The Puzzle of Educated Unemployment in West Africa

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Motivation

- Unemployment decreases in education in most developed countries
  - Trickle-down of unemployment (Mincer 1991, Barnichon & Zylberberg 2021)
- Unemployment **increases** with education in many developing countries Educated Unemployment
- Puzzling because self-employment is widespread
- Many possible mechanisms
  - Frictional labour markets
  - Role of the public sector
  - Importance of family background
- Major policy concern
  - Sustainable development goals (education, employment)

Research Questions

The puzzle of educated unemployment
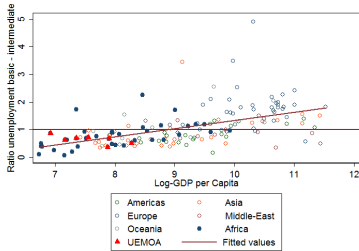
Figure: Ratio unemployment rate basic – intermediate education
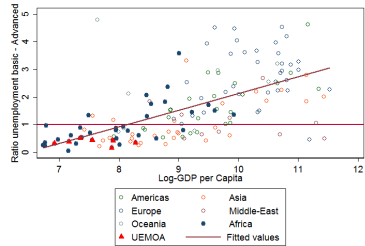
Figure: Ratio unemployment rate basic – advanced education

back

Questions and contributions

Research questions

1. Why are educated workers more likely to be unemployed than their uneducated peers?

2. (How much) Is the public sector contributing to it?

3. Which labour market policies can reduce educated unemployment?

Questions and contributions

Research questions

1. Why are educated workers more likely to be unemployed than their uneducated peers?
2. (How much) Is the public sector contributing to it?
3. Which labour market policies can reduce educated unemployment?

- Study these question in the context of West Africa Public hiring

- Develop and estimate a search and matching model
  - heterogeneous workers (education, parental background)
  - multiple labour market sectors, incl. self-employment Employment sectors

- Public sector distortions
  - wage offers, minimum wage rule
  - vacancies

- Simulate different labour market policies in equilibrium

Related literature

- **Education and unemployment**
  - Migration prospects:
    Fan & Stark (2007); Stark & Fan (2011)

  - Skill-biased technological change:
    Feng & al. (2021 WP)

  - Trickle-down of unemployment:
    Gautier (2002); Barnichon & Zylberberg (2021)

- **Labour markets in developing countries**
  - Youth unemployment in Sub-Saharan Africa:
    Alfonsi & al. (2020); Abebe & al. (2021); Duflo & al. (2021)

  - Informal sector/self-employment:
    Albrecht & al. (2011); Meghir & al. (2015); Langot & Yassin (2017);
    Narita (2021); Rud & Trapeznikova (2021); Poschke (2018 WP)

  - Public sector:
    Langot & Yassin (2017); Albrecht & al. (2019)

Outline

1. Model sketch

2. Data, Estimation and Results

3. Policy simulations

4. Conclusion

A search- and matching model

Framework: Search- and matching model with public sector &
self-employment

- Labour demand: **Three labour market sectors**
  - private (formal) sector
  - exogenous public sector
  - self-employment: workers as entrepreneurs
    $\rightarrow$ exogenous job destruction in all sectors

A search- and matching model

Framework: Search- and matching model with public sector & self-employment

- Labour demand: **Three labour market sectors**
  - private (formal) sector
  - exogenous public sector
  - self-employment: workers as entrepreneurs
    $\rightarrow$ exogenous job destruction in all sectors

- Labour supply: **Heterogeneous workers**
  - heterogeneity $y = (h, k)$: education-parental background
  - costless random search
  - get job offer at rate λ_j in sector j
    $\rightarrow$ λ_j depends on parental background k for public/private jobs
  - accept/reject offer
    $\rightarrow$ acceptance thresholds $R_j(y)$ differ by y & sector $\rightarrow$ sorting
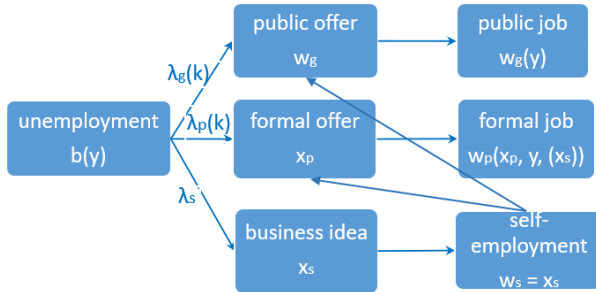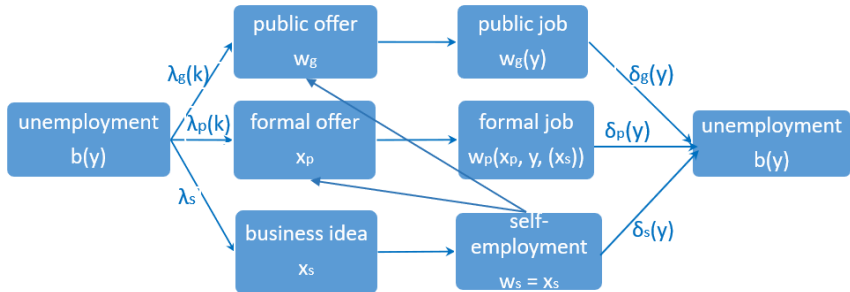 - only continue search when self-employed

Sketch of the worker's problem

Problem of a worker of type y (i.e. education h, parental background k)
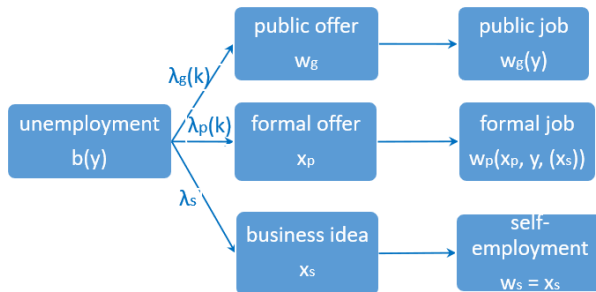
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Worker's problem: equations

Private firms, public sector & self-employment

Private (formal) firm

- endogenous vacancy creation `Firm's problem: equations`
- Nash bargaining over wage
    - $w_p(x_p, y) = \beta x_p + (1 - \beta) r V_U(y)$

Private firms, public sector & self-employment

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(Exogenous) Public sector

- fixed vacancy posting v_g
- public wage $w_g(y) \geq \bar{w}_g$

$\rightarrow$ Cobb-Douglas matching in public and private sector:
$m = A l^\eta (v_p + v_g)^{1-\eta}$

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Self-employment

- business ideas arrive independently at rate λ_s
- self-employment income equals productivity: $w_s(y) = x_s$
- continue to receive public/private offers (at lower rate): $\psi \lambda_j$

Model solution & steady-state equilibrium

Solution of the model

1. solve the worker's problem
   $\rightarrow$ reservation productivity for each sector j by type y $\boxed{\text{Res. productivity}}$

2. solve the firm's problem $\boxed{\text{Vacancy}}$
   $\rightarrow$ private vacancies v_p

3. public sector only hires if: $w_g(y) \geq \underline{\omega}_h$
   $\rightarrow$ match only happens if $w_g(y) \geq max(\underline{\omega}_h, R_g(y))$

4. steady-state conditions on unemployment and sectoral employment
   $\boxed{\text{steady-state conditions}}$

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4. steady-state conditions on unemployment and sectoral employment
   [steady-state conditions]

Equilibrium pins down:
$\rightarrow$ sectoral reservation productivities $R_j(y)$
$\rightarrow$ offer arrival rates λ_j:
   LM tightness k, formal vacancy share ϕ

Data, Estimation and Results

Data

Data

- 1-2-3 Survey in seven West African capitals Map
- cross-sectional household labour force survey in 2001-2003
- key feature: self-employment income, labour market transitions

Identification and estimation

- assumption: steady-state equilibrium
- estimation by simulated method of moments
  $\rightarrow$ minimise (weighted) squared distance between observed and simulated
  moments: $\hat{\theta}_{MSM} = \arg \min (\hat{\mu}(\theta) - \hat{m})' W (\hat{\mu}(\theta) - \hat{m})$
- 50 (46) parameters
  - log-normal wage offer distribution parameters μ_j, σ_j
  - reservation wage $R_p(h, k)$, minimum wage rule $\underline{\omega}_h$
  - search efficiency in self-employment, high k: ψ, ξ
  - arrival rates λ_j
  - destruction rates $\delta_j(h)$
  - 4 parameters fixed ex-ante
- 263 observed moments Identification
  - type distribution $P(h, k)$ is observed
  - unemployment rates
  - trimmed **wage distributions**
  - sectoral size and **worker distribution**
  - sectoral **employment duration**
  - 3-year transition rates

Results

Goodness of fit

- Unemployment rates GoF Unemp
- Other moments

Estmation results for Burkina Faso and Senegal

- Low job arrival rates $\lambda_j \rightarrow$ high frictions
- High inefficiency in public hiring, high public mininum wage $\underline{\omega}_h$
- Differential job destruction $\delta_j(h)$
- Key difference between Burkina & Senegal: private sector is more marginal in Burkina

Public sector distortions (Burkina Faso)

	Baseline	Align offers (1)		No min. wage (2)		Same wages (1) + (2)		Same destr. (3)	No pub. sect. (4)
		v_g fixed	bill fixed	v_g fixed	bill fixed	v_g fixed	bill fixed	v_g fixed	v_g −99%
	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)	(ix)
Burkina Faso									
Unemp.	16.6%	8.2%	10.1%	10.4%	12.3%	7.7%	9.9%	15.7%	10.2%
Ed. unemp.	3.1%	1.0%	0.8%	1.1%	1.4%	0.5%	0.7%	2.9%	0.9%
Public	15.9%	65.7%	16.2%	55.7%	34.5%	67.9%	17.5%	15.7%	0.1%
Private	12.8%	0.0%	44.3%	0.0%	14.7%	0.0%	43.7%	18.4%	60.4%
Self-emp.	54.6%	26.0%	29.4%	33.9%	38.5%	24.3%	28.8%	50.2%	29.2%
Welfare	31.1	68.6	57.8	25.8	31.0	68.9	57.8	33.3	58.9
Public bill	12.5	61.0	12.5	17.2	12.5	61.4	12.5	10.2	0.1
Share prior v_g	1	1	0.08	1	0.62	1	0.08	1	0.1

Policy simulations for Burkina Faso (Ouagadougou)

Labour market policy simulations

- Three popular labour market policies
  1. Public vacancy creation
  2. Reduce recruitment costs for private firms
  3. Subsidise self-employment

- Compare their effects on labour market equilibrium
  - (educated) unemployment:
    $$EdU := \sum_{(h,k)} P(h,k) \left(U_h - \min \left\{ U_{\tilde{h}} : \tilde{h} < h \right\} \right).$$
  - sectoral shares
  - workers' welfare (overall, by type)

- Keep **government expenditures constant** across policies:
  - initial public wage bill:
    $$B_0 := \sum_{(h,k)} P(h,k) n_g(h,k) \frac{\int_{R_{ug}(h,k)} \omega \, dF_{(\Omega|h)}(\omega|h)}{1 - F_{(\Omega|h)}(R_{ug}(h,k)|h)}$$
  - policy related costs: subsidy to vacancy creation, self-employment subsidy

Costs of different policies: Burkina Faso
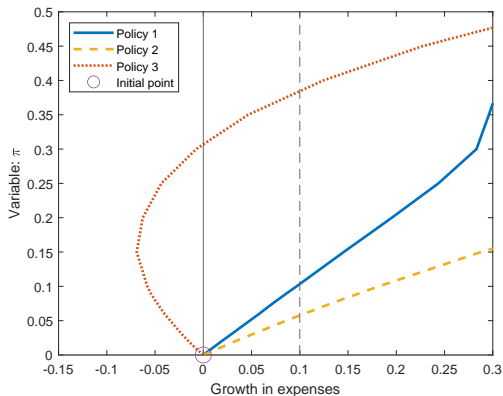
Figure: Relationship between π and government expenses growth

Policies: Unemployment and educated unemployment
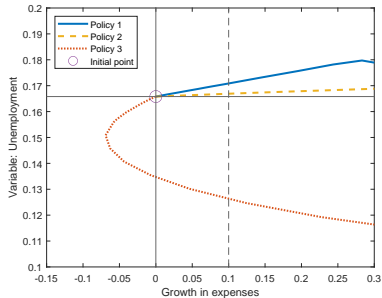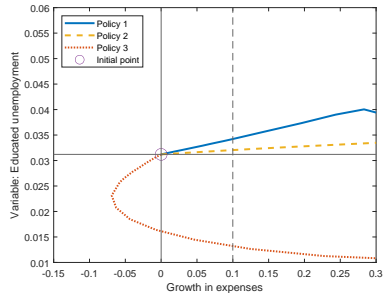

Figure: Unemployment

Figure: Educated Unemployment

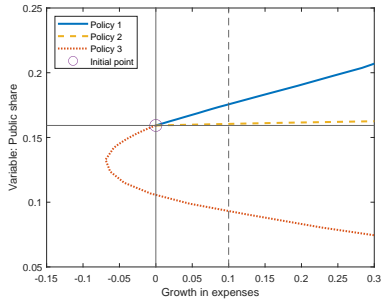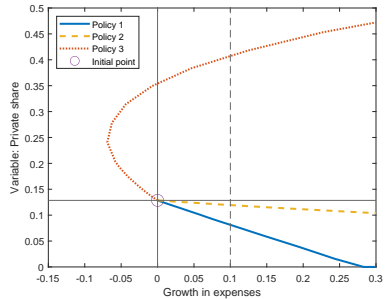# Policies: Public and private sector employment

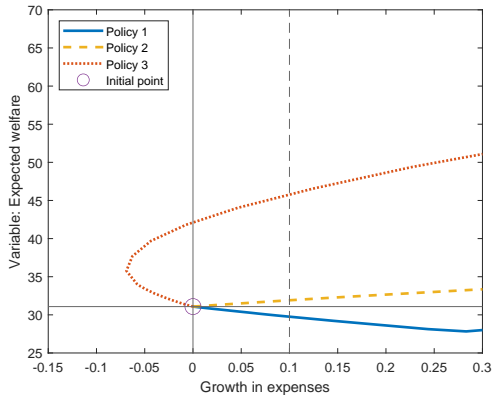Figure: Public Sector

Figure: Private sector

Policies: Welfare

Figure: Workers' welfare

Which policy is best?

Public sector vacancy creation

- overall unemployment increases, welfare stagnates
- public vacancies **displace private vacancies**

Reducing vacancy posting cost

- private **vacancies increase**
- unemployment drops, welfare increases

Subsidising self-employment

- incomes in self-employment increase $\rightarrow$ private **vacancies decrease**
- unemployment increases marginally, slight increase in welfare

Conclusion

Educated unemployment because of

- high **frictions** (jobs are hard to come by)
- public sector distortions
- differential destruction (mismatch?)

Conclusion

Educated unemployment because of

- high **frictions** (jobs are hard to come by)
- public sector distortions
- differential destruction (mismatch?)

Lessons for public policy

- negative (unintended) effects of public vacancy creation
- positive effects of vacancy posting cost reduction
- subsidising self-employment increases welfare, but unemployment, too!

Indirect labour market policies ...

... reduce frictions, and
... should be preferred over public employment creation!

Thank you for your attention!

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Figure: Stadium Iba Mar Diop in February 2012

back
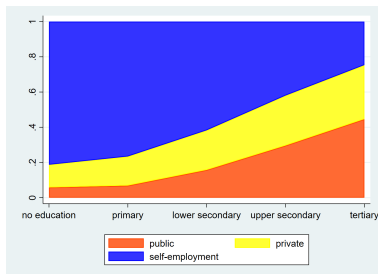
Figure: Sector of employment (men)
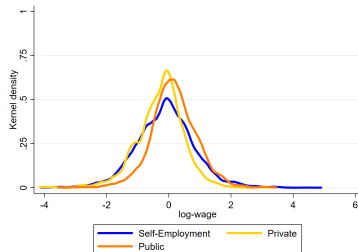

Figure: Residual wages by sector (men)

back

The worker's problem

Unemployment value

$$rV_U(y) = b(y) + \lambda_p(k)\mathbb{E}_{X,p}\max\{V_p(x_p, y) - V_U(y), 0\}$$
$$+\lambda_g(k)\mathbb{E}_{X,g}\max\{V_g(x_g, y) - V_U(y), 0\}$$
$$+\lambda_s\mathbb{E}_{X,s}\max\{V_s(x_s, y) - V_U(y), 0\}$$

- flow value of unemployment $b(y)$
- job arrival rates λ_j, productivity/wage distributions F_{x_j}

Employment value in sector j

$$rV_j(x_j, y) = w_j(x_j, y) + \delta_j(y)(V_U(y) - V_j(x_j, y)) \quad \text{for j=g,p}$$
$$rV_k(x_j, x_s, y) = w_k(x_j, x_s, y) + \delta_j(y)(V_U(y) - V_k(x_j, x_s, y)) \quad \text{for k=gs,ps}$$
$$rV_s(x_s, y) = x_s + \delta_s(y)(V_U(y) - V_s(x_s, y)) \quad \text{for self-employment}$$
$$+\psi\lambda_p(k)\mathbb{E}_{X,p}\max\{V_{ps}(x_p, y) - V_s(x_s, y), 0\}$$
$$+\psi\lambda_g(k)\mathbb{E}_{X,g}\max\{V_{gs}(x_p, y) - V_s(x_s, y), 0\}$$

- wage w_j and production x_s
- destruction rates δ_j back

- Wage from Nash bargaining is:
  $w_p(x_p, y) = \beta x_p + (1 - \beta) r V_U(y)$
- Assume public wage rule to be:
  $w_g(x_g, y) = \pi(y) + \gamma x_g + (1 - \gamma) r V_U(y)$

Reservation productivity: $R_p(y) = r V_u(y)$

$R_p(y) = b(y) + \frac{\lambda_{p,u}\beta}{r+\delta_p(y)} \int_{R_p(y)} [x - R_p(y)] \ dF_{X,p}(x|y)$
$\qquad\qquad + \frac{\lambda_{g,u}}{r+\delta_g(y)} \int_{R_g(y)} [w_g(x, y) - R_p(y)] \ dF_{X,g}(x|y)$
$\qquad\qquad + \frac{\lambda_s}{r+\delta_p(y)} \int_{R_s(y)} [R_{p,s}(x_s, y) - R_p(y)] \ dF_{X,s}(x|y)$

$R_s(y) = R_p(y) - \frac{\lambda_{p,s}\beta}{r+\delta_p(y)} \int_{R_p(y)} [x - R_p(y)] \ dF_{X,p}(x|y)$
$\qquad\qquad - \frac{\lambda_{g,s}}{r+\delta_g(y)} \int_{R_{g,s}(R_s(y),y)} [w_g(x, y) - R_p(y)] \ dF_{X,g}(x|y)$

Formal sector firm's problem

Value of filled job

$$rJ_u(x, y) = x - w_p(x, y) - \delta_p(y)J_u(x, y)$$
$$rJ_s(x, x_s, y) = x - w_{p,s}(x, x_s, y) - \delta_p(y)J_s(x, x_s, y)$$

- no vacancy posting after job destruction

Value of private sector vacancy posting

$$rV = -c + q(k)\frac{u}{u+\psi s}\mathbb{E}_{FX,Y,p} \max\{J_u(x, y) - V, 0\}$$
$$+ q(k)\frac{\psi s}{u+\psi s}\mathbb{E}_{FX,X_s,Y,p} \max\{J_s(x, x_s, y) - V, 0\}$$

- vacancy posting cost c
- contacts per vacancy $q(k)$ (k is LM tightness)
- joint distribution of x_p, y among unemployed and self-employed by parental background (back)

Solve firm's problem: Vacancy posting

- assume free-entry $\rightarrow V = 0$

Vacancy posting condition

$c = q(k)\frac{u}{u+\psi s} \int \int_{R_p(y)} \frac{1-\beta}{r+\delta_p(y)}(x - R_p(y))dF_{X,p}(x|y)dF_Y(y|U)$

$\quad + q(k)\frac{\psi s}{u+\psi s}$

$\int \int_{R_s(y)} \int_{R_{ps}(x_s,y)} \frac{1-\beta}{r+\delta_p(y)}(x - R_{ps}(x_s,y))dF_{X,p}(x|y)dF_{X,s}(x_s|y)dF_Y(y|S)$

back

Steady state conditions

$$
\begin{aligned}
\delta_p(y)n_p(y) &= \lambda_p\left[1 - F_{X,p}(R_p(y)|y)\right]u(y) \\
&+ \lambda_{p,s}\int_{R_s(y)}\left[1 - F_{X,p}(R_{p,s}(x_s,y)|y)\right]dF_{X,s}(x_s|y)n_s(y) \\
\delta_g(y)n_g(y) &= \lambda_g\left[1 - F_{X,g}(R_g(y)|y)\right]u(y) \\
&+ \lambda_{g,s}\int_{R_s(y)}\left[1 - F_{X,g}(R_{p,s}(x_s,y)|y)\right]dF_{X,s}(x_s|y)n_s(y) \\
\delta_s(y)n_s(y) &= \lambda_s\left[1 - F_{X,s}(R_s(y)|y)\right]u(y) \\
&- \lambda_{p,s}\int_{R_s(y)}\left[1 - F_{X,p}(R_{p,s}(x_s,y)|y)\right]dF_{X,s}(x_s|y)n_s(y) \\
&- \lambda_{g,s}\int_{R_s(y)}\left[1 - F_{X,g}(R_{g,s}(x_s,y)|y)\right]dF_{X,s}(x_s|y)n_s(y) \\
1 &= n_p(y) + n_g(y) + n_s(y) + u(y)
\end{aligned}
$$

Map of West Africa

Identification

Parameter	Moment	#
Income/productivity distribution by sector $F_{x,j,y}$		
Public sector: $\mu_g(h)$, $\sigma_g(h)$	Mean & std. dev. of public income by education and background	20
Private sector: $\mu_p(h)$, $\sigma_p(h)$	Mean & std. dev. of private income by education and background	20
Self-employment: $\mu_s(h)$, $\sigma_s(h)$	Mean & std. dev. of self-employment income by education and background	20
	Mean of public and private income by education	10
	conditional on past self-employment	
Reservation wages, public minimum wage, search efficiency		
Reservation wage private sector: $R_{up}(h, k)$	1st percentile of private income by education and background	10
Public min. wage rule: $\underline{\omega}_h$	1st percentile of public income by education and background	10
Search efficiency in self-employment: ψ	1st percentile of self-employment income by education and background	10
Search efficiency with high parental background: ζ	same as above and sectoral shares by background as below	
Offer arrival and destruction rates		
Self-employment arrival rate: λ_s	Share of self-employment by education and background	10
Labour market tightness: κ	Share of public sector by education and background	10
Share of private vacancies: ϕ	Share of private sector by education and background	10
Destruction rates: $\delta_j(h)$	Mean employment duration by sector	3
	Unemployment rate by education and background	10
All above	Corrected 3-year transition rates by education	80
	Educational-background composition of each sector	40
Calibrated parameters		
Interest rate: $r = 0.10$		
Bargaining power worker: $\beta = 0.5$		
Matching elasticity: $\eta = 0.5$		
Matching efficiency: $A = 0.1$		
	Total moments	263

Goodness of fit: Unemployment
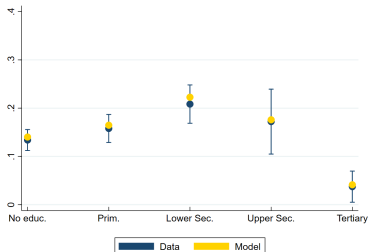
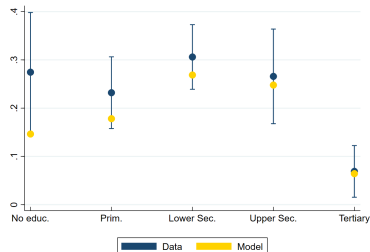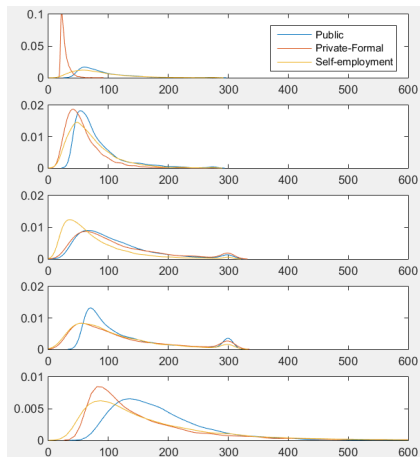Figure: Unemployment - low parental background k

Figure: Unemployment - high parental background k

back

back

Param.	Description	Value				
		no educ	prim	low sec	up sec	tert
$R_p(y)$	Res. prod. formal	20.2	12.0	25.1	24.9	61.6
$\pi(y)$	Public wage premium	13.2	14.4	2.3	16.5	4.4
$R_s(y)$	Res. prod. self-emp	18.0	7.6	14.9	14.3	45.8
$b(y)$	Unemployment flow	-68.9	-80.8	-95.9	-112.3	-156.2
β	Bargaining pow. (calib.)	0.5				
γ	Prod. in public (calib.)	0.5				

back

Results: Productivity parameters

	Public		Formal		Self	
	μ	σ	μ	σ	μ	σ
No education	4.52	0.68	3.03	0.56	4.28	0.53
Primary	4.39	0.69	4.49	0.55	4.12	0.52
Lower sec.	5.05	0.68	5.06	0.76	4.05	0.71
Higher sec.	4.21	1.19	5.06	0.87	4.49	0.67
Tertiary	5.57	0.52	5.06	0.88	4.80	0.71

back

Parameter	Description	Value
$q(k)/k$	Offer arrival rate	0.15
k	LM tightness	47.7
λ	Offer arrival rate self-employment	0.17
ϕ	Fraction formal-sector vacancies	0.56
ψ	Search efficiency in self-employment	0.14
v_g	Public-sector vacancies	0.25%
c	Vacancy cost	2496
	Mean wage private sector	88.6

back

Results: Destruction rates

Senegal: Destruction rates

back

Figure: Unemployment before and after policy
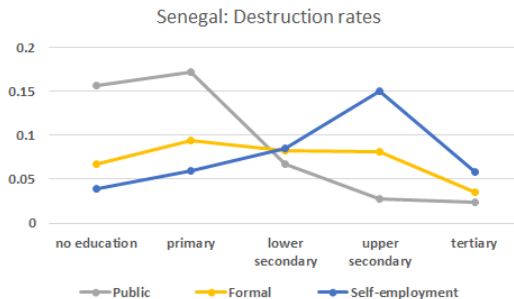
Policy simulations: Unemployment
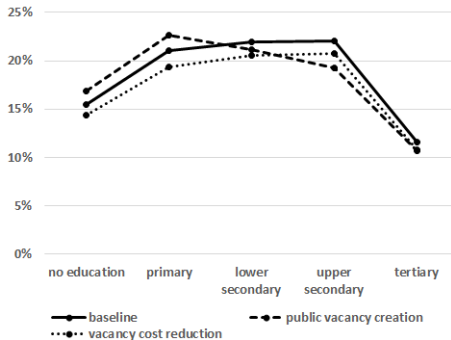
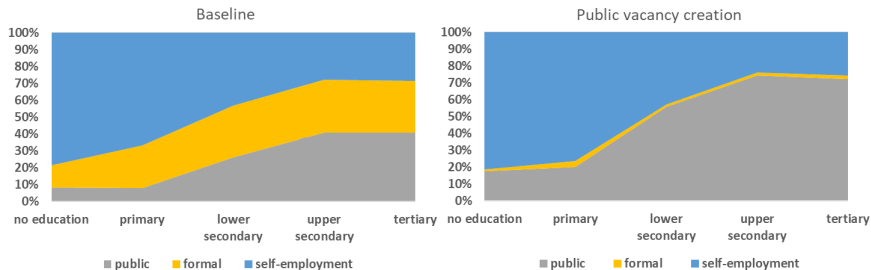Figure: Unemployment before and after policies

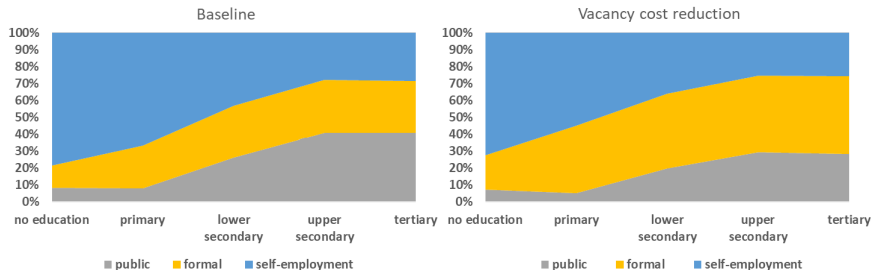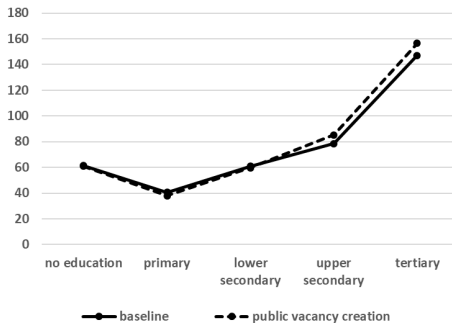Figure: Sectoral employment before and after policy

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Figure: Sectoral employment before and after policy

back

Policy simulations: Welfare (ex-post)
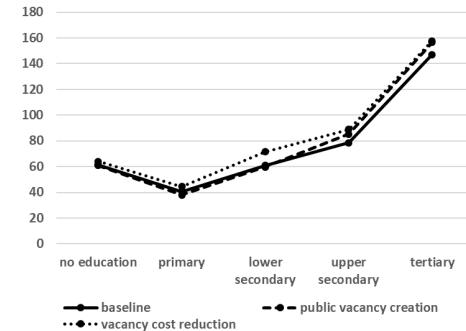

Figure: Welfare (ex-post) before and after policy

back

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back