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**IMA**  
5<sup>th</sup> CONGRESS  
**2015**

# A dynamic microsimulation model to predict labour market indicators in Tuscany

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# Aim

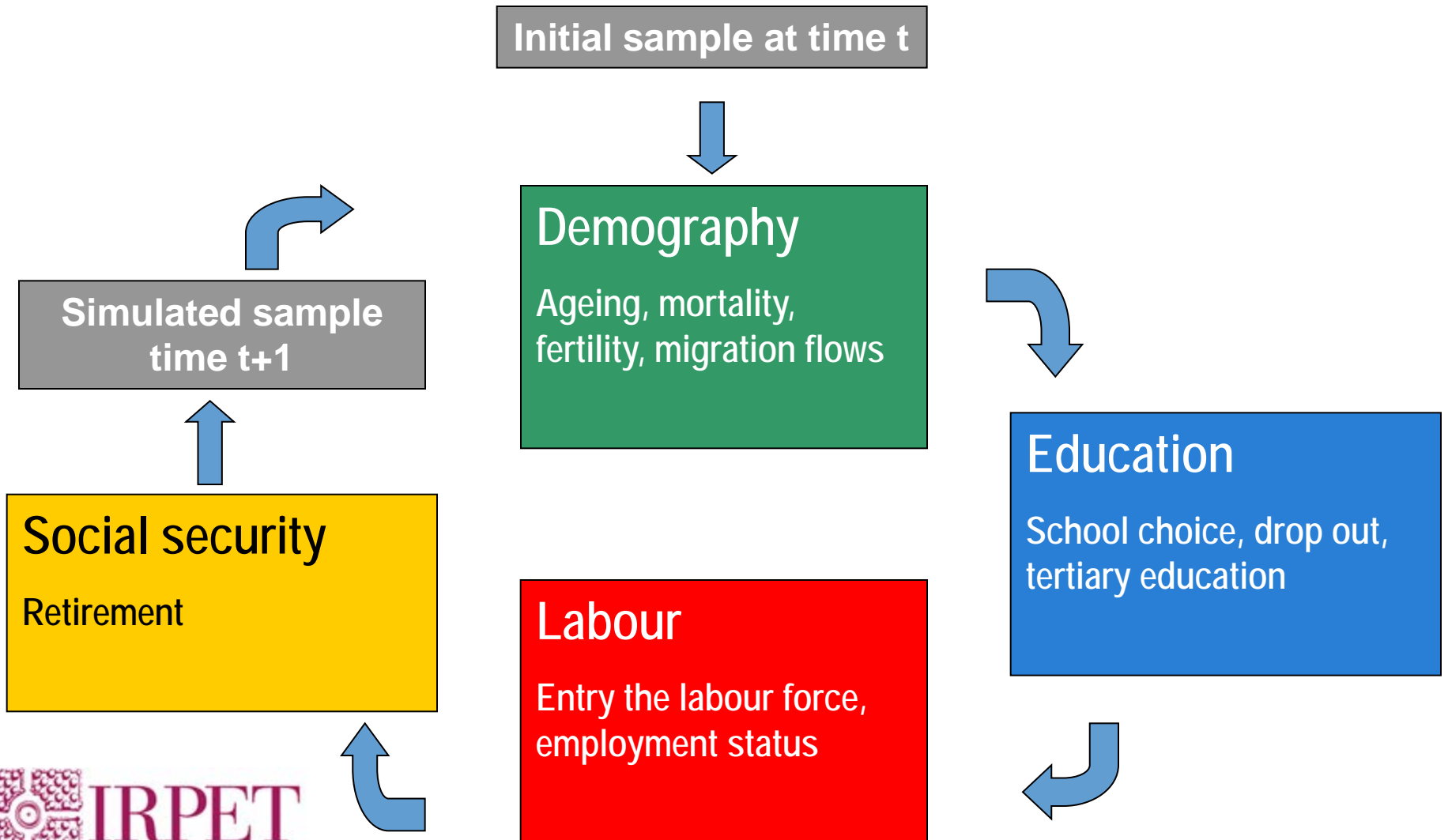
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- **Overview:** Italy is experiencing a strong worsening on employment conditions, especially for young → labour has become an important issue for the regional policy maker
- **Aim:** to predict labour market indicators in the short medium run
- **Objective:** to set a dynamic microsimulation model for a representative sample of the tuscan population

# Model's general features

- **Population based:** ageing and adjustment of a cross sectional sample of the entire population
- **Database:** Italian Labour Force Survey for Tuscany
- **Closed model:** except newly born children and migrants, the model only uses a fixed set of individuals
- **Dynamic ageing:** produces a longitudinal database of histories of each individual in each period of the simulation
- **Probabilistic:** transitions among states through probabilistic methodologies → Monte Carlo technique
- **Discrete time:** transition and updating for each year
- **Simulation period:** short medium run → 2013-2018

# The modules structure



# Labour market

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Labour Supply

Labour Demand

Matching between  
Supply and Demand

# Labour supply

$$O_t = (O_{t-1,t} - P_t - M_t) + \varphi_t$$

$$\varphi_t = \varphi_{t-1} + f_t$$

$O_t$  = supply time  $t$

$O_{t-1,t}$  = employed time  $t-1$

$P_t$  = retired

$M_t$  = died

$\varphi_t$  = unemployed time  $t$

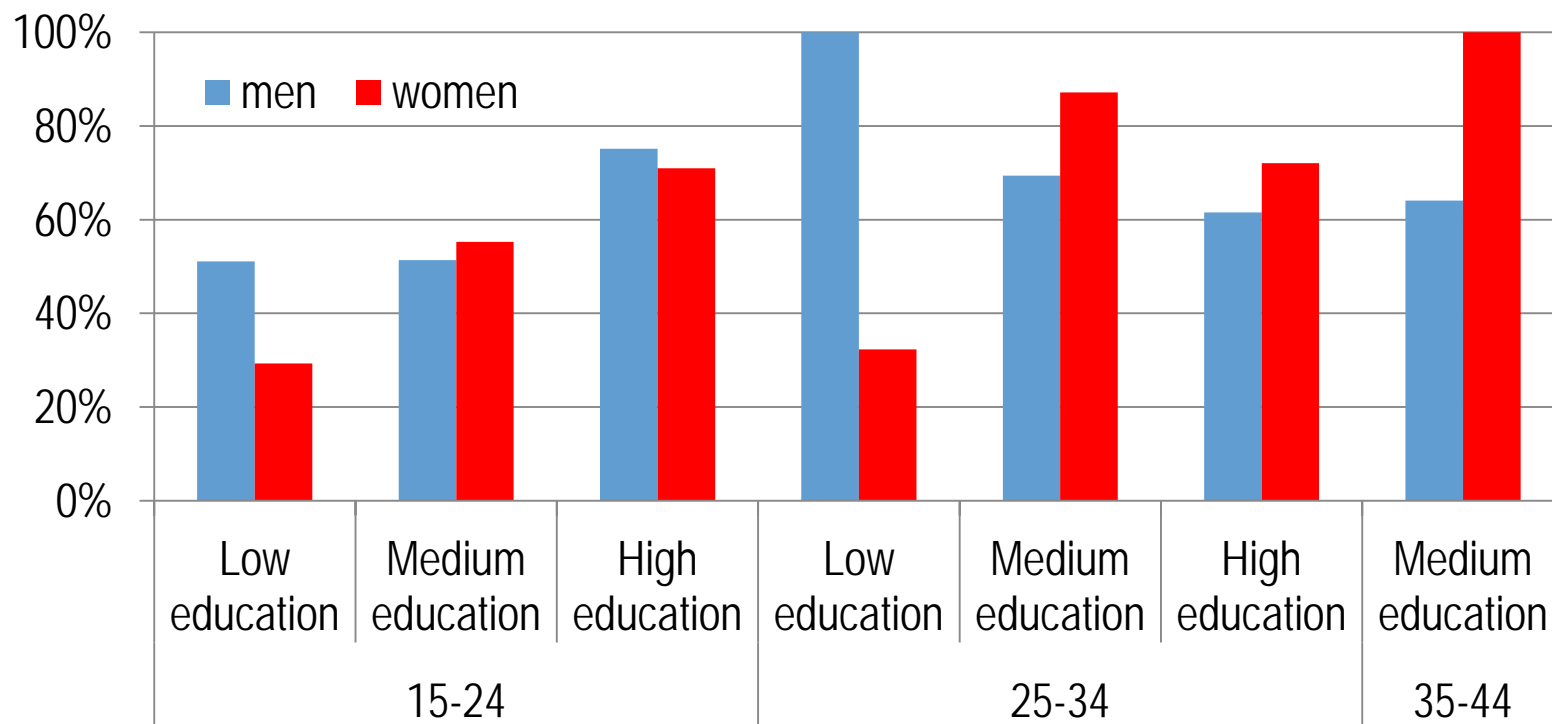
$\varphi_{t-1}$  = unemployed time  $t-1$

$f_t$  = new unemployed

- For  $t = 2013, \dots, 2018$
- For each sector of activity  $s=1, \dots, 10$
- For each level of education  $\rightarrow$   $g$ =tertiary education,  $b$ =secondary education,  $c$ =primary education

# Labour supply: activation procedure

## Estimated participation rates by gender, education, age class



Source: elaborations on IFL 2011, 2012, 2013 (Tuscany)

# Labour demand

- Estimation in **three phases** and for each sector of activity
  1. From IRPET macro model (DANTE) → estimation of Standard Labour Units (SLU) for each simulation year



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  1. From IRPET macro model (DANTE) → estimation of Standard Labour Units (SLU) for each simulation year
  2. From INPS → employed in redundancy funds (CIG) → scenarios about its evolution in the future → CIG's employed are translated in SLU
  3. Estimation of the coefficient  $\text{Coef\_SLU\_on\_employed} = \text{SLU/employed}$  → scenarios about its evolution in the future →  $(\text{SLU} + \text{CIG's SLU}) / \text{Coef\_SLU\_on\_employed} = \text{Labour demand}$

# Labour demand for education level

	low education	medium education	high education
Agriculture	76%	21%	3%
Manufacturing	36%	51%	13%
Construction	54%	45%	1%
Trade	40%	56%	4%
Hotels and restaurants	33%	66%	1%
Transport, storage, communication, real estate, renting and others	38%	47%	15%
Financial intermediation	0%	41%	59%
Public administration and defence	5%	67%	28%
Education, health and social services	5%	67%	28%
Other service activities	16%	76%	7%

- The resulting labour demand  $L_{g,s}, L_{b,s}, L_{c,s}$  is then **EXOGENOUSLY** introduced in our model

# Matching between demand and supply

$$L_{t,s} \quad VS \quad O_{t,s}$$



$O_{t-1,t,s}$  = stock of employed at time t-1 still present at time t

$$\begin{aligned} &\text{If } L_{t,s} \geq O_{t-1,t,s} \\ &\text{else } L_{t,s} < O_{t-1,t,s} \end{aligned}$$



Over-demand



Under-demand

# Matching between demand and supply over-demand

$$O_{t-1,t,s} = O_{t-1,s}$$

$$l^*_t = L_{t,s} - O_{t-1,t,s}$$

$$\text{if } l^*_g \geq \phi_g \Rightarrow \pi_g = 1$$

$$\text{else } \pi_g = \pi_b = \frac{l^*_b}{\phi_b + (\phi_g - l^*_g)}$$

$$\text{if } l^*_b \geq \phi_b + (\phi_g - l^*_g) \Rightarrow \pi_g = \pi_b = 1$$

$$\text{else } \pi_g = \pi_b = \pi_c = \frac{l^*_c}{\phi_c + (\phi_g + \phi_b - l^*_b - l^*_g)}$$

$O_{t-1,t,s}$  = employed time t-1 and t

$O_{t-1,t}$  = employed time t-1

$L_{t,s}$  = labour demand at time t

$l^*_t$  = excess labour demand time t

For each time t

For each sector s

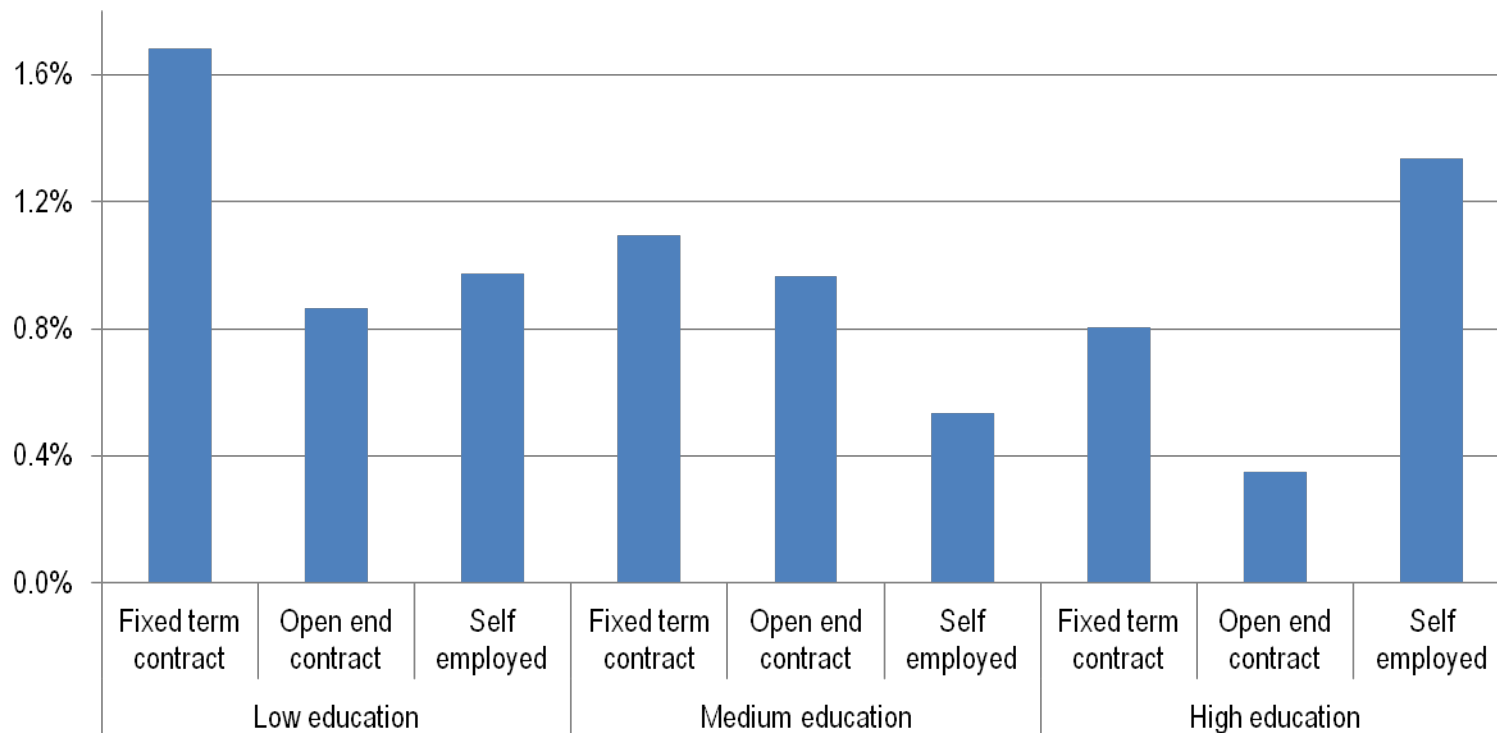
$l^*$  = excess labour demand

$\phi$  = unemployed

$\pi$  = probability to find job

# Matching between demand and supply under-demand

- If  $L_{t,s} < O_{t-1,t,s} \Rightarrow O_{t-1,t,s} = O_{t-1,s} - P_{t,s} - U_{t,s}$
- Probability to be fired is estimated by type of contract and education level



# Validation: labour market indicators

## Labour market indicators 2014 Simulated VS Real

	Model	IFL
Active (thousand)	1,707	1,708
Employed (thousand)	1,536	1,535
Unemployed (thousand)	172	173
Participation rate (15-64)	70.9%	71.2%
Employment rate (15+)	47.7%	47.2%
Unemployment rate (15+)	10.1%	10.1%



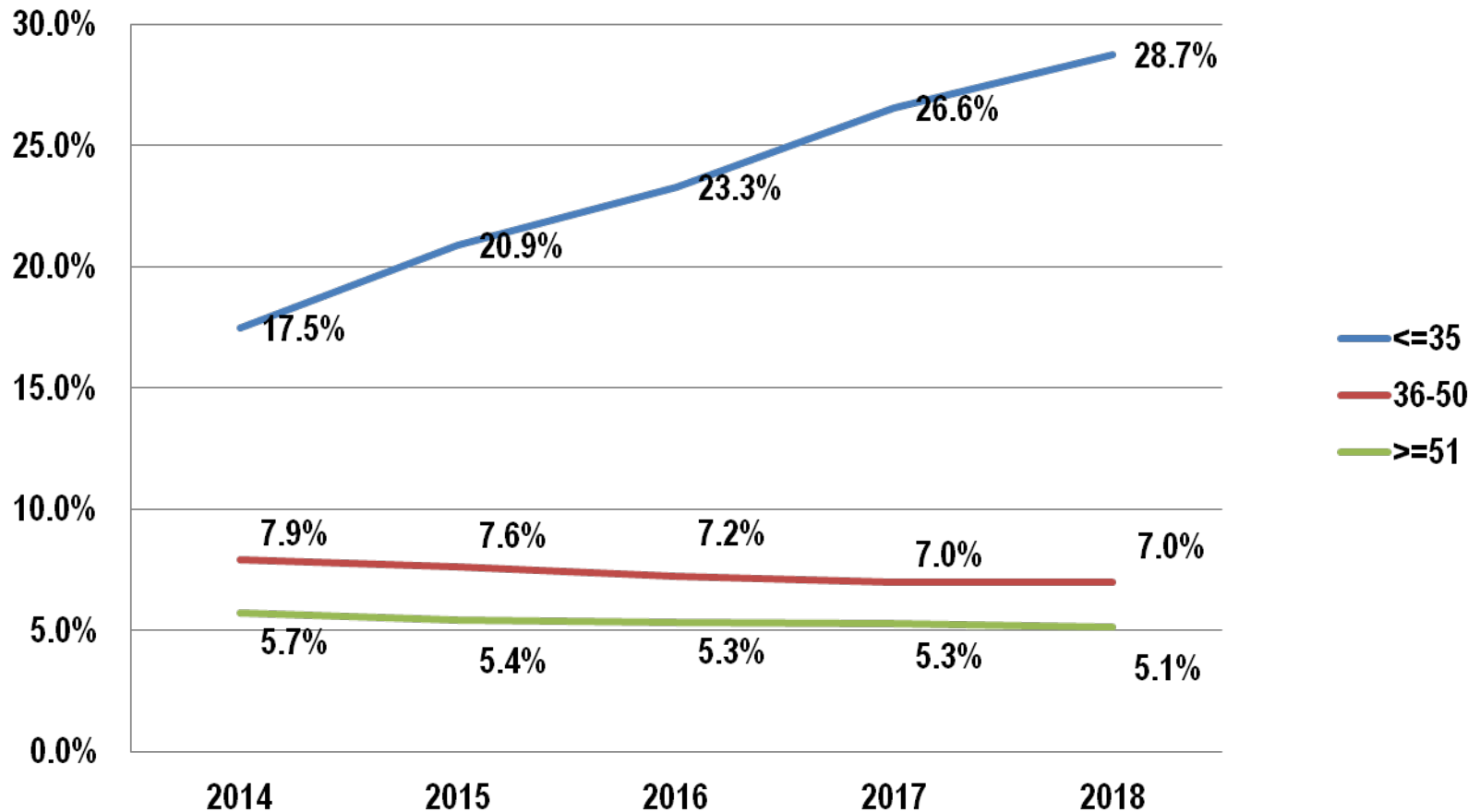
# Main results: the basic scenario parameters

Exogenous variables	Parameters
Standard Labour Units growth rates	Non public sector: -0.0828 (2015), 0.3269 (2016), 0.3197 (2017), 0.1334 (2018) Public sector: -0.1 (2015), 0 (2016-2018)
Coef_SLU_on_employed growth rates	-0.415 for each year (2015-2018)
CIG (redundancy fund) growth rates	CIG of each year 89% of CIG of the year before (2015-2018)

# Basic scenario: mismatch

	2014	2015	2016	2017	2018
Labour demand	1536	1538	1545	1547	1547
Labour supply	1707	1721	1734	1745	1752
Unemployed	172	183	189	199	205
Employment rate	47.7%	47.7%	47.9%	48.0%	48.0%
Unemployment rate	10.1%	10.7%	10.9%	11.4%	11.7%

# Basic scenario: unemployment by age classes



# Main results: alternative scenario 1

Exogenous variables	Parameters
Standard Labour Units growth rates	Non public sector: -0.0828 (2015), 0.3269 (2016), 0.3197 (2017), 0.1334 (2018) Public sector: -0.1 (2015), 0 (2016-2018)
Coef_SLU_on_employed growth rates	-0.415 for each year (2015-2018)
CIG (redundancy fund) growth rates	CIG of each year <b>89%</b> of CIG of the year before (2015-2018)

# Main results: alternative scenario 1

Exogenous variables	Parameters
Standard Labour Units growth rates	Non public sector: -0.0828 (2015), <b>0.6538</b> (2016), <b>0.6934</b> (2017), <b>0.2668</b> (2018) Public sector: -0.1 (2015), 0 (2016-2018)
Coef_SLU_on_employed growth rates	-0.415 for each year (2015-2018)
CIG (redundancy fund) growth rates	CIG of each year <b>89%</b> of CIG of the year before (2015-2018)

# Main results: alternative scenario 2

Exogeneous variables	Parameters
Standard Labour Units growth rates	Non public sector: -0.0828 (2015), 0.3269 (2016), 0.3197 (2017), 0.1334 (2018) Public sector: -0.1 (2015), 0 (2016-2018)
Coef_SLU_on_employed growth rates	-0.415 for each year (2015-2018)
CIG (redundancy fund) growth rates	CIG of each year 89% of CIG of the year before (2015-2018)

# Main results: alternative scenario 2

Exogenous variables	Parameters
Standard Labour Units growth rates	Non public sector: -0.0828 (2015), 0.3269 (2016), 0.3197 (2017), 0.1334 (2018) Public sector: -0.1 (2015), 0 (2016-2018)
Coef_SLU_on_employed growth rates	-0.83 for each year (2015-2018)
CIG (redundancy fund) growth rates	CIG of each year 89% of CIG of the year before (2015-2018)

# Main results: alternative scenario 3

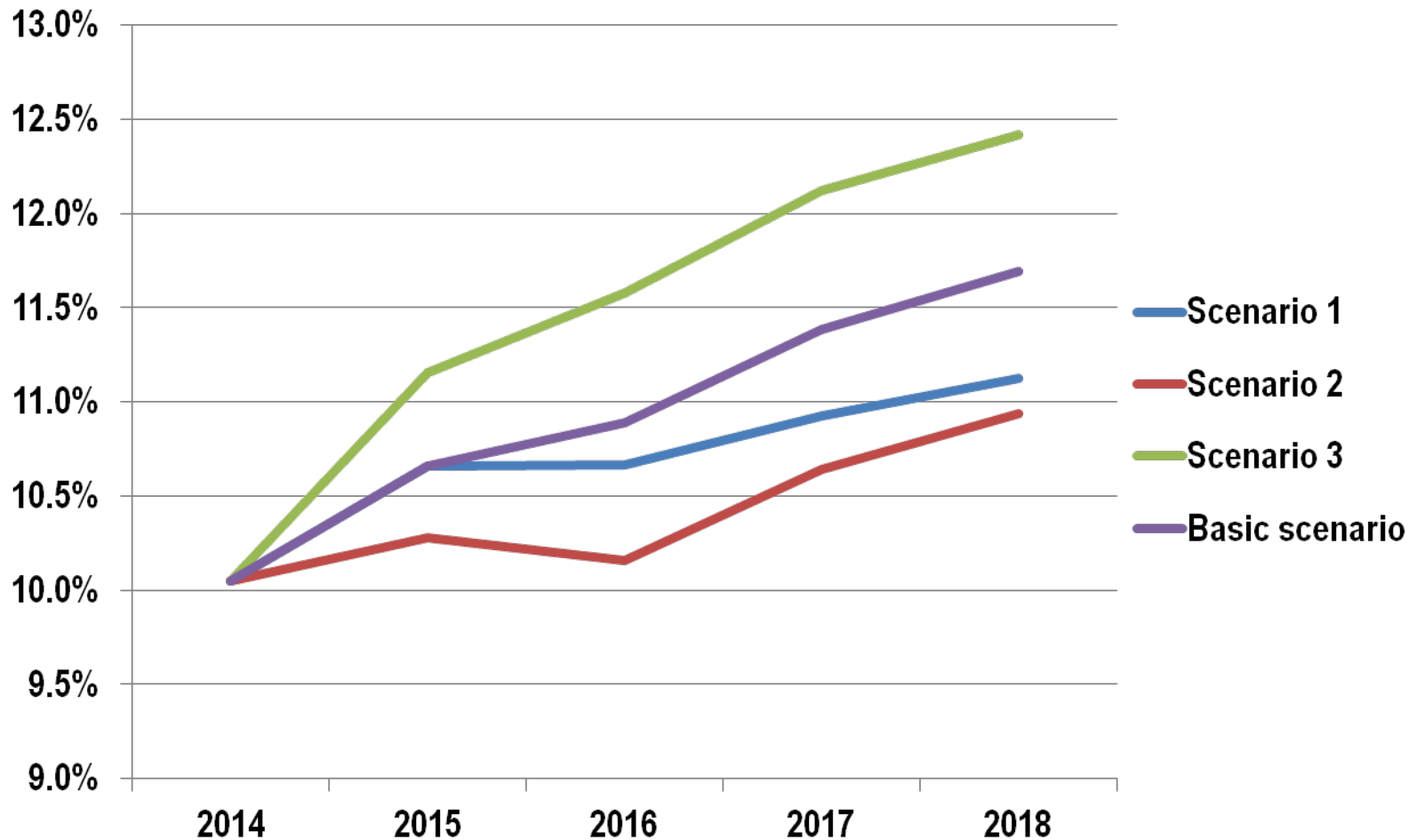
Exogenous variables	Parameters
Standard Labour Units growth rates	Non public sector: -0.0828 (2015), 0.3269 (2016), 0.3197 (2017), 0.1334 (2018) Public sector: -0.1 (2015), 0 (2016-2018)
Coef_SLU_on_employed growth rates	-0.415 for each year (2015-2018)
CIG (redundancy fund) growth rates	CIG of each year 89% of CIG of the year before (2015-2018)



# Main results: alternative scenario 3

Exogenous variables	Parameters
Standard Labour Units growth rates	Non public sector: -0.0828 (2015), 0.3269 (2016), 0.3197 (2017), 0.1334 (2018) Public sector: -0.1 (2015), 0 (2016-2018)
Coef_SLU_on_employed growth rates	-0.415 for each year (2015-2018)
CIG (redundancy fund) growth rates	CIG of each year 20% of CIG of the year before (2015-2018)

# Unemployment rates under alternatives scenarios



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Thanks for your attention

