Lecture 18
The Keynesian Model

Noah Williams
University of Wisconsin - Madison
Economics 312
An Example Problem

Suppose that problems in the banking sector lead to an unanticipated reduction in the money supply. In each of the following scenarios consider the effects of this shock on output and real interest rates. In addition, suppose that one option to respond to this shock would be to increase government spending temporarily, without raising current taxes (but increasing them in the future). If the policy goal is to stabilize output, is this fiscal policy response a good idea?

1. Use the real intertemporal model with flexible prices.
2. Use the Lucas-type misperceptions model.
In the real intertemporal model with flexible prices the only effect of a change in the money supply is a change in the price level. Thus there is no effect of this change on output or interest rates. A temporary increase in government spending would increase output and interest rates, as it would shift the output demand curve more than the output supply curve. But this response is unnecessary here, and so not a good idea.
In this model, an unanticipated fall in the money supply is interpreted by households as at least partly a reduction in total factor productivity. Labor supply and hence output supply fall, leading to a reduction in output and an increase in the real interest rate. The effects are just the opposite direction of the following figure.

**Figure 11.1** The Effects of an Unanticipated Increase in the Money Supply in the Money Surprise Model
The response of the economy to an increase in government spending is just the same as in the real intertemporal model above, with output and interest rates increasing. If the goal is to stabilize output, this policy response would be a good idea, as it could offset the negative shock to output supply. Interest rates would increase even further in comparison to the original equilibrium. (While fiscal policy may help stabilize output, it may not increase welfare, as the government spending leads to lower private consumption and less leisure.)
The Keynesian Model


- Original theory NOT general equilibrium. In particular viewed unemployment in the Great Depression as resulting from excess labor supply, due to rigid nominal wages.

- Reconciled (at least somewhat) with classical theory by Samuelson and Tobin in 1950s-1960s.

- Predominant view in macroeconomics through the 1960s. Challenged by Friedman and monetarists in 1960s, later by rational expectations models (Lucas, Kydland-Prescott).

- Later work in 1970s and 1980s on incorporating micro-foundations and building general equilibrium models with real and/or nominal rigidities: New Keynesian economics.
The Basic Keynesian Setup

- **Premise:** Some prices or wages are fixed in the short-run. Implies that some markets need not clear.
- Money market: reacts quickly to information. Assume it always clears.
- Goods market: reacts somewhat more slowly, but assume able to change production so it clears.
- Labor market: reacts most slowly. When economy out of general equilibrium, assume labor supply not equal to labor demand. Rigid nominal wage $W = wP$.
- Employment determined by labor demand. May have excess supply of labor, hence unemployment.
Figure 12.1 The Labor Market in the Keynesian Sticky Wage Model

The diagram illustrates the labor market in the Keynesian Sticky Wage Model. The graph plots the real wage, \( w \), against employment, \( N \). The demand for labor, \( N^d \), is represented by a downward-sloping curve, while the supply of labor, \( N^s(r) \), is represented by an upward-sloping curve. The equilibrium is at point \( (w^*, N^*) \), where the demand and supply curves intersect. The real wage at equilibrium is \( w^* \), and the employment level is \( N^* \).
The *IS-LM-FE* Model

- Depict relationship between output and real interest rate via three curves.
- *IS* (investment=savings) represents goods market equilibrium. Re-labelling of output demand curve.
- *LM* (liquidity=money) represents money market equilibrium for a given price. Assume expected inflation constant, so $R \approx r$.
- *FE* (full-employment) represents labor market equilibrium. Re-labelling of output supply curve.
- In short run with fixed prices/nominal wages, output determined by intersection of *IS* and *LM*. In long run, prices/wages adjust so reach general equilibrium at intersection of *IS-LM-FE*.
Figure 12.6 Money Demand, Money Supply, and the LM Curve
Short-run equilibrium in the Keynesian Model
Long-run equilibrium in the Keynesian Model

The graph illustrates the intersection of the IS and LM curves at point FE, indicating the long-run equilibrium. The points Y* and r* denote the equilibrium levels of income and interest rate, respectively.
Figure 12.8 The Effect of an Increase in the Money Supply on the LM Curve

(a) 

(b)
Figure 12.9  The Effect of an Increase in the Price Level on the LM Curve

![Graph showing the effect of an increase in the price level on the LM Curve.](image)
Short-run Effect of Increase in Money Supply
Long-run Effect of Increase in Money Supply:
Money is neutral in the long-run.
Can define aggregate demand $AD$ as demand for current output dependent on price level. Derive by changing $P$ which shifts $LM$, trace out effect on $Y$ for fixed $IS$.

In discussion so far have considered horizontal (short-run) aggregate supply curve $AS$. With sticky prices (fixed in short run), assume that producers meet whatever demand at the current price.

Firms’ effective labor demand then determines output. With $P = \bar{P}$ fixed, $AD$ determines $Y$. With current $K = \bar{K}$, find labor demand from production $Y = F(\bar{K}, N) \rightarrow N = F^{-1}(Y)$.

In long-run prices adjust to clear labor market, so long-run aggregate supply curve is vertical: money is neutral in long-run.
Figure 12.11
The Aggregate Demand Curve
Figure 12.12
A Shift to the Right in the IS Curve Shifts the AD Curve to the Right
Figure 12.13
A Shift to the Right in the LM Curve Shifts the AD Curve to the Right
Short-run equilibrium in the Keynesian Model: Sticky prices.
Long-run equilibrium in the Keynesian Model:
Sticky prices.
Price Stickiness

- Tendency of prices to adjust slowly in economy.
- Sources: Monopolistic competition and menu costs.
- Under perfect competition, market forces prices to adjust rapidly. But in many markets, sellers produce differentiated goods with some market power: monopolistic competition. Sellers set prices.
- Menu costs: costs of changing prices may lead to price stickiness. Even small costs like these may prevent sellers from changing prices often.
- Since competition isn’t perfect, having the wrong price temporarily won’t affect the seller’s profits much. The firm will change prices when demand or costs of production change enough to warrant the price change.
Industrial changed more often the more competitive is the industry (Carlton).

Catalog prices don’t seem to change much from one issue to the next. Menu costs may not be cause of stickiness (Kashyap).

Bils-Klenow (2004): Half of all goods prices last more that 5.5 months. Varies dramatically over types of goods, amount of competition in industry.

Steinsson-Nakamura (2008): Excluding sales, frequency of price changes is 9-12 % per month. Median duration regular prices is 8-11 months.
## Table 2
Monthly Frequency of Price Changes for Selected Categories

<table>
<thead>
<tr>
<th></th>
<th>% of Price Quotes with Price Changes</th>
<th>% of Price Quotes with Price Changes, excluding observations with item substitutions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>All goods and services</strong></td>
<td>26.1 (1.0)</td>
<td>23.6 (1.0)</td>
</tr>
<tr>
<td><strong>Durable Goods</strong></td>
<td>29.8 (2.5)</td>
<td>23.6 (2.5)</td>
</tr>
<tr>
<td><strong>Nondurable Goods</strong></td>
<td>29.9 (1.5)</td>
<td>27.5 (1.5)</td>
</tr>
<tr>
<td><strong>Services</strong></td>
<td>20.7 (1.5)</td>
<td>19.3 (1.6)</td>
</tr>
<tr>
<td><strong>Food</strong></td>
<td>25.3 (1.8)</td>
<td>24.1 (1.9)</td>
</tr>
<tr>
<td><strong>Home Furnishings</strong></td>
<td>26.4 (1.8)</td>
<td>24.2 (1.8)</td>
</tr>
<tr>
<td><strong>Apparel</strong></td>
<td>29.2 (3.0)</td>
<td>22.7 (3.1)</td>
</tr>
<tr>
<td><strong>Transportation</strong></td>
<td>39.4 (1.8)</td>
<td>35.8 (1.9)</td>
</tr>
<tr>
<td><strong>Medical Care</strong></td>
<td>9.4 (3.2)</td>
<td>8.3 (3.3)</td>
</tr>
<tr>
<td><strong>Entertainment</strong></td>
<td>11.3 (3.5)</td>
<td>8.5 (3.6)</td>
</tr>
<tr>
<td><strong>Other</strong></td>
<td>11.0 (3.3)</td>
<td>10.0 (3.3)</td>
</tr>
<tr>
<td><strong>Raw Goods</strong></td>
<td>54.3 (1.9)</td>
<td>53.7 (1.7)</td>
</tr>
<tr>
<td><strong>Processed Goods</strong></td>
<td>20.5 (0.8)</td>
<td>17.6 (0.7)</td>
</tr>
</tbody>
</table>

Notes: Frequencies are weighted means of category components. Standard errors are in parentheses. Durables, Nondurables and Services coincide with U.S. National Income and Product Account classifications. Housing (reduced to home furnishings in our data), apparel, transportation, medical care, entertainment, and other are BLS Major Groups for the CPI. Raw goods include gasoline, motor oil and coolants, fuel oil and other fuels, electricity, natural gas, meats, fish, eggs, fresh fruits, fresh vegetables, and fresh milk and cream.

FIGURE 3: PRICE OF TRISCUIT 9.5 oz IN DOMINICK’S FINER FOODS SUPERMARKET IN CHICAGO

Source: Chevalier, Kashyap and Rossi (2000)
**Figure I**

Construction of Price Change Variables with and without Sales
### TABLE I

**Frequency of Price Change in the CPI**

<table>
<thead>
<tr>
<th></th>
<th>Median frequency</th>
<th>Median implied duration</th>
<th>Mean frequency</th>
<th>Mean implied duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Including sales</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excluding substitutions</td>
<td>20.3</td>
<td>19.4</td>
<td>4.4</td>
<td>4.6</td>
</tr>
<tr>
<td>Including substitutions</td>
<td>21.7</td>
<td>20.5</td>
<td>4.1</td>
<td>4.4</td>
</tr>
<tr>
<td>B. Excluding sales and substitutions</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contiguous observations</td>
<td>11.1</td>
<td>8.7</td>
<td>8.5</td>
<td>11.0</td>
</tr>
<tr>
<td>Carry regular price forward during sales and stockouts</td>
<td>11.2</td>
<td>9.0</td>
<td>8.4</td>
<td>10.6</td>
</tr>
<tr>
<td>Estimate frequency of price change during sales</td>
<td>11.5</td>
<td>9.6</td>
<td>8.2</td>
<td>9.9</td>
</tr>
<tr>
<td>Estimate frequency of price change during sales and stockouts</td>
<td>11.9</td>
<td>9.9</td>
<td>7.9</td>
<td>9.6</td>
</tr>
<tr>
<td>C. Excluding sales, including substitutions</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contiguous observations</td>
<td>12.7</td>
<td>10.9</td>
<td>7.4</td>
<td>8.7</td>
</tr>
<tr>
<td>Carry regular price forward during sales and stockouts</td>
<td>12.3</td>
<td>10.6</td>
<td>7.6</td>
<td>8.9</td>
</tr>
<tr>
<td>Estimate frequency of price change during sales</td>
<td>12.8</td>
<td>11.3</td>
<td>7.3</td>
<td>8.3</td>
</tr>
<tr>
<td>Estimate frequency of price change during sales and stockouts</td>
<td>13.0</td>
<td>11.8</td>
<td>7.2</td>
<td>8.0</td>
</tr>
</tbody>
</table>

**Notes.** All frequencies are reported in percent per month. Implied durations are reported in months. “Median frequency” denotes the weighted median frequency of price change. It is calculated by first calculating the mean frequency of price change for each ELI and then taking a weighted median across ELIs within the major group using CPI expenditure weights. The “Median implied duration” is equal to $-1/\ln(1-f)$, where $f$ is the median frequency of price change. “Mean frequency” denotes the weighted mean frequency of price change. “Mean implied duration” denotes the weighted implied duration of price change. It is calculated by first calculating the implied duration for each ELI as $-1/\ln(1-f)$, where $f$ is the frequency of price change for a particular ELI, and then taking a weighted mean across ELIs using CPI expenditure weights.
**Figure II**

Inflation and the Frequency of Regular Price Change for Consumer Prices

*Note.* The figure plots the annual evolution of the weighted median frequency of regular price increases and decreases along with the CPI inflation rate.
Other sources of nominal rigidities lead to similar effects. The book considers the case of nominal wage stickiness.

Wages may be fixed in the short-run due to nominal wage contracts. Ex.: union contracts typically set nominal wages for one year at a time.

This was the original argument of Keynes. Leads to a different aggregate supply curve.

With flexible prices, sticky nominal wages, aggregate supply curve is upward sloping.
Figure 12.3 Construction of the Aggregate Supply Curve
Figure 12.14  The Keynesian Sticky Wage Model

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Figure 12.15  An Increase in the Money Supply in the Sticky Wage Model
There are also situations in which the real wage itself is rigid. The prime example is the efficiency wage model due to Shapiro and Stiglitz (1984).

Effort put forth by worker depends on wage $e(w)$. Effort is not directly observable by employers.

Workers who feel well treated will work harder and more efficiently: “the carrot”.

Workers who are well paid won’t risk losing their jobs by being caught shirking: “the stick”.

$e(w)$ is $S$-shaped: increases in $w$, flattens out at high $w$. 
Figure 16.17 Effort of the Worker as a Function of His or Her Wage
Firms take as given effort curve. Problem now:

\[
\max_{N} F(K, e(w)N) - wN
\]

First order condition: \( e(w)F_{N}(K, e(w)N) = w \). Gives firm labor demand for any real wage.

But how to choose wage to set? Want to minimize cost of inducing effort. Choose efficiency wage to maximize \( e(w)/w \).

\[
\max_{w} e(w)/w \Rightarrow w = \frac{e(w)}{e'(w)}
\]

Note the real wage is then rigid. Changes in labor supply then only affect level of unemployment, not employment. No downward pressure on wages with excess labor supply, since if firms reduce wages effort will decline.
Figure 16.20 Determination of the Efficiency Wage

![Graph showing the determination of the efficiency wage.](image-url)