



# LABOUR MARKET MISMATCH AND LABOUR PRODUCTIVITY: *EVIDENCE FROM PIAAC DATA*

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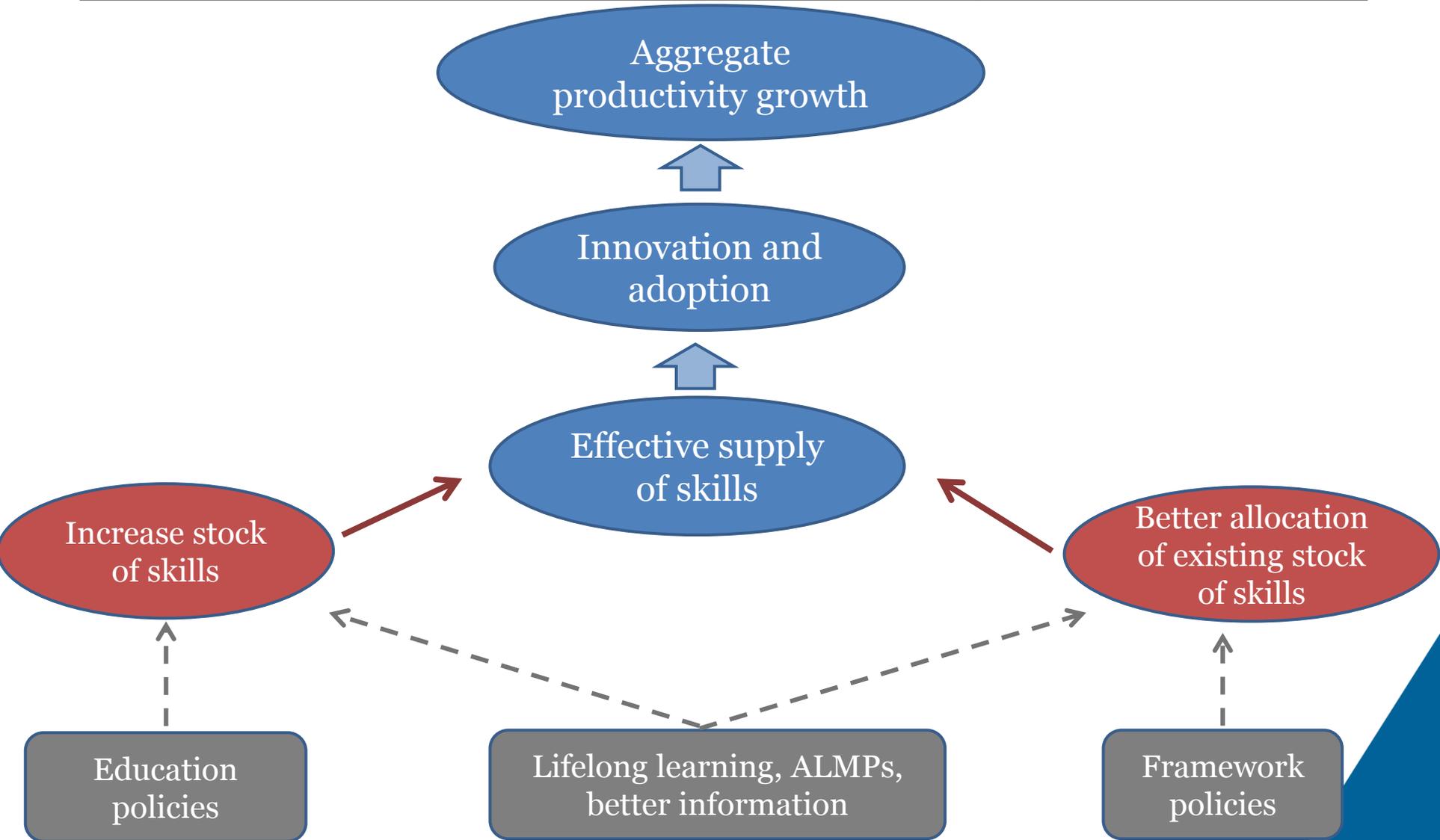
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# Skills, productivity growth and public policy





# Motivation: Efficient skill allocation will become more important

Projections for OECD economies over coming decades entail:

1. A slowdown in the rate of human capital accumulation.

*In the future, one can reasonably expect a reduced contribution from education and, other things equal, slower income growth.*

– Fernald and Jones (AER, 2014)

2. MFP-driven growth centered on investments in new knowledge.

The returns to better allocating human talents may rise.

**How is the allocation of skills linked to productivity?**



# Our contribution

**OECD Survey of Adult Skills** suggests non-trivial rates of skill mismatch (SM) across OECD countries.

- But no direct evidence on the SM-productivity link.

Aggregate to the country\*industry level PIAAC SM indicators and harmonised firm level data from ORBIS:

- Higher SM is associated with lower labour productivity.
- **Over-skilling** matters most.
- Key channel: less efficient **resource allocation**.
  - Over-skilling might be good from the perspective of a single firm but not for the economy as a whole.
- SM might account for 1/5 of the US-Italy labour productivity gap.



# OECD Survey of Adult Skills (PIAAC)

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## PIAAC:

- Administered to households representing the population aged 16-65 in 24 countries (166k adults) in 2011-12.
- Data for 9 additional countries in 2016.
- Test computer-based for 77.5%; paper-based for others.
- Test typically conducted in the language of country of residence.
- Assesses proficiency (scale 0-500) in **literacy**, numeracy and problem-solving in technology rich environments.



# Skill mismatch: combining self-assessment with skill proficiency

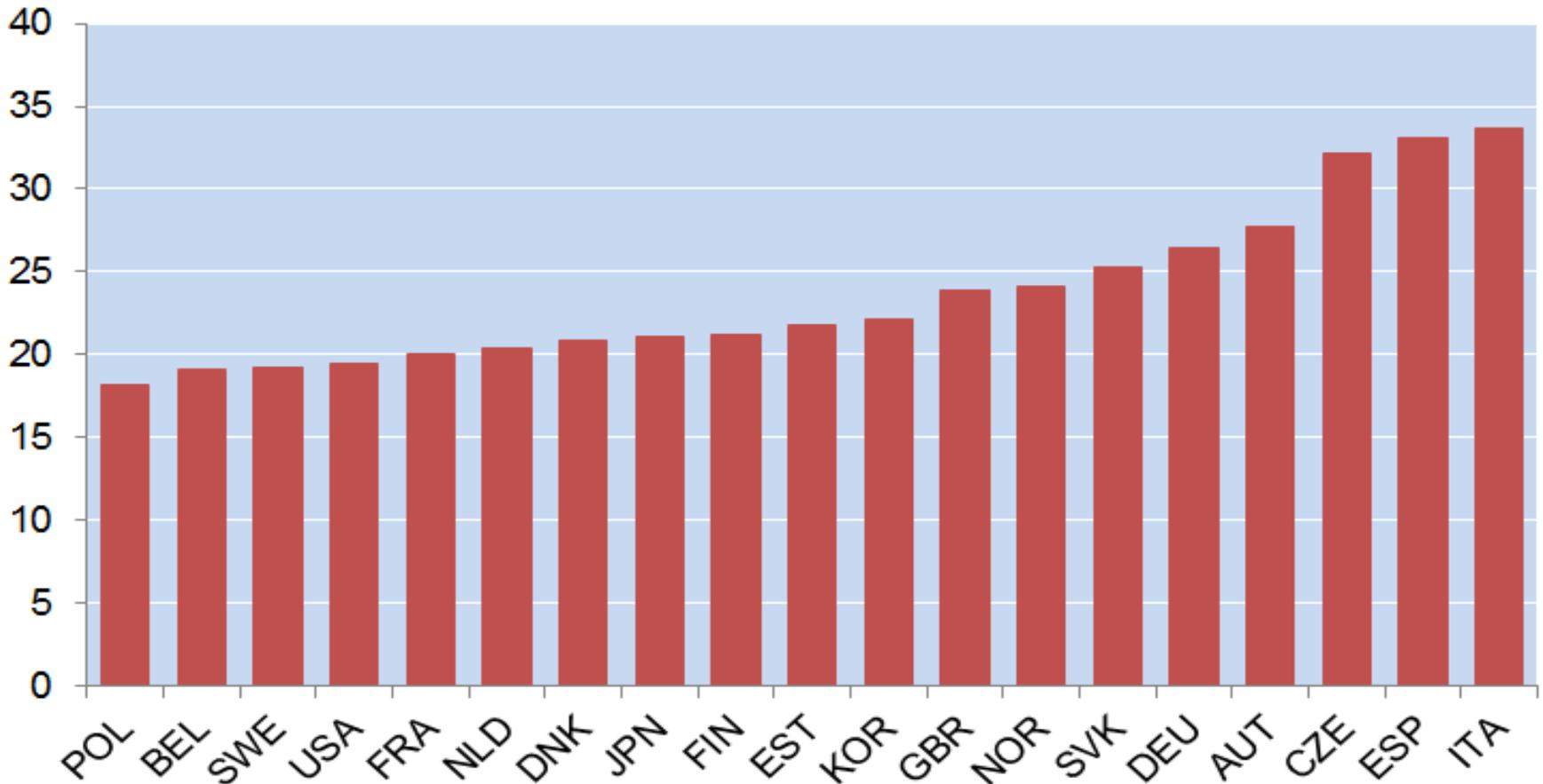
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1. Create a quantitative scale of the skills required to perform the job for each (1 digit ISCO) occupation using the literacy scores of well-matched workers – *those who neither feel they have the skills to perform a more demanding job nor require further training to perform their current job satisfactorily.*
2. Use this scale to identify *min* and *max* threshold values (e.g., based on the 10<sup>th</sup> and 90<sup>th</sup> percentile), which bounds what it is to be a well-matched worker.
3. Workers with scores lower (higher) than this *min* (*max*) threshold in their occupation are under (over) skilled.



# Cross-country differences in skill mismatch are significant

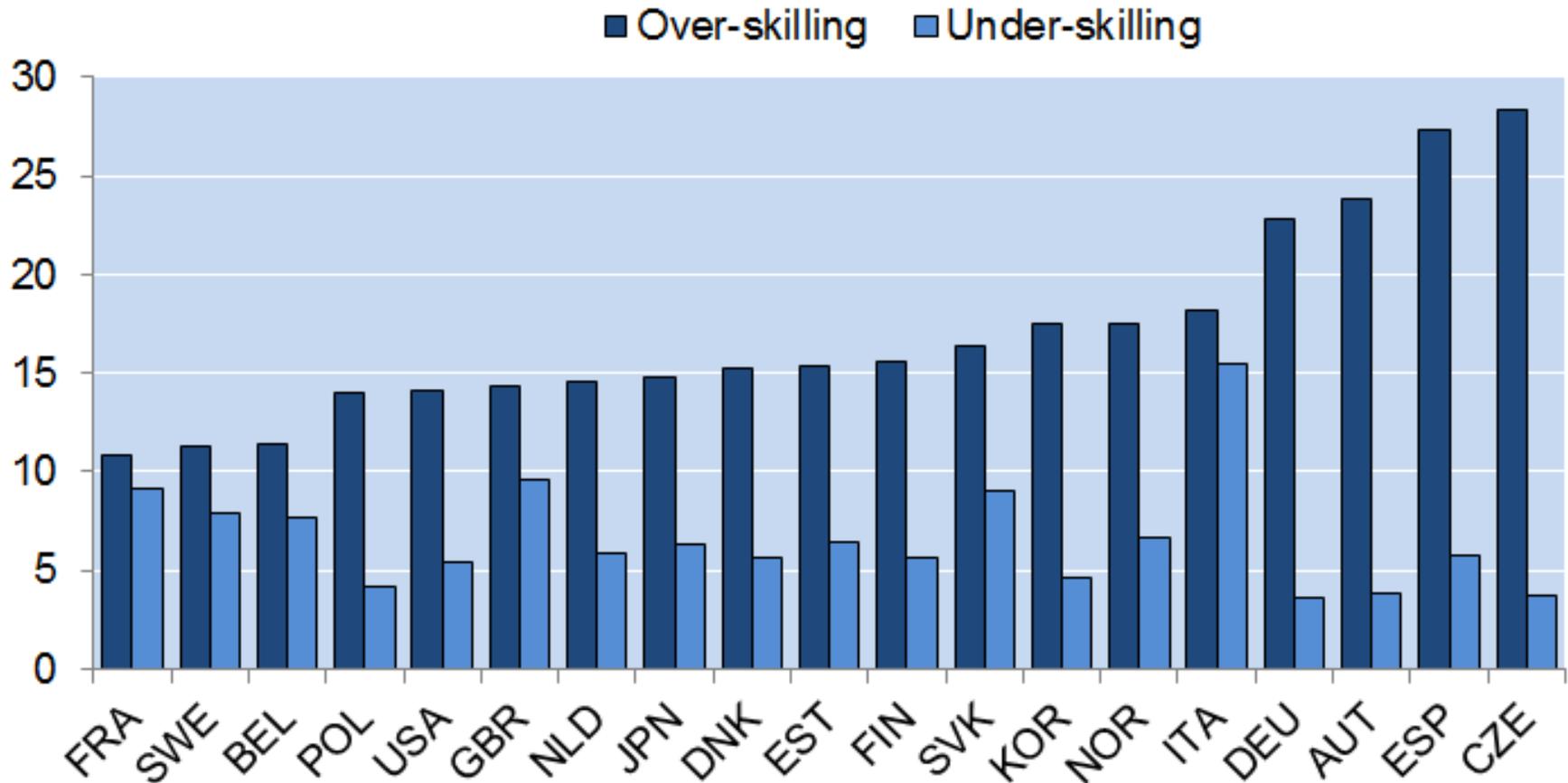
Percentage of workers with skill mismatch





# ... with over-skilling more prevalent than under-skilling

Percentage of workers with skill mismatch



On average, over-skilling is ~2½ times more likely than under-skilling



# Qualification mismatch

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There are different approaches (each with their pros and cons) BUT we follow the approach used in OECD (2013):

- Create a benchmark of “appropriate” qualifications based on: *“If applying today, what would be the usual qualifications, if any, that someone would need to get this type of job?”*.
- Workers whose qualification (measured by ISCED level) is above (below) this benchmark is over (under) qualified.



# Channels linking mismatch to productivity

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***Within-firm effects:*** literature focuses on mismatch from the perspective of a given firm and its *indirect* links with productivity via wages or job satisfaction.

***Reallocation effects:*** what if over-skilling in one firm constrains the growth of more productive firms?

- Scarce and fixed pool of skilled labour to supply innovation in the short-to-medium run.
- Over-skilling → human talent is clogged-up in inefficient firms?
- Firm heterogeneity implies potentially large aggregate productivity gains from better matching workers to jobs.



# Oley-Pakes decomposition of industry-level productivity

*Decompose industry productivity:*

$P_i$  = log productivity of firm  $i$   
 $\Theta_i$  = firm  $i$ 's employment as share of industry  $j$  employment  
Bar terms = unweighted average of firm  $P_i$  or  $\Theta_i$  in industry  $j$ .

$$\sum_{i \in j} \theta_i P_i = \bar{P}_j + \sum_{i \in j} (\theta_i - \bar{\theta}_j) (P_i - \bar{P}_j)$$

1. Weighted productivity:  
weighted average of firm-level productivity in industry  $j$

2. Within-firm productivity:

$$1/N_j \sum_{i \in j} P_i$$

3. Allocative efficiency: AE  
is positive when firms with higher than average productivity have higher than average employment shares

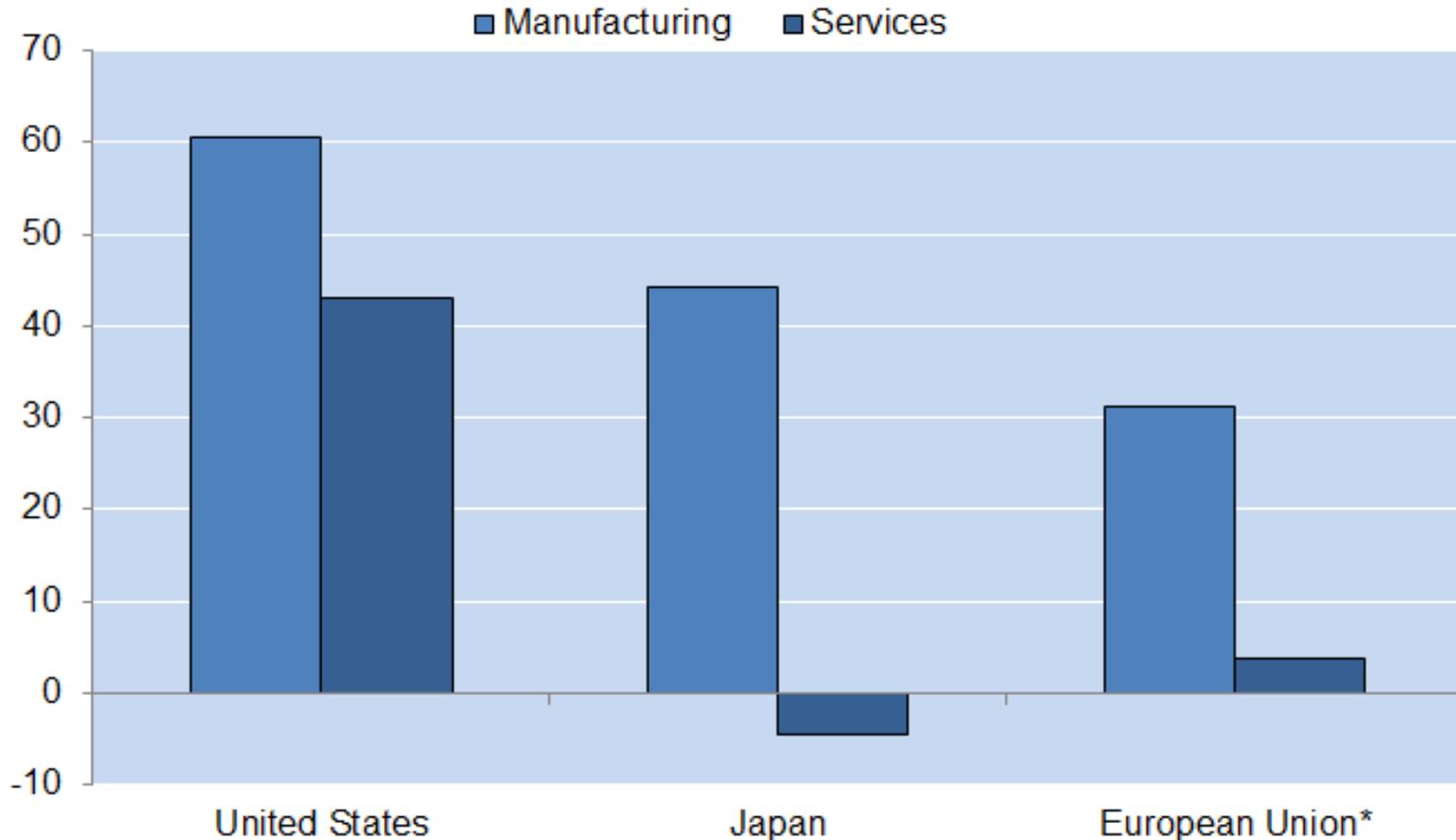
*AE is the %pt increase in index  $P_j$  due to the actual allocation of employment across firms vs. a random employment allocation (AE=0 if term 1= term 2)*



# Cross-country differences in allocative efficiency are significant

## Static Allocative Efficiency

Contribution of the allocation of labour across firms to the level of labour productivity; %





# Labour productivity and skill mismatch are negatively correlated

## Cross-country industry-level regression\*

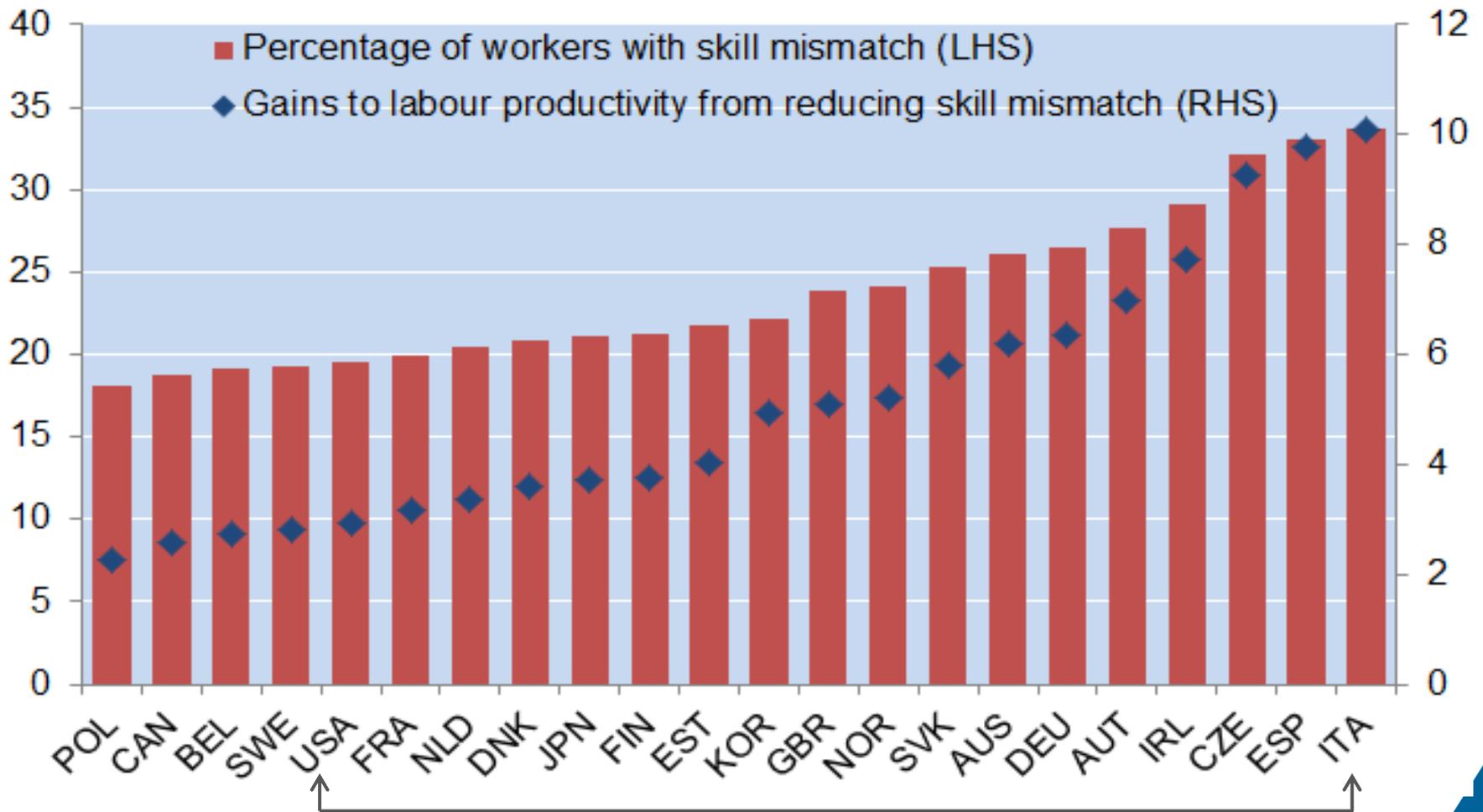
Base category: well-matched workers

	(1)	(2)	(3)	(4)	(5)	(6)
	Weighted productivity		Allocative efficiency		Within-firm productivity	
% workers with skill mismatch	-0.0042* (0.002)		-0.0050** (0.002)		0.0009 (0.001)	
% over-skilled workers		-0.0102** (0.004)		-0.0130*** (0.004)		0.0028 (0.003)
% under-skilled workers		-0.0057 (0.004)		0.0008 (0.003)		-0.0065 (0.004)
<i>Controls</i>						
% of workers with qualification mismatch	YES		YES		YES	
% over & under qualified workers		YES		YES		YES
Other controls	YES	YES	YES	YES	YES	YES
Country fixed effects	YES	YES	YES	YES	YES	YES
Industry fixed effects	YES	YES	YES	YES	YES	YES
AdjR2	0.895	0.911	0.636	0.675	0.923	0.930
Observations	205	205	205	205	205	205

\* Based on 11 1-digit industries across 19 OECD countries.



# Productivity gains from reducing skill mismatch to the best practice level



*Differences in skill mismatch can account for one-fifth of the gap in allocative efficiency between Italy and the US.*



# Caveats and extensions

**Caveats:** small sample size; broadly defined industries; correlation, not causality.

## Overlap between skill & qualification mismatch

	Skills	Qualifications	%
Well-matched workers	Yes	Yes	49
Mismatched workers	Yes	No	15
	No	Yes	27
	<b>Yes</b>	<b>Yes</b>	<b>9</b>

Over-qualified & over-skilled is positively related to *within-firm* productivity, but negatively related to *allocative efficiency*.



# Overlap between skill and qualification mismatch

## Cross-country industry-level regression\*

Base category: well-matched workers on skills and qualifications

	(1)	(2)	(3)
	Weighted productivity	Allocative efficiency	Within-firm productivity
1. Over-skilled and over-qualified	0.0157 (0.010)	-0.0126*** (0.004)	0.0282** (0.011)
2. Over-skilled and well-matched (qualification)	-0.0207*** (0.004)	-0.0129*** (0.004)	-0.0078 (0.005)
3. Under-skilled and over-qualified	-0.0322* (0.017)	-0.0263 (0.023)	-0.0059 (0.022)
4. Under-skilled and under-qualified	-0.0166 (0.020)	0.0151 (0.015)	-0.0317** (0.014)
5. Well-matched (skill) and under-qualified	-0.0200*** (0.004)	-0.0191*** (0.005)	-0.0009 (0.006)
<i>Controls</i>			
Over-skilled and under-qualified	YES	YES	YES
Under-skilled and well-matched (qualification)	YES	YES	YES
Well-matched (skill) and over-qualified	YES	YES	YES
Other controls	YES	YES	YES
Country fixed effects	YES	YES	YES
Industry fixed effects	YES	YES	YES
AdjR2	0.916	0.704	0.936
Observations	205	205	205

\* Based on 11 1-digit industries across 19 OECD countries.



# Skill mismatch, productivity and public policy

Higher SM – esp. over-skilling – is associated with lower labour productivity via the allocative efficiency channel.

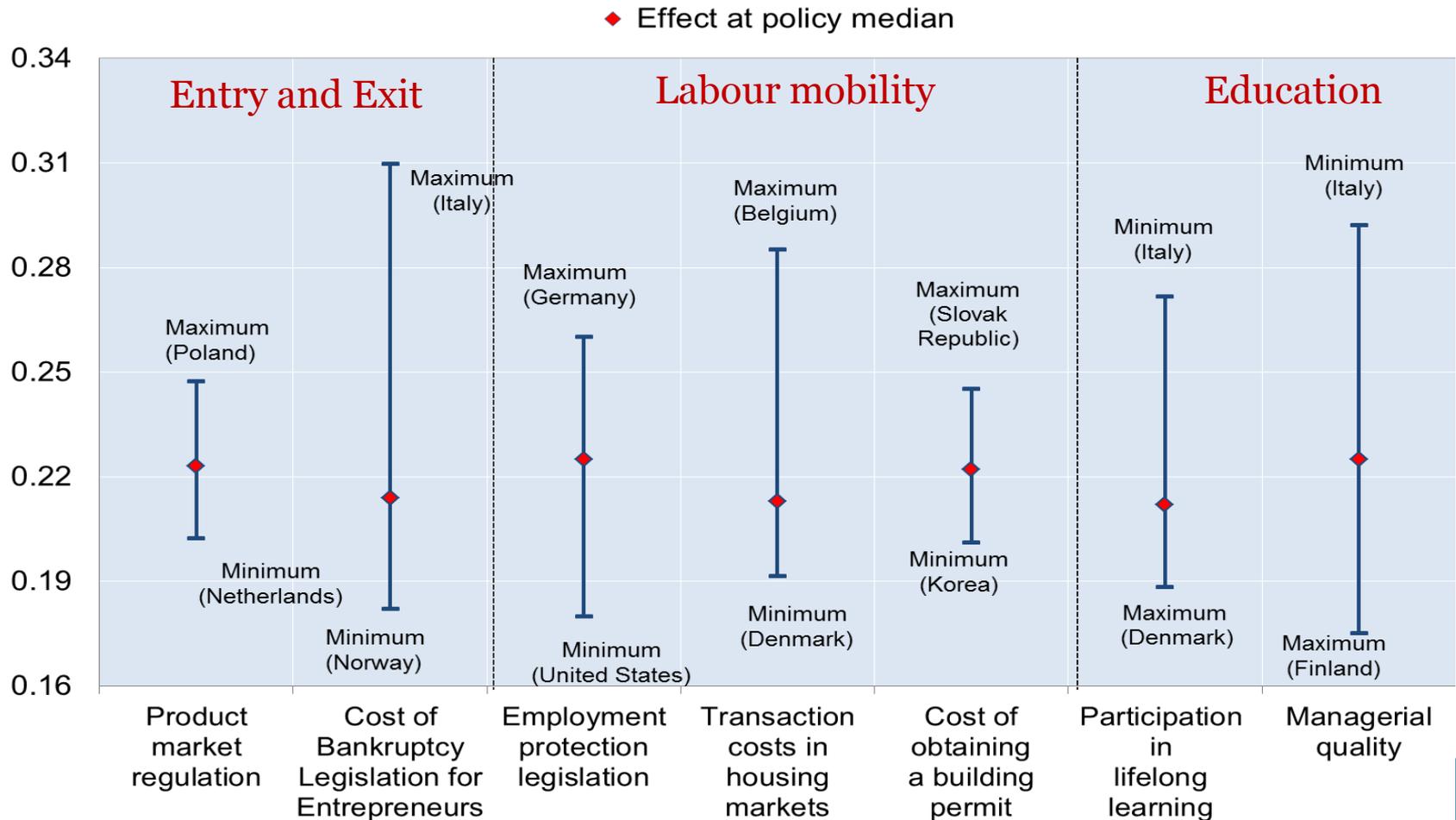
## *What drives skill mismatch?*

- Education/training systems
- Managerial quality
- SM as a channel through which market regulations affect productivity? SM lower in countries with fewer:
  - Barriers to firm entry and exit (PMR, bankruptcy costs).
  - Barriers to labour mobility (EPL, housing policies).
- High SM may blunt the effectiveness of innovation policies.



# Reducing skill mismatch requires a range of policies

## The probability of skill mismatch and public policies



Source: Adalet McGowan, M. and D. Andrews (2015), “Skill mismatch and public policy in OECD countries”, *OECD Economics Department Working Paper*, No. 1210.



# Appendix





# Qualification mismatch is also negatively linked to productivity

## Cross-country industry-level regression\*

Base category: well-matched workers

	(1)	(2)	(3)	(4)	(5)	(6)
	<b>Weighted productivity</b>		<b>Allocative efficiency</b>		<b>Within-firm productivity</b>	
% workers with skill mismatch	-0.0042* (0.002)		-0.0050** (0.002)		0.0009 (0.001)	
% over-skilled workers		-0.0102** (0.004)		-0.0130*** (0.004)		0.0028 (0.003)
% under-skilled workers		-0.0057 (0.004)		0.0008 (0.003)		-0.0065 (0.004)
% workers with qualification mismatch	-0.0074* (0.004)		-0.0068* (0.004)		-0.0007 (0.003)	
% over-qualified workers		0.0049 (0.008)		0.0014 (0.005)		0.0035 (0.005)
% under-qualified workers		-0.0224*** (0.007)		-0.0094** (0.004)		-0.0131** (0.005)
<i>Controls</i>						
Other controls	YES	YES	YES	YES	YES	YES
Country fixed effects	YES	YES	YES	YES	YES	YES
Industry fixed effects	YES	YES	YES	YES	YES	YES
AdjR2	0.895	0.911	0.636	0.675	0.923	0.930
Observations	205	205	205	205	205	205

\* Based on 11 1-digit industries across 19 OECD countries.



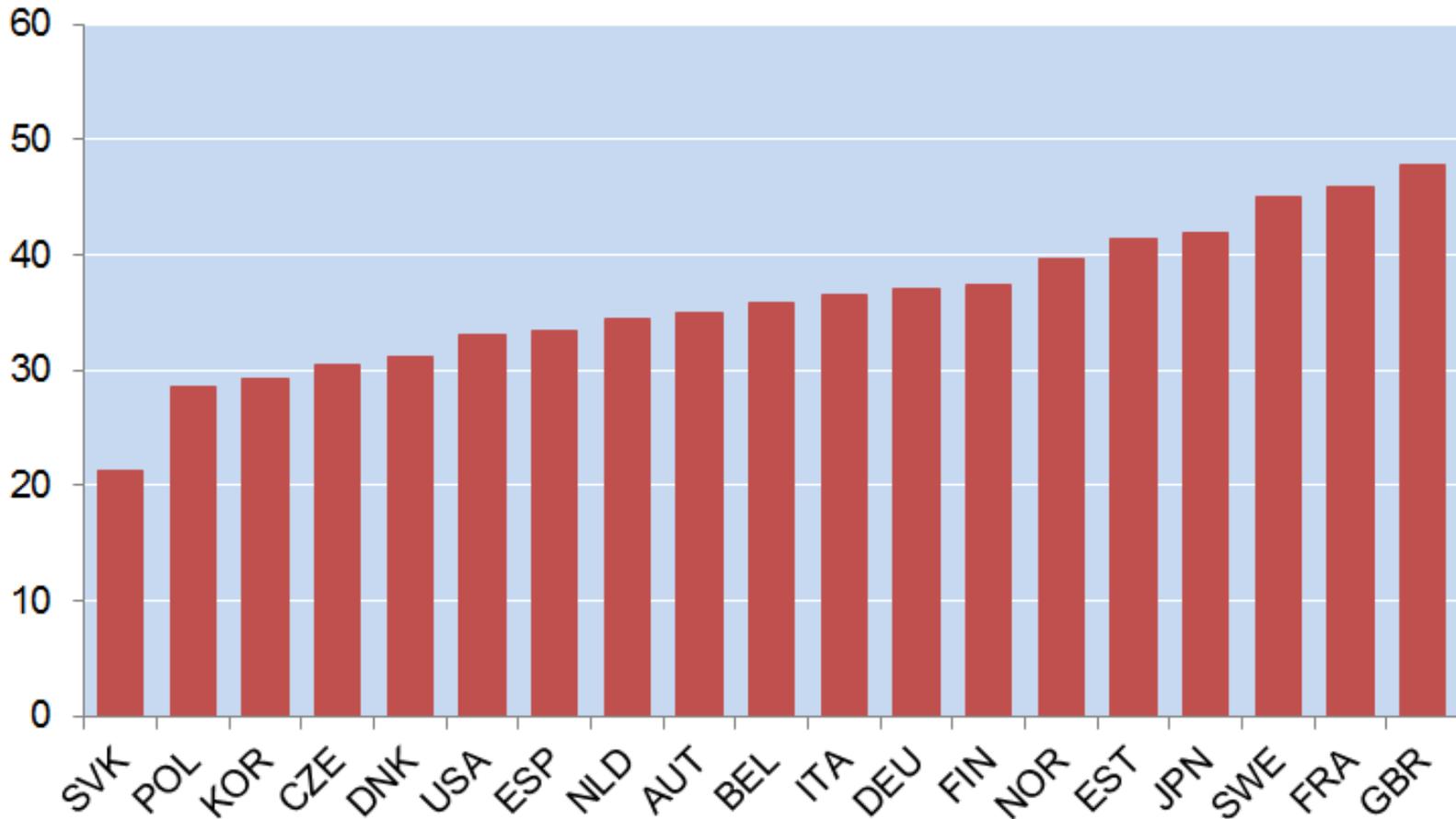
# Managerial quality, mismatch and productivity

	(1)	(2)	(3)
	<b>Weighted Productivity</b>	<b>Allocative Efficiency</b>	<b><i>Within-firm</i> Productivity</b>
Over-qualified workers	0.0060 (0.008)	-0.0001 (0.006)	0.0061 (0.006)
Under-qualified workers	-0.0195*** (0.007)	-0.0122** (0.006)	-0.0073 (0.005)
Over-skilled workers	-0.0108*** (0.004)	-0.0124*** (0.004)	0.0016 (0.003)
Under-skilled workers	-0.0038 (0.004)	-0.0016 (0.003)	-0.0022 (0.004)
Herfindahl index	-3.6242*** (1.073)	-2.7424*** (0.696)	-0.8818* (0.461)
Mean scores of managers	0.0028 (0.002)	-0.0030 (0.002)	0.0059** (0.003)
AdjR2	0.911	0.680	0.935
Observations	201	201	201



# Cross-country differences in qualification mismatch are significant

Percentage of workers with qualification mismatch





# Mismatch and productivity

Existing literature focuses on the *indirect* impact of mismatch on productivity using two main approaches:

- *Human capital theory*: mismatch will be reflected in **wage** differentials which tells us about productivity, since  $W_i \sim MPL_i$  (Quintini, 2011a,b).
  - Over- (under-) qualified/skilled workers should be inherently more (less) productive.
- Impact on correlates of productivity (e.g. **job satisfaction**, absenteeism and turnover): Sloan et al., 1999; Green & Zhu, 2010.
  - Over-skilling/qualification → ↓ job satisfaction → ↑ absenteeism/turnover → ↓ investment in firm-specific HK → ↓ firm productivity.

Only a few studies that model the direct impact of mismatch on productivity (Mahy et al., 2013; Kampelman and Rycx, 2012).

- Based on LEED for Belgium; consistent with human capital theory.
- **Country-specific**: so how generalisable are the results?

From this perspective, *cross-country* evidence that *directly* relates mismatch to productivity would be of value.



# Mismatch and productivity: what about reallocation effects?

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The existing literature focuses on the impact of mismatch on productivity from the perspective of any given firm (*i.e.* “**within-firm**” productivity).

BUT the **aggregate** consequences could be different if over-skilling in one firm affects the ability of other more productive firms to expand.

- Would aggregate productivity rise if mismatch workers were reallocated to more productive uses?
- Widespread heterogeneity in firm performance (within narrowly defined sectors) implies potentially significant gains from this reallocation.

Emerging evidence on the significant consequences of **resource misallocation** for aggregate productivity.

- The allocation of employment across firms of varying productivity levels matters (Hsieh and Klenow, 2009; Bartelsman et al., 2013; Andrews and Cingano, 2014).



# Sample composition and descriptive statistics

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Aggregate all indicators at 1-digit industry level (not enough observations within 2-digit country\*industry cells).

**Sample** of 19 countries and 11 industries:

- Reliable productivity data not available for Australia, Canada, Ireland, Russia and Cyprus.
- Caution about sample size (only 205 country/industry cells).

Summary statistics on mismatch:

- Significant cross-country variation in mismatch.
- **Low overlap** between qualification and skill mismatch.
- Most of the variance in mismatch explained by country fixed effects, while industry fixed



## Baseline results

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Both skill and qualification mismatch are correlated with lower productivity, but the channel varies.

Over-skilling: The main channel is the **allocative efficiency**.

- 1 std. dev. increase in the share of over-skilled workers is associated with a 6% reduction in allocative efficiency.

Under-qualification: The main channel is ***within-firm*** productivity, but allocative efficiency also plays a role.

- 1 std. dev. increase in the share of under-qualified workers is associated with a 10% reduction in labour productivity.

**Robustness checks**: SM defined with different threshold values, dropping one country and industry at a time, including mean scores for each industry, different year for the productivity indicators



## Extensions

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The results are also robust to a number of extensions that might help explain some of the channels from the baseline results.

### **The overlap between qualification and skill mismatch:**

- The impact of under-qualification on *within-firm* productivity is driven by workers who are under-qualified and under-skilled.
- A higher share of workers who are both over-qualified and over-skilled is positively associated with *within-firm* productivity, but negatively related to *allocative efficiency*.

### **Managerial quality (average scores of managers in each industry):**

- Better managerial quality can improve productivity (Bloom et al., 2013), but also be associated with lower mismatch.
- Managerial quality accounts for most of the impact of under-qualification on *within-firm* productivity