Topic: Sudden Stops and Unemployment in a Currency Union

Case Study: The Great Recession in Peripherical Europe: 2008-2011
Claim: Sudden Stops tend to be associated with less Real Depreciation in countries that are in a currency union or countries with a fixed exchange rate than in countries with flexible exchange rates.
Document the

**Sudden Stops in PerIPHERAL Europe: 2000-2011**
Spain

Current Account / GDP

Labor Cost Index, Nominal

Unemployment Rate
Sudden Stops in Peripheral Europe: 2000-2011

Data Source: Eurostat. Data represents arithmetic mean of Bulgaria, Cyprus, Estonia, Greece, Lithuania, Latvia, Portugal, Spain, Slovenia, and Slovakia
Some Observations:

- Peripherical Europe experienced a sudden stop in 2008.
- Large current account reversals
- Sudden Stops lead to unemployment

Question: What about the Real exchange rate (RER)?

Next graph plots the real exchange rate: \( e = \frac{S\pi^*}{\pi} \)

A RER depreciation is when \( e \uparrow \)

RER scaled so that 2008 is 100

example: a 5 percent real depreciation between 2008 and 2014 would be reflected in an increase in the RER index from 100 to 105
Real Exchange Rate, $e$, (2008 = 100)

Cyprus

Greece

Spain

Portugal
Observations on the figure:

Even 6 years after the sudden stop we see very little real depreciation, of less than 5 percent.

Compare this with the large real depreciations that we saw for the Sudden Stops in Iceland in 2008 (about 50%), Chile, 1979-1985, (close to 100%) and in Argentina, 2001-2002, (about 200%).
Why Do Sudden Stops lead to Unemployment in a Currency Union?

**Possible Answer:** Because nominal wages are downwardly rigid and the combination of this nominal rigidity and a fixed nominal exchange rate fundamentally changes an economy’s adjustment to a sudden stop.

Thus, let’s go ahead and introduce downward nominal wage rigidity into our model (of adjustment to sudden stops)

\[ W_t \geq \gamma W_{t-1} \]

\( W_t = \) nominal wage rate in period \( t \)
\( \gamma = \) wage rigidity parameter

What value is empirically realistic for \( \gamma \)?

Based on the empirical evidence presented in the following slides, we will set \( \gamma \approx 1 \)
Empirical Evidence on Downward Nominal Wage Rigidity (i.e., the Size of $\gamma$)

• Downward wage rigidity is a widespread phenomenon:
  — Evident in micro and macro data.
  — Rich, emerging, and poor countries.
  — Developed and underdeveloped regions of the world.
Probability of Decline, Increase, or No Change in Wages

U.S. data, SIPP panel 1986-1993, between interviews one year apart.

<table>
<thead>
<tr>
<th></th>
<th>Interviews One Year apart</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Males</td>
</tr>
<tr>
<td>Decline</td>
<td>5.1%</td>
</tr>
<tr>
<td>Constant</td>
<td>53.7%</td>
</tr>
<tr>
<td>Increase</td>
<td>41.2%</td>
</tr>
</tbody>
</table>

Source: Gottschalk (2005)

- Large mass at ‘Constant’ suggests nominal wage rigidity.
- Small mass at 'Decline' suggests downward nominal wage rigidity.
Distribution of Non-Zero Nominal Wage Changes
United States 1996-1999

Source: Barattieri, Basu, and Gottschalk (2012)
Evidence From The Great Contraction Of 2007
Distribution of Nominal Wage Changes, U.S. 2011

Figure 2
Distribution of observed nominal wage changes

Source: Daly, Hobijn, and Lucking (2012).
Micro Evidence On Downward Nominal Wage Rigidity From Other Developed Countries

• Canada: Fortin (1996).

• Japan: Kuroda and Yamamoto (2003).

• Switzerland: Fehr and Goette (2005).

Evidence From Informal Labor Markets

• Kaur (2012) examines the behavior of nominal wages, employment, and rainfall in casual daily agricultural labor markets in rural India (500 districts from 1956 to 2008).

• Finds asymmetric nominal wage adjustment:
  — $W_t$ increases in response to positive rainfall shocks
  — $W_t$ fails to fall in response to negative rain shocks. Instead, labor rationing and unemployment are observed.

• Inflation (uncorrelated with local rain shocks) tends to moderate rationing and unemployment during negative rain shocks, suggesting downward rigidity in nominal rather than real wages.
Evidence From the Great Depression, 1929-1933

• Enormous contraction in employment: 31% between 1929 and 1931.

• Nonetheless, during this period nominal wages fell by 0.6% per year, while consumer prices fell by 6.6% per year. See the figure on the next slide.

• A similar pattern is observed during the second half of the Depression. By 1933, real wages were 26% higher than in 1929, in spite of a highly distressed labor market.
Nominal Wage Rate and Consumer Prices, United States
1923:1-1935:7

Evidence From the Great Depression In Europe

• Countries that left the gold standard earlier recovered faster than countries that remained on gold.

— Left Gold Early (sterling bloc): United Kingdom, Sweden, Finland, Norway, and Denmark.

— Countries That Stuck To Gold (gold bloc): France, Belgium, the Netherlands, and Italy.

• Think of the gold standard as a currency peg (a peg not to a currency, but to gold).

• When sterling-bloc left gold, they effectively devalued, as their currencies lost value against gold.

• Look at the figure on the next slide. Between 1929 and 1935, sterling-bloc countries experienced less real wage growth and larger increases in industrial production than gold-bloc countries.
Changes In Real Wages and Industrial Production, 1929-1935

Evidence From Emerging Countries

- Argentina: pegged the peso at a 1-to-1 rate with the dollar between 1991 and 2001.

- Starting in 1998, the economy was buffeted by a number of large negative shocks (weak commodity prices, large devaluation in Brazil, large increase in country premium, etc.).


- Nonetheless, nominal wages remained remarkably flat.

- This evidence suggests that nominal wages are downwardly rigid, and that $\gamma$ is about 1.

- Why $\gamma \approx 1$? The slackness condition $(\bar{h} - h_t)(W_t - \gamma W_{t-1})$ (recall $\epsilon_t = 1$ during this period), implies that if unemployment is growing, wages must grow at the gross rate $\gamma$. 

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Argentina 1996–2006

Nominal Exchange Rate ($E_t$)

Unemployment Rate + Underemployment Rate

Nominal Wage ($W_t$)

Real Wage ($W_t/E_t$)

Implied Value of $\gamma$: Around unity.
Evidence From Peripheral Europe (2008-2011)

• Look at the table on the next slide.

• Between 2008 and 2011, all countries in the periphery of Europe experienced increases in unemployment. Some very large increases.

• In spite of this context of extreme duress, nominal hourly wages experienced significant increases in most countries and modest declines in very few.

• The slide following the table explains how to use the information in the table to infer a range for $\gamma$. 
## Unemployment, Nominal Wages, and $\gamma$

### Evidence from the Eurozone

<table>
<thead>
<tr>
<th>Country</th>
<th>Unemployment Rate 2008Q1 (in percent)</th>
<th>Unemployment Rate 2011Q2 (in percent)</th>
<th>Wage Growth $\frac{W_{2011Q2}}{W_{2008Q1}}$ (in percent)</th>
<th>Implied Value of $\gamma$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulgaria</td>
<td>6.1</td>
<td>11.3</td>
<td>43.3</td>
<td>1.028</td>
</tr>
<tr>
<td>Cyprus</td>
<td>3.8</td>
<td>6.9</td>
<td>10.7</td>
<td>1.008</td>
</tr>
<tr>
<td>Estonia</td>
<td>4.1</td>
<td>12.8</td>
<td>2.5</td>
<td>1.002</td>
</tr>
<tr>
<td>Greece</td>
<td>7.8</td>
<td>16.7</td>
<td>-2.3</td>
<td>0.9982</td>
</tr>
<tr>
<td>Ireland</td>
<td>4.9</td>
<td>14.3</td>
<td>0.5</td>
<td>1.0004</td>
</tr>
<tr>
<td>Italy</td>
<td>6.4</td>
<td>8.2</td>
<td>10.0</td>
<td>1.007</td>
</tr>
<tr>
<td>Lithuania</td>
<td>4.1</td>
<td>15.6</td>
<td>-5.1</td>
<td>0.996</td>
</tr>
<tr>
<td>Latvia</td>
<td>6.1</td>
<td>16.2</td>
<td>-0.6</td>
<td>0.9995</td>
</tr>
<tr>
<td>Portugal</td>
<td>8.3</td>
<td>12.5</td>
<td>1.91</td>
<td>1.001</td>
</tr>
<tr>
<td>Spain</td>
<td>9.2</td>
<td>20.8</td>
<td>8.0</td>
<td>1.006</td>
</tr>
<tr>
<td>Slovenia</td>
<td>4.7</td>
<td>7.9</td>
<td>12.5</td>
<td>1.009</td>
</tr>
<tr>
<td>Slovakia</td>
<td>10.2</td>
<td>13.3</td>
<td>13.4</td>
<td>1.010</td>
</tr>
</tbody>
</table>

How To Infer $\gamma$

The model (to be presented below) implies that if unemployment increases from one period to the next, then nominal wages must be growing at the rate $\gamma$.

How to calculate $\gamma$:

$$\gamma = \left( \frac{W_{2011:Q2}}{W_{2008:Q1}} \right)^{\frac{1}{13}}$$

Subtract 0.6% per quarter to adjust for foreign inflation and long-run growth (because they are not explicitly incorporated in the model) to obtain the estimate:

$$\gamma \in [0.99, 1.022]$$
A Model with Unemployment Due to Downward Nominal Wage Rigidity
Model

small open economy
free capital mobility
2 periods
2 goods, traded and nontraded

\[ P_t^N = \text{nominal price of nontraded goods in period } t \]
\[ P_t^T = \text{nominal price of traded goods in period } t \]
\[ P_t^* = \text{foreign price of traded goods in period } t \]
\[ S_t = \text{nominal exchange rate} \]

Law of one price holds for tradables: \[ P_t^T = S_t P_t^* \]
Assume that \( P_t^* = 1 \), hence \( P_t^T = S_t \)

\[ p_t = \frac{P_t^N}{P_t^T} \] relative price of nontradables, or RER in period \( t \)
\[ B_1^* = \text{international bonds held by household at end of period 1, denominated in traded gods.} \]
The Problem of Households

\( C_t^N \) = nontraded good consumption in period \( t \)
\( C_t^T \) = traded good consumption in period \( t \)
\( Y_t \) = income, in terms of tradables, of the household in period \( t \)
\( r_t \) = interest rate on assets held from \( t \) to \( t + 1 \)

The household takes income, \( Y_1 \) and \( Y_2 \), as exogenously given.
Preferences:

\[ U(c_1^T, c_1^N) + U(c_2^T, c_2^N) \]

Budget constraint in period 1:

\[ P_1^T c_1^T + P_1^N c_1^N + P_1^T B_1^* = P_1^T Y_1 + (1 + r_0) P_1^T B_0^* \]

Budget constraint in period 2:

\[ P_2^T c_2^T + P_2^N c_2^N = P_2^T Y_2 + (1 + r_1) P_2^T B_1^* \]
Write budget constraint in terms of tradables, that is, divide by $P_t^T$:

Budget constraint in period 1:

$$c_T^1 + p_1 c_N^1 + B_1^* = Y_1 + (1 + r_0)B_0^*$$

Budget constraint in period 2:

$$c_T^2 + p_2 c_N^2 = Y_2 + (1 + r_1)B_1^*$$

For simplicity, assume that initial assets are zero, $B_0^* = 0$.

Then obtain the single present value budget constraint:

$$c_T^1 + p_1 c_N^1 + \frac{c_T^2 + p_2 c_N^2}{1 + r_1} = Y_1 + \frac{Y_2}{1 + r_1}$$
So we can state the household problem as follows: Pick $c^T_1$, $c^N_1$, $c^T_2$, $c^N_2$, taking as given $p_1$, $p_2$, $Y_1$, $Y_1$, and $r_1$, to maximize:

$$U(c^T_1, c^N_1) + U(c^T_2, c^N_2)$$

subject to the budget constraint:

$$c^T_1 + p_1 c^N_1 + \frac{c^T_2 + p_2 c^N_2}{1 + r_1} = Y_1 + \frac{Y_2}{1 + r_1}$$

One first-order condition to this problem is that the marginal rate of substitution between traded and nontraded good consumption in period 1 has to be equal to the relative price, that is, at the utility maximizing allocation it must be the case that:

$$\frac{U_2(c^T_1, c^N_1)}{U_1(c^T_1, c^N_1)} = p_1$$
How can we interpret this optimality condition. Suppose the household has 1 unit of traded good in period 1 and wants to decide to either consume it now or to sell it and buy nontraded goods for it. The marginal utility of consuming the one unit of traded good in period 1 is: $U_1(c_1^T, c_1^N)$. If the household sells the unit of consumption and buys nontradables for it, how many nontraded good does he get? He obtains $1/p_1$ units of nontradables. How much additional utility do these nontraded goods generate? They increase utility by $U_2(c_1^T, c_1^N)/p_1$. At the optimum the additional utility of consuming one more traded good must be the same as that of exchanging the traded good for a nontraded one and then consuming the nontraded good. Hence it must be the case that $U_2(c_1^T, c_1^N)/p_1 = U_1(c_1^T, c_1^N)$, which is the same as the above first-order condition.

We interpret this first-order condition as a demand function for nontradables as a function of the real exchange rate, or the relative price of nontradables, $p_t$, for a given level of traded consumption $c_1^T$. Let’s plot this demand function in the space $(c_1^N, p_1)$. See
This demand function is downward sloping as long as both consumption of tradables and consumption of nontradables are normal goods. For example, suppose the period 1 utility function is of the form: $U(c^T, c^N) = a \ln c^T + (1 - a) \ln c^N$. Then the marginal rate of substitution is:

$$\frac{U_2(c_1^T, c_1^N)}{U_1(c_1^T, c_1^N)} = \frac{(1 - a) c^T}{a c^N}$$

In this case the demand function for nontradables becomes:

$$p_1 = \left( \frac{1-a}{a} \right) \left( \frac{c_1^T}{c_1^N} \right)$$
The Effect of a Sudden Stop ($r_1 \uparrow$) on the Demand for Nontradables

We will consider a sudden stop, which we interpret as an increase in the world interest rate, $r_1$. Recall that in the model with only a single good a rise in the world interest rate in period 1, lowers consumption in period 1 and increases it in period 2. We will show below that the same holds in the two-good model considered here. For the moment, however, we just take it as given that when there is a sudden stop, i.e., $r_1 \uparrow$, then $c_T^1 \downarrow$.

Our question is how does a sudden stop affect the demand for nontradables. Figure xxx shows that a decline in $c_T^1$ shifts the demand schedule down and to the left. That is, for the same price agents now demand less nontradables.
The Production of Nontraded Goods

Nontraded goods are produced by perfectly competitive firms using labor, $h_t$, as the only factor input. The production function for nontraded goods is given by:

$$Q_t^N = F(h_t),$$

where $F$ is increasing and concave function. The latter assumption is made to ensure that the marginal product of labor is decreasing, that is, the production technology exhibits diminishing returns to scale. Nominal profits of firms operating in the nontraded sector are given by

$$P_t^N F(h_t) - W_t h_t,$$

where $W_t$ denotes the nominal hourly wage rate in period $t$. It will be convenient to express profits in terms of tradables and thus we divide nominal profits by $P_t^T$. This yields:

$$p_t F(h_t) - (W_t/S_t)h_t$$
Notice that we used the fact that \( p_t = \frac{P_t^N}{P_t^T} \) and that by the LOOP \( P_t^T = S_t P_t^* \). Firms take as given the real exchange rate \( p_t \) and the wage rate \( \frac{W_t}{S_t} \). The profit maximizing choice of employment calls for equating the value of the marginal product of labor to marginal cost of labor, \( p_t F'(h_t) = \frac{W_t}{S_t} \). Rearranging we have

\[
\frac{p_t}{F'(h_t)} = \frac{W_t}{S_t}.
\]

We interpret this first-order condition as the demand for labor in the nontraded sector. This schedule is a function of the real exchange rate, \( p_t \), and the real wage in terms of tradables, \( \frac{W_t}{S_t} \). We can also interpret this condition as the supply schedule of nontraded goods by recognizing that \( Q_t^N \) is a monotonically increasing function of \( h_t \). In what follows we will tend to use the latter interpretation more often. Figure
The Supply of Nontraded Goods

shows this supply schedule in the space \((h, p)\) with a solid upward sloping line. Why is the supply schedule upward sloping? All else constant, higher prices increase the value of the marginal product of labor but do not affect marginal cost and thus induce firms to produce more goods.
A potential shifters of this supply schedule is the real wage in terms of tradables given by $W_t/S_t$. Suppose the real wage falls, then the supply schedule will shift down and to the right.

As we will discuss in detail below, our key departure from earlier models is that nominal wages, $W_t$ are downwardly rigid. Specifically, we assume that $W_t \geq \gamma W_{t-1}$, so that in a crisis nominal wages cannot fall below $\gamma W_{t-1}$. Further, we are studying sudden stops in the context of countries whose nominal exchange rate is fixed, either because they are on the Gold Standard, or because they are members of a currency union (like the Euroarea), or because they are simply pegging to another country’s currency. So for most of our analysis $S_t$ will also be fixed, say at $\bar{S}$.

Notice that the combination of a fixed exchange rate monetary policy and downward nominal wage rigidity results in wages that are rigid downwards in real terms. This downward real rigidity in wages (expressed in terms of tradables) will be the key distortion in our
model and is the reason why in this model we will have involuntary unemployment in response to a sudden stop. At the same time nominal wages are free to increase so that during a boom when nominal wages want to rise, the supply schedule can shift up and to the left.

We wish to determine how much firms produce in a given period, that is, we wish to find which point of the supply schedule will actually be chosen. We assume that production is demand determined, that is, firms will pick a pair \((h_t, p_t)\) so that private households demand at that price all goods that are produced, or \(c^N_t = Q^N_t = F(h_t)\). Next we derive the demand for nontradables of households.
• Workers supply $\bar{h}$ hours inelastically, but may not be able to sell them all. They take $h_t \leq \bar{h}$ as given.
• One first-order condition (Demand for Nontradables):

\[
\frac{A_2(c^T_t, c^N_t)}{A_1(c^T_t, c^N_t)} = p_t
\]

Traded goods, stochastic endowment: \( y^T_t \)

Nontraded goods, produced with labor: \( y^N_t = F(h_t) \)
Firms in the Nontraded Sector

\[
\max_{\{h_t\}} \quad p_tF(h_t) - w_th_t,
\]

taking as given \(p_t\) and \(w_t\),

where \(w_t \equiv W_t/S_t\) is the real wage in terms of tradables.

Optimality condition (or the Supply of Nontradables):

\[
p_t = \frac{W_t/S_t}{F'(h_t)}
\]
The Supply of Nontraded Goods

\[ \frac{W_0}{E_0} \frac{1}{F'(h)} \]

\[ p \]

\[ h \]
$S_t \uparrow$: A Devaluation Shifts The Supply Schedule Down

\[
\frac{W_0/(P_0^* M \tilde{E})}{F'(h)} \quad \frac{W_0/(P_1^* M \tilde{E})}{F'(h)}
\]

$(S_1 > S_0)$
The Demand for Nontraded Goods

\[
p = \frac{A_2 \left( c_0^T, F(h) \right)}{A_1 \left( c_0^T, F(h) \right)}
\]
A Contraction in Traded Absorption, $c_T^t \downarrow$, Shifts the Demand for Nontradables Down and to the Left

\[
\begin{align*}
\frac{A_2(c_T^0, F(h))}{A_1(c_T^0, F(h))} & \quad \quad \frac{A_2(c_T^1, F(h))}{A_1(c_T^1, F(h))}
\end{align*}
\]

\((c_T^1 < c_T^0)\)