

NBER WORKING PAPER SERIES

THE OLD KEYNESIAN MODEL

Robert J. Barro

Working Paper 33850

<http://www.nber.org/papers/w33850>

NATIONAL BUREAU OF ECONOMIC RESEARCH

1050 Massachusetts Avenue

Cambridge, MA 02138

May 2025

I have no sources of funding to report. The views expressed herein are those of the author and do not necessarily reflect the views of the National Bureau of Economic Research.

NBER working papers are circulated for discussion and comment purposes. They have not been peer-reviewed or been subject to the review by the NBER Board of Directors that accompanies official NBER publications.

© 2025 by Robert J. Barro. All rights reserved. Short sections of text, not to exceed two paragraphs, may be quoted without explicit permission provided that full credit, including © notice, is given to the source.

The Old Keynesian Model
Robert J. Barro
NBER Working Paper No. 33850
May 2025
JEL No. E12

ABSTRACT

Articles from the 1970s applied a general-disequilibrium framework to the determination of output and employment with sticky nominal prices and wages. Quantities are determined on the short sides of the goods and labor market and involve non-price rationing. With general excess supply, where prices and wages are “too high,” output and employment are determined by the Keynesian demand multiplier, based on the marginal propensity to consume. In the case of general excess demand, where prices and wages are “too low,” output and employment are determined by a supplier multiplier, based on the marginal propensity to work. In these two cases, output and employment are independent of the real wage. However, starting from general market clearing, deviations from the general-market-clearing real wage in either direction reduce output and employment. The New Keynesian Model, which also relies on sticky prices, amounts to an extension of the general-excess-supply case of the Old Keynesian Model. The New Keynesian Model assumes that quantities are always demand determined, but this assumption is tenable only under general excess supply. A promising alternative to the non-price rationing of quantities in the Old Keynesian Model is a setup with search-and-matching frictions in the markets for goods and labor.

Robert J. Barro
Harvard University
Department of Economics
and NBER
rbarro@harvard.edu

In the 1970s, Barro and Grossman (1971) developed a version of Keynesian models with sticky nominal prices and wages.¹ That model, which I call the Old Keynesian or OK model, emphasized interactions between goods and labor markets. The familiar Keynesian demand multiplier emerged from these interactions. This multiplier, which featured the marginal propensity to consume, applied in the context of general excess supply, where nominal prices and wages were stuck at excessive levels. At going prices and wages, firms could not sell all the goods that they supplied and households could not sell all the labor services that they supplied.

The Old Keynesian framework included the case of general excess demand, where nominal prices and wages were stuck at insufficient levels. At going prices and wages, firms could not buy all the labor services that they demanded and households could not buy all the goods that they demanded. This excess-demand case featured a supply multiplier, which is much less familiar than the demand multiplier. The supply multiplier is based on the marginal propensity to work.

Although the OK Model was prominent through the 1980s, as evidenced by citations, it was almost forgotten by the 1990s. Most macroeconomists instead embraced the New Keynesian or NK Model. The NK model shares with the OK model the key assumption that prices are sticky. In some respects, the NK model has a richer structure, which includes intertemporal substitution in consumption, a model of gradual price adjustment, and a rule whereby the central bank adjusts the nominal interest rate. However, the NK Model is less advanced in other respects, notably, it assumes that output of goods is always demand-determined. This situation applies in the OK Model only when excessive nominal prices and wages create excess supply in goods and labor markets. I argue that this key assumption in the

¹We noted in the 1971 paper that important earlier contributions were made by Clower (1965) and Patinkin (1965, Ch. 13).

NK Model is untenable as a general proposition even when the model includes price markups. It may be a good time to return to the Old Keynesian Model and then improve on this framework.

I. The Old Keynesian Model

The setup with a goods market and a labor market comes from Barro and Grossman (1971), which was extended in Barro and Grossman (1976, Chs. 1, 2). The present analysis uses the basic model developed in Barro and Grossman (1976, Ch. 1) and includes here a sketch of that model.

The quantity of goods is denoted by Y , with each unit selling at the nominal price, P . (Variables written without a time subscript refer to the current point in time.) The quantity of labor is denoted by L , with each unit selling at the nominal wage rate, w . The real wage rate is w/P . The representative firm demands labor, denoted by L^d , and supplies goods, denoted by Y^s . The representative household supplies labor, denoted by L^s , and demands goods for consumption, the sole form of demand for goods, denoted by Y^d .

The nominal quantity of money, M , is set by the central bank. Households hold real money balances, M/P , as the only store of value and then choose consumption and leisure over time. The model can be extended to include other forms of wealth and to allow for direct utility from holdings of real money balances.

Firms, owned by households, demand labor, L^d , as the only variable input to production. Sales of goods correspond to production and are linked to labor input via the production function,

$$(1) \quad Y = F(L).$$

The production function has the usual properties, including positive and diminishing marginal product of labor. The model can be extended to allow for firms' inventories of goods. As is standard, an increase in w/P motivates the representative profit-maximizing firm to reduce labor demand, L^d , and goods supply, Y^s . Firms' profits go to the households.

Barro and Grossman (1976, Ch. 1) work out the representative household's choices of consumer demand, Y^d , and labor supply, L^s , in an intertemporal context of utility maximization. The household's real money balances start at M/P . The intertemporal problem is simplified by assuming that the household anticipates that P , w/P , and profit income will be constant over time. An increase in w/P has the standard substitution effect that motivates an increase in labor supply, L^s , and consumer demand, Y^d . The positive substitution effect on L^s is assumed to dominate a negative income effect.² For given M , a once-and-for-all rise in P reduces M/P and, thereby, has negative wealth effects. These effects imply a reduction in Y^d and an increase in L^s (corresponding to a fall in leisure).

Figure 1 shows the market-clearing conditions for the goods and labor markets. The equations of quantities demanded and supplied in each market imply two equilibrium conditions, which determine the two prices, P and w , or, equivalently, P and w/P . The first panel shows Y^d and Y^s as functions of w/P . The line for Y^d applies for a given P , assumed initially to equal its general market-clearing value, P^* . When $P=P^*$, the equation of the quantities of goods demanded and supplied occurs at the general market-clearing real wage rate, $(w/P)^*$, as shown in the first panel. Similarly, in the second panel, the line for L^s applies for a given P , assumed

²In any event, when effects on firms' profits are considered, there is no overall income effect from a change in w/P if the production function does not shift.

initially to equal P^* . In that case, the equation of the quantities of labor demanded and supplied occurs at the general market-clearing value, $(w/P)^*$, the same as the value in the first panel.

A. General Excess Supply; the Keynesian Demand Multiplier

Standard Keynesian results apply when the price level, P , is fixed at a value above P^* . The assumption initially is that the nominal wage rate, w , is proportionately above w^* , so that the real wage rate, w/P , equals its general market-clearing value, $(w/P)^*$. In other words, this case applies when P and w are, in some sense, equally sticky downwards. This case is depicted in Figure 2.

When $P > P^*$, the reduced level of M/P implies via wealth effects a leftward shift in the Y^d line in the first panel of Figure 2 and a rightward shift in the L^s line in the second panel. Therefore, when $w/P = (w/P)^*$, there is excess supply of goods and labor.

Quantities are assumed to be determined by the short-side of each market. This assumption embeds two conditions. First, under voluntary exchange, no party can be forced to transact a quantity larger than the one they wish to demand or supply. (This condition is often violated in the NK model, as discussed below.) Second, all mutually advantageous trades occur at the going price and wage rate. This condition could be modified to allow for frictions due to costs of search and matching, as in Michaillat and Saez (2015) and Bianchi, et al. (2024).

It is convenient to work out the general (dis-) equilibrium results in the form of hypothetical stages. In the first panel of Figure 2, the first-stage quantity of goods is Y_I , which is determined on the short side of the goods market by the quantity demanded. This amount falls short of the quantity supplied by firms at the going real wage rate, $w/P = (w/P)^*$. The assumption is that the available sales are allocated to firms by a non-price rationing mechanism, which does

not in itself consume any resources. The rationed quantity, Y_1 , is then a parameter for the representative firm in the same sense that w and P are parameters for the firm. Since firms can sell only Y_1 , they no longer demand the quantity of labor L^* , specified by the notional labor-demand line when $w/p=(w/P)^*$ in the second panel of Figure 2. Instead, the effective demand for labor becomes the smaller quantity $L_1=F^{-1}(Y_1)$. That is, firms demand the quantity of labor needed to produce and sell the rationed quantity Y_1 , in accordance with the production function in Eq. (1).

In the second panel of Figure 2, the first-stage quantity of labor is L_1 , which is determined on the short side of the market by the quantity demanded. This amount falls short of the quantity supplied by households at the going real wage rate, $w/P=(w/P)^*$. The assumption, paralleling that about sales for firms, is that the available employment is allocated to households by a non-price rationing mechanism. This quantity of labor translates into labor income of $(w/P)^* \cdot L_1$ and profit income of $Y_1 - (w/P)^* \cdot L_1$. That is, total income equals Y_1 , and the assumption is that the representative household cares only about this total income and not about its division between labor and profit income. The key point is that household income falls short of the amount associated with the quantity of labor supplied along the line for notional labor supply, L^s , at the real wage rate $w/P=(w/P)^*$. Households react to this shortfall of income by demanding a smaller quantity of goods, shown as the second-stage value $Y_2=Y^d(L_1)$ in the second panel of Figure 2. That is, $Y^d(L_1)$ is consumer demand when household employment is constrained to equal L_1 , which falls short of the quantity supplied, so that household income is Y_1 . The quantity sold, Y_2 , then equals the quantity demanded on the short side of the goods market.

This process continues as each reduction in sales generates a reduction in employment, which generates a further drop in income and, hence, in consumer demand and, therefore, sales.

The ultimate outcome emerges from a sequence of stages, each one analogous to those already discussed. However, in the present application, the division of the results into these stages is solely an expository device; the only meaningful general (dis-) equilibrium solution is the one approached asymptotically as the number of stages becomes large. This full result corresponds to the familiar Keynesian demand multiplier, defined by the condition $Y=Y^d(Y)$ and often referred to as the “Keynesian Cross.” This solution is well-defined as long as the marginal propensity to consume out of income is between zero and one. Oddly, this result typically appears in introductory economics classes and textbooks even though the underlying logic of the Keynesian demand multiplier is highly sophisticated (involving the interplay between goods and labor markets as sketched here).

One property of the result given by $Y=Y^d(Y)$ is that the solution for Y and, therefore, also for L is independent of the real wage rate, w/P . This conclusion holds as long as the economy remains in the state of general excess supply shown in Figure 2. In this sense, the assumption $w/P=(w/P)^*$ is unimportant for the main results. This conclusion is revisited below.

In the present application, the results apply to a downward shift in the Y^d line and an upward shift in the L^s line generated by an increase in P , which reduces M/P . Results are analogous for other shifts that amount to negative wealth effects, such as a preference shift away from current consumption and leisure and toward saving. When a government sector is introduced, contractionary fiscal policy can have analogous effects.

Another property is that, when general excess supply prevails, a shift in goods supplied, Y^s , does not affect output and employment, Y and L . For example, an increase in productivity leaves unchanged current output, which is determined in accordance with the Keynesian condition, $Y=Y^d(Y)$. At least this conclusion obtains unless the rise in productivity

makes households raise Y^d because the prospect of higher future income makes them feel richer. This independence of current quantity from a shock that affects the slack side of the market would not apply when markets clear by adjustments in search and matching frictions, as in Michailat and Saez (2015), discussed below. The result may also not hold when suppliers of goods make adjustments in non-price characteristics of a product, such as quality, waiting times, and locations, along the lines suggested by Mulligan (2024).

B. General Excess Demand; the Supply Multiplier

The case of general excess demand is analogous to that of general excess supply, except that the nominal price, P , and wage rate, w , are now fixed below their general market-clearing values. Therefore, instead of thinking of the nominal price and wage as sticky downward, one thinks of these values as sticky upward. This case is emphasized in Barro and Grossman (1974). In the period following that 1974 paper, the excess-demand case was thought to be particularly applicable to Communist countries in which inflation was suppressed. See Muellbauer and Portes (1978), Kornai (1979), and Portes and Winter (1980). For a more recent application, one can think of difficulties of raising prices of retail goods (a practice sometimes characterized as “price-gouging”) in the context of supply-chain shortages during the early part of the COVID pandemic. This negative perspective on raising prices applies more generally in the aftermath of natural disasters, such as for plywood or shovels following a hurricane.

The assumption now is that the price level, P , and nominal wage rate, w , are below their general market-clearing values in the same proportion, so that the real wage rate, w/P , again remains at its general market-clearing value, $(w/P)^*$. In other words, this case applies when P and w are, in some sense, equally sticky upwards. This case is depicted in Figure 3.

When $P < P^*$, the increased level of M/P implies via wealth effects a rightward shift in the Y^d line in the first panel of Figure 2 and a leftward shift in the L^s line in the second panel. That is, at a given w/P , consumer demand and leisure are each increased by the heightened value of M/P . Therefore, there is excess demand for goods and labor when $w/P = (w/P)^*$.

In the bottom panel of Figure 3, the first-stage quantity of labor is L_1 , determined on the short side of the market by the quantity supplied. This amount falls short of the quantity demanded by firms at the going real wage rate, $w/P = (w/P)^*$. The assumption, paralleling that made before, is that the available labor input is allocated to firms by a non-price rationing mechanism. The rationed quantity, L_1 , is then a parameter for the representative firm in the same sense that w and P are parameters for the firm. Since firms can buy only L_1 of labor, they no longer produce and sell in accordance with the notional goods supply curve, Y^s , in the upper panel of Figure 3. Instead, the effective quantity of goods supplied is given by $Y_1 = F(L_1)$ in accordance with the production function in Eq. (1). The quantity of goods in the first round, determined on the short-side of the market, therefore equals Y_1 .

Since the quantity of goods falls short of the households' quantity demanded, households are motivated to cut back further on labor supply. That is, the notional labor supply was predicated on the households' ability to buy the quantity of goods that they demanded at the going price. With fewer goods available to buy, households cut back on their effective supply of labor to the value $L_2 = L^s(Y_1)$, which is below L_1 . The quantity of employment is then determined in the second stage on the short-side of the labor market to equal L_2 .

This process continues as each reduction in labor generates a reduction in output, which generates a further decrease in effective labor supply and, hence, in the quantity of labor and, therefore, in the quantity of goods. The ultimate outcome emerges from a sequence of stages,

each one analogous to those already discussed. The full result corresponds to a supply multiplier. In contrast to the familiar Keynesian demand multiplier and its reliance on the marginal propensity to consume, the supply multiplier features a marginal propensity to work.

To derive the supply multiplier, note that the incentive to work depends on the quantity of goods available, Y , which is given to the representative household. This quantity will enter net of profit income, $Y - (w/P) \cdot L$, because households get that income without doing any work. Therefore, the key variable is the goods available net of profit income; that is, $(w/P) \cdot L$. In a simple case, the representative household, which is paid at the real rate w/P , would work just enough to cover this net amount. More generally, the household might adjust saving by working more or less than this amount. The solution takes the form

$$(2) \quad L = L^s(L).$$

The labor supply on the right-hand side reflects the impact on effective labor supply from an increase in L by one unit (corresponding to a rise in net goods available by $(w/P) \cdot L$ units). This response can be labeled as the marginal propensity to work.

The solution for L from equation (2) determines output from the production function, $Y=F(L)$, in Eq. (1). Note that the solutions for L and, therefore, for Y are independent of w/P . This result in the excess-demand case parallels the one for the excess-supply case. As before, the independence of the outcomes from w/P applies when the solution remains in the prescribed region; in this case one of general excess demand.

In the present application, the results apply to an upward shift in Y^d and a downward shift in L^s generated by a decrease in P , which produces an increase in M/P . Results are analogous for other shifts that amount to positive wealth effects, such as a preference shift toward current consumption and leisure and away from saving.

C. Integrating Excess Supply and Excess Demand

An unappealing feature of the analysis is that the nature of the solution shifts discretely from the general-excess-demand case (where $P < P^*$) to the general-excess-supply case (where $P > P^*$) when P crosses the border at P^* . However, when viewed in terms of output and employment, the relationships with P are smooth. In the excess-demand region, Y rises toward Y^* as P increases toward P^* . In the excess-supply region, Y rises toward Y^* as P declines toward P^* . When graphed versus P there are smooth, non-linear relationships of Y and L to P , with Y and L peaking at Y^* and L^* , respectively, when $P = P^*$. To the left of P^* (excess-demand region), Y and L are increasing in P , and to the right of P^* (excess-supply region), Y and L are decreasing in P .

In the present analysis, the real effects from deviations of P from P^* result from real-money-balance effects. However, in richer versions of the model, the real effects from “incorrect” price levels could involve financial effects that work through interest rates. As discussed below, the New Keynesian Model amounts to an extension of the excess-supply part of the Old Keynesian model to incorporate these types of financial channels.

D. Excessive or Insufficient Real Wage Rate

The results thus far from the Old Keynesian Model show that output and employment can be independent of w/P if the environment is one of general excess supply or general excess demand. The conclusions are different if one starts at the general market-clearing equilibrium and then considers an exogenous change in w/P with P held fixed at P^* . Figure 4 shows the case where w/P is “too high.” The excess of $(w/P)_1$ over $(w/P)^*$ can result from a rise in w

above w^* with P maintained at P^* . Note that, in this case, none of the demand or supply lines shift in Figure 4.

In Figure 4, when $w/P=(w/P)_I$, there is excess demand for goods and excess supply of labor. Quantities determined on the short side of each market are denoted by Y_I and L_I , respectively. In this setting, households are constrained in both markets.

Since households cannot obtain the quantity of goods that they desire, corresponding to the value $(w/P)_I$ along the Y^d line, they cut back on the quantity of labor supplied. Since households also cannot obtain the quantity of work that they seek, corresponding to the value $(w/P)_I$ along the L^s line, they cut back on the quantity of goods demanded. However, in contrast to the cases considered in Figures 2 and 3, these adjustments do not impact the short side of either market and, therefore, do not affect the quantities, Y and L . Hence, there is no “multiplier” in this case. The important conclusion is that an exogenous rise in w/P , starting from a position of general market clearing, reduces output and employment.

Results are analogous for an exogenous reduction in w/P . In this case, $Y^s > Y^d$ and $L^d > L^s$ apply when $(w/P)_I < (w/P)^*$. The short-side quantities, Y_I and L_I , again fall short of their general market-clearing values.³

As in the cases of general excess supply and general excess demand, one can integrate the cases of “excessive” and “insufficient” real wage rates, w/P . When w/P crosses from the range above $(w/P)^*$ to that below $(w/P)^*$, there is a discrete shift in the form of the analysis in the sense of where excess demand or supply prevails. However, the relationships of Y and L to w/P are smooth. Y and L are maximized at the position of general market clearing, where $w/P=(w/P)^*$

³As noted in Barro and Grossman (1976, Ch. 2), firms cannot be constrained simultaneously in the goods and labor market, because Y and L are linked through the production function in Eq. (1). This result need not apply if inventory accumulation is admitted.

(assuming that $P=P^*$ holds throughout). Movements of w/P away from $(w/P)^*$ in either direction, with P held fixed at P^* , reduce output and employment.

One can also consider jointly deviations of P from P^* and of w/P from $(w/P)^*$. As already noted, Y and L are maximized at the position of general market clearing, where $P=P^*$ and $w/P=(w/P)^*$. However, it is not always the case that a movement of one of these variables toward its general-market-clearing value leads to increases in Y and L . For example, the earlier analysis showed that, in the region of general excess supply or general excess demand, small changes in w/P had no impact on Y and L .

II. The Michailat-Saez Model; Search and Matching Frictions

The main modification of the Old Keynesian Model in Michailat and Saez (2015, Section 4) is that search-and-matching frictions replace the rationing rules that apply to situations of sustained excess demand or supply in the goods or labor market. A tight goods market in the MS model, where firms have an easy time selling goods, corresponds to excess demand for goods in the OK model. The reverse situation with excess supply of goods corresponds to a loose goods market. A tight labor market in the MS model, where households have an easy time selling labor, corresponds to excess demand for labor in the OK Model. The reverse situation with excess supply of labor corresponds to a loose labor market.

Michailat and Saez (2015, Section 4) show that an increase in aggregate demand in their model raises output and goods-market tightness. This increase also raises employment and labor-market tightness.

In the MS model, quantities demanded and supplied always end up equated, but the equilibrium features resources used up in the process of finding goods and jobs. In the OK

Model, the non-price rationing process is assumed not to consume resources directly. However, deadweight losses result from the imbalances between quantities demanded and supplied, and these losses reflect departures of prices and wages from their general-market-clearing values.

Michaillat and Saez (2015, p. 30) point out some advantages of their approach:

“... in our model, the equilibrium is determined by the same system of smooth equations in all the types of equilibria (the only difference between the four types of equilibria are the slopes of the aggregate supply and labor supply); but in the general disequilibrium model [which refers to Barro and Grossman, 1971], each regime is described by a distinct system of equations, depending on whether the supply or the demand binds in each market; our representation of the four regimes is therefore more tractable.”

It may be that a search-and-matching approach as proposed by Michaillat and Saez (2015) could usefully replace the quantity-rationing approach of Barro and Grossman (1971; 1976, Ch. 2).

However, one shortcoming of the current version of the MS model is that it is unclear how to relate the results to the multiplier-type analysis discussed in Part I of this paper for the OK Model. Further work along these lines could be useful.

III. The New Keynesian Model

This section relates the Old Keynesian Model, as worked out in previous sections, to the New Keynesian Model. The main thesis is that the NK Model is an extension of the general-excess-supply case of the OK Model. In particular, the NK Model assumes that output is always demand determined, as is true in the general-excess-supply case. However, this assumption is generally untenable when general excess supply does not prevail.

I work with a version of the NK Model that is a simplification of the framework developed in Gali (2018, pp. 89-90) and Gali (2015, Ch. 3), some of which relates to Woodford (2003). The main model deals with a goods market (or an array of goods markets)

and does not deal directly with a labor market.⁴ Price stickiness is central to the NK Model, as is also true for the OK Model.

The NK Model features three equations. The first is a dynamic *IS* equation. This equation relates the growth rate of aggregate output positively to the real interest rate. (The baseline model has private consumption as the only use of output.) This aggregate condition derives from choices applying to an array of sectors, each of which produces a variety of goods.

The second equation is a New Keynesian Phillips Curve, which is based on optimal price adjustment by firms with some degree of monopoly power in each sector. This equation relates the aggregate inflation rate positively to the deviation of aggregate output from “natural output” and to expected future inflation.

The third equation is an interest-rate rule, assumed here to take the form of a “Taylor Rule.”⁵ This equation relates the nominal interest rate positively to the aggregate inflation rate and to the deviation of aggregate output from natural output.

A key feature of the NK Model is that output of each variety j , $Y(j)$, is assumed always to equal the quantity demanded, $Y^d(j)$. (The symbols Y and Y^d denote the corresponding aggregates.) The equation of each sector’s output to the quantity demanded when prices are not fully flexible makes the NK model comparable to the general-excess-supply case of the OK Model.

To simplify the structure of the NK Model, I assume that there is a competitive sector where firms produce homogeneous output using homogeneous labor input. The homogeneous goods sell at a single nominal price, denoted \hat{P} . If w is the nominal wage rate for labor, the

⁴Gali (2015, Ch. 6) works out a model that also includes sticky nominal wage rates. This model assumes that workers have monopoly power working through labor unions in determining the supply of labor. Alternatively, as in Denery (2020), firms might be assumed to have monopsony power in their dealings with workers.

⁵See, for example, Taylor (1993).

nominal marginal cost for the competitive producers equals the ratio of w to the marginal product of labor, MPL . The markup ratio is the ratio of \hat{P} to this nominal marginal cost. With a competitive labor market, where $w/\hat{P} = MPL$, the markup ratio for these competitive firms equals one.

There are also specialized goods, which are consumed by households and produced and sold by monopolistic firms. Each firm j effectively places a label on each unit of homogeneous output to create specialized good j . The nominal marginal cost for all specialized goods is \hat{P} . Good j sells at price $P(j)$, determined by firm j to target a desired markup over marginal cost (based on the elasticity of demand, assumed to be the same for each variety of product). That is, $P(j)/\hat{P} > 1$ for all j . In this range for $P(j)$, firm j is willing to produce and sell the quantity demanded of good j over a range of prices even when the realized markup diverges from the desired markup. This result can rationalize the New Keynesian assumption that quantity is demand determined over some range of prices.⁶

Suppose that there is a positive shock to goods demanded, $Y^d(j)$, in all sectors. In the general-excess-supply case of the OK Model, this shock would end up raising output in each sector, $Y(j)$, and, thereby, aggregate output, Y , through the workings of the Keynesian demand multiplier. In the NK Model, this multiplier is moderated by the endogenous changes that occur in the price level and real interest rates. (This moderation arises through the LM curve in simple macro models.)

In the NK Model, the new Keynesian Phillips curve implies that the inflation rate, $\pi(j)$, in sector j rises in response to the increase in $Y(j)$ for a given natural level of output, $Y_n(j)$. The

⁶This idea depends also on the presence of monopoly power on the selling side of the market. In the labor market, monopoly power on the buying side may be more common.

comparison with the OK Model is straightforward for a version of the NK model that includes real-money-balance effects, but these effects can be excluded. The higher $\pi(j)$ implies that $P(j)$ rises (by more than otherwise) over time and, therefore, that $M/P(j)$ falls (by more than otherwise) over time, where M is the aggregate nominal quantity of money. This real-money-balance effect lowers $Y^d(j)$ for all j .

The higher $\pi(j)$ also lowers sector j 's (actual and expected) real interest rate, $r(j)=i-\pi(j)$, for a given nominal interest rate, i . Offsetting this effect is that the rise in each $\pi(j)$ raises aggregate inflation, π , which increases i in accordance with the Taylor Rule part of the NK model. This channel implies an increase in $r(j)$ for all j . If the response of i to π is more than one-to-one, as assumed here, the net effect on $r(j)$ is positive in each sector.

Finally, the rise in each sector's $Y(j)$ implies that aggregate output, Y , increases. This change raises i further in accordance with the Taylor rule (which depends positively on $Y-Y_n$). Thus, there is an additional source of an increase in $r(j)$ for all j .

Overall, the increase in $r(j)$ in the typical sector reduces $Y^d(j)$ in accordance with the NK model's dynamic IS equation (the Euler equation for output). When aggregated and combined with the real-money-balance effect, the overall response is a decline in aggregate demand, Y^d . These changes therefore offset the increase in Y that corresponds to the initial positive shock to aggregate demand and the workings of the Keynesian demand multiplier.

Goods supplied do not appear directly in the NK model but enter indirectly through the "natural level of output," $Y_n(j)$, which is exogenously determined. Consider a "supply shock," where $Y_n(j)$ falls for all j . Repeating the steps from before, the New Keynesian Phillips curve implies that the inflation rate, $\pi(j)$, in sector j rises for given $Y(j)$; that is, $\pi(j)$ depends positively on $Y(j)-Y_n(j)$. As before, $M/P(j)$ falls over time, and this real-money-balance effect lowers $Y^d(j)$

for all j . Also as before, real interest rates, $r(j)$, rise in each sector, thereby lowering $Y^d(j)$ in each sector. When aggregated, the overall response is a decline in aggregate demand, Y^d , and, hence, in aggregate output, Y . This fall in Y coincides with a rise in the overall inflation rate, π —as would be expected for a supply shock.

An odd aspect of the model is that, aside from the response of the nominal interest rate, i , to the reduction in Y_n , the effects of supply shocks on output have to work through the New Keynesian Phillips curve; that is, the price-adjustment equation. In the case of complete price rigidity, which can be viewed as the Keynesian extreme, these effects on output that work through the Phillips Curve would not exist. The basic issue is that the NK model cannot get a change in output, Y , unless it gets the corresponding change in aggregate demand, Y^d . This correspondence does not apply, for example, to the case of general excess demand in the Old Keynesian Model. In that case, Y equals the quantity supplied, and the goods available are rationed among the demanders.

From the perspective of the general-excess-supply case, the main addition from the NK model compared to the OK Model is, first, the introduction of new forms of shifts to aggregate demand and, second, the inclusion of effects that moderate the size of the Keynesian demand multiplier. In the first respect, shifts to aggregate demand may reflect changes in interest rates due to monetary policy. There may also be shocks to preferences over time, though the OK Model already allowed for shifts between consumption and saving. In the second respect, the process of changing output in the context of the Keynesian demand multiplier leads to changes in real interest rates and price levels that offset an initial shock to aggregate demand. These effects arise in standard textbook treatments of IS/LM models.

IV. Concluding Thoughts

I stopped working on Keynesian models many years ago because I found unconvincing the idea that stickiness in nominal prices and wages was important enough to account for much of business fluctuations. For present purposes, I am putting these concerns aside. Specifically, I think that macroeconomic analysis conditional on price stickiness was done better in the Old Keynesian Model than in the New Keynesian Model, which has taken over the field. This perspective does not mean that the OK Model cannot be usefully modified, including the introduction of search-and-matching frictions. However, this perspective also does not eliminate concerns about whether price-wage stickiness is important.

References

- Barro, Robert J. and Herschel I. Grossman, 1971. "A General Disequilibrium Model of Income and Employment," *American Economic Review*, 61, 82-93.
- Barro, Robert J. and Herschel I. Grossman, 1974. "Suppressed Inflation and the Supply Multiplier," *Review of Economic Studies*, 41, 87-104.
- Barro, Robert J. and Herschel I. Grossman, 1976. *Money, Employment, and Inflation*, Cambridge UK, Cambridge University Press.
- Bianchi, Javier, Alisdair McKay, and Neil Mehrotra, 2024. "How Should Monetary Policy Respond to Housing Inflation?," December, Federal Reserve Bank of Minneapolis.
- Clower, Robert W., 1965. "The Keynesian Counter-Revolution: a Theoretical Appraisal," in Frank H. Hahn and Frank P. R. Brechling, eds., *The Theory of Interest Rates*, London, Macmillan.
- Dennery, Charles, 2020. "Monopsony with Nominal Rigidities: An Inverted Phillips Curve," *Economics Letters*, 191, 1-5.
- Gali, Jordi, 2015. *Monetary Policy, Inflation, and the Business Cycle*, 2nd ed., Princeton NJ, Princeton University Press.
- Gali, Jordi, 2018. "The State of New Keynesian Economics: A Partial Assessment," *Journal of Economic Perspective*, 32, 87-112.
- Hicks, John R., 1937. "Mr. Keynes and the 'Classics'; a Suggested Interpretation," *Econometrica*, 5, 147-159.
- Kornai, Janos, 1979. "Resource-Constrained versus Demand-Constrained Systems," *Econometrica*, 47, 801-819.
- Michaillat, Pascal and Emmanuel Saez, 2015. "Aggregate Demand, Idle Time, and Unemployment," *Quarterly Journal of Economics*, 130, 507-569.
- Muellbauer, John and Richard Portes, 1978. "Macroeconomic Models with Quantity Rationing," *Economic Journal*, 88, 788-821.
- Mulligan, Casey B., 2024. "Equilibrium Responses to Price Controls: A Supply-Chain Approach," *Public Choice*, September, <https://doi.org/10.1007/s11127-024-01196-8>.
- Patinkin, Don, 1965. *Money, Interest, and Prices, an Integration of Monetary and Value Theory*, 2nd ed., New York, Harper & Row.

Portes, Richard and David Winter, 1980. "Disequilibrium Estimates for Consumption Goods Markets in Centrally Planned Economies," *Review of Economic Studies*, 47, 137-159.

Taylor, John B., 1993. "Discretion versus Policy Rules in Practice," *Carnegie-Rochester Conference Series on Public Policy*, 39, 195-214.

Woodford, Michael, 2003. *Interest and Prices*, Princeton NJ, Princeton University Press.

Figure 1 General Market Clearing of Goods and Labor Markets

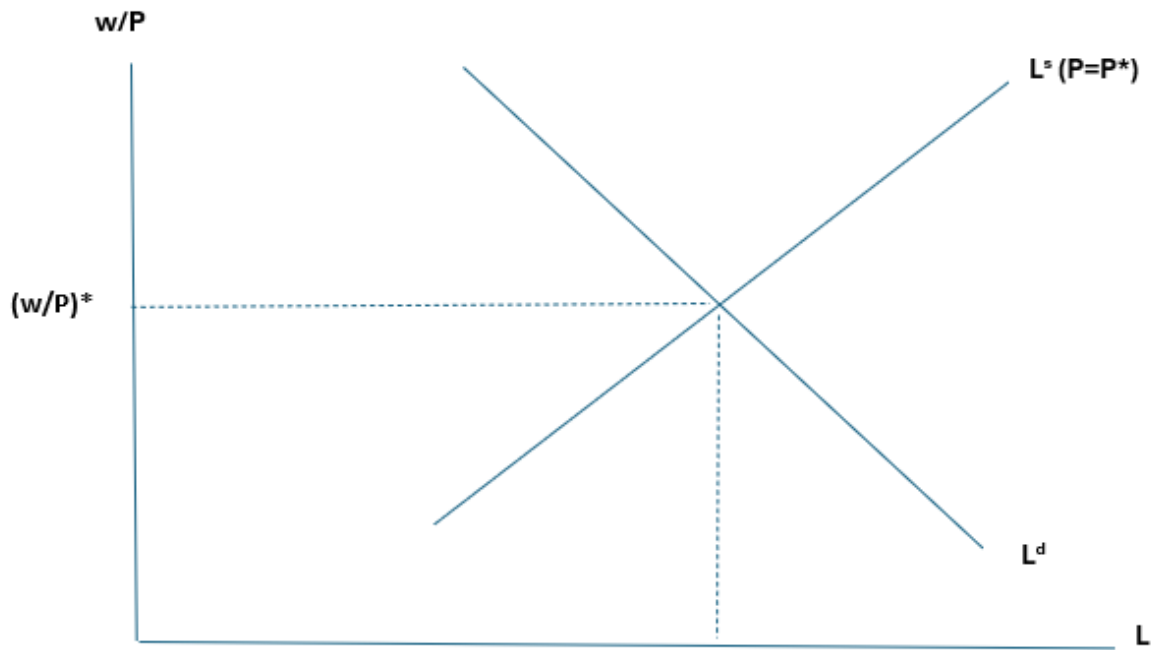
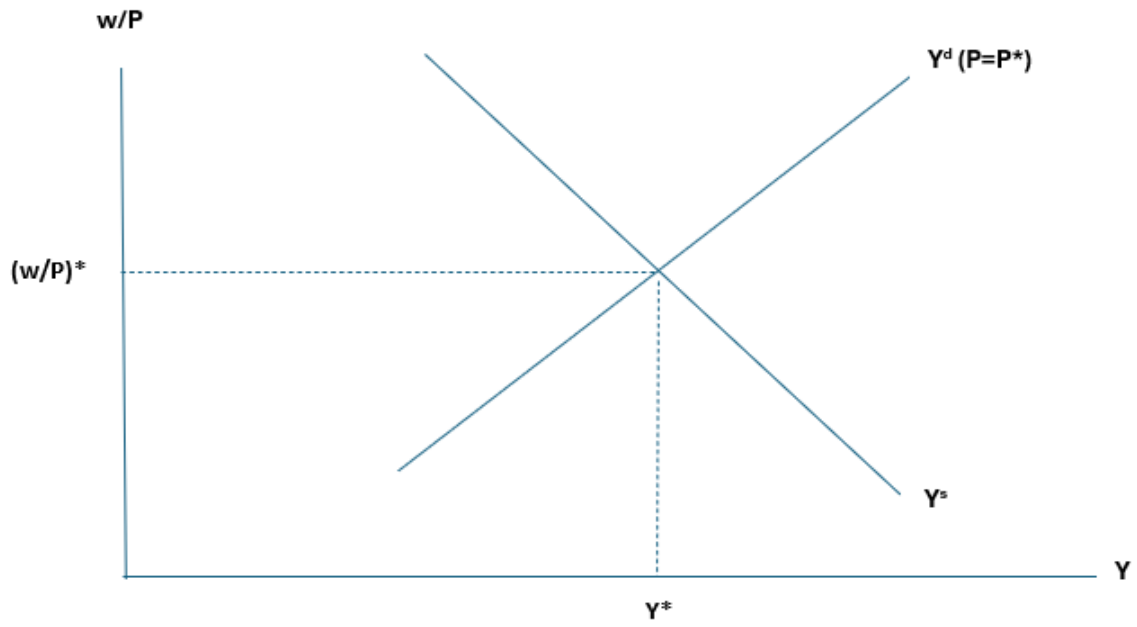


Figure 2 Excess Supply in Goods and Labor Markets

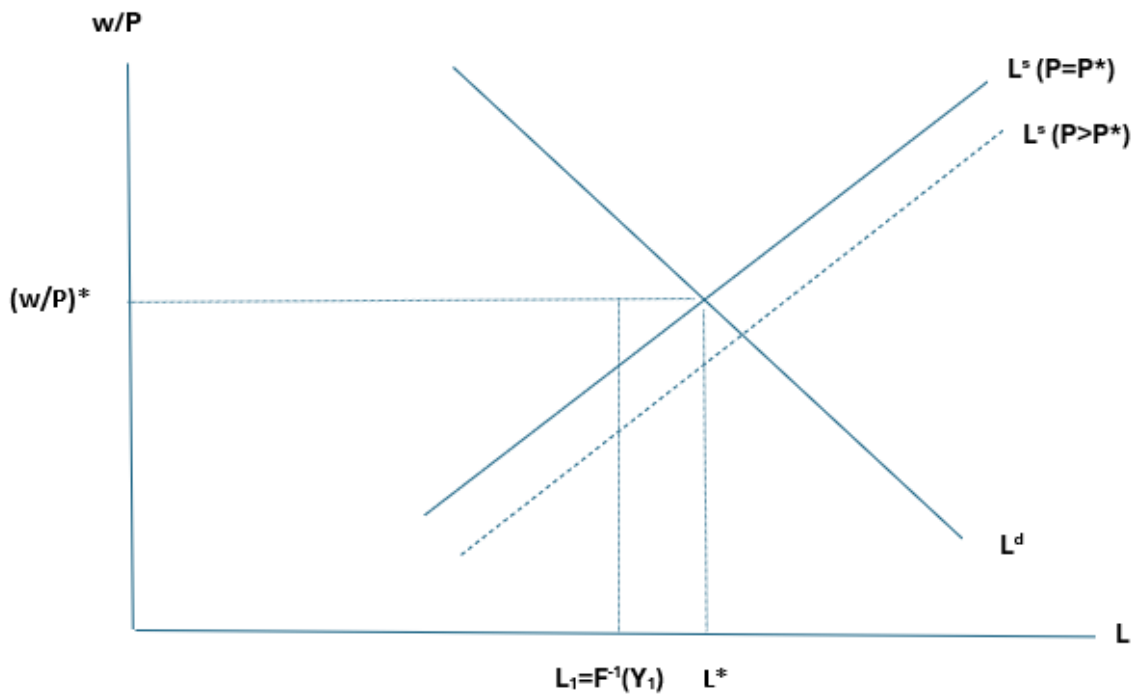
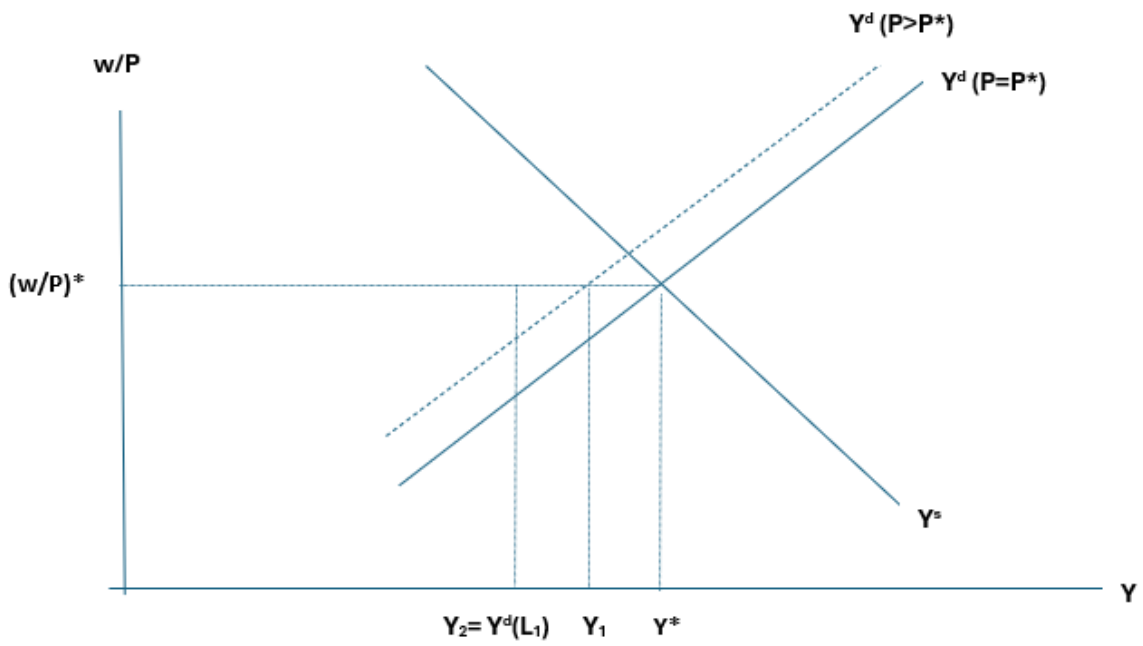


Figure 3 Excess Demand in Goods and Labor Markets

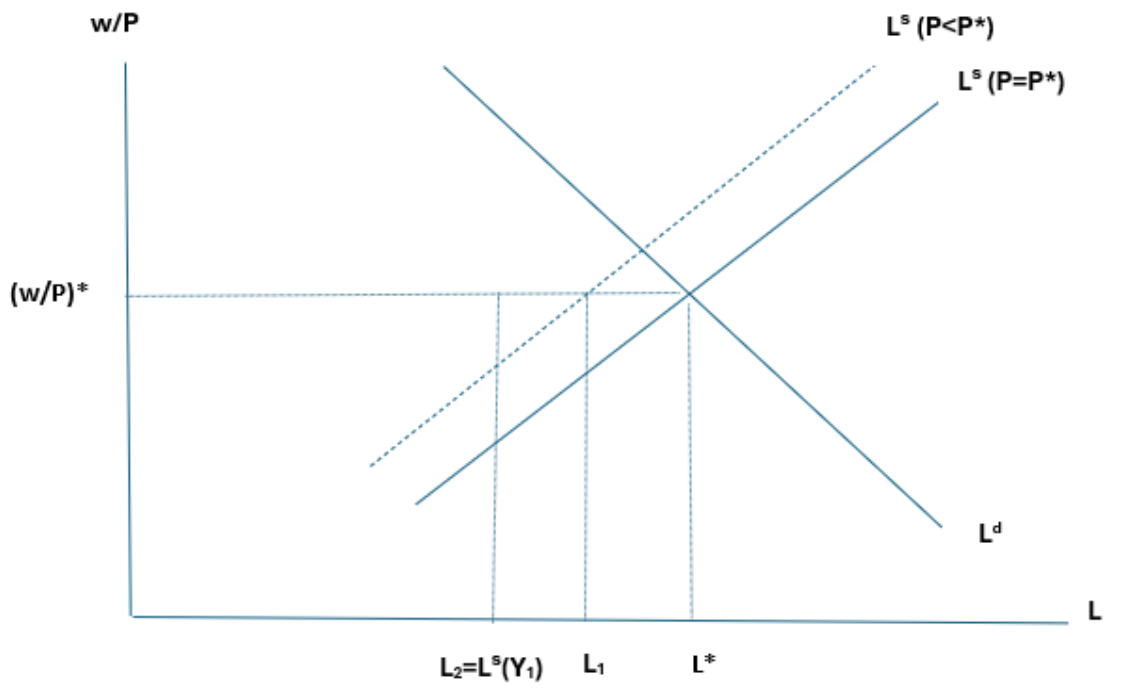
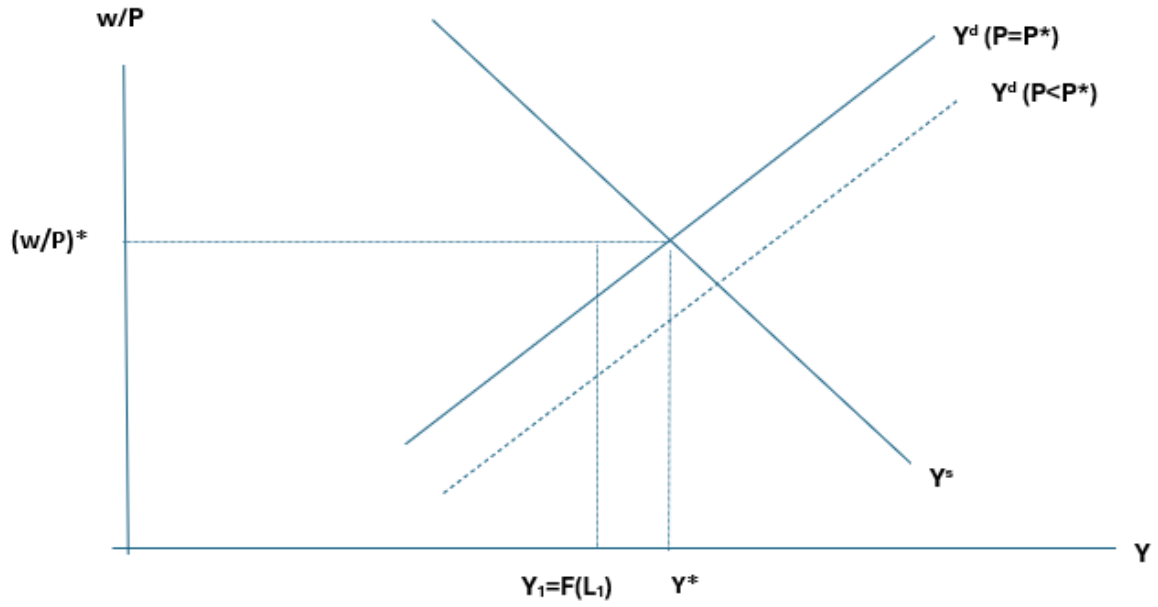


Figure 4 Excessive Real Wage Rate

