New Keynesian model. The slackish model assumes that prices and wages are determined by price and wage norms instead of through Calvo pricing. Because the Calvo pricing assumption requires sellers to sell any quantity demanded at the current price—even if the price has no been reset in a very long time—a significant number of sellers are forced to engage in involuntary exchange (Huo and Rios-Rull 2020). In a other words, many sellers are forced to sell at a loss: for monopolistic firms, it means selling goods at a price below marginal cost; for labor unions, it means selling labor at a wage below the marginal rate of substitution. By contrast, in the slackish model, all exchanges are voluntary: sellers and buyers who trade are always happy to do it.

The version of the slackish model with directed search, presented in chapter 16, does incorporate a Phillips curve, just like the New Keynesian model. However, the slackish Phillips curve links the unemployment gap to inflation instead of linking output gap to inflation: it specifies how changes in slack translate into inflationary or disinflationary pressures.

Fourth, both the New Keynesian model and the slackish model are generally inefficient. In both cases, it is because prices and wages are rigid and can therefore not remain at their efficient level. And in both models, stabilization policies should reduce these inefficiencies as much as possible. However, in the New Keynesian model, measuring departures from efficiency requires to measure markups, which is notoriously difficult to do. In the slackish model, departures from efficiency are measured by tightness gaps, which can be computed in real time. Accordingly, the slackish perspective on inefficiency is much more practical for policymaking.

A central difference between the two models is that the slackish business cycle model is simpler and more diagram-based than the New Keynesian apparatus. Krugman (2000, 2018) argues that policymakers still use the IS-LM model for their day-to-day thinking about policies because the New Keynesian model is just too complicated. His point is reinforced by the fact that popular undergraduate textbooks do not use the New Keynesian model to teach business cycles, but instead still rely on the IS-LM model (Abel, Bernanke, and Croushore 2017; Mankiw 2019). Hopefully this criticism will not be leveled at the slackish model.

Additionally, because the slackish product and labor markets are organized around a matching function, while the New Keynesian product and labor markets are monopolistically competitive, the two models operate very differently. Unlike in the slackish model, there is no slack in the New Keynesian model, as firms sell all their production and unions sell all their labor. Because firms and unions charge markups, they under-supply goods and labor, so the New Keynesian model is not well designed to think about tight, overheating economies. By contrast, in the slackish model, markets can be overly tight as easily as overly slack. Finally, the New Keynesian model is generally analyzed in a linear form, which features no state-dependence (Parker 2011). By contrast, because of the matching process, the slackish model is sharply nonlinear and hence sharply state-dependent: it behaves very differently in slack and tight times.

22.4. Kuhnian assessment of the slackish model

We have discussed all three qualities of a good model: it must be descriptive, economical, and a good guide to the unknown. This is the gold standard—we aspire to have models that check all these three boxes. To conclude this book, let's briefly assess the slackish model that we have developed. Of course, this is not an unbiased assessment: beauty is after all in the eyes of the beholder. The point of this short section is simply to highlight a few of the qualities that I see in the slackish model, with the hope to convince a few readers to give it a try.

22.4.1. Is the slackish model descriptive?

Well, the slackish business cycle model describes why unemployment and slack always prevail. It also explains why buyers of goods and labor always coexist with sellers of goods and labor. It explains why price and wage norms prevail on markets, and why they are insulated from day-to-day market forces and shocks. It explains why slack and unemployment are sharply countercyclical. It also explains how these fluctuations generate business cycle fluctuations in output and consumption even when the economy's productive capacity is acyclical. It explains Okun's law, which appears in the model under aggregate demand shocks, and the Beveridge curve, which appears under labor demand shocks.

22.4.2. Is the slackish model economical enough?

One motivation throughout the book was to keep the framework as straightforward as possible so it could be represented and studied through simple diagrams: supply-and-demand diagrams in tightness-quantity planes to solve the model and perform comparative statics; Beveridge curve diagrams in visit-slack planes to study the efficiency properties of the model. Such straightforwardness might allow us to always keep these diagrams in our heads and use them to articulate our thoughts when we are presented with existing data, new data, and new problems. Besides diagrams, we rely extensively on sufficient statistics when we design optimal macroeconomic policies: this is something done to simplify the policy analysis and the description of the policy tradeoffs. By using diagrams and sufficient statistics consistently, we hoped to develop an economical business cycle apparatus.

22.4.3. Might the slackish model be fruitful?

Last, a good model is fruitful: it is a good guide to the unknown. This means that it opens up new, interesting avenues for research and discovery. It guides empirical exploration—suggesting where to look and what might be there—so that researchers go and look and often find things they would not have sought without it. It is too early to say how well the slackish model will do on that front.

However, on one occasion, the slackish business-cycle model pointed to one direction that eventually led to a very exciting discovery. In chapter 13 we observed that the US labor market is systematically too tight (tightness above 1) during major US wars: World War 2, the Korean War, and the Vietnam War. The only peacetime episode of inefficiently tight labor market came in the aftermath of the pandemic. Motivated by this result, and the brilliant observation that these wars and the pandemic were also periods of high inflation, Benigno and Eggertsson (2023) discover a new Phillips curve in US data, which links labor market tightness to inflation. Furthermore, they find that the Phillips curve displays a kink at the efficient tightness: the Phillips curve is flatter when the labor market is inefficient slack and much steeper when the labor market is inefficient tight. This discovery has important implications for the behavior of inflation and the conduct of monetary policy. For instance, it explains why inflation did not fall much during the Great Recession but why it flared so rapidly after the pandemic. In a related project, Gitti (2025) discovered similar regional Phillips curves in US metropolitan areas. The curves link regional inflation to regional labor market tightness, and just like the aggregate Phillips curve, they display a kink at a labor market tightness of 1.

The slackish labor market model of chapter 11 has also been useful for a few projects, where its predictions guided researchers in their empirical investigations.

A prediction of the slackish labor market model is that if a worker searches less for a job, the worker is less likely to find a job, but such reduced search will help other workers find jobs more rapidly. As in a rat race, as the worker moves down in the job queue, other workers move up ahead of them. This rat-race spillover is specific to the slackish model—it does not exist in other models—and it prompted Lalive, Landais, and Zweimuller (2015) to look for evidence of the existence of rat-race spillovers in Austrian data, using a fascinating natural experiment. They use a reform of the unemployment insurance system in Austria which extended the duration of benefits for selected workers in selected regions of Austria. They discover that workers who were not eligible for the higher benefits in treated regions had higher job-finding rates and lower unemployment durations than similar workers in nontreated regions.

Rat-race spillovers conversely imply that if a policy helps a worker find a job, this worker is more likely to find a job, but the benefit comes at the expense of other workers. In this case, the assisted worker moves ahead in the job queue and other workers move down. Critically, the rat-race spillover is predicted to be weak in tight markets but strong in slack markets. Crepon et al. (2013, tables 6 and 10) went to look for the state-dependence of rat-race spillovers, since they had conducted the perfect field experiment to identify it. They had run a large-scale double-randomization experiment in France, in which some jobseekers had received job-search assistance and some had not, and some local labor markets had been treated and some had not. And they found the predicted results: rat-race spillovers not only appeared, but they were stronger in local labor markets that were slacker.

In the slackish labor market model, unemployment insurance not only affects individual search effort but also labor market tightness. Tightness goes up when unemployment insurance increases, as the labor supply curve recedes along a downward-sloping labor demand curve. The model therefore hinted that to understand the complete effect of unemployment insurance, we should look not only at the response of search effort (which public economists had been doing for a long time), but also at the response of labor market tightness (which nobody had done). So, using a rich dataset with job vacancies and job applications from a large job board, Marinescu (2017) decided to estimate the impact of the unemployment benefits extensions enacted during the Great Recession on labor market tightness. As the slackish model predicted, she found that labor market tightness went up when benefits were extended, and therefore that the macro effect of unemployment insurance was significantly less than the micro effect on which public economists had focused until then.

Another example of the fruitfulness of the slackish labor market appears in a paper by Toohey (2017). In it, Toohey studied the effects of work-search requirements in unemployment insurance systems. Motivated by the prediction of the slackish model that job-search effort has a stronger effect on unemployment in a tight market, he compared the impact of work-search requirements attached to unemployment insurance across states with different labor market conditions. Just as the slackish model suggested, he found that increasing search requirements to stimulate job-search effort reduces unemployment more when the market is tight than when it is slack.

As a final example, the slackish model says that public employment is much more effective in bad times, when unemployment is high, than in good times. If the government hires one worker, it has a much stronger effect on the labor market in bad times than in good times because government hiring crowds out private hiring much less. Holden and Sparrman (2016) used that prediction to examine the effect of government spending on employment in OECD countries and found that indeed government employment boosts employment more effectively when the labor market is slack than when it is tight.

Overall, the slackish framework has been quite fruitful in understanding the effects of policy on the labor market over the business cycle. The slackish labor market model was useful to guide empirical investigations: pointing to empirical regularities that might not have been observed without the predictions of the model. Hopefully the framework will open more interesting avenues for empirical research in the future.

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