

Labor force participation, wage rigidities, and inflation

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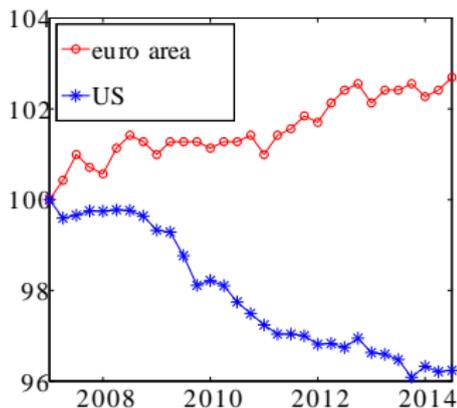
Challenges for macroeconomic policy in a low inflation environment
ECB 5-6 November 2015

Motivation

► LFP

ECB, Economic Bulletin, 1-2015 "Despite the severe recessionary periods that have affected the euro area in recent years, the labour force participation rate in the euro area has shown atypically positive developments."

Labor force participation rate, Aged 15-64



US, OECD; euro area: Labor Force Survey (Eurostat). Euro area data refer to the EA-18 aggregate

- YELLEN (2014): "...the key question is: What portion of the decline in LFP reflects structural shifts and what portion reflects cyclical weakness in the labor market? [...] the pace of the decline (in LFP) accelerated with the recession [...] greater worker discouragement is most directly the result of a weak labor market...The interaction of labor force participation and inflationary pressures has been understudied"

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- ERCEG AND LEVIN (2014): "Our paper provides compelling evidence that cyclical factors account for the bulk of the recent decline in the LFP rate " Similar results in Van Zandweghe 2012; Hotchkiss and Rios-Avila 2013, among others.

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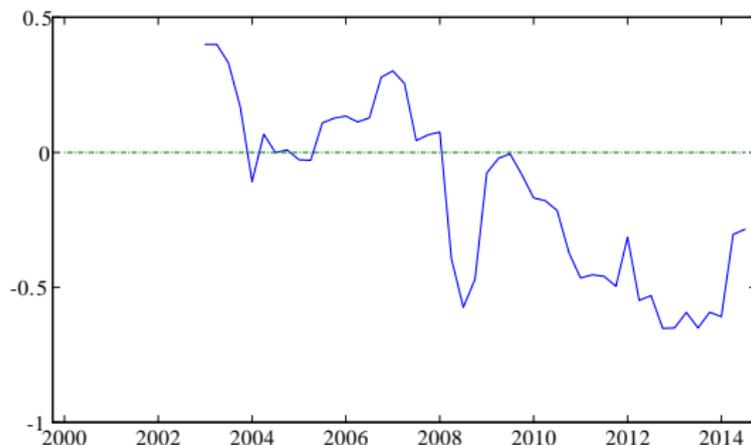
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 - Irrelevance of real wage rigidities for inflation

Labor force cyclicality in the euro area

Rolling Correlations between hp-filtered LFP and gdp growth
in the euro area



Correlations are calculated in a 3-year rolling window of quarterly data

LFP rate refers to the working age population (15-64)

Labor force cyclical in the euro area

	hp-filtered LFP	
	<i>Post 2008</i>	<i>Post 2000</i>
Constant	-0.010 (0.036)	-0.027 (0.029)
$\frac{GDP_t - GDP_{t-1}}{GDP_{t-1}}$	-0.088** (0.043)	--
$\frac{GDP_t - GDP_{t-1}}{GDP_{t-1}} * D_{pre_2008}$	--	-0.090 (0.062)
$\frac{GDP_t - GDP_{t-1}}{GDP_{t-1}} * D_{post_2008}$	--	-0.090** (0.041)

** significance at the 5 per cent level.

Labor force cyclical in the euro area

Panel regression

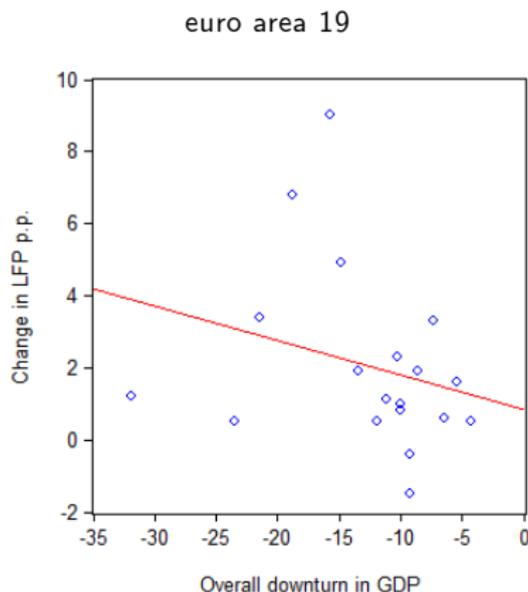
	<i>Post 2008</i>
	hp-filtered LFP
<i>Constant</i>	-0.015 (0.031)
$\frac{GDP_{it} - GDP_{it-1}}{GDP_{it-1}}$	-0.048** (0.020)

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Panel regression on euro area countries, where we control for cross-country heterogeneity by allowing for time-invariant, country-specific fixed effects in the estimation.

Labor force cyclicality in the euro area

The increase in the labor force participation rate has been larger in those euro area countries that have been hit the hardest by the crisis



Notes: on the horizontal axis, we consider the difference between the lowest and the highest value of real GDP attained by each country in the post-2007 period. In the vertical axis the overall change in the LFP rate over the post-2007 period is considered.

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Standard business cycle models ignore the participation margin.
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- We follow Campolmi and Gnocchi (2014) in modeling labor market flows

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The relevant decision unit is the representative household with a continuum of members represented by the unit interval.

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- The household allocates members between the market and home sectors, on the basis of the relative return to being in either sector:

$$\max E_0 \sum_{t=0}^{\infty} \beta^t U(C_t, E_t, L_t)$$

$$\text{st } \int_0^1 P_t(i) C_t(i) di + Q_t B_t \leq B_{t-1} + W_t E_t + T_t$$

$$E_t = (1 - \rho) (1 - f_t) E_{t-1} + f_t N_t$$

The cyclical profile of LFP

► Utility

The household allocates members to market production up to the point at which the marginal cost in terms of foregone home production equals the marginal return to market work:

$$\underbrace{\frac{\chi(1 - N_t)^{-\phi}}{\Omega_t}}_{MRS_{t,L,C}} = f_t \underbrace{\left(\frac{W_t}{P_t} - \frac{\psi E_t^C}{\Omega_t} \right)}_{\text{wage markup}} + f_t \mathbb{E}_t \beta (1 - \rho) \frac{\Omega_{t+1}}{\Omega_t} \frac{(1 - f_{t+1})}{f_{t+1}} MRS_{t+1,L,C}$$

- N_t : the pool of labor market participants
- Ω_t : marginal utility of consumption
- f_t : the probability of being hired in period t
- E_t : the mass of employed
- ρ : the separation rate

The cyclical profile of LFP

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After a recessionary shock:

- discouragement effect: the fall in workers' chances of finding jobs $f_t \downarrow$ and the worsening of real wages $\frac{W_t}{P_t} \downarrow$ drive potential workers out of the labor force $N_t \downarrow$ leading to a procyclical response of labor force participation, as in the US.

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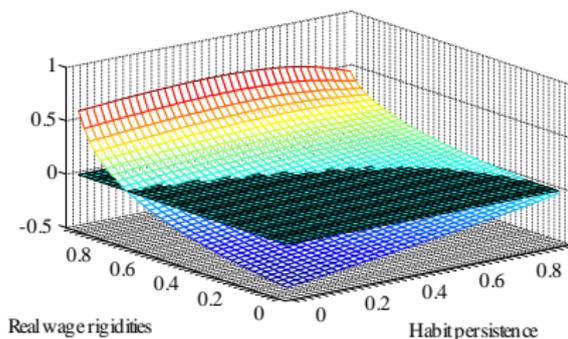
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- added worker effect: when the degree of habit formation is strong (i.e. when household aspires to maintain its pre-crisis consumption level) and/or in the presence of high wage rigidities (preventing real wages from falling as much as reservation wages): family members might be prompted to seek jobs $N_t \uparrow$, leading to a countercyclical profile of labor force participation, as in the euro area.

The cyclical profile of LFP

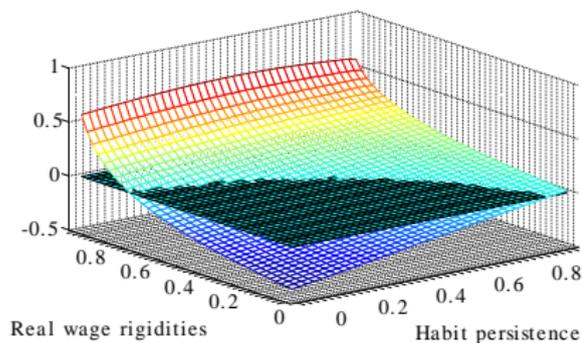
- Higher relevance of real wage rigidities in the euro area
- Differences in preferences: a higher degree of habit formation in the consumers' behavior in the euro area

Response at impact of labor market participation

to a contractionary demand shock



to a contractionary supply shock



Wage rigidities, labor force and inflation

- Two sectors: intermediate firms and retailers. Household's members are employed by intermediate firms - which face hiring costs and operate in a competitive market in relation to the goods they produce. Intermediate firms sell their output to retailers, which are monopolistically competitive and set prices in a staggered fashion (Calvo)

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$$\bullet MC_t = \underbrace{\frac{W_t}{P_t A_t}}_{\text{wage/productivity}} + \underbrace{Bf_t^\eta}_{\text{hiring costs}} - \underbrace{\beta \mathbb{E}_t \frac{\Omega_{t+1} \bar{\zeta}_{t+1}}{\Omega_t \bar{\zeta}_t} (1 - \rho) \frac{A_{t+1}}{A_t} Bf_{t+1}^\eta}_{\text{reduced hiring needs}}$$

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- Hiring costs are increasing with labor market tightness.

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Sum of labor disutility - net of the discounted future surplus resulting from the employment relationship- and the value of searching for other jobs
- \overline{W}_t^r and \underline{W}_t^r are both increasing with labor market tightness: a tighter labor market increases both the workers outside option during the bargaining process (it is easier to find a job) and the firm's surplus from an employment relationship (it is more difficult to replace the worker).

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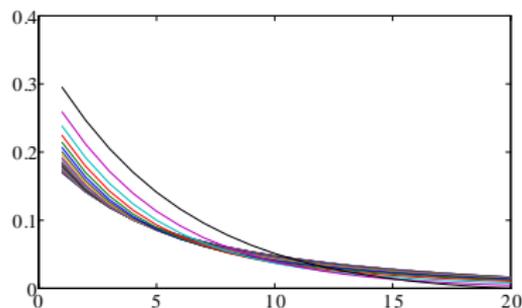
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- When labor force cyclicality is considered, RWRs become irrelevant for inflation dynamics:
to the extent RWRs stimulate a countercyclical behavior of labor force, they leave roughly unchanged inflation.

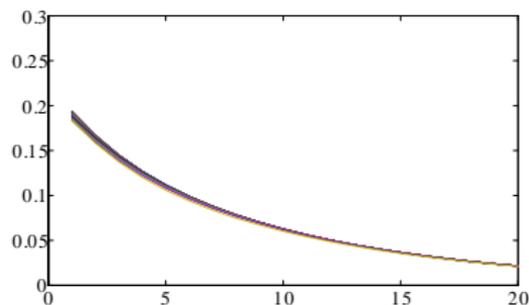
Wage rigidities, labor force and inflation

IRFs of inflation to a recessionary supply shocks
for different degrees of RWRs

Constant participation



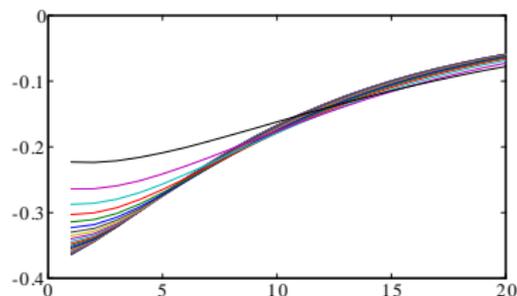
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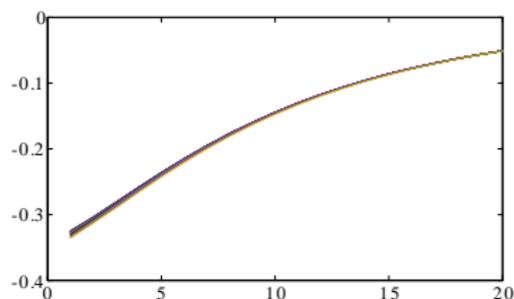
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A looser labor market reduces both the worker's outside option during the bargaining process (it is more difficult to find a job) and the firm's surplus from an employment relationship (it is easier to replace the worker).

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Why are real wage rigidities irrelevant for inflation, when labor force is endogenous?

- In a downturn, by limiting the downward adjustment of real wages, RWRs entail UPWARD pressures on the marginal cost of production.
- But, RWRs make the wage markup countercyclical, and this drives potential workers into the labor market
 - >labor market tightness decreases
 - >This additional looseness in the labor market provides DOWNWARD pressures on marginal costs, counterbalancing the upward pressures coming from the standard channel.

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- The assessment of the effects of wage rigidities on inflation cannot disregard the impact that they exert on labor supply.

Conclusions

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 - Wage rigidities and habit can be the relevant driving forces behind a countercyclical profile of labor force
 - When endogenous movements in LFP are allowed for, the effects of wage rigidities on inflation are considerably reduced

Conclusions

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 - Fit the model to data
 - Wage rigidities, labor force and optimal monetary policy; how monetary policy should differ depending on the cyclical profile of LFP

Labor market flows

Family members can be employed, unemployed and searching for a job, or out of the labor force.

U =mass of unemployed; E =mass of employed; L =mass of non-participants

$$\underbrace{U_{t-1} + \rho E_{t-1} + L_{t-1}}_{\text{non-employment pool}} = 1 - (1 - \rho) E_{t-1}$$

S_t =pool of jobless individuals who are available for hire at the beginning of period t

$$S_t = N_t - (1 - \rho) E_{t-1}$$

$$E_t = (1 - \rho) E_{t-1} + f_t S_t$$

▶ Go back

- Family members can be employed, unemployed and searching for a job, or out of the labor force. Those who are not participating in the labor force engage in housework, that increases the utility of the whole family
- The household allocates family members between the market and home sectors, on the basis of the relative return to being in either sector, and assigns equal consumption to all members in order to share consumption risk within the family

$$\max \mathbb{E}_0 \sum_{t=0}^{\infty} \zeta_t \beta^t \left[\log (C_t - h C_{t-1}) - \psi \frac{E_t^{1+\zeta}}{1+\zeta} + \chi_t \frac{(1 - N_t)^{1-\phi}}{1-\phi} \right]$$

st.

$$\int_0^1 P_t(i) C_t(i) di + Q_t B_t \leq B_{t-1} + W_t E_t + T_t$$

$$(1 - \rho) (1 - f_t) E_{t-1} + f_t N_t$$

Preferences

- Solving the household's optimization problem we obtain a conventional Euler equation and the participation condition:

$$Q_t = \beta \mathbb{E}_t \frac{\Omega_{t+1}}{\Omega_t} \frac{\zeta_{t+1}}{\zeta_t} \frac{P_t}{P_{t+1}}$$

$$\underbrace{\frac{\chi(1 - N_t)^{-\phi}}{\Omega_t}}_{MRS_{t,L,C}} = f_t \underbrace{\left(\frac{W_t}{P_t} - \underbrace{\frac{\psi E_t^C}{\Omega_t}}_{MRS_{E,C}} \right)}_{\text{wage markup}} + f_t \mathbb{E}_t \beta (1 - \rho) \frac{\Omega_{t+1}}{\Omega_t} \frac{(1 - f_{t+1})}{f_{t+1}} MRS_{t+1,L,C}$$

where

$$\Lambda_t = \frac{1}{C_t - hC_{t-1}} - h\beta \mathbb{E}_t \frac{\zeta_{t+1}}{\zeta_t} \frac{1}{C_{t+1} - hC_t}$$

Two sectors: retail and intermediate firms. Household's members are employed by intermediate firms which face a hiring cost and operate in a competitive market in relation to the goods they produce. Intermediate firms sell their output to retailers, which are monopolistically competitive and set prices in a staggered fashion.

Firms

Intermediate firms

- A large number of identical, perfectly competitive intermediate firms, indexed by $j \in [0, 1]$, and with a technology:

$$X_t(j) = A_t E_t(j)$$

- Firms incur a cost to hire new workers. Vacancies are filled immediately by paying the hiring costs: $G_t = A_t B f_t^\eta$

$$\max \mathbb{E}_t \sum_{k=0}^{\infty} \beta^k \frac{\Omega_{t+k}}{\Omega_t} \frac{\bar{\zeta}_{t+k}}{\bar{\zeta}_t} \left(\begin{array}{l} \frac{1}{\mu_{t+k}} A_{t+k} E_{t+k}(j) + \\ - \frac{W_{t+k}}{P_{t+k}} E_{t+k}(j) + A_{t+k} B f_{t+k}^\eta M_{t+k}(j) \end{array} \right)$$

subject to employment law of motion

$$\frac{1}{\mu_t} = \frac{W_t}{P_t A_t} + B f_t^\eta - \beta E_t \frac{\Omega_{t+1}}{\Omega_t} \frac{\bar{\zeta}_{t+1}}{\bar{\zeta}_t} (1 - \rho) \frac{A_{t+1}}{A_t} B f_{t+1}^\eta + \mu_t^p$$

- A continuum of retailers indexed by $i \in [0, 1]$, each producing a differentiated final good. The retail firm purchases the intermediate output on a perfectly competitive market and converts it into a differentiated final good. All retail firms have access to an identical technology

$$Y_t(i) = X_t(i)$$

- Following Calvo (1983), retailers can reset their price at random dates: in each period only a randomly chosen fraction $(1 - \theta)$ of retailers adjusts their prices. The remaining retailers keep their prices unchanged. The pricing decision of a retail firm obeys the following equilibrium condition:

$$E_t \sum_{k=0}^{\infty} \theta^k \beta^k \frac{\Omega_{t+k}}{\Omega_t} \frac{\xi_{t+k}}{\xi_t} \frac{P_t}{P_{t+k}} Y_{t+k/t} \left(\frac{P_t^*}{P_{t-1}} - \frac{\epsilon}{\epsilon - 1} MC_{t+k/t} \frac{P_{t+k}}{P_{t-1}} \right) = 0$$

The presence of a surplus associated with existing relations implies that many wages may be consistent with equilibrium. We follow Hall (2005), assuming equilibrium wage stickiness:

$$\frac{W_t}{P_t} = \left(\frac{W_{t-1}}{P_{t-1}} \right)^\gamma W_t^{r*(1-\gamma)}$$

where W_t^{r*} is defined as the Nash wage schedule. Nash bargaining satisfies:

$$S_t^H = \vartheta S_t^F$$

S_t^H : the household's surplus from an established employment relationship

S_t^F : denotes the household's and firm's surplus from an established employment relationship

$$(W_t^r)^* = \frac{\psi E_t^\zeta}{\Omega_t} + \vartheta A_t B f_t^\eta - \beta \vartheta E_t \frac{\Omega_{t+1}}{\Omega_t} \frac{\zeta_{t+1}}{\zeta_t} (1 - \rho) (1 - f_{t+1}) A_{t+1} B f_{t+1}^\eta$$

$$(W_t^r)^* = b\overline{W}_t^r + (1 - b)\underline{W}_t^r$$

where \underline{W}_t^r and \overline{W}_t^r are defined as follows:

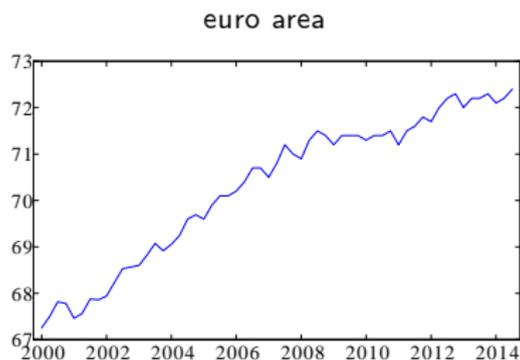
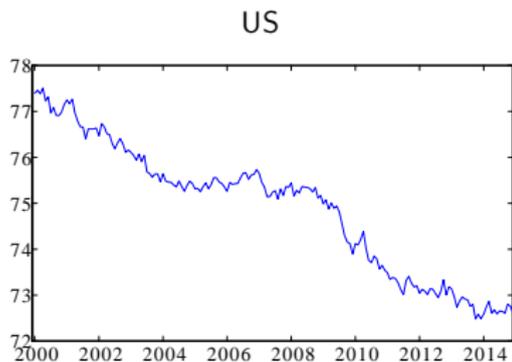
$$\underline{W}_t^r \equiv \frac{\psi E_t^c}{\Omega_t} - \beta \mathbb{E}_t \frac{\Omega_{t+1}}{\Omega_t} \frac{\zeta_{t+1}}{\zeta_t} (1 - \rho) \mathcal{S}_{t+1}^H + \beta \mathbb{E}_t \frac{\Omega_{t+1}}{\Omega_t} \frac{\zeta_{t+1}}{\zeta_t} (1 - \rho) f_{t+1} \mathcal{S}_{t+1}^H$$

$$\overline{W}_t^r \equiv \frac{A_t}{\mu_t} + \beta \mathbb{E}_t \frac{\Omega_{t+1}}{\Omega_t} \frac{\zeta_{t+1}}{\zeta_t} (1 - \rho) A_{t+1} B f_{t+1}^\eta$$

Aggregate resource constraint

$$C_t = A_t(E_t - Bf_t^\eta M_t)$$

Labor force participation rate, Aged 15-64



US: OECD; euro area: Labor Force Survey (Eurostat).

Euro area data refer to the EA-18 aggregate and figures between 2000 and 2004 have been reconstructed by aggregating national data using the working-age population shares as weights.

