Microfoundations of DSGE Models: II Lecture

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14 Giugno 2010
**Basic New Keynesian Model**

**Introduction**

- The *basic* RBC models
  - business cycle driven by real shocks (mainly by productivity shocks)
  - perfect competition (no market power)
  - flexible prices and wage (no nominal rigidities)
  - the competitive equilibrium is Pareto optimal
  - no role for stabilizing policies in general
  - monetary policy has no role (money is a *veil* - classical dichotomy)
  - rational expectations
  - no asymmetric information
The basic New Keynesian (NK) models

- business cycles driven by nominal and real shocks
- monopolistic competition (either in the product and/or labor market)
- nominal rigidities (either of goods’ prices and/or of wages)
- the competitive equilibrium is not Pareto optimal
- monetary policy does play a role (money is not a veil - classical dichotomy breaks down - nominal variables affect real variables at least in the short run)
- role for stabilizing policies in general
- rational expectations
- no asymmetric information
Basic New Keynesian Model

General Features

- Focus on the nominal side of the economy and on the stabilizing role of monetary policy
- A new perspective on the nature of inflation dynamics
- Frictions and imperfections
  - Prices do not adjust instantaneously
  - Firms are not identical and have some market power (monopolistic competition)
  - Infinitely lived identical price-taking households (only in the basic version of the model)
- 4 agents: households, firms, the government and the central bank
- Some references: Clarida et al. (1999); Galí (2003, 2008); Woodford (2003); Goodfriend and King (1997); Goodfriend (2007).
Basic New Keynesian Model
A short digression on monopolistic competition

- Assumptions
  - Each firm is able to differentiate its product from those of its rivals (it acts as a monopolist in its particular product);
  - Each firm takes the prices charged by its rivals as given (no strategic interaction);
  - Consumers *love variety* - goods are not perfect substitutes (they will not rush to buy other firms’ products as a result of a slight increase in the price charged by one producer) → the larger the market size the higher the demand faced by each producer;
  - Firms have the same technology - symmetry → we can focus on a representative producer.
**Basic New Keynesian Model**

**Households**

A representative infinitely-lived agent seeking to maximize her conditional expected lifetime utility function:

\[ E_0 \sum_{t=0}^{\infty} \beta^t U(C_t, N_t) \]

where \( U(C_t, N_t) = \frac{C_t^{1-\sigma}}{1-\sigma} - \frac{N_t^{1+\phi}}{1+\phi} \) and \( C_t \equiv \left( \int_0^1 C_t(i)^{1-\frac{1}{\varepsilon}} di \right)^{\frac{\varepsilon}{\varepsilon-1}} \) (love for variety)

\( \sigma \) is the inverse of the intertemporal elasticity of substitution
\( \varepsilon \) is the constant elasticity of substitution \( \varepsilon > 1 \) between different goods

\( i \in [0, 1] \)

as \( \varepsilon \to \infty \) higher and higher degree of substitution \( \to \) less market power of producers

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\(^1\)This follows Galí (2008), chapter 3, extended to include government spending.
Basic New Keynesian Model²

Households

The period budget constraint is

\[ \frac{1}{0} \int P_t(i) C_t(i) \, di + Q_t B_t = B_{t-1} + W_t N_t - Tax_t + D_t \]

\( B_t \) purchase of one-period bonds at a price \( Q_t \) (financial assets yielding a gross nominal return \( Q_t^{-1} \))

\( D_t \) dividends from ownership of firms

households are subject to a solvency constraint \( \lim_{T \to \infty} E_t \{ B_T \} = 0 \)

²This follows Galí (2008), chapter 3, extended to include government spending.
Basic New Keynesian Model

Households

Households minimize the cost function $\int_0^1 P_t(i) C_t(i) \, di$ wrt $C_t(i)$ given $C_t$

At the optimum:

$$C_t(i) = \left( \frac{P_t(i)}{P_t} \right)^{-\varepsilon} C_t$$

where $P_t \equiv \left( \int_0^1 \frac{1}{P_t(i)^{1-\varepsilon}} \, di \right)^{\frac{1}{1-\varepsilon}}$ - ideal price index such that $\int_0^1 P_t(i) C_t(i) \, di = P_t C_t$. The demand for the individual goods of type $i$ depends negatively on the firm-specific goods price relative to the average price level and positively on the consumption index.
Basic New Keynesian Model

Households

The intertemporal Lagrangian

\[ \mathcal{L}_t = E_t \sum_{j=0}^{\infty} \beta^j \left[ \left( \frac{C_{t+j}^{1-\sigma}}{1-\sigma} - \frac{N_{t+j}^{1+\phi}}{1+\phi} \right) + \lambda_{t+j} \left( B_{t+j-1} + W_{t+j} N_{t+j} - Tax_{t+j} + \Pi_{t+j} - P_{t+j} C_{t+j} - Q_{t+j} B_{t+j} \right) \right] \]

FOCs
wrt \( C_t \)

\[ C_t^{-\sigma} = \lambda_t P_t \]

wrt \( N_t \)

\[ -N_t^\phi + \lambda_t W_t = 0 \]

wrt \( B_t \)

\[ \lambda_t Q_t = \beta E_t \lambda_{t+1} \]
Basic New Keynesian Model

Households

Combine all FOCs

The Euler consumption equation

\[
Q_t = \beta E_t \left\{ \frac{C_{t+1}^{-\sigma}}{C_t^{-\sigma}} \frac{P_t}{P_{t+1}} \right\}
\]

labor supply

\[
N_t^\phi = C_t^{-\sigma} \frac{W_t}{P_t}
\]

where the wage is given, that is workers do not have any market power.

1/\phi is the Frisch elasticity: the elasticity of labor supply to the wage rate, given a constant marginal utility of consumption (i.e. given \(C_t^{-\sigma}\))
In log-linear version
The Euler consumption equation

\[ c_t = E_t \{ c_{t+1} \} - \frac{1}{\sigma} (i_t - E_t \{ \pi_{t+1} \} - \rho) \]

where \( \pi_{t+1} \equiv \log P_{t+1} - \log P_t; \rho = -\log \beta; i_t = -\log Q_t \) (log of the gross yield on the one-period bond: the nominal interest rate - the nominal yield on a riskless one-period bond)
Labor supply

\[ w_t - \rho_t = \sigma c_t + \phi n \]
Basic New Keynesian Model

Firms

Assume a continuum of firms indexed by \( i \in [0, 1] \). Each firm produces a differentiated good.

Identical technology, represented by the production function:

\[
Y_t(i) = A_t N_t(i)^{1-\alpha} \quad \alpha < 1
\]

All firms face an identical isoelastic demand schedule and take the aggregate price level and the aggregate demand as given

\[
Y_t(i) = \left( \frac{P_t(i)}{P_t} \right)^{-\varepsilon} Y_t
\]

Aside: Why do we need monopolistic competition with price rigidities?

Monopolistic competition: No perfect substitutability between different goods types \( \rightarrow \) different prices do not lead to a perfect substitution. The larger \( Y_t \), the higher the demand for each variety (think of the implications in an open economy....).
The firm’s objective is to max profits wrt $N_t(i)$ and $P_t(i)$ given
$Y_t(i) = A_t N_t(i)^{1-\alpha}$ and $Y_t(i) = \left(\frac{P_t(i)}{P_t}\right)^{-\varepsilon} Y_t$.

The Lagrangian is

$$
\mathcal{L}_t = P_t(i) Y_t(i) \left(\frac{P_t(i)}{P_t}\right)^{-\varepsilon} Y_t - W_t N_t(i) - MC_t^N(i) \left(\frac{P_t(i)}{P_t}\right)^{-\varepsilon} Y_t - A_t N_t(i)^{1-\alpha}
$$

where $MC_t^N(i)$ is the Lagrange multiplier (nominal marginal cost).
Basic New Keynesian Model
Firms - under flexible prices

At the optimum:

\[ W_t = (1 - \alpha)MC^N_t(i)N_t(i)^{-\alpha} \rightarrow \frac{W_t}{(1 - \alpha)A_tN_t(i)^{-\alpha}} = MC^N_t(i) \]

\[ P_t(i) = \frac{\epsilon}{\epsilon - 1} MC^N_t(i) \]

desired markup

Remarks: decreasing returns imply firm's specific marginal costs.

\[ \frac{W_t}{P_t(i)} = \frac{\epsilon - 1}{\epsilon} (1 - \alpha)A_tN_t(i)^{-\alpha} \rightarrow \text{while in perfect competition we would have:} \frac{W_t}{P_t(i)} = (1 - \alpha)A_tN_t(i)^{-\alpha} \]

Define real marginal costs as \( MC_t(i) = MC^N_t(i) / P_t(i) \rightarrow MC_t(i) = \frac{\epsilon - 1}{\epsilon} \).
Modelling price rigidities?

- Stochastic staggering à la Calvo (1983): each period a constant fraction of randomly selected firms can readjust their prices.
- Quadratic adjustment costs à la Rotemberg (1983): the larger the price change, the more costly the adjustment (in Lecture III).
- Deterministic staggering à la Taylor (1980): prices are set on the basis of x-period contracts in a staggered fashion.

In the basic NK model the Calvo scheme is used.
Basic New Keynesian Model

The Calvo pricing

- Each firm may reset its price with probability $1 - \theta$ in any given period.
- Thus each period a fraction $1 - \theta$ of producers reset their prices, while a fraction $\theta$ keep their price unchanged.
- As a result the average duration of a price is given by $(1 - \theta)^{-1}$ and $\theta$ is an index of price stickiness.

All firms resetting prices will choose an identical price, say $P_t^*$. Recalling $P_t$:

$$P_t = \left[ \int_{S(t)} P_t(i)^{1-\varepsilon} \, di + (1 - \theta) (P_t^*)^{1-\varepsilon} \right]^{\frac{1}{1-\varepsilon}}$$

$S(t)$ set of firms not reoptimizing their posted price.
Basic New Keynesian Model

The Calvo pricing

Since the distribution of prices among firms not-resetting their prices corresponds to the distribution of prices prevailing in the previous period we have:

\[ P_t = \left[ \theta P_{t-1}^{1-\varepsilon} + (1 - \theta) (P_t^*)^{1-\varepsilon} \right]^{\frac{1}{1-\varepsilon}} \]

\[ = \Pi_t^{1-\varepsilon} = \theta + (1 - \theta) \left( \frac{P_t^*}{P_{t-1}} \right)^{1-\varepsilon} \]

where \( \Pi_t = P_t / P_{t-1} \).

Log-linearizing around \( \Pi_t = 1 \) (no trend inflation) (in steady state \( \frac{P_t^*}{P_{t-1}} = 1 \)):

\[ \pi_t = (1 - \theta) (p_t^* - p_{t-1}) \]

Inflation results from the fact that firms reoptimizing in any given period choose a price, \( p_t^* \), that differs from the economy’s average price in the previous period, \( p_{t-1} \). Under flex prices: \( \pi_t = p_t - p_{t-1} \).
Basic New Keynesian Model

The Calvo pricing

A firm reoptimizing in period $t$ will choose the price $P_t^*$ that max the current market value of the profits generated while that price remains effective

$$
\max_{P_t^*} \sum_{k=0}^{\infty} \theta^k E_t \left\{ Q_{t,t+k} \left( P_t^* Y_{t+k|t} - \Psi_{t+k} (Y_{t+k|t}) \right) \right\}
$$

where $Y_{t+k|t} =$ output in period $t + k$ for a firm resetting its price at time $t$, $\Psi_{t+k} (\bullet) =$ cost function, $Y_{t+k|t} = \left( \frac{P_t^*}{P_{t+k}} \right)^{-\varepsilon} Y_{t+k}$.
Basic New Keynesian Model

The Calvo pricing

At the optimum:

\[
\sum_{k=0}^{\infty} \theta^k E_t \left\{ Q_{t,t+k} Y_{t+k|t} \begin{pmatrix}
    P_t^* \\
    \text{optimal price}
\end{pmatrix} - \begin{pmatrix}
    \varepsilon \\
    \varepsilon - 1
\end{pmatrix} \begin{pmatrix}
    \frac{\partial \Psi_{t+k}}{\partial Y_{t+k|t}} \\
    \text{desired markup}
\end{pmatrix} \begin{pmatrix}
    \frac{\partial Y_{t+k}}{\partial Y_{t+k|t}} \\
    \text{MC}_{t+k|t} \text{nominal marginal cost}
\end{pmatrix} \right\} = 0
\]

N.B. with \( \theta = 0 \), flex prices, we have: \( P_t^* = M \frac{\partial \Psi_{t+k}}{\partial Y_{t+k|t}} = \varepsilon \frac{\text{MC}_t^N}{\varepsilon - 1} \) (see above)
Basic New Keynesian Model

The Calvo pricing

The optimal conditions can be rewritten as

\[ \sum_{k=0}^{\infty} \theta^k E_t \left\{ Q_{t+k} Y_{t+k|t} \left( \frac{P_t^*}{P_{t-1}} - \mathcal{M}MC_{t+k|t} \Pi_{t-1,t+k} \right) \right\} = 0 \]

\( MC_{t+k|t} \) real marginal cost in period \( t + k \) for a firm whose price was last set in period, \( MC_{t+k|t} = \frac{\partial \Psi_{t+k}}{\partial Y_{t+k|t}} / P_{t+k} \). Log-linearizing around a zero inflation steady state:

\[ p_t^* = \log \mathcal{M} + (1 - \beta \theta) \sum_{k=0}^{\infty} (\beta \theta)^k E_t \left\{ mc_{t+k|t} + p_{t+k} \right\} \]

Intuition: \( p_t^* \) corresponds to the desired markup, \( \log \mathcal{M} \), + a weighted average of their current nominal marginal cost, \( mc_t + p_t \), and expected nominal marginal costs \( E_t \left\{ mc_{t+k|t} + p_{t+k} \right\}_{k=1}^{\infty} \).
Basic New Keynesian Model
The Calvo pricing and the nature of inflation

After some math we obtain:

\[
\pi_t = \beta E_t \{ \pi_{t+1} \} + (1 - \beta \theta) \left[ \frac{1 - \theta}{\theta} \Theta \hat{mc}_t \right]
\]

\[
\hat{mc}_t = mc_t - mc = (mc = -\log M = -\mu). \text{Iterating forward:}
\]

\[
\pi_t = \lambda \sum_{k=0}^{\infty} \beta^k E_t \{ \hat{mc}_{t+k} \}
\]
Using $\hat{mc}_t = mc_t - mc = (mc = - \log M = -\mu)$ we have:

$$\pi_t = \lambda \sum_{k=0}^{\infty} \beta^k E_t \left\{ \begin{array}{c} \mu \\ \text{desired markup} \end{array} - \begin{array}{c} \mu_{t+k} \\ \text{average markup} \end{array} \right\}$$

In words: inflation will be higher when firms expect average markups to be lower than their steady state level $\mu$. Firms having the opportunity to reset their prices will choose a price above the economy average’s price level in order to readjust their markup closer to the desired level $\mu$.

Nature of inflation: inflation here results from the price-setting decisions of firms setting their prices in response to current and expected cost conditions.
Basic New Keynesian Model

The Government

For simplicity, assume that the government consumes a fraction \( \tau_t \) of the output of each good

\[
G_t(i) = \tau_t Y_t(i)
\]

In aggregate terms:

\[
G_t = \tau_t Y_t
\]

where it is assumed a balanced-budget fiscal rule

\[
P_t G_t = Tax_t
\]
Basic New Keynesian Model
Equilibrium in the goods’ market

Mkt clearing in each good mkt requires

\[ Y_t(i) = C_t(i) + G_t(i) \]

In aggregate and taking logs:

\[ y_t = c_t + g_t \]

Recalling the log-linearized Euler’s equation

\[ y_t = E_t \{ y_{t+1} \} - \frac{1}{\sigma} \left( i_t - E_t \{ \pi_{t+1} \} - \rho \right) + \left( 1 - \rho_g \right) g_t \]  (IS)

\[ g_{t+1} = \rho_g g_t + \zeta_{g,t+1} \]
Basic New Keynesian Model

Equilibrium in the labor market

Take the production function:

\[ Y_t(i) = A_t N_t(i)^{1-\alpha} \]

In equilibrium

\[ \text{labor supply} = \text{labor demand} \]

\[ N_t = \int_0^1 \left( \frac{Y_t(i)}{A_t} \right)^{\frac{1}{1-\alpha}} \, di \]

\[ = \left( \frac{Y_t}{A_t} \right)^{\frac{1}{1-\alpha}} \int_0^1 \left( \frac{P_t(i)}{P_t} \right)^{-\frac{\varepsilon}{1-\alpha}} \, di \]

price dispersion

In logs:

\[ (1 - \alpha) n_t = y_t - a_t + d_t \]

\[ d_t = \text{price dispersion} \sim 0 \text{ (up to a first-order approximation around a zero inflation steady-state) and } a_t = \rho_a g_t + \zeta_{a,t+1}. \]
Basic New Keynesian Model

The New Phillips Curve (NPC)

The traditional Phillips Curve is expressed in terms of the output (or unemployment). Starting from \( \pi_t = \beta E_t \{ \pi_{t+1} \} + \lambda \widehat{mc}_t \), after some tedious calculations:

\[
\pi_t = \beta E_t \{ \pi_{t+1} \} + \lambda \left( \sigma + \frac{\phi + \alpha}{1 - \alpha} \right) (y_t - y_t^n) \quad \text{(NPC)}
\]

where \( \kappa > 0 \) and \( y_t^n = \) natural level of output (output under flex prices - which markup=\( \mu \) - second best output).

\[
y_t^n = \bar{y} + \theta_a a_t + \theta_g g_t
\]
Basic New Keynesian Model
The New Phillips Curve (NPC)

Remarks

- Forward looking (the traditional Phillips curve was backward looking... see below)
- Derived from microfoundations (the traditional Phillips curve was a sort of empirical regularity)
- The evolution of inflation depends on the level of economic activity
- In contrast with classical monetary models an increase in the money supply has no direct effect on prices. Its impact is indirect, working through the induced changes in the level of economic activity.
The **traditional Phillips Curve** relates inflation to some cyclical indicators as well as its own lagged values. A common specification takes the form:

\[
\pi_t = \nu \pi_{t-1} + \zeta (y_t - \bar{y}) + \text{shock}_t
\]

where past inflation matters for the determination of current inflation and current inflation is positively correlated with past output.
Basic New Keynesian Model
The New Phillips Curve (NPC)

The previous properties stand in contrast with those characterizing the NPC. Iterating it forward yields:

\[ \pi_t = \kappa E_t \sum_{i=0}^{\infty} \beta^i (y_{t+i} - y_{t+i}^n) \]

Remarks

- past inflation is not a relevant factor in determining current inflation
- inflation is positively correlated with future output (so inflation leads output)
- intuition: in a world with staggered price setting, inflation results as a consequence of the price setting decisions by firms currently resetting their prices; price setting decisions depends on current and expected marginal costs, not on past inflation.
Basic New Keynesian Model

The Model to be simulated

The IS

\[ y_t = E_t \{ y_{t+1} \} - \frac{1}{\sigma} \left( i_t - E_t \{ \pi_{t+1} \} - \rho \right) + (1 - \rho_g) g_t \]

The NPC

\[ \pi_t = \beta E_t \{ \pi_{t+1} \} + \kappa \left( y_t - y^n_t \right) \]

where \( y^n_t = \bar{y} + \vartheta_a a_t + \vartheta_g g_t \).
We have a model with two forward looking (jump) variables. Blanchard-Kahn condition for the existence of a unique rational expectations equilibrium requires a number of eigenvalues outside the unit circle equal to the number of forward looking variables. We need one more equation, namely, the conduct of monetary policy.

N.B. if $i_t = i$ (peg) the Blanchard-Kahn condition is not satisfied → Self-fulfilling increases (or decreases) in inflation cannot be ruled out (real indeterminacy).
The central bank reacts to deviations from the natural level output and from the inflation target (0 inflation) according to a simple Taylor’s rule (Taylor 1993):

\[ i_t = \rho + \varphi \pi_t + \varphi_y (y_t - y_t^n) + u_t \]

where \( u_t \) is an exogenous stochastic component:

\[ u_t = \rho_u u_{t-1} + \zeta_{i,t} \]
Basic New Keynesian Model
The Monetary Policy: The Taylor Principle

In the basic setup if $\iota_y = 0$, it must be $\iota_\pi > 1$ in order to have a unique equilibrium (the monetary authority should respond to deviations of inflation from its target level by adjusting the nominal interest rate more than proportionally, so as to increase the real rate) (i.e. the Taylor’s principle).

This condition rules out self-fulfilling inflationary (or deflationary) dynamics (and in doing so, it ensures real determinacy - the existence of a unique equilibrium).

Otherwise the condition is: $\kappa (\iota_\pi - 1) + (1 - \beta) \iota_y > 0$.

We neglect the zero-lower bound problem ($i_t \geq 0$) → and the emergence of a liquidity trap at $i_t = 0$ (see Benhabib, Schmitt-Grohé and Uribe 2001).... problem arising also with wealth effects...
Basic New Keynesian Model

Where's money?

- We have a cashless economy
- Money is not incorporated in the analysis: money as unit of account
- Assuming money in the utility function (with separability) we will have an LM of the form: \( m_t - p_t = \sigma \frac{c_t}{v} - \eta i_t \). Here the LM determines the quantity of money that the central bank must supply in order to support the nominal interest rate implied by the Taylor’s rule.
- Cashless (or careless?) theory of monetary policy.
- Even under the assumption of non-separability, the real effects of having real balances into the model are negligible. See Walsh (2003), Woodford (2003).
- However, when we have OLG real balances do play a role (see Bénassy 2007, Piergallini 2006).
**Basic New Keynesian Model**

**Calibration**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Description</th>
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<td>$\alpha$</td>
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<td>$\rho_u$</td>
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<td>persistence of the interest rate shock</td>
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</tbody>
</table>
Effects of a Technology Shock

- Income: Decrease over time
- Inflation: Increase over time
- Employment: Increase over time
- Consumption: Decrease over time
- Output gap: Increase over time
- Nominal Interest Rate: Increase over time
Higher productivity → lower (real) marginal costs → lower inflation → the Central Bank partially accommodates the improvement in technology by lowering the nominal interest rate and the real rate; the policy is not sufficient to close the negative output gap; income increases but less than its natural counterpart; employment declines. *Intuition:* such a response of employment is due to price rigidities preventing an immediate adjustment of the price level to the new level of costs.

The economy’s response to a positive technology shock is in contrast with the results of the standard RBC model (comovement between productivity, output and employment in response to technology shocks, see Lecture I).

However, empirical evidence points to a negative relationship between employment and productivity.
Effects of a Positive Technology Shock

Weaker response (baseline Taylor rule in red)

\[ \pi = 1.1; y = 0 \]
Effects of a Government Spending Shock

- Income
- Inflation
- Employment
- Consumption
- Output gap
- Nominal Interest Rate

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An increase in government spending leads to an increase in AD $\rightarrow$ current output increases by more than natural output $\rightarrow$ employment increases.

Firms will revise their prices upward (as real marginal costs are higher) $\rightarrow$ the Central Bank will react to inflation by increasing the nominal interest rate more than proportionally $\rightarrow$ as a result the real interest rate will increase (*lean against the wind policy*).

What about consumption? Here again a positive government spending shock leads to a decline in consumption!
Effects of a Government Spending Shock
Weaker response (baseline Taylor rule in red)

\[ \pi_\pi = 1.1; \pi_y = 0 \]
Effects of a Monetary Policy Shock

![Graphs showing the effects of a monetary policy shock on various economic variables over 15 quarters.](image)
The presence of price rigidities is a source of nontrivial real effects of monetary policy shocks. Firms cannot adjust the price of their good when they receive new information about costs or demand conditions. The shock corresponds to an increase of 1% in $\xi_{i,t} \rightarrow$ the shock generates an increase in the real rate, a decrease in inflation, output and employment; the natural level of output is not affected by the monetary policy shock. The increase in the nominal rate is less than 1% because of the decline in inflation and in the output gap.
The NPC is theoretically appealing, however it cannot account for many features of the data that motivated the traditional Phillips curve specification. In particular, cross-correlations between inflation and detrended output observed in the data suggest that output leads inflation (not the opposite). In this sense, empirical evidence tends to be more consistent with a traditional, backward-looking Phillips curve than with the new version. This evidence seems reinforced by many of the estimates of hybrid Phillips curves of the form

$$\pi_t = \gamma_b \pi_{t-1} + \gamma_f E_t \{ \pi_{t+1} \} + \kappa (y_t - y_n^t)$$

How can we "microfound" this hybrid NPC? In the periods between price reoptimizations firms mechanically adjust their prices according to the previous period inflation → This specification generates a certain degree of inflation persistence (observed in the data).
Effects of a Technology Shock

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Effects of a Government Spending Shock

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The basic New Keynesian model generates some implausible results, such as:

- No inflation persistence
- No output persistence
- No comovement between consumption and public spending
Lack of inflation persistence: in this forward looking model current inflation is a jump variable, but actual inflation displays highly serially correlated behavior. Possible solutions:

- Indexation (see e.g. Christiano et al., 2005)
- Deviations from the assumption of full-information in price setting
- Rule of thumb firms (Galí and Gertler, 1999) - each firm is able to adjust its price in any given period with a fixed probability $1 - \theta$. A fraction $1 - \omega$ of the firms set prices optimally. The remaining fraction of firms, $\omega$, instead use a simple rule of thumb that is based on the past aggregate price behavior.
- Wage rigidities
- Variable capital utilization (marginal costs less sensitive to output variations). See Christiano et al. (2001)
Lack of output persistence: the response of output to shock is hump shaped. Possible solutions:

- Adjustment costs on labor and investments
- Price and wage staggering
- Habit formation
- Diminishing returns
Discussion

- No comovement between consumption and public spending.
  Possible solutions:
  - Rule of thumb consumers (Galí et al. 2007).
  - Wealth effects and accommodating monetary policy.
In the basic New Keynesian model there is no trade-off between output and inflation stabilization (in the absence of cost push shock). In addition, the "divine coincidence": stabilizing the inflation rate stabilizes the welfare relevant output gap too (see Galí and Blanchard 2007), where the welfare relevant output gap=distance between the actual level of output and the efficient level of output (first best level). Under real wage rigidities the divine coincidence does not holds. The gap between the first and the second best output is not constant.
Empirically the basic model does a poor job (too much forward looking...).  
Maybe we need a more structural model.....
References

References


- Piergallini, A., (2006), Real Balance Effects and Monetary Policy, Economic Inquiry, 44(3).


