Managers and Productivity Differences

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Motivation

- Understanding cross-country income differences remains to be the Holy Grail of economics.
- Development accounting exercises suggest that productivity differences are key.
- Growing body of work emphasizes differences in management practices as a sources of productivity differences across countries.
    - Bloom and Van Reenen (2011), Bloom, Genakos, Sadun and Van Reenen (2012), Bloom, Sadun and Van Reenen (2013).
- How to interpret differences in management practices?

This Paper

- We document that age-earnings profiles of managers are steeper than those for non-managers.
- There are important cross country differences in the steepness of age-earnings profiles for managers.
  - Profiles are steeper in countries with higher GDP per worker.
  - Profiles are also steeper in countries with better management practices.
- We study a life-cycle version of Lucas (1978) span-of-control model along a balanced growth path to interpret these facts:
  - managers can invest in their managerial abilities
  - steepness of age-earnings profiles depends on incentives of managers to invest in their skills
  - distribution of managerial abilities is endogenous
- Differences in management practices reflect the fact that some individuals have better managerial skills.

This Paper

- Managers invest part of their income to enhance their skills
  - Goods are used to produce new skills.
  - Goods and current skills are complementary in skill production.
- More able managers have larger incentives to invest and affected more by distortions
- Amplification
  - Atkeson and Burstein (2010, 2011), Erosa, Koreshkova and Restuccia (2010), Manuelli and Seshadri (2010), Rubini (2011), Cubas, Ravikumar and Ventura (2013), Gabler and Poschke (2013)

What we do

- Study effect of cross country differences in exogenous aggregate productivity levels
  - Bhattacharya, Guner and Ventura (2013), Roys and Seshadri (2014), Poschke (2014)
- Study the role of distortions (implicit output taxes)
  - Restuccia and Rogerson (2008) and Guner, Ventura and Yi (2008)
  - Reallocation effect: resources (capital and labor) will move from more productive to less productive establishments.
  - Skill investment effect: managers choose to invest less to improve their skills.
- Interaction between differences in aggregate productivity and distortions

Managerial Earnings

- Use large cross sectional data sets for a group of high income countries to estimate

$$\ln y_{it} = \alpha + \beta_1 a_{it} + \beta_2 a_{it}^2 + \gamma_t + \phi\ e_i + \varepsilon_{it},$$

  - y_{it} : earnings of individual i in period t.
  - a : age
  - e : college dummy
  - γ_t : time fixed effect

- Estimate this equation for managers and non-managers separately.

- Focus on age-earnings profiles implied by β_1 and β_2.

- Lagakos, Moll, Porzio and Qian (2013).

- We have 20 countries in our sample
  - USA – Census (1990, 2000, 2005, 2010)
  - Canada – Canadian Census (1981, 1991, 2001)
  - Australia – Survey of Income and Housing Costs (1995, 2001, 2003, 2008, 2010)
  - Israel – Household Expenditure Survey (2001,2005,2007,2010)
  - Austria, Belgium, Denmark, Finland, France, Germany, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Spain, Sweden, Switzerland, UK – European Union Statistics on Income and Living Conditions (2004-2012)

- Restrict sample to ages 25 to 64
- Earnings as sum of wage and salary income plus self-employment income.
- Use reported occupations to separate managers and non-managers.
- Key measure is income growth for managers relative to non-managers

$$\hat{g} = \ln\left(\frac{\frac{\text{income manager, 50-54}}{\text{income manager, 25-29}}}{\frac{\text{income non manager, 50-54}}{\text{income non manager, 25-29}}}\right)$$

Managerial Earnings

Who is a manager?

Austria, Belgium, Denmark, Finland, France, Germany, Iceland, Ireland, Luxembourg, Netherlands, Norway, Spain, Sweden, Switzerland, UK

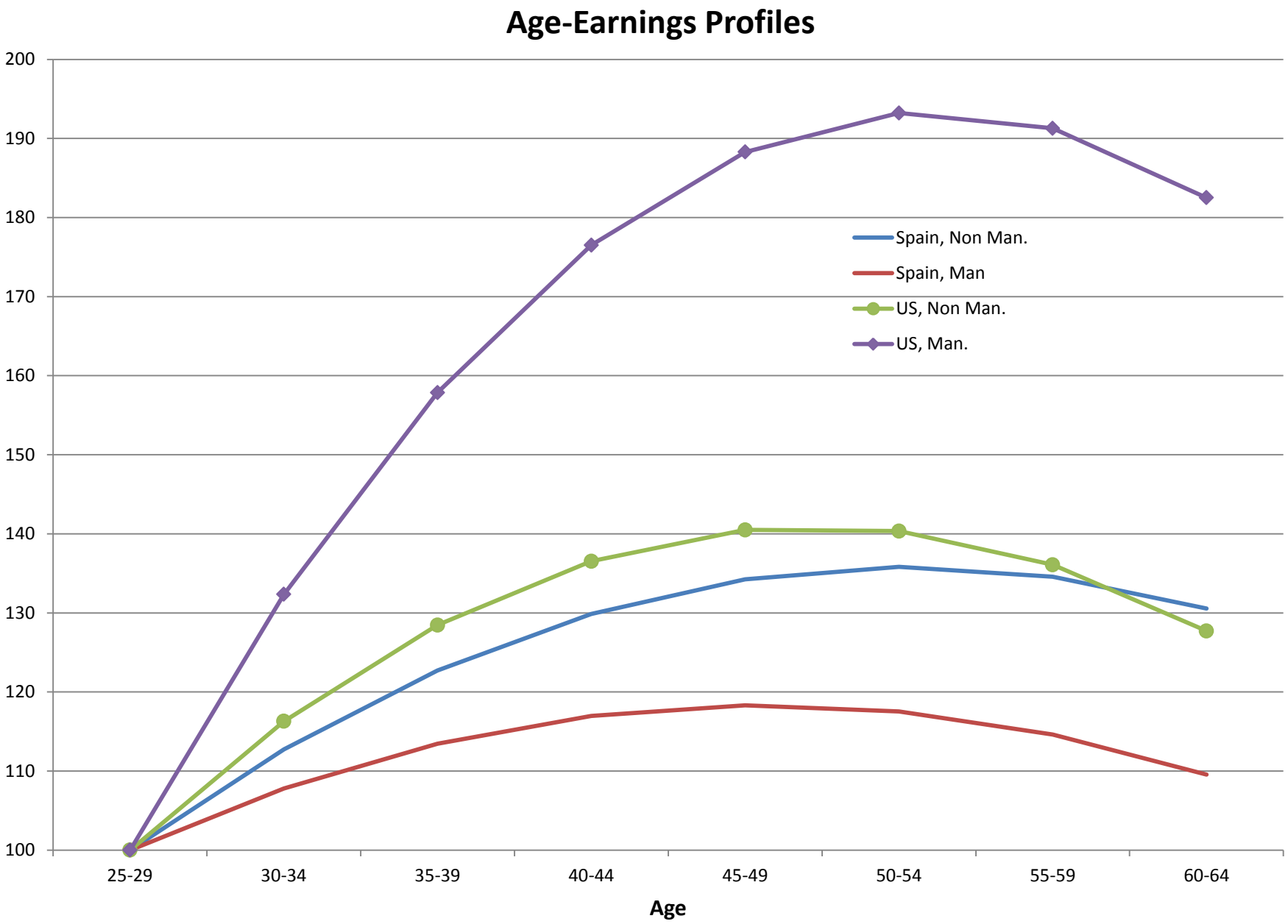
Legislators, senior officials and managers

Corporate managers

Managers of small enterprises

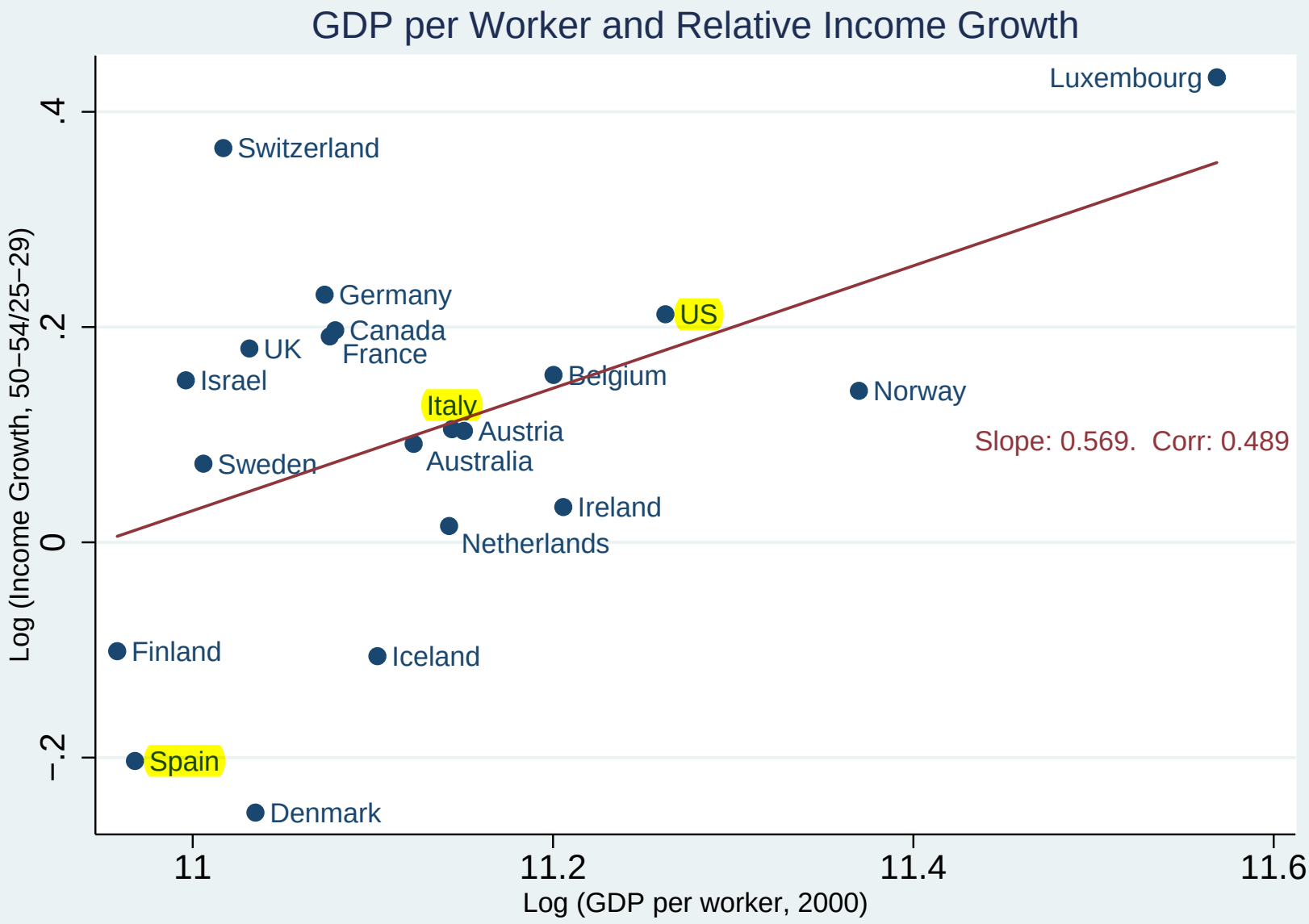
US

Legislators, Chief executives and public administrators, Financial managers, Human resources and labor relations managers,
Managers and Specialists in marketing,
advertising, and public relations, Man. in educ. and related fields, Man. of medicine and health occupations, Postmasters and mail superintendents,
Managers of food services and lodging occupations,
Managers of properties and real estate, Funeral directors,
Managers of service organizations, Managers and administrators

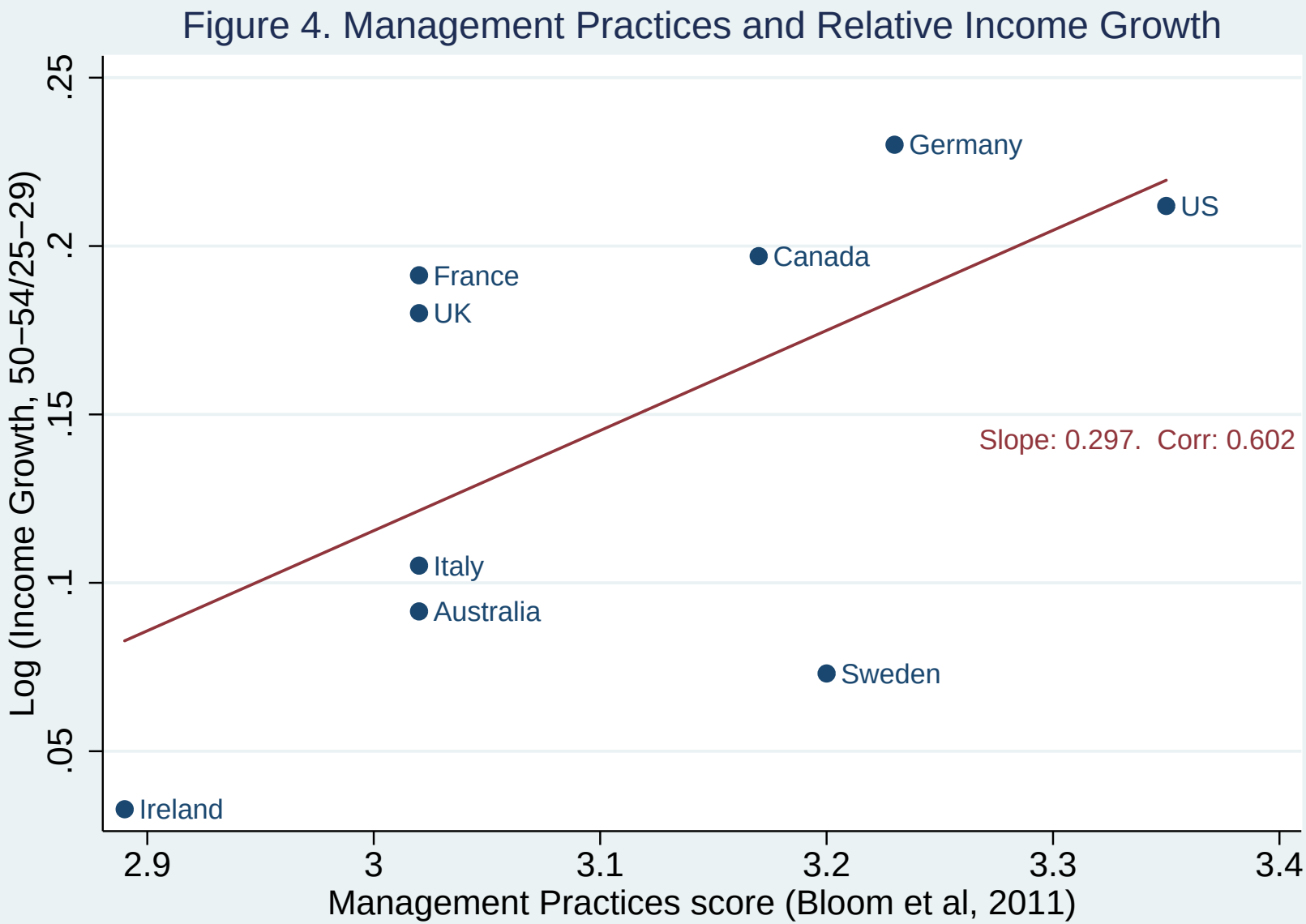

Age-Earnings Profiles
200
190
180
170
160
150
140
130
120
110
100
25-29
30-34
35-39
40-44
45-49
50-54
55-59
60-64
Age
Spain, Non Man.
Spain, Man
US, Non Man.
US, Man.

- Relative income growth for managers is higher in richer countries.
- Relative income growth for managers is higher in countries with better management practices.

Relative Slopes Across Countries



Relative Slopes and Managerial Practices



Robustness

- Finding robust to consideration of different subsamples (e.g. exclude self-employed) and income definitions (e.g. using only wage and salary income)
- Finding robust to consideration of country-size weights.
- Finding are robust to controlling for individual working in the finance sector.
- It is specific to managers.
    - It does not hold for self employed versus non managers, nor for professionals versus non managers, nor for college to non-college individuals.

- Life-cycle economy along *a balanced growth path*.
- Heterogenous individuals, all born with an initial endowment of managerial ability, $z_1(t) = G_z(t)\ z$.
  - z is drawn from a cumulative distribution $F(z)$
  - $G_z(t)$ grows at rate $1 + g_z$
- Individuals can be workers or managers.
- Workers earn wage w.
- Managers operate Lucas (1978) technology. They rent capital and labor services, produce output and collect managerial rents.
- Occupational choice takes place at start of life, and it is irreversible – extension with a model of occupational transitions.

- Workers decide how much to consume and how much to save.
- Managers decide how much to consume and how much to save.
- Managers also decide how many workers and how much capital to hire each period and how much to invest in their skills.
- All agents are born without any assets.
- There are no borrowing constraints.

- Production in each plant

$$y(t) = A(t)z^{1-\gamma}(k^{\alpha}n^{1-\alpha})^{\gamma}$$

  - $A(t) = \overline{A}G_A(t)-$ economy-wide productivity level, $G_A(t)$ grows at rate $1 + g_A$
  - $\gamma-$ span of control parameter

- Managers can enhance future skills

$$z_{j+1}(t+1) = (1-\delta_z)z_j(t) + \underbrace{B(j)z_j(t)^{\theta_1}x_j(t)^{\theta_2}}_{g(z,x,j)}$$

  - $x-$ goods invested in skills
  - $\theta_1 > 0$ and $0 < \theta_2 < 1$
  - Complementarity between current ability and investments.
  - $B(j) = (1-\delta_\theta)B(j-1)$, with $B(1) = \theta$

- Managerial income for a manager with ability z at date t is given by

$$\pi(z, r, w, A, t) \equiv \max_{n,k}\{A(t)z^{1-\gamma}\left(k^{\alpha}n^{1-\alpha}\right)^{\gamma} - w(t)n - (r(t)+\delta)k\}$$

- Factor demands and profits are linear in z

$$\frac{k(z', r, w, A, t)}{k(z, r, w, A, t)} = \frac{n(z', r, w, A, t)}{n(z, r, w, A, t)} = \frac{\pi(z', r, w, A, t)}{\pi(z, r, w, A, t)} = \frac{z'}{z}.$$

- The problem of the manager is

$$\max_{c_j(t),\, a_j(t), x_j(t)} \sum_{j=1}^{J} \beta^{j-1} \log(c_j),$$

subject to

$$c_j(t) + x_j(t) + a_{j+1}(t+1) = \pi(z, r, w, A, t) + (1 + r(t))a_j(t),$$

$$c_j(t) + a_{j+1}(t+1) = (1 + r(t))a_j(t), \qquad j \geq J_R,$$

and

$$z_{j+1}(t+1) = (1 - \delta_z)z_j(t) + B(j)z_j(t)^{\theta_1}x_j(t)^{\theta_2},\ j < J_R - 2$$

with $a_{J+1}(.) = 0$.

- Standard Euler equation for asset accumulation

$$\frac{1}{c_j(t)} = \beta(1 + r(t+1))\frac{1}{c_{j+1}(t+1)}.$$

- Skill investment

$$\underbrace{(1 + r(t+1))}_{\text{marginal cost}} = \underbrace{\pi_z\,(t+1)\,g_x(t) + \frac{g_x(t)}{g_x(t+1)}[1 + g_z(t+1) - \delta_z]}_{\text{marginal benefit}},$$

- Given the functional forms,
  - Managers with higher abilities invest more
  - Potential for amplification of initial managerial skills

Decisions

- Focus on stationary equilibria.
- At start of life, given their initial managerial ability, individuals choose to be either workers or managers.
- There is a threshold value such that those with $z \geq z^*$ become managers, and those with $z < z^*$become workers.
- Details – Balanced Growth Path

- Aggregate managerial skills per manager, $\hat{Z}$.

$$\hat{Z} \equiv \frac{\sum_{j=1}^{J_R-1} \mu_j \int_{z^*}^{\overline{z}} z f_j(z) dz}{\hat{M}},$$

where $\hat{M}$ is the number of managers in equilibrium.

- Changes in managerial quality in response to changes in the environment are determined by changes in
  - the number of managers (i.e. changes in z^*)
  - changes in the distribution of skills

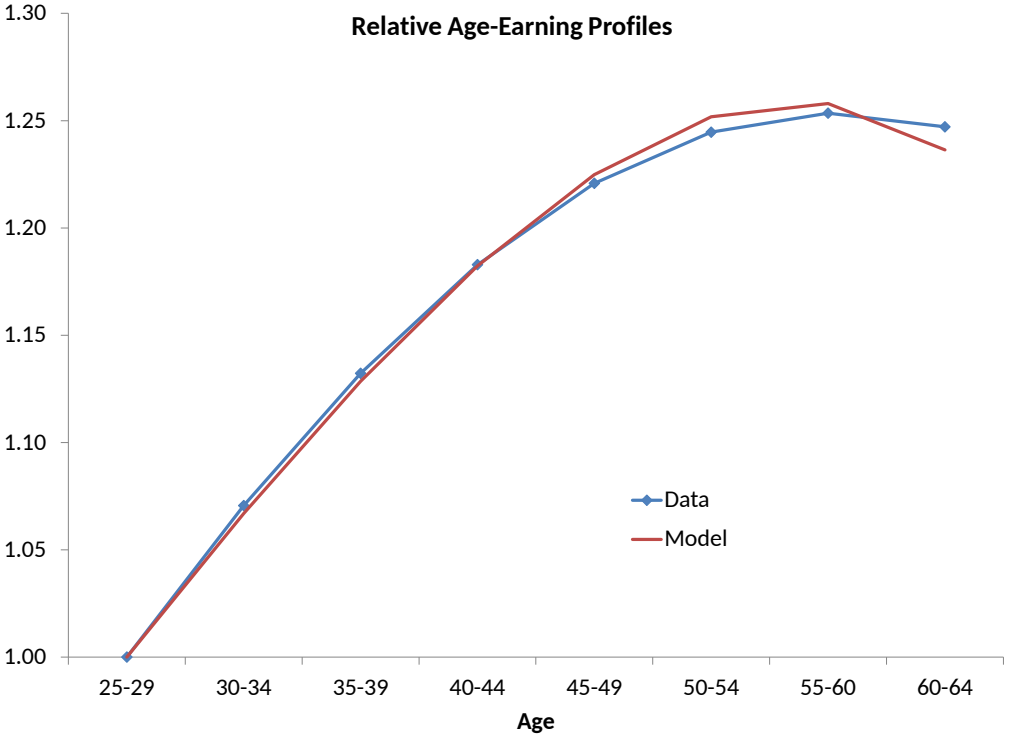
Benchmark Economy

- Model period: 5 years. Agents live for 11 model period (8 as workers and 3 as retirees).
- Log-normal distribution of initial ability, (μ_z, σ_z)
- Take the population growth rate (n) and the depreciation rate (δ) from the data.
- Normalize $\mu_z = 0$ and set $A = 1$.
- Select δ_z based on the decline of managerial earnings between ages 55-59 to 60-64 in the data.
- There are 8 parameters $\{\beta, \gamma, \alpha, \sigma_z, \theta_1, \theta_2, \delta_\theta, \theta\}$.
- Note that $\gamma\alpha$ is the capital share.
- Calibrate $\{\beta, \gamma, \sigma_z, \theta_1, \theta_2, \delta_\theta, \theta\}$ to hit 7 targets.

Benchmark Economy

- Calibrate $\{\beta, \gamma, \sigma_z, \theta_1, \theta_2, \delta_\theta, \theta\}$ to hit 7 targets.
- KEY:
  - Replicate earnings of managers to non managers over the life cycle
  - Properties of plant-size distribution.

Statistic	Data	Model
Mean Size	17.9	17.7
Capital Output Ratio	2.32	2.31
Managerial Income (40-44/25-29)	1.18	1.18
Managerial Income (60-64/25-29)	1.25	1.24
Fraction of Establishments		
1-9 workers	0.725	0.726
10-20 workers	0.126	0.128
20-50 workers	0.091	0.085
50-100 workers	0.032	0.031
100+ workers	0.026	0.030
Employment Share		
1-9 workers	0.151	0.172
10-20 workers	0.094	0.100
20-50 workers	0.164	0.148
50-100 workers	0.128	0.121
100+ workers	0.462	0.459


Relative Age-Earning Profiles
1.30
1.25
1.20
1.15
1.10
1.05
1.00
25-29
30-34
35-39
40-44
45-49
50-54
55-60
60-64
Age
Data
Model

Parameter Values (annualized)

Parameter	values
Population Growth Rate (g_N)	0.011
Productivity Growth Rate (g)	0.025
Depreciation Rate (δ)	0.040
Importance of Capital (α)	0.423
Returns to Scale (γ)	0.77
Mean Log-managerial Ability (μ_z)	0
Dispersion in Log-managerial Ability (σ_z)	2.875
Discount Factor (β)	0.944
Skill accumulation technology (θ)	0.881
Skill accumulation technology (δ_θ)	0.053
Skill accumulation technology (θ_1)	0.68
Skill accumulation technology (θ_2)	0.49
Skill accumulation technology (δ_z)	0.048

Effect of Economy-Wide Productivity

- What are the effects of changes in economy-wide productivity?

Economy-Wide Productivity	$\overline{A} = 1$	$\overline{A} = 0.9$	$\overline{A} = 0.8$	$\overline{A} = 0.7$
Statistic				
Output	100	84.5	70.2	56.9
Mean Size	17.7	17.2	17.0	16.0
Investment in Skills	100	73.3	52.1	35.3
Investment in Skills (% Output)	0.92	0.80	0.68	0.57
Number of Managers	100	102.9	102.9	105.8
Managerial Quality	100	93.6	90.1	84.6
Employment Share (100+)	0.46	0.45	0.44	0.43
Relative Earnings Growth ($\hat{g}$)	0.22	0.16	0.11	0.05

Size-Dependent Distortions

- We model distortions as size-dependent output taxes.
- An establishment with out put y faces an average tax rate

$$T(y) = 1 - \lambda y^{-\tau}$$

  - $\tau = 0$, all establishments pay $(1 - \lambda)$.
  - $\tau > 0$, the distortions are size-dependent

- With distortions,

$$\frac{k(z',.)}{k(z,.)} = \frac{n(z',.)}{n(z,.)} = \frac{\pi(z',.)}{\pi(z,.)} = \left(\frac{z'}{z}\right)^{\frac{(1-\gamma)(1-\tau)}{1-\gamma(1-\tau)}},$$

where

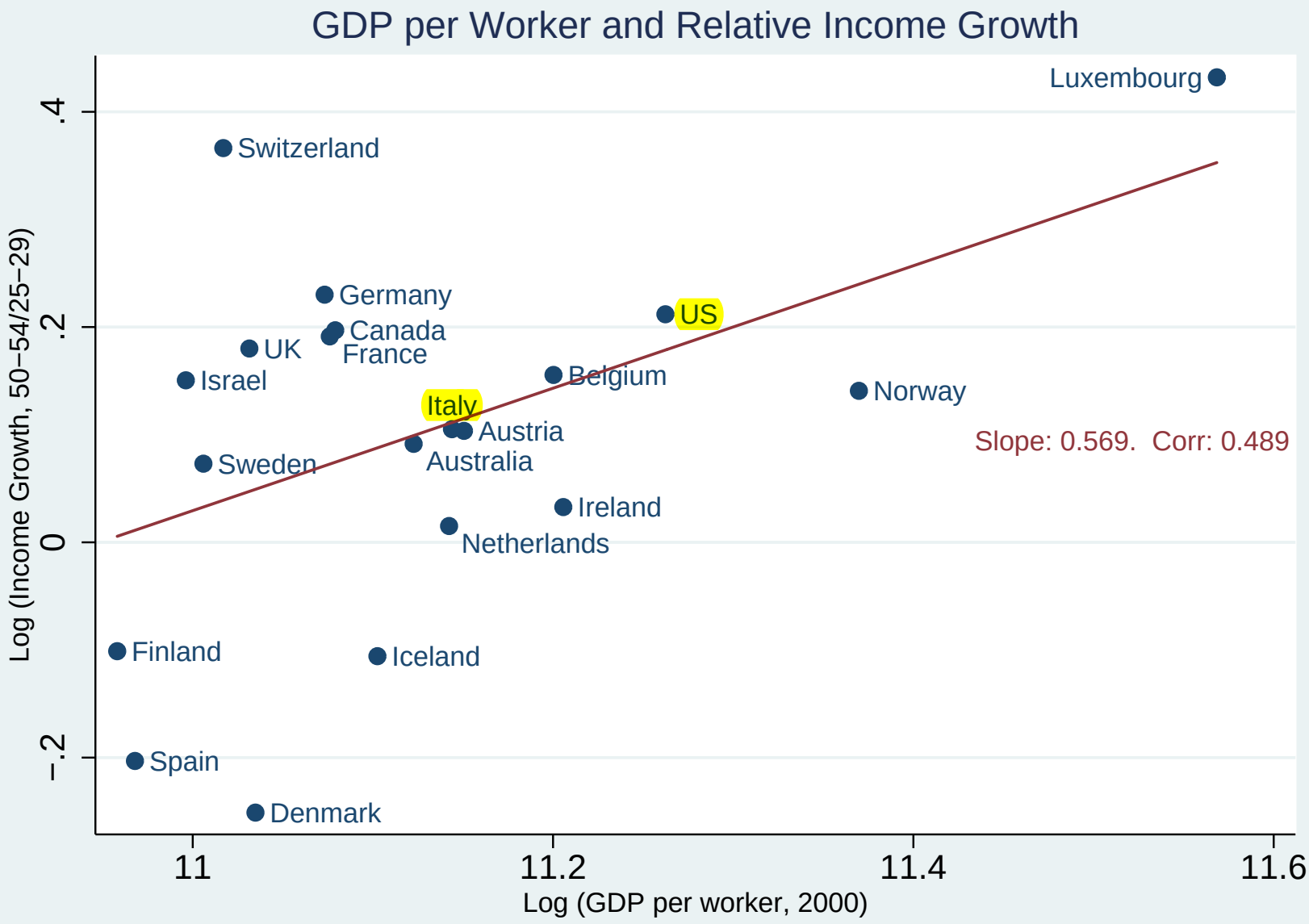
$$\frac{(1-\gamma)(1-\tau)}{1-\gamma(1-\tau)} < 1 \text{ for } \tau > 0.$$

  - size-dependent distortions produce a more compressed size distribution of establishments and managerial incomes.

Effects of Size-Dependent Distortions

Size Dependency (τ)	0	0.02	0.04	0.06	0.08
Tax Wedge $\left(\frac{1-T(5\overline{y})}{1-T(y)}\right)$	1	0.97	0.94	0.91	0.88
Statistic					
Output	100.0	92.9	86.7	81.3	76.2
Mean Size	17.7	13.2	10.2	8.2	6.8
Investment in Skills	100.0	62.1	41.6	29.6	22.1
Investment in Skills (% Output)	0.92	0.61	0.44	0.33	0.27
Number of Managers	100.0	131.9	166.9	203.4	239.8
Managerial Quality	100.0	73.2	56.6	45.6	38.2
Employment Share (100+)	0.46	0.34	0.25	0.17	0.11
Relative Earnings Growth $(\hat{g})$	0.22	0.09	0.02	-0.02	-0.05

Relative Slopes Across Countries



Distortions versus Productivity Differences

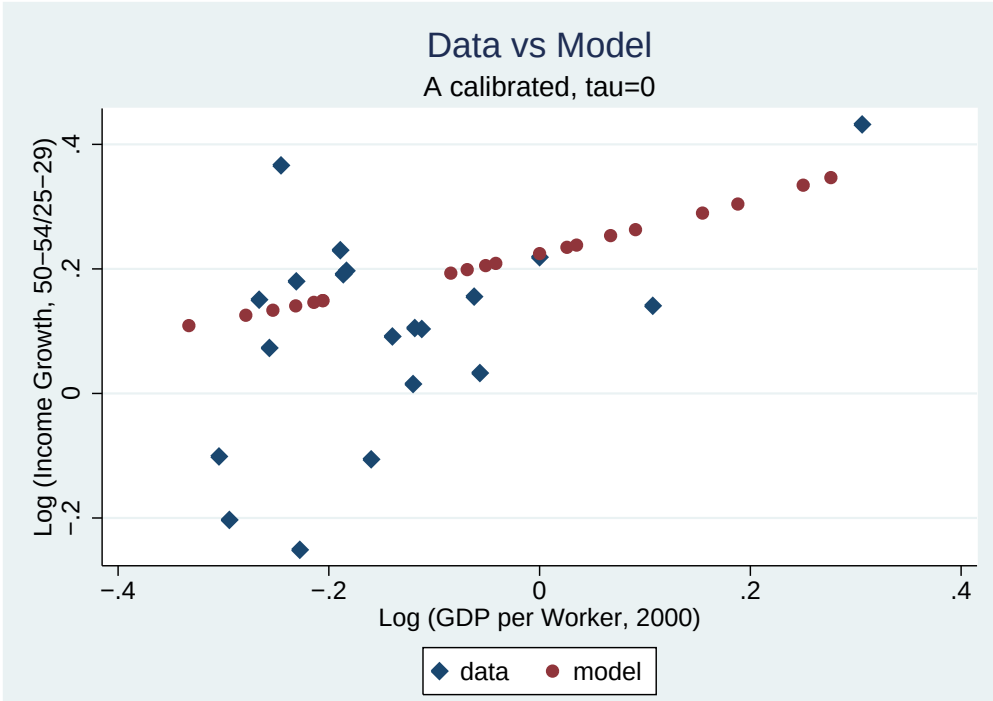
- Question: What is contribution of differences in economy-wide productivity versus distortions in accounting for output and earnings of managers to non-managers differences?

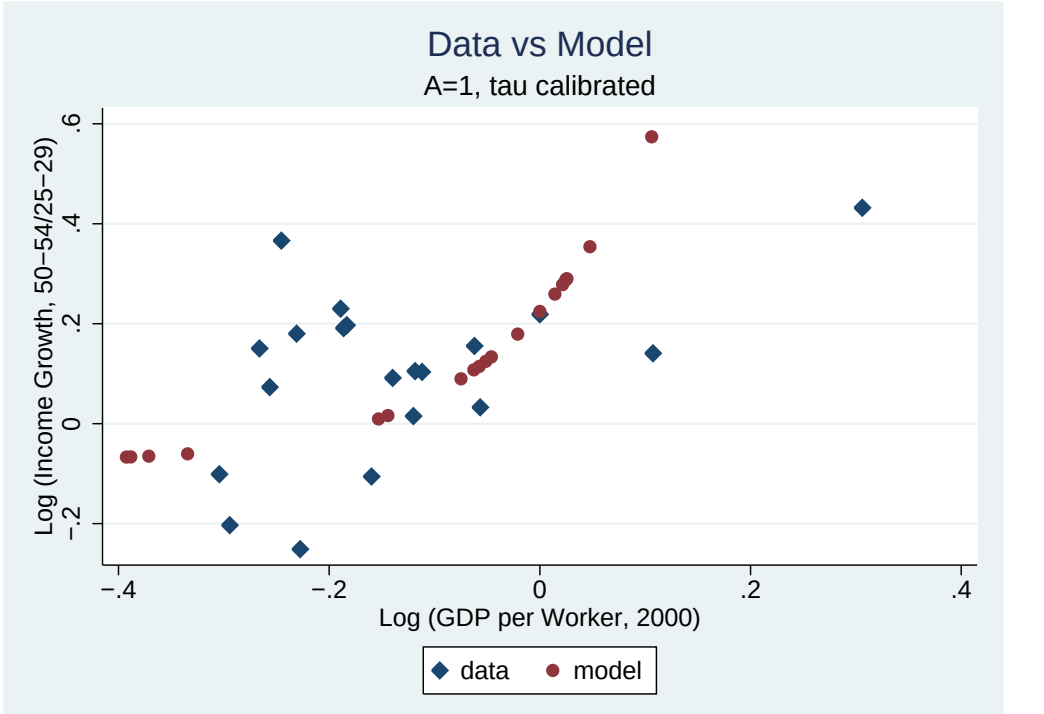
- Cross-country exercise: select $\overline{A}$ and $\overline{\tau}$ for each country to reproduce
  - output per worker
  - relative earnings slopes.

- Mean value of $\overline{A}$ is 0.978 and the mean value of $\tau = 0.028$.
- $\tau = 0.028$ implies an establishment that is 5 time larger than the mean faces 4% points higher taxes.

Distortions versus Productivity Differences

- DATA: Slope coefficient $(\widehat{g}, log(Y)) = 0.57$
- ONLY $\overline{A}$ differences (set $\tau = 0$). Slope coefficient $(\widehat{g}, log(Y)) = 0.39$.
- ONLY distortions (set $\overline{A} = 1$). Slope coefficient $(\widehat{g}, log(Y)) = 0.90$.
- Distortions are critical to generate cross-country variation in earnings of managers to non-managers over the life cycle.
- Distortions account for about 42% of output per worker gaps in the data.


Data vs Model
A calibrated, tau=0
Log (Income Growth, 50−54/25−29)
−.2
0
.2
.4
−.4
−.2
0
.2
.4
Log (GDP per Worker, 2000)
data
model


Data vs Model
A=1, tau calibrated
Log (Income Growth, 50−54/25−29)
−.2
0
.2
.4
.6
−.4
−.2
0
.2
.4
Log (GDP per Worker, 2000)
data
model

Conclusions

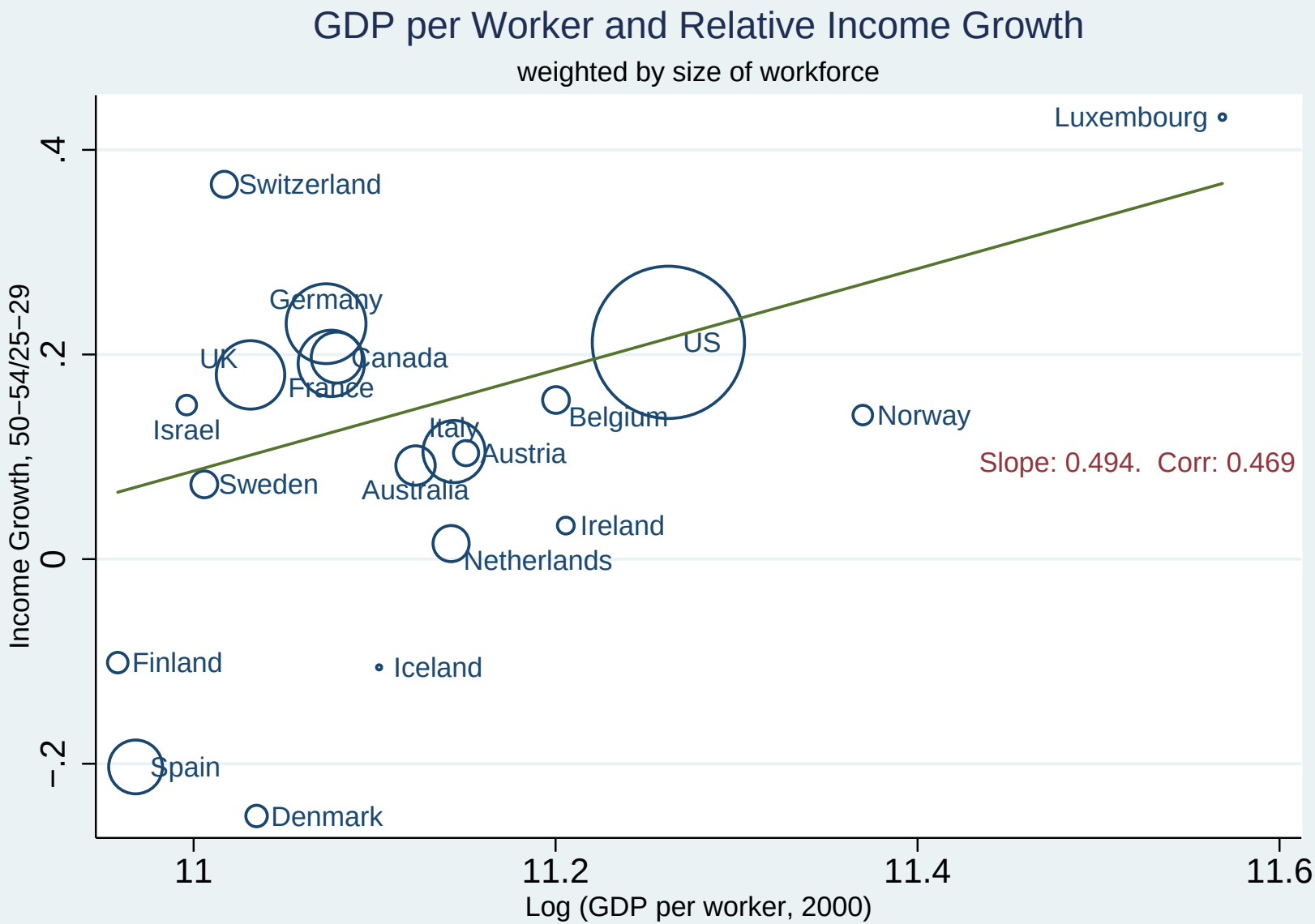
- We document that earnings of managers grow faster with age than earnings of non managers in richer countries. We use a life-cycle, span-of-control model to interpret these facts.

- KEY: Managers invest in their managerial abilities.

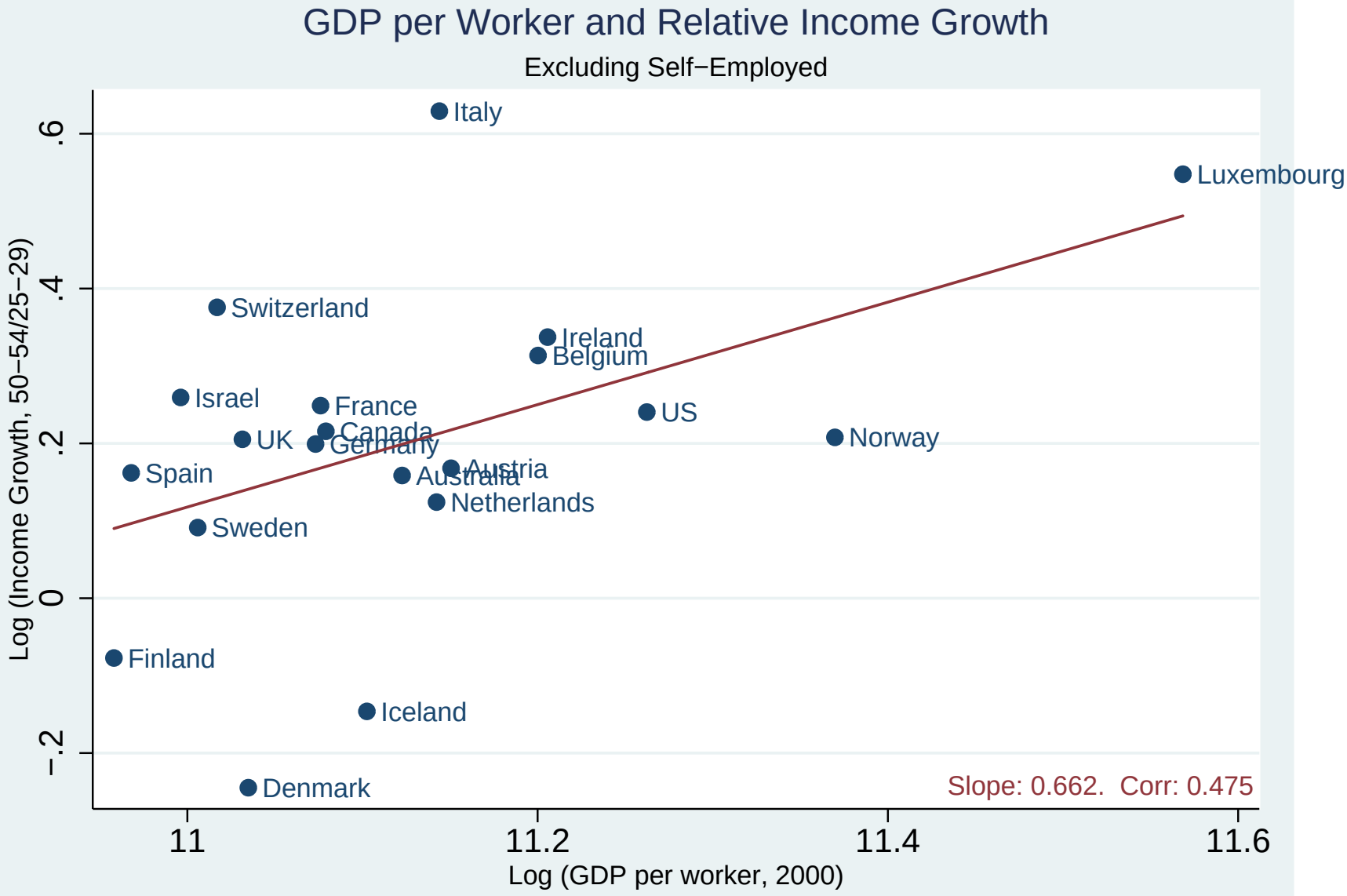
  Distribution of managerial abilities (plant productivity) is endogenous.
  Distortions lead to significant effects on managerial quality.

- Distortions are critical in generating differences in earnings between managers and non managers.

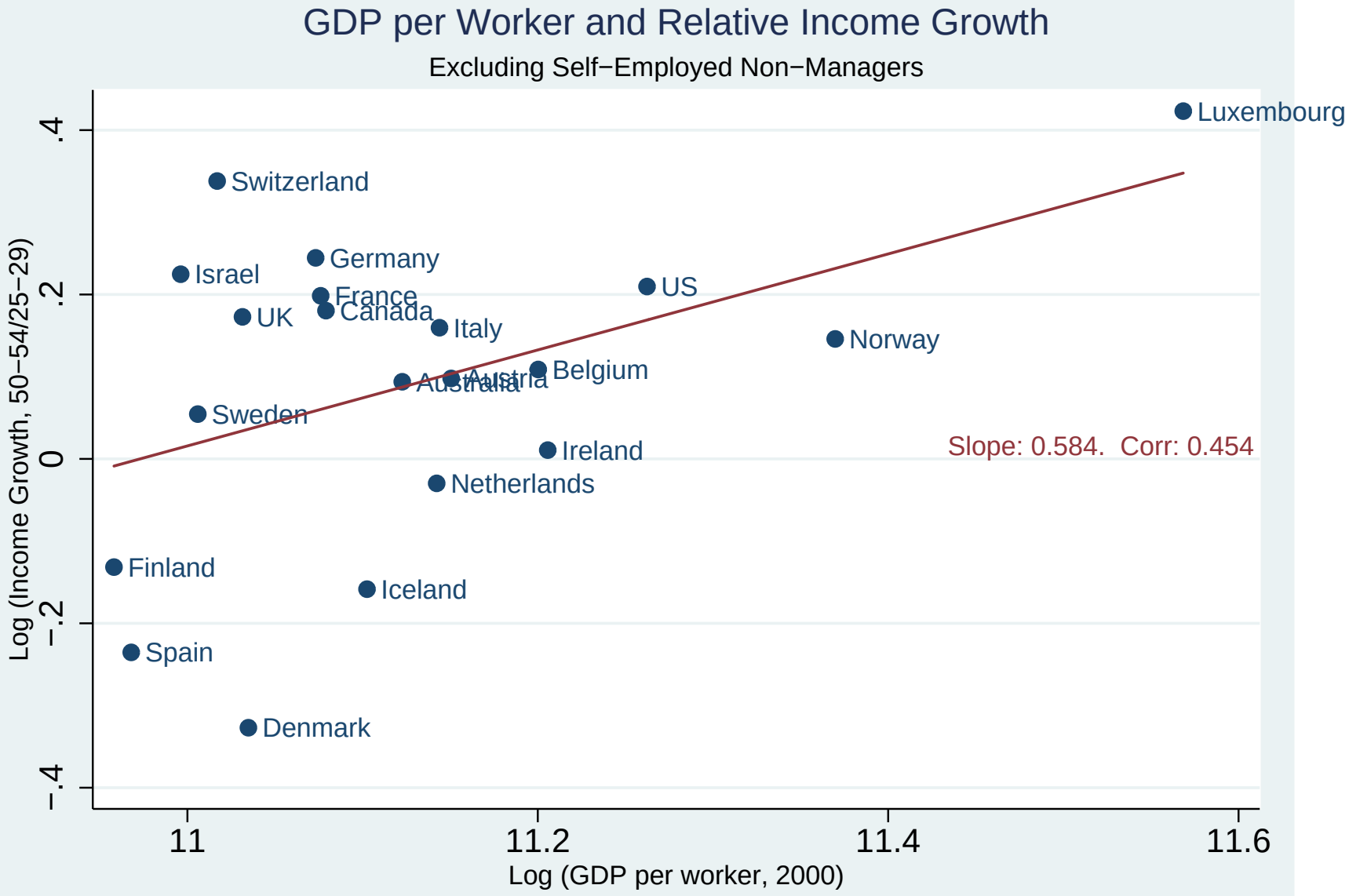
Robustness


GDP per Worker and Relative Income Growth
weighted by size of workforce
Luxembourg
Switzerland
Germany
US
UK
Canada
France
Israel
Belgium
Norway
Italy
Austria
Slope: 0.494. Corr: 0.469
Sweden
Australia
Ireland
Netherlands
Finland
Iceland
Spain
Denmark
Income Growth, 50−54/25−29
.4
.2
0
−.2
11
11.2
11.4
11.6
Log (GDP per worker, 2000)

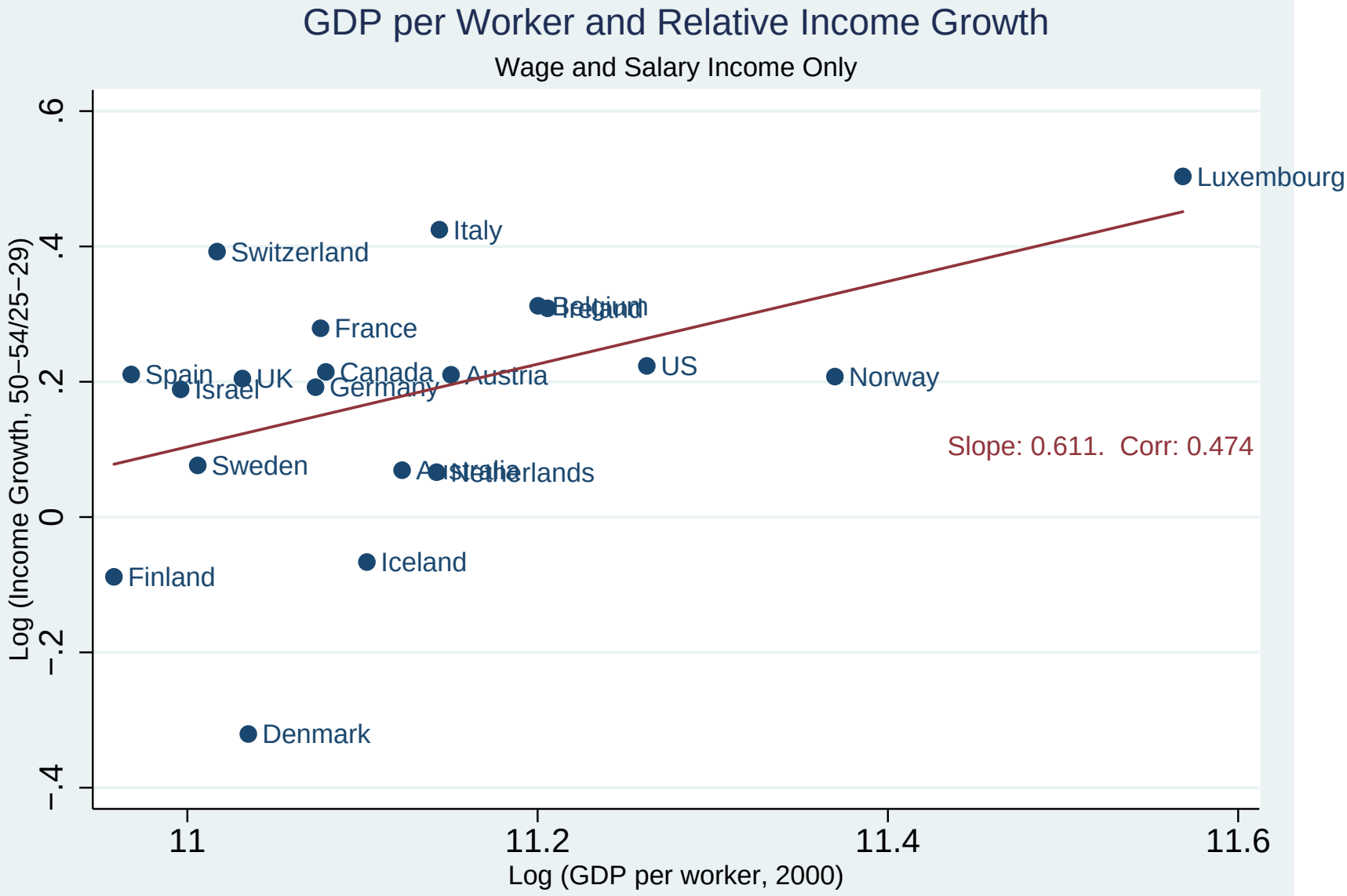
Robustness


GDP per Worker and Relative Income Growth
Excluding Self−Employed
Log (Income Growth, 50−54/25−29)
−.2
0
.2
.4
.6
Italy
Luxembourg
Switzerland
Ireland
Belgium
Israel
France
US
Canada
UK
Germany
Norway
Spain
Austria
Australia
Netherlands
Sweden
Finland
Iceland
Denmark
Slope: 0.662. Corr: 0.475
11
11.2
11.4
11.6
Log (GDP per worker, 2000)

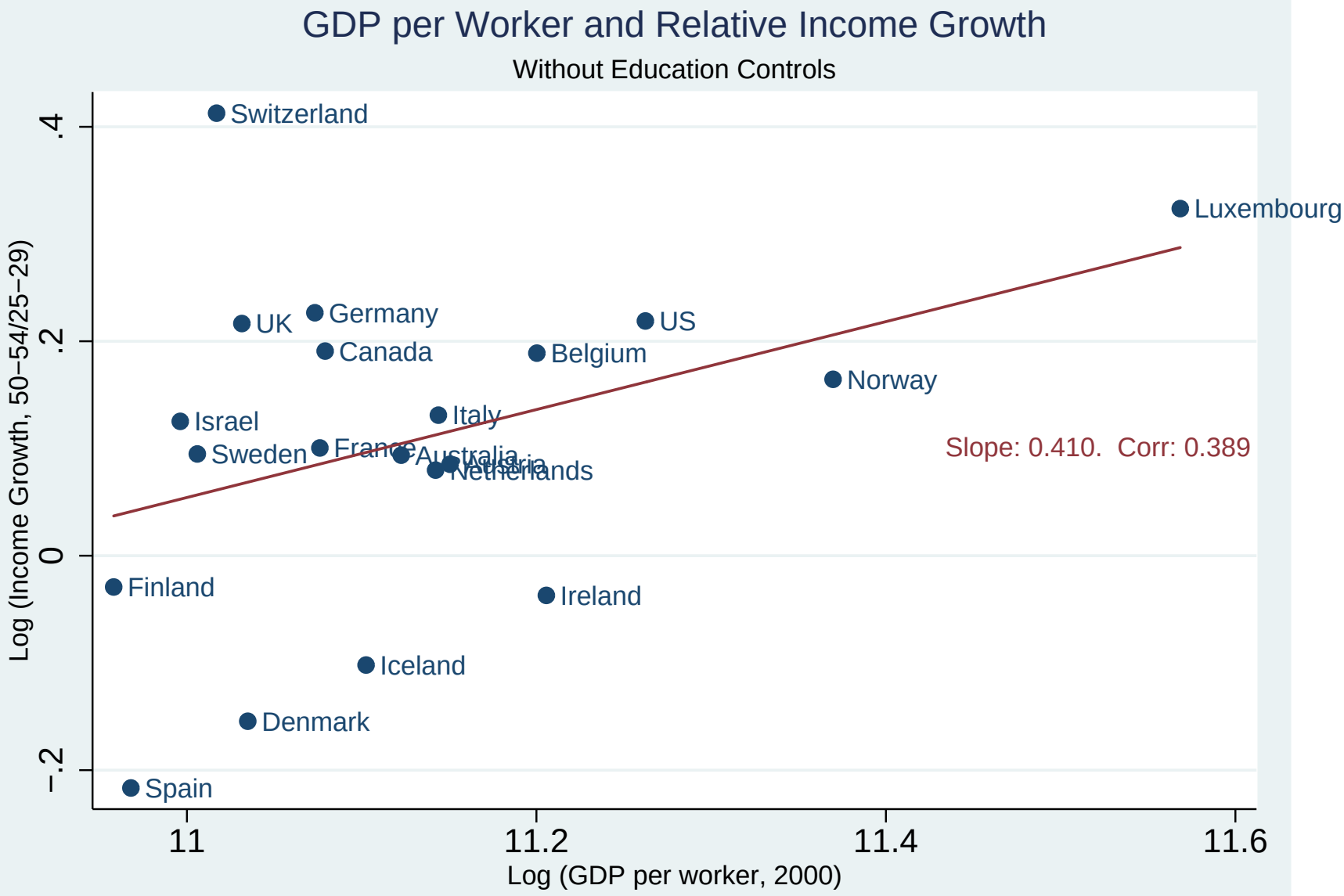
Robustness


GDP per Worker and Relative Income Growth
Excluding Self−Employed Non−Managers
Log (Income Growth, 50−54/25−29)
.4
.2
0
−.2
−.4
11
11.2
11.4
11.6
Log (GDP per worker, 2000)
Luxembourg
Switzerland
Germany
Israel
France
US
UK
Canada
Italy
Norway
Belgium
Austria
Australia
Sweden
Ireland
Slope: 0.584. Corr: 0.454
Netherlands
Finland
Iceland
Spain
Denmark

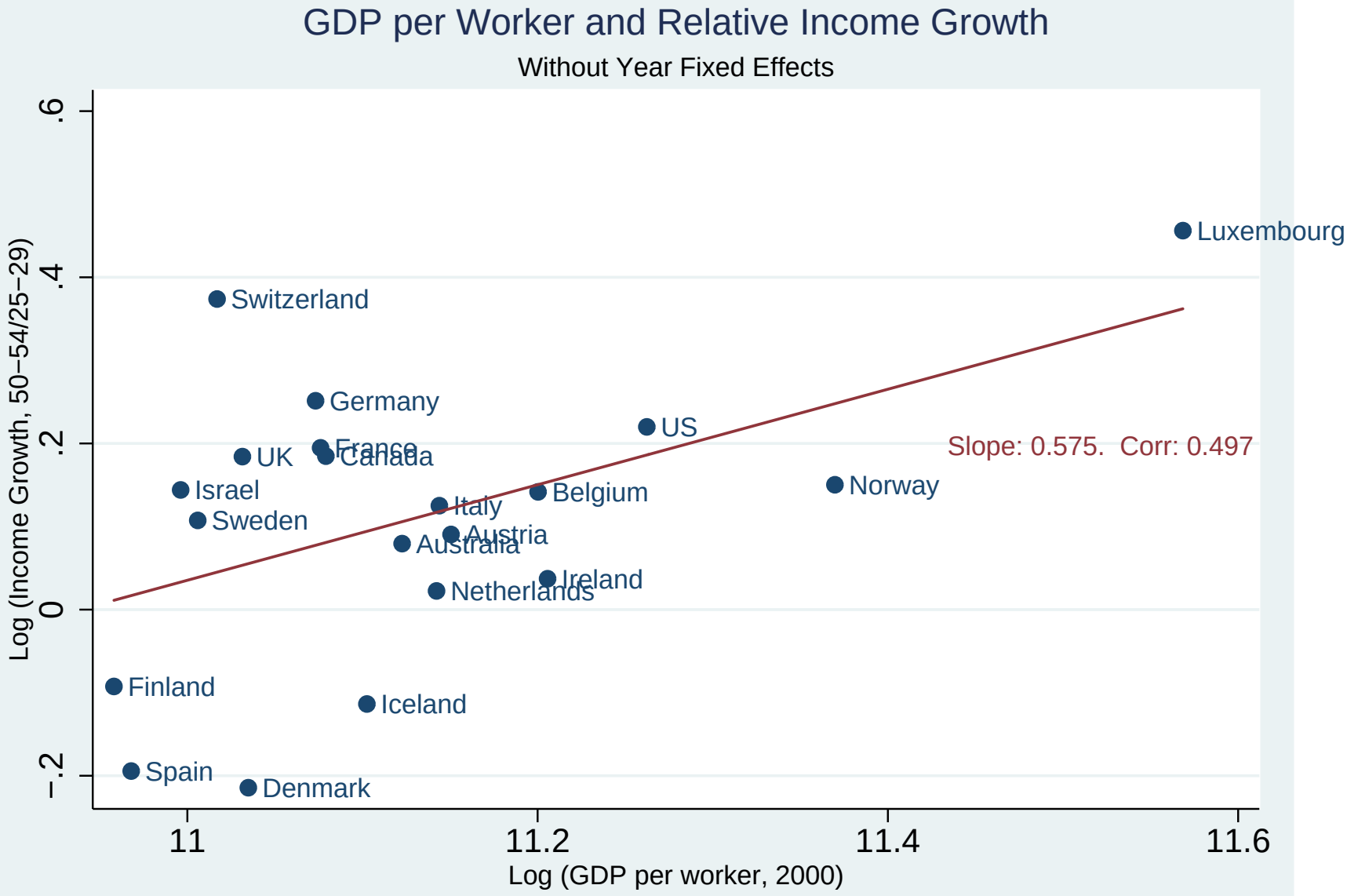
Robustness


GDP per Worker and Relative Income Growth
Wage and Salary Income Only
Log (Income Growth, 50−54/25−29)
.6
.4
.2
0
−.2
−.4
11
11.2
11.4
11.6
Log (GDP per worker, 2000)
Luxembourg
Italy
Switzerland
Belgium
Ireland
France
Spain
UK
Canada
Austria
US
Norway
Israel
Germany
Slope: 0.611. Corr: 0.474
Sweden
Australia
Netherlands
Iceland
Finland
Denmark

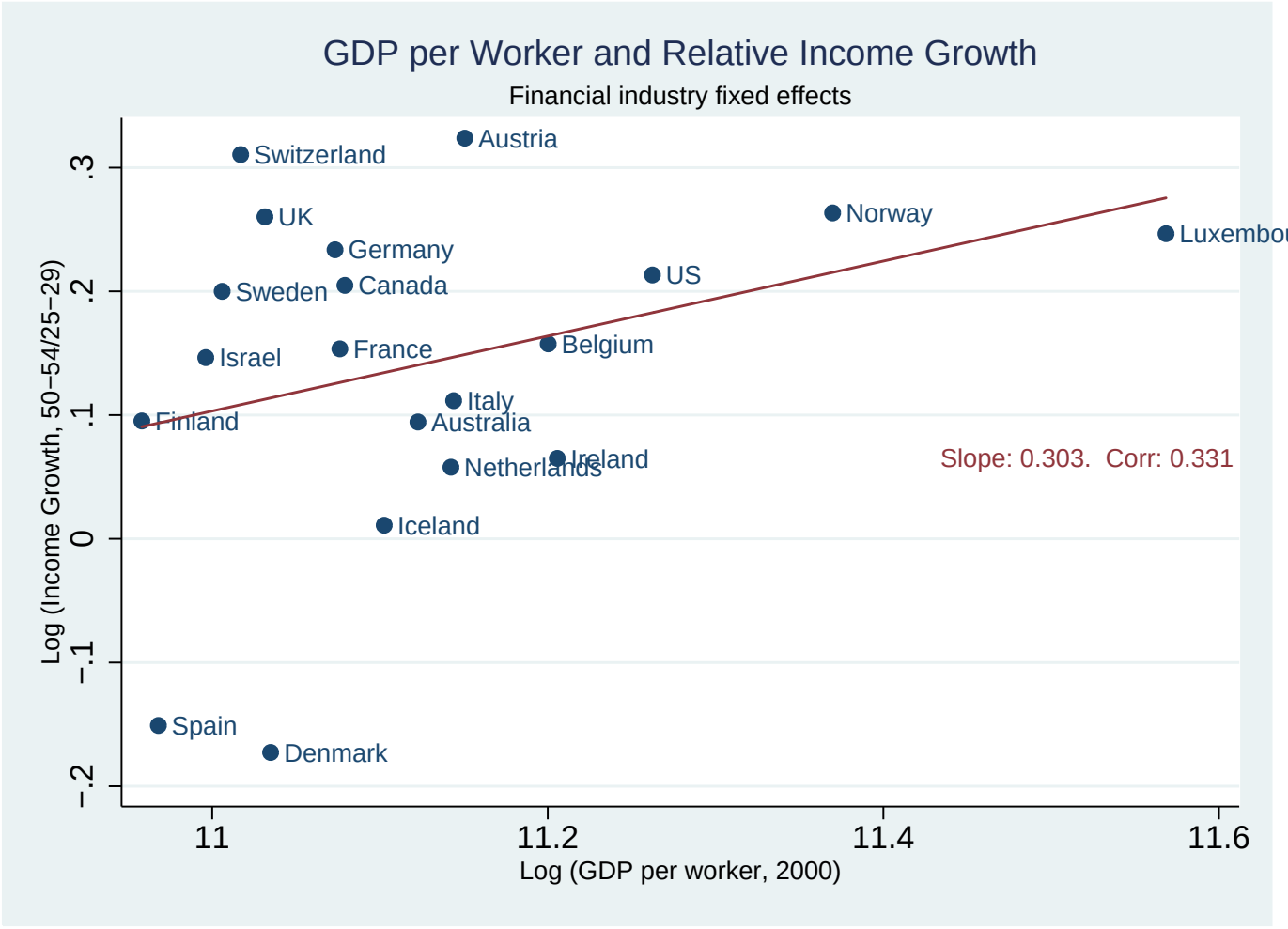
Robustness


GDP per Worker and Relative Income Growth
Without Education Controls
Log (Income Growth, 50−54/25−29)
.4
.2
0
−.2
Switzerland
Luxembourg
UK
Germany
US
Canada
Belgium
Norway
Israel
Italy
Sweden
France
Australia
Netherlands
Slope: 0.410. Corr: 0.389
Finland
Ireland
Iceland
Denmark
Spain
11
11.2
11.4
11.6
Log (GDP per worker, 2000)

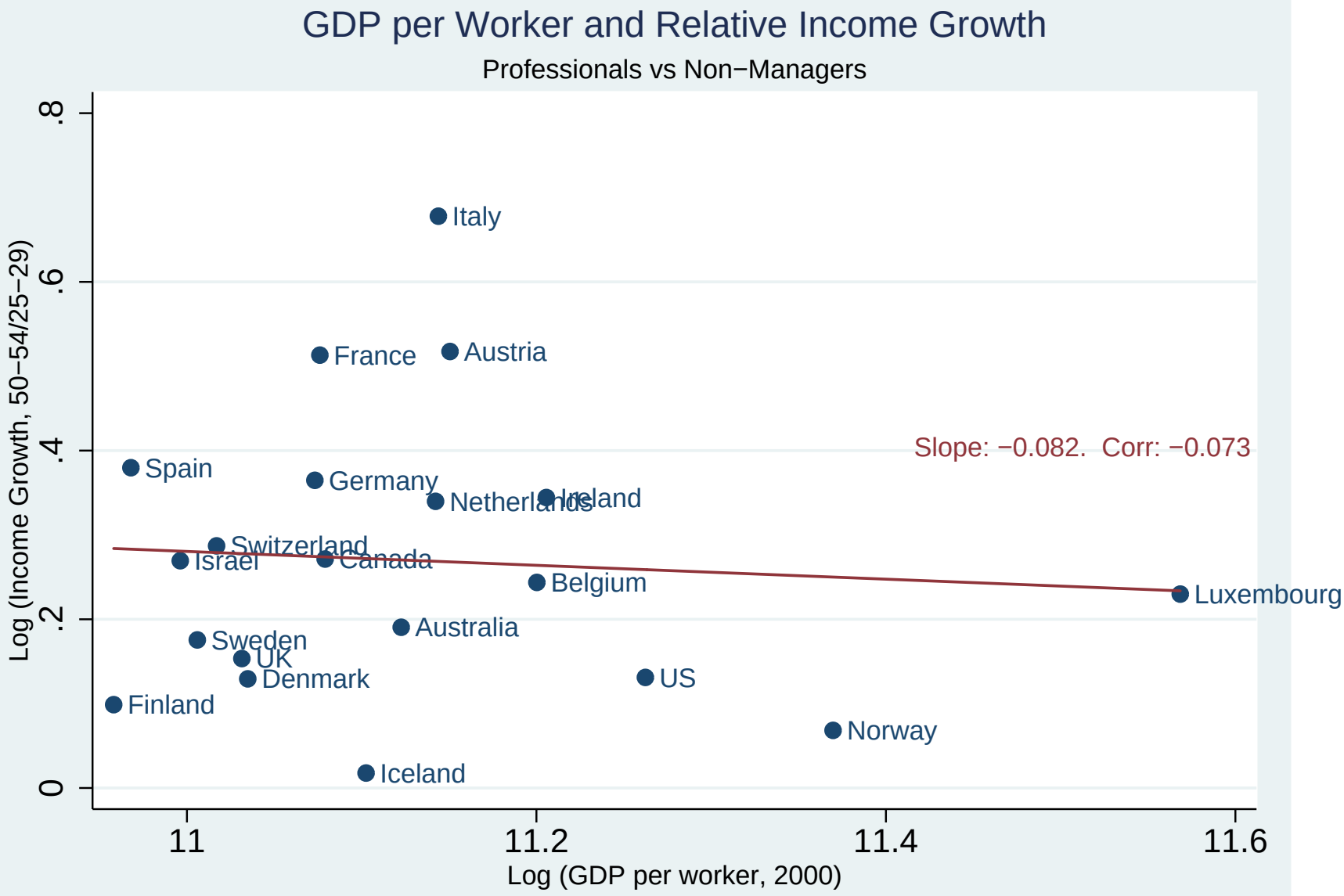
Robustness


GDP per Worker and Relative Income Growth
Without Year Fixed Effects
Log (Income Growth, 50−54/25−29)
.6
.4
.2
0
−.2
Luxembourg
Switzerland
Germany
US
France
UK
Canada
Slope: 0.575. Corr: 0.497
Israel
Belgium
Norway
Italy
Sweden
Austria
Australia
Ireland
Netherlands
Finland
Iceland
Spain
Denmark
11
11.2
11.4
11.6
Log (GDP per worker, 2000)

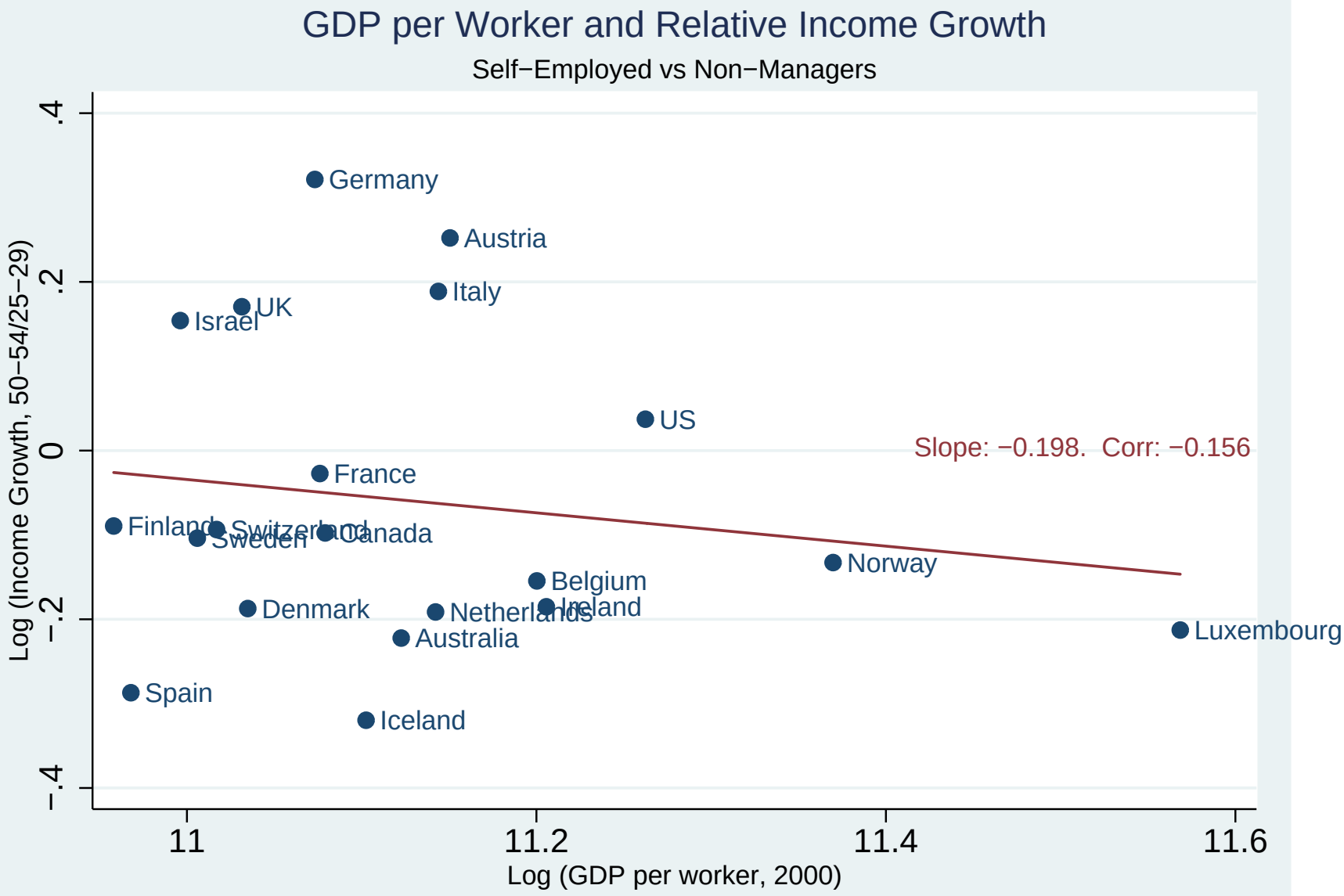
Robustness


GDP per Worker and Relative Income Growth
Financial industry fixed effects
Log (Income Growth, 50−54/25−29)
.3
.2
.1
0
−.1
−.2
Switzerland
Austria
UK
Norway
Luxembourg
Germany
US
Sweden
Canada
Israel
France
Belgium
Italy
Finland
Australia
Ireland
Netherlands
Iceland
Spain
Denmark
Slope: 0.303. Corr: 0.331
11
11.2
11.4
11.6
Log (GDP per worker, 2000)

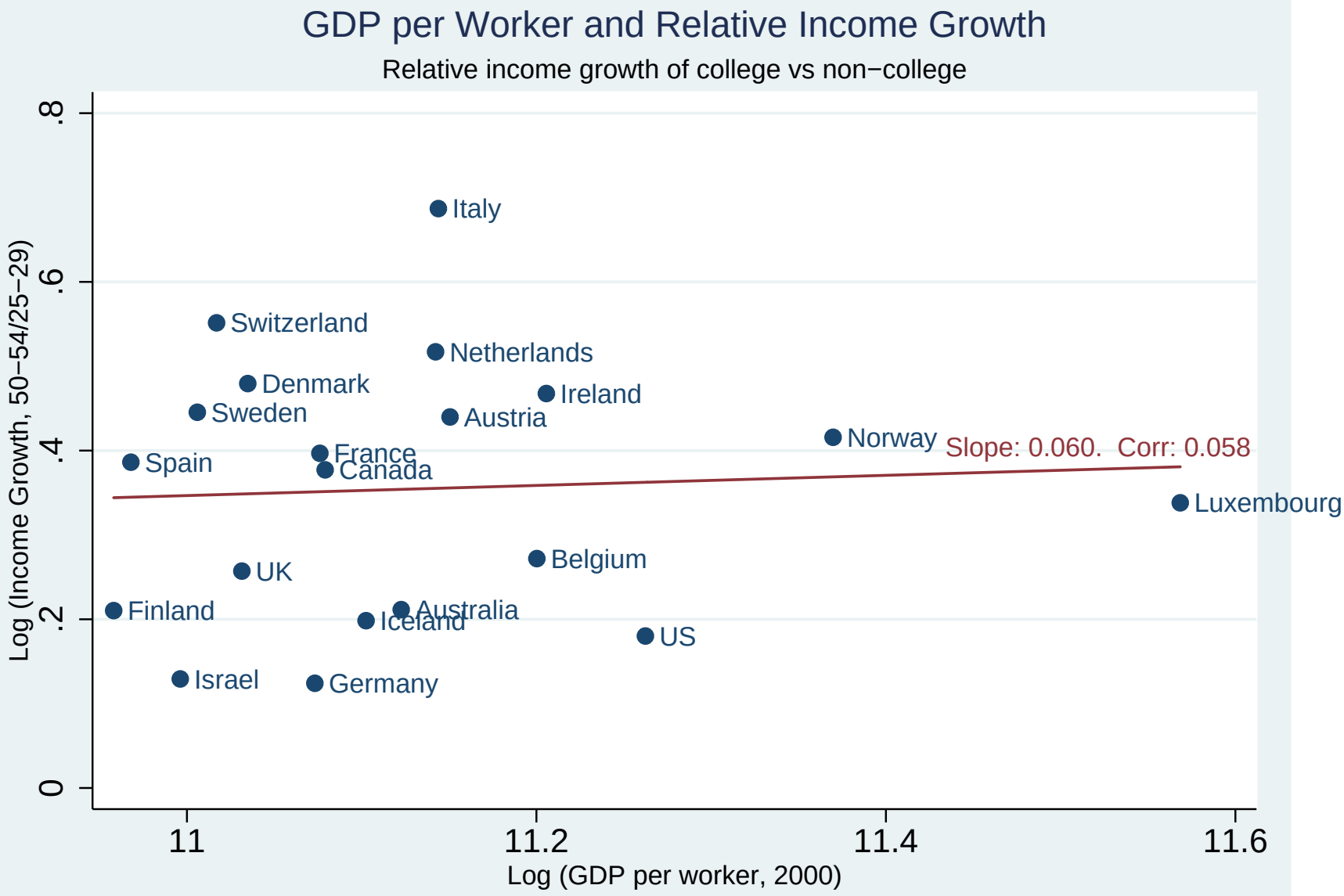
Robustness


GDP per Worker and Relative Income Growth
Professionals vs Non−Managers
Log (Income Growth, 50−54/25−29)
0
.2
.4
.6
.8
11
11.2
11.4
11.6
Log (GDP per worker, 2000)
Slope: −0.082. Corr: −0.073
Italy
France
Austria
Spain
Germany
Netherlands
Ireland
Switzerland
Israel
Canada
Belgium
Luxembourg
Australia
Sweden
UK
Denmark
US
Finland
Norway
Iceland

Robustness


GDP per Worker and Relative Income Growth
Self−Employed vs Non−Managers
Log (Income Growth, 50−54/25−29)
.4
.2
0
−.2
−.4
Germany
Austria
Italy
UK
Israel
US
France
Finland
Switzerland
Sweden
Canada
Norway
Belgium
Ireland
Denmark
Netherlands
Australia
Luxembourg
Spain
Iceland
Slope: −0.198. Corr: −0.156
11
11.2
11.4
11.6
Log (GDP per worker, 2000)

Robustness


GDP per Worker and Relative Income Growth
Relative income growth of college vs non−college
Log (Income Growth, 50−54/25−29)
0
.2
.4
.6
.8
11
11.2
11.4
11.6
Log (GDP per worker, 2000)
Italy
Switzerland
Netherlands
Denmark
Ireland
Sweden
Austria
Norway
Slope: 0.060. Corr: 0.058
Spain
France
Canada
Luxembourg
Belgium
UK
Finland
Australia
Iceland
US
Israel
Germany