Skill distances and the cost of moving to “safe haven” occupations

Mariagrazia Squicciarini

OECD Directorate for Science, Technology and Innovation
mariagrazia.squicciarini@oecd.org

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NEED TO **RETHINK EDUCATION** AND **LIFELONG LEARNING POLICIES**

- Digitalisation heightens the need for workers to adapt and **transition to different/new occupations**
- These transitions require individuals to **have or develop cognitive skills and skills for the performance of job-related tasks**
- Education and training policies **can prepare workers for these transitions** and facilitate **transitions towards occupations with *close* skills requirements and *low* automation probability.**

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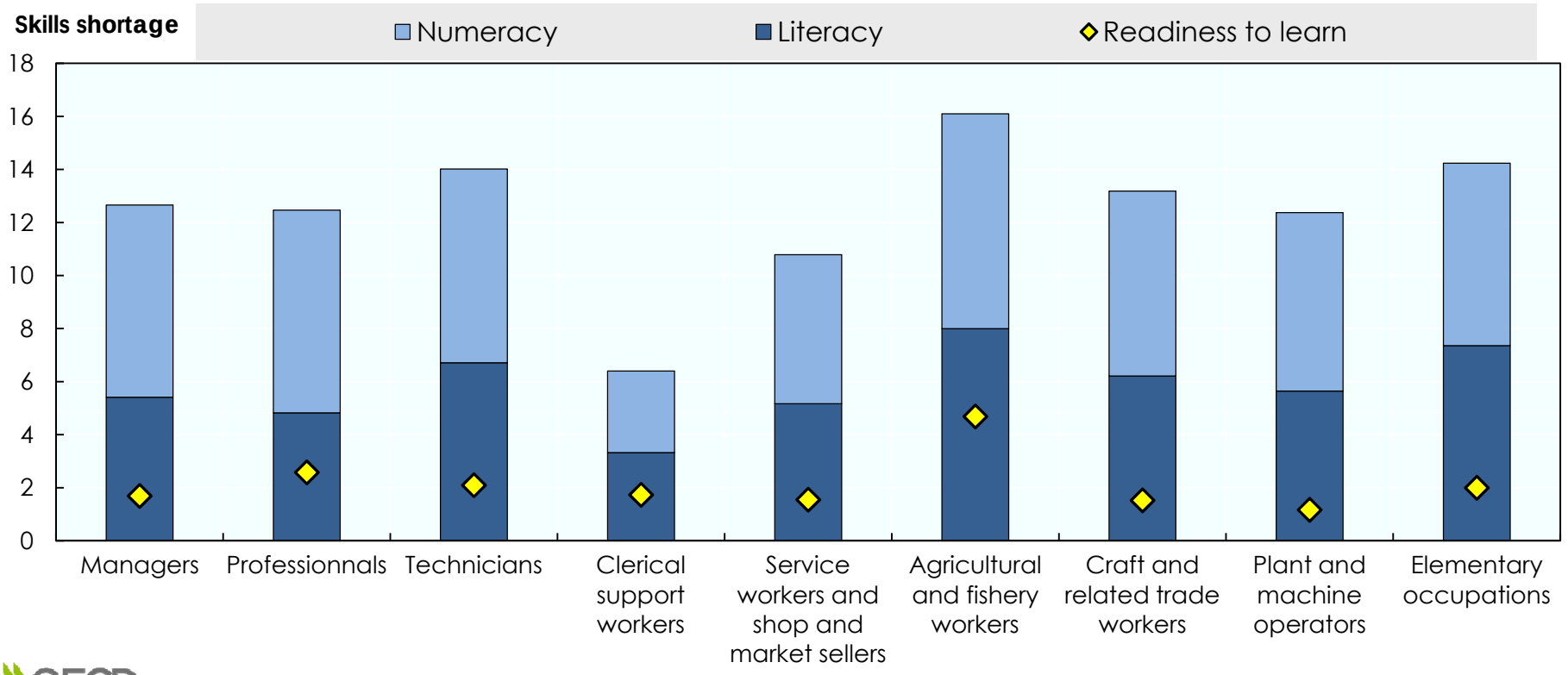
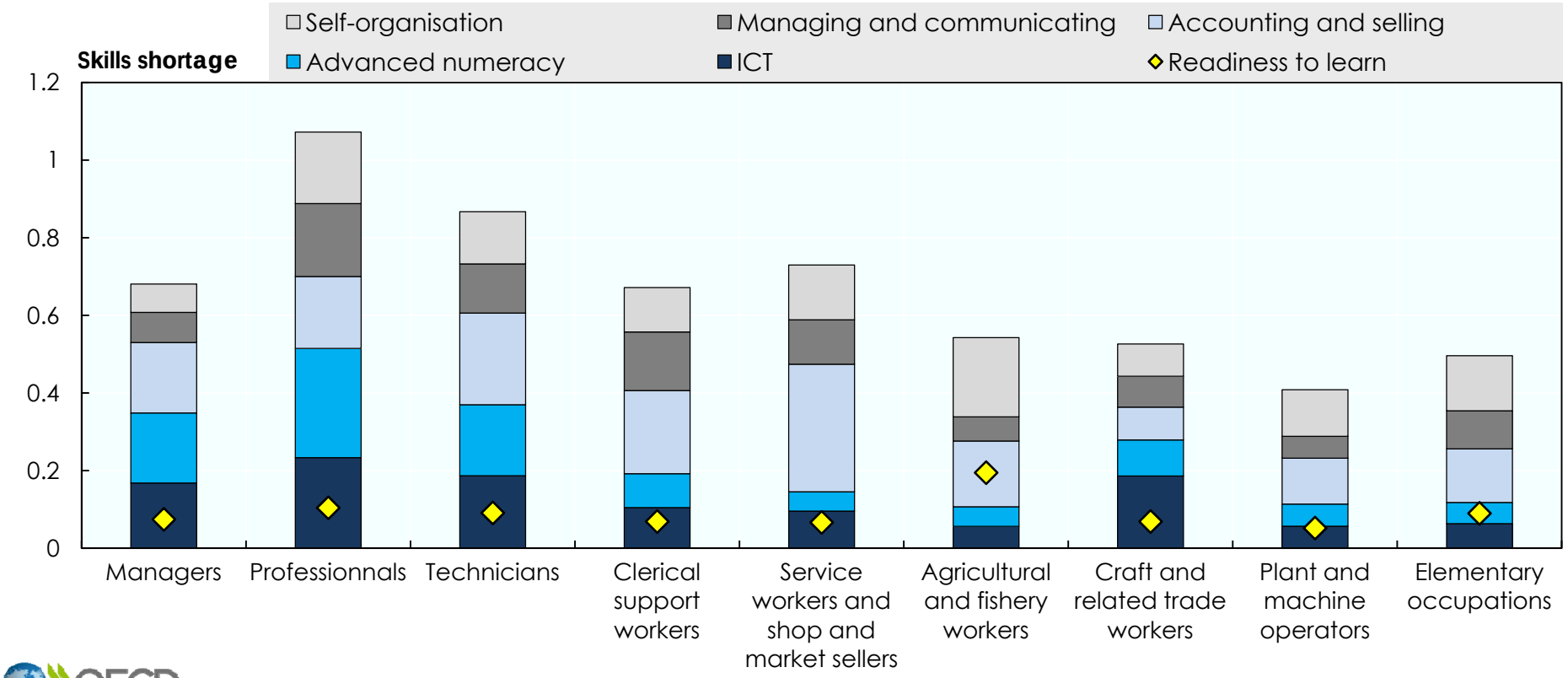
MOVING WITHIN THE SAME GROUP OF OCCUPATIONS - COGNITIVE SKILLS



Source: Survey of Adult Skills (2012, 2015) based on Bechichi et al., 2018

MOVING WITHIN THE SAME GROUP OF OCCUPATIONS - TASK-BASED SKILLS



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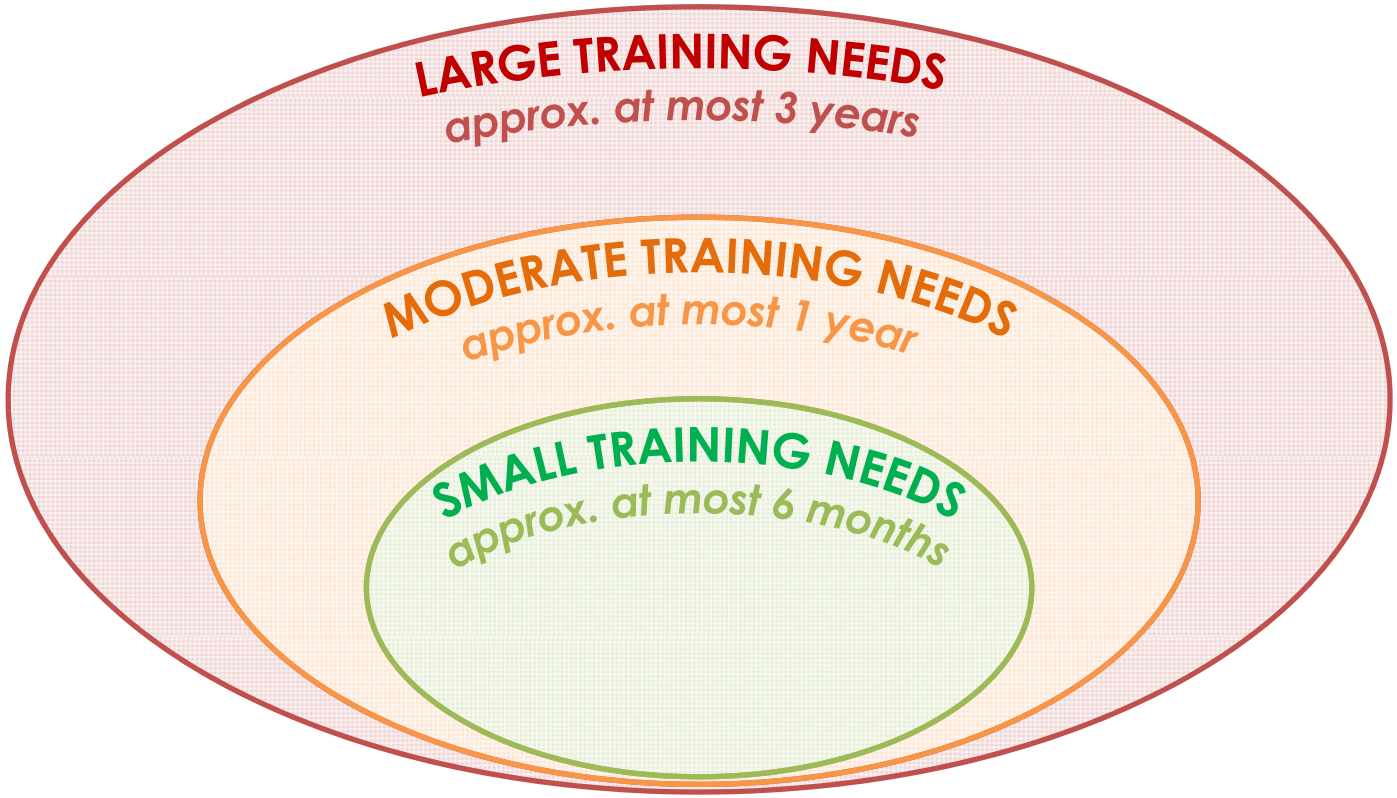
3 UP-SKILLING OR RE-TRAINING EFFORTS



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EXAMPLE

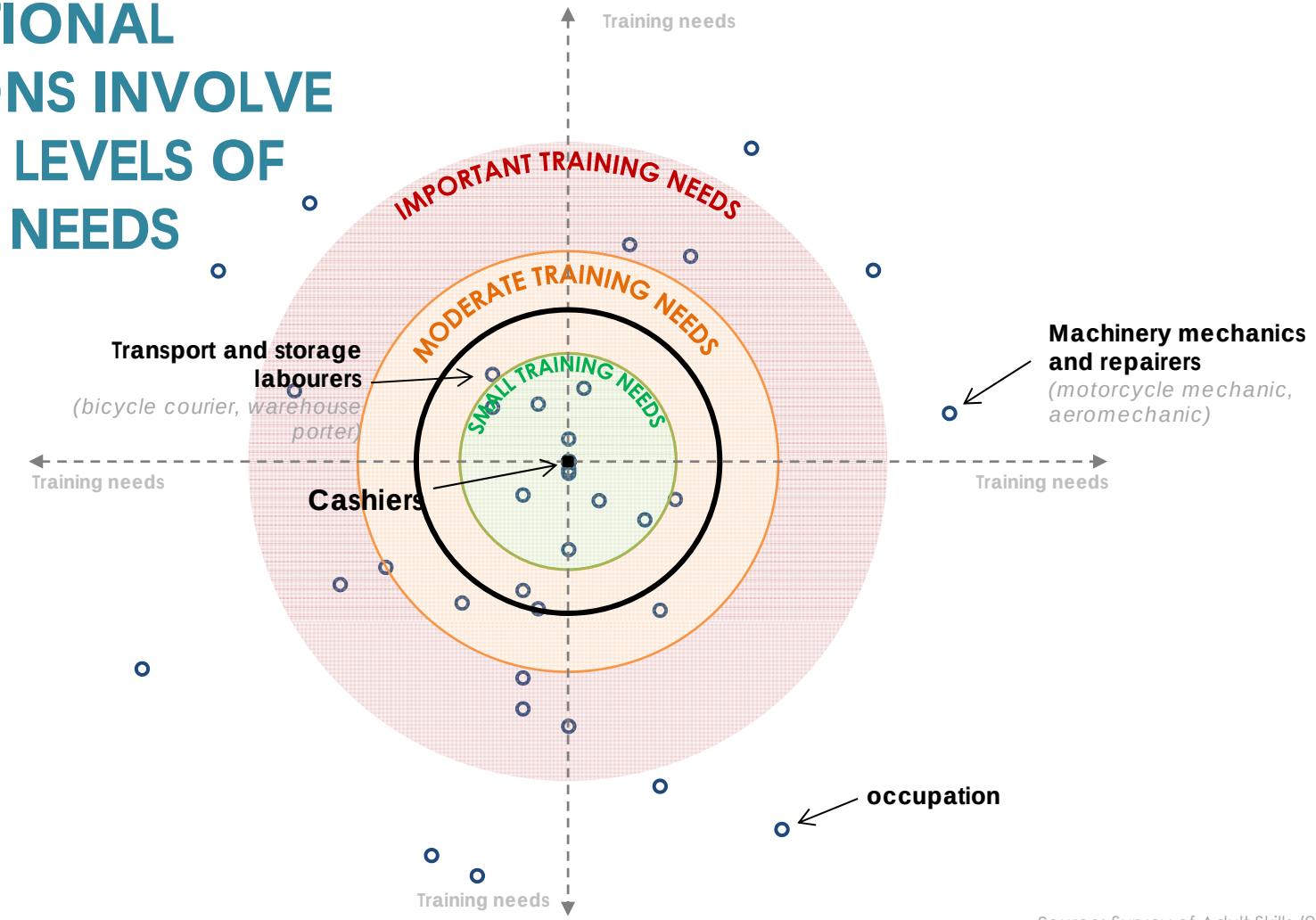
CASHIERS AND TICKET CLERKS

AUTOMATION PROBABILITY: 90%

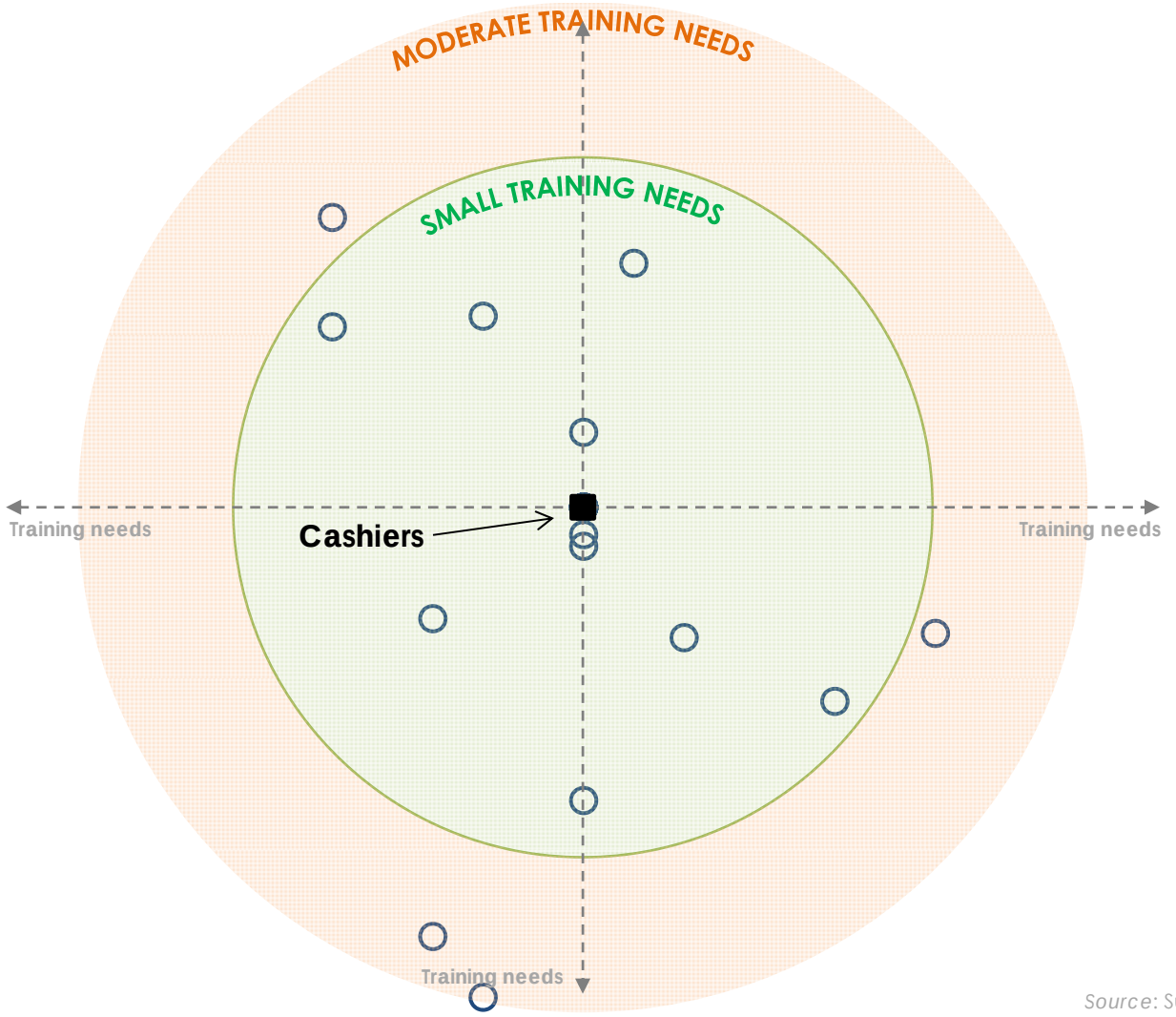
 # JOBS IN THE US: >3 MILLION

Source: Frey and Osborne (2013); U.S. Bureau of Labor Statistics

OCCUPATIONAL TRANSITIONS INVOLVE DIFFERENT LEVELS OF TRAINING NEEDS

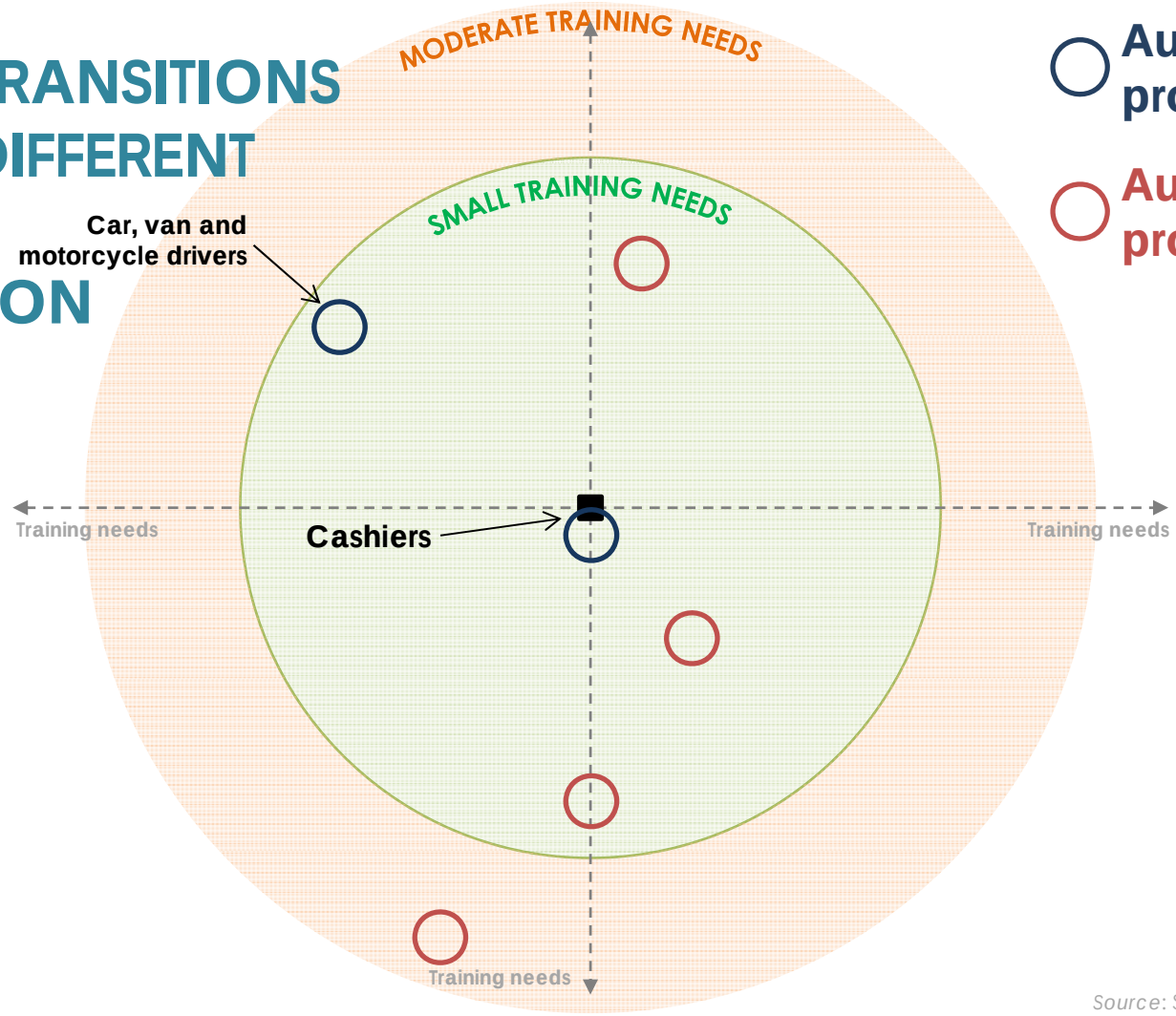


Source: Survey of Adult Skills (2012, 2015)



Source: Survey of Adult Skills (2012, 2015)

POSSIBLE TRANSITIONS INVOLVE DIFFERENT RISKS OF AUTOMATION



Automation probability <70%

Automation probability >70%

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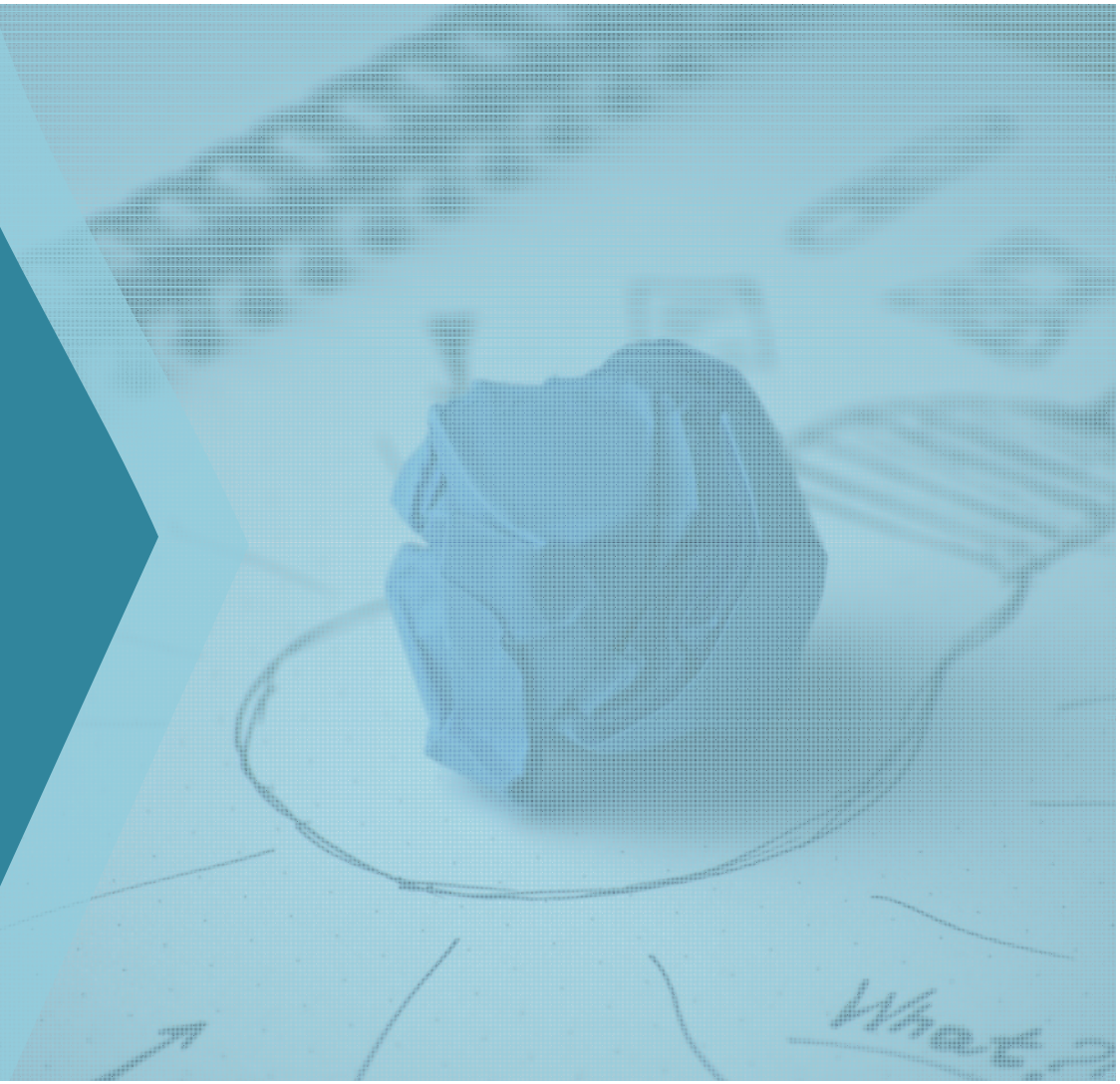
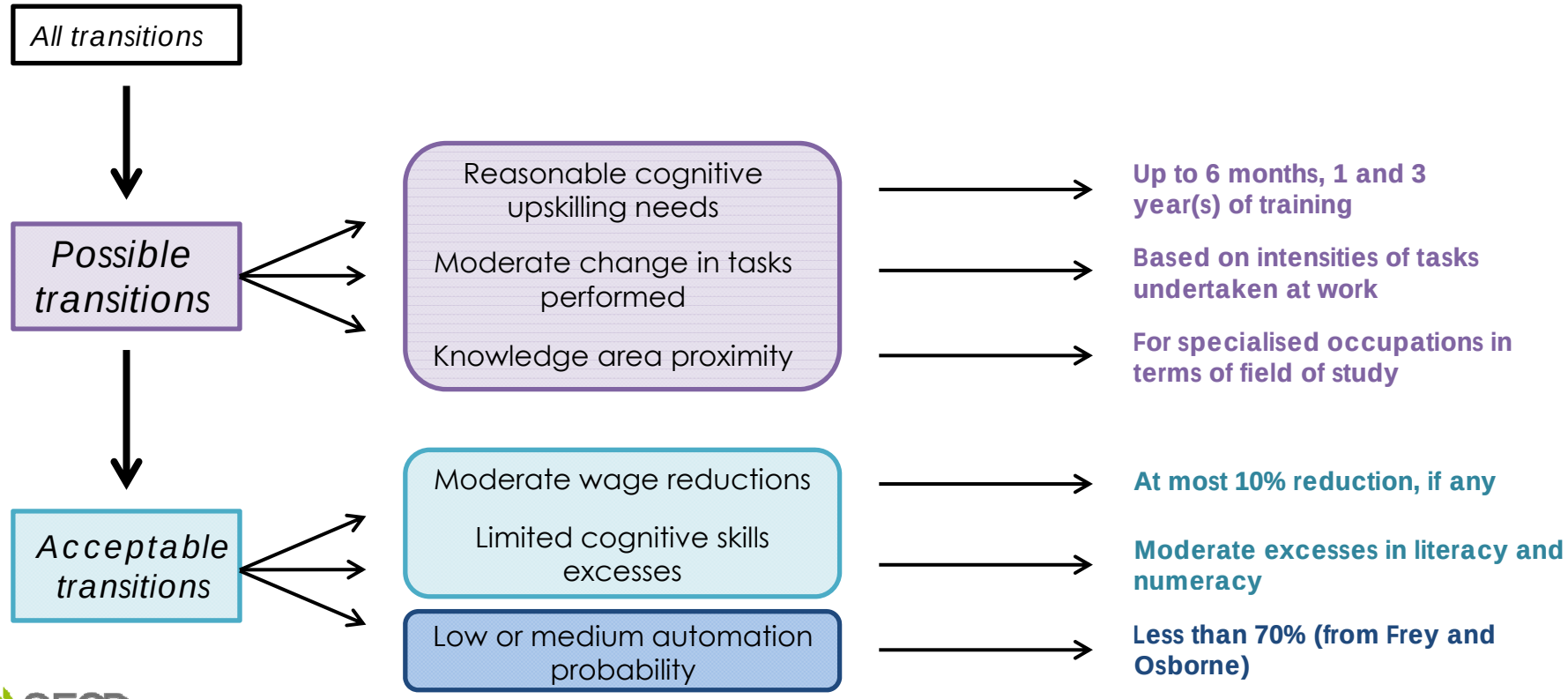
Source: Survey of Adult Skills (2012, 2015)

TRAINING EFFORTS AND TYPOLOGY OF TRANSITIONS



TYPOLOGY OF TRANSITIONS



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COUNTRY CLUSTERS

CLUSTER	COUNTRIES		CHARACTERISTICS of Skills distribution
Cluster 1	Chile Greece Italy Lithuania	Russian Federation Slovak Republic Turkey	Low skills proficiency + small dispersion
Cluster 2	Australia Canada Ireland	New Zealand United Kingdom United States	Medium skills proficiency + large dispersion
Cluster 3	Austria Belgium Czech Republic Denmark Finland	Germany Japan Netherlands Norway Sweden	High skills proficiency + small dispersion
Cluster 4	Estonia France Israel Korea	Poland Singapore Slovenia Spain	Medium skills proficiency + medium dispersion

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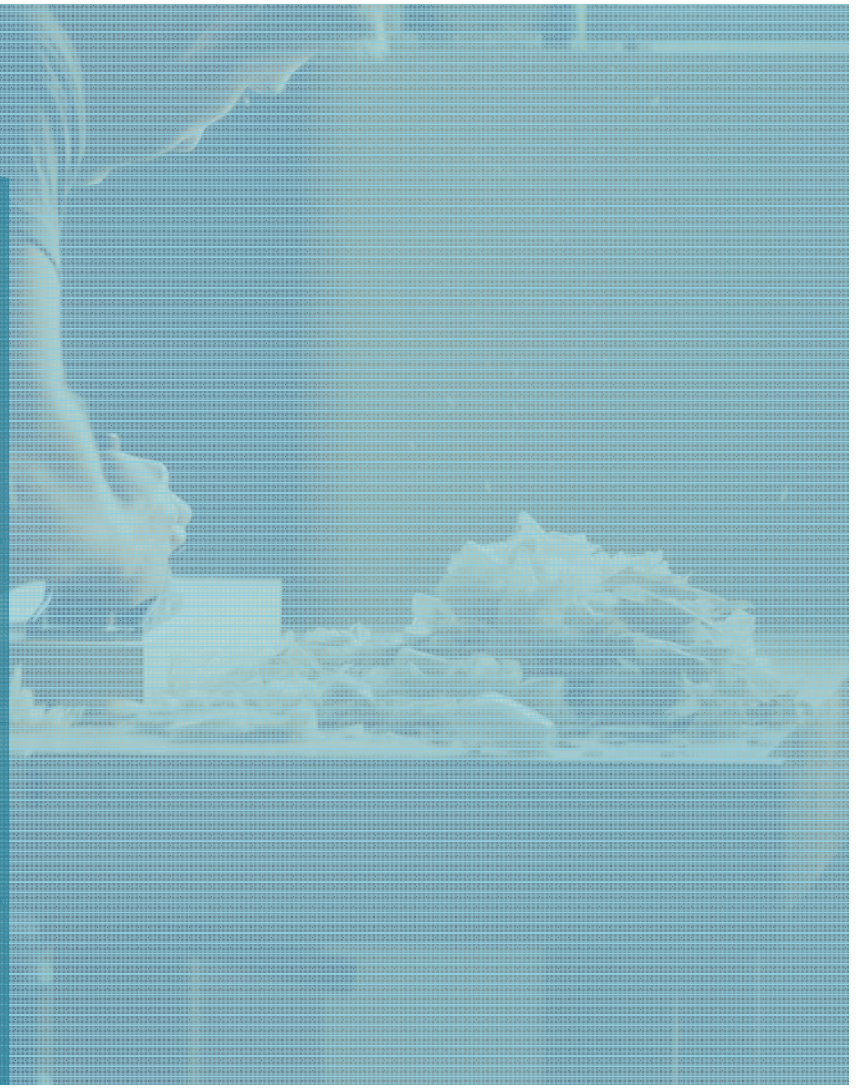
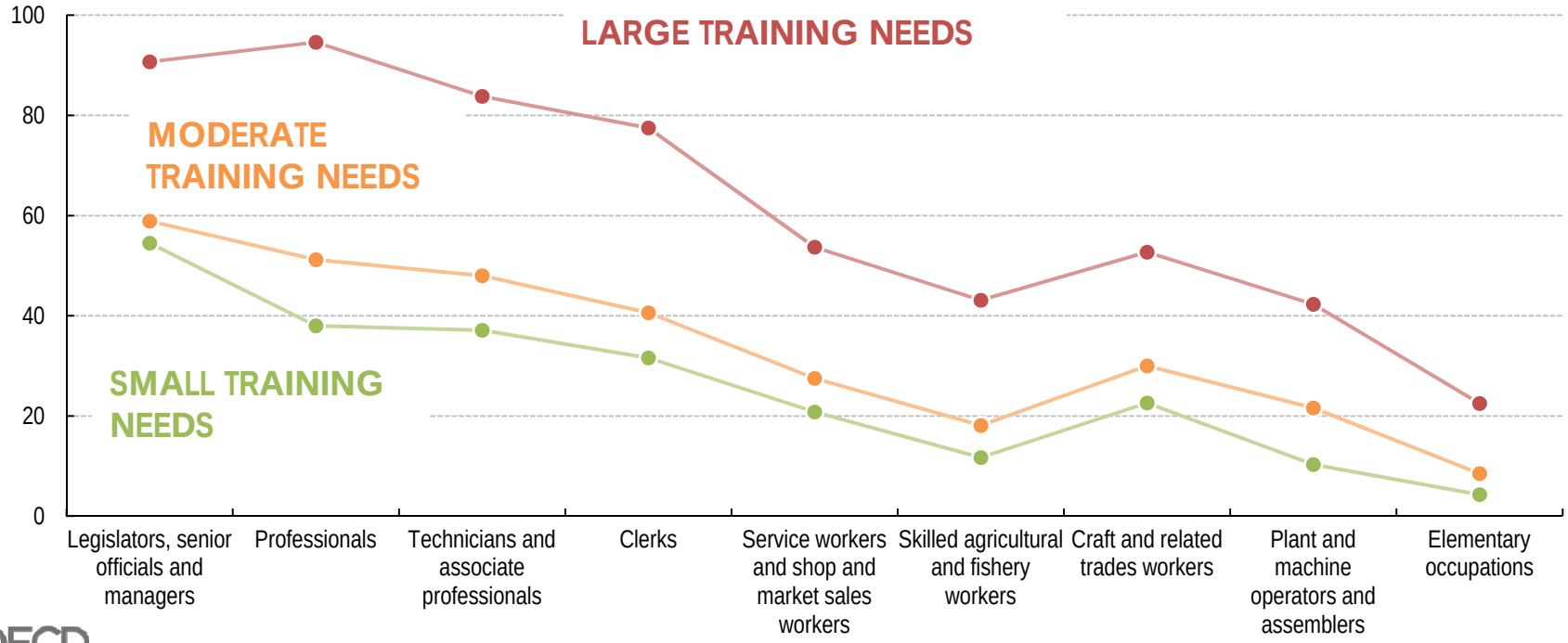
POSSIBLE AND ACCEPTABLE TRANSITIONS



NUMBER OF POSSIBLE TRANSITIONS INCREASING WITH SKILL LEVEL

SHARE OF POSSIBLE TRANSITIONS BY SCENARIO AND OCCUPATION GROUP (%)



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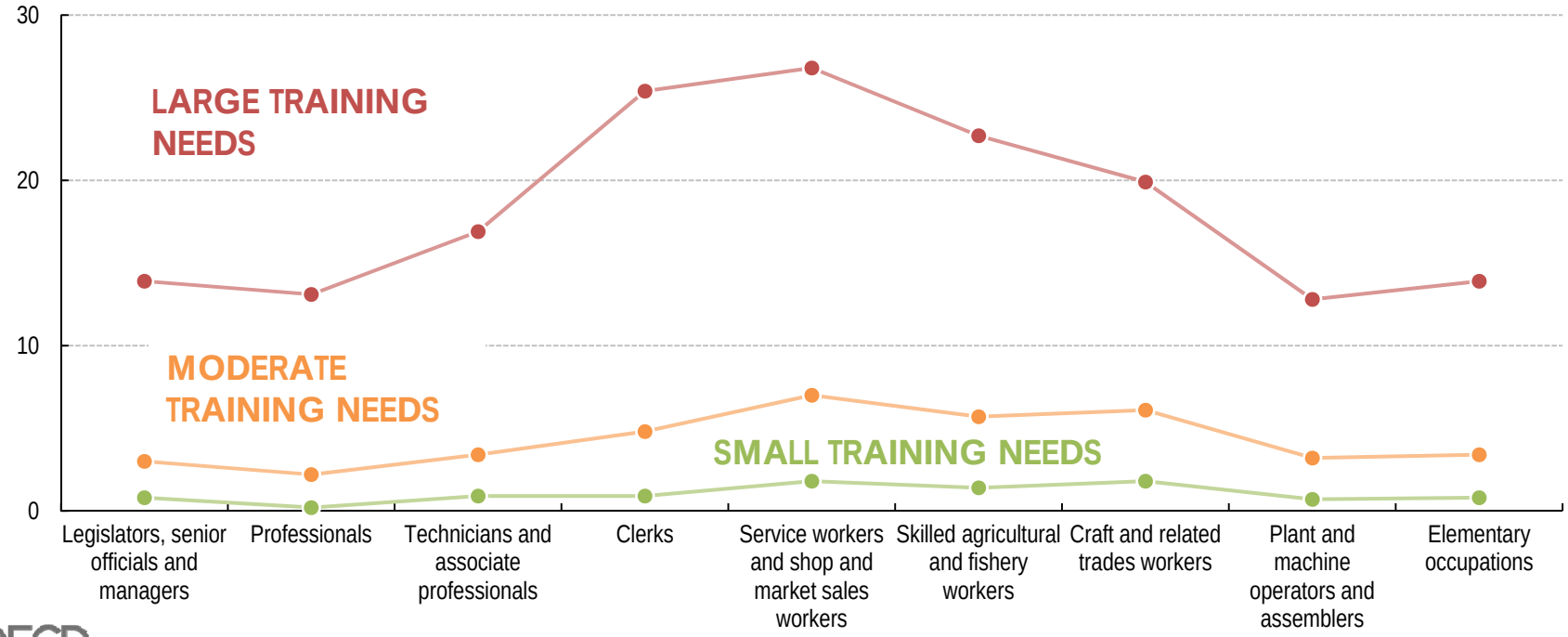
Source: Survey of Adult Skills (2012, 2015)

HIGH AND LOW SKILLED OCCUPATIONS HAVE FEW ACCEPTABLE TRANSITIONS

SHARE OF ACCEPTABLE TRANSITIONS BY SCENARIO AND OCCUPATION GROUP (%)



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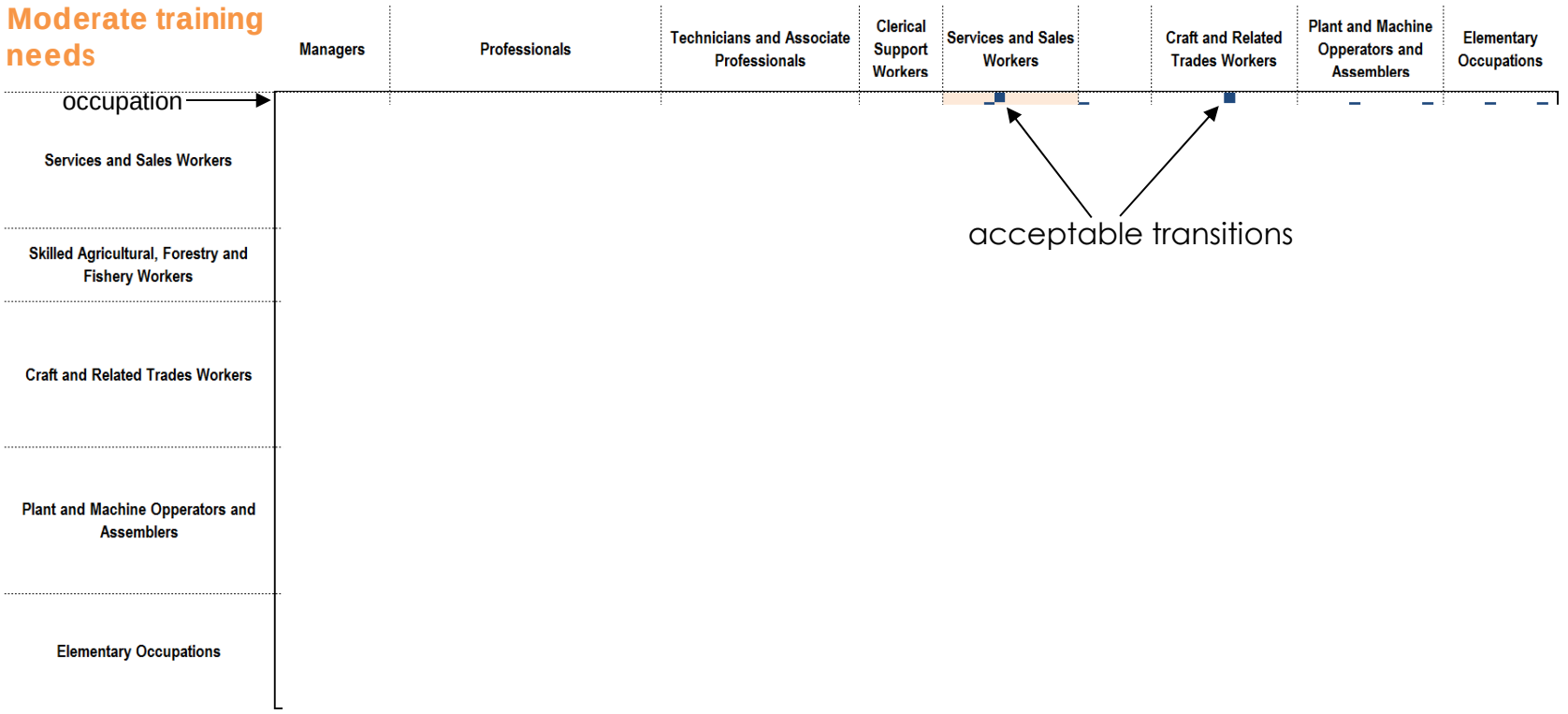
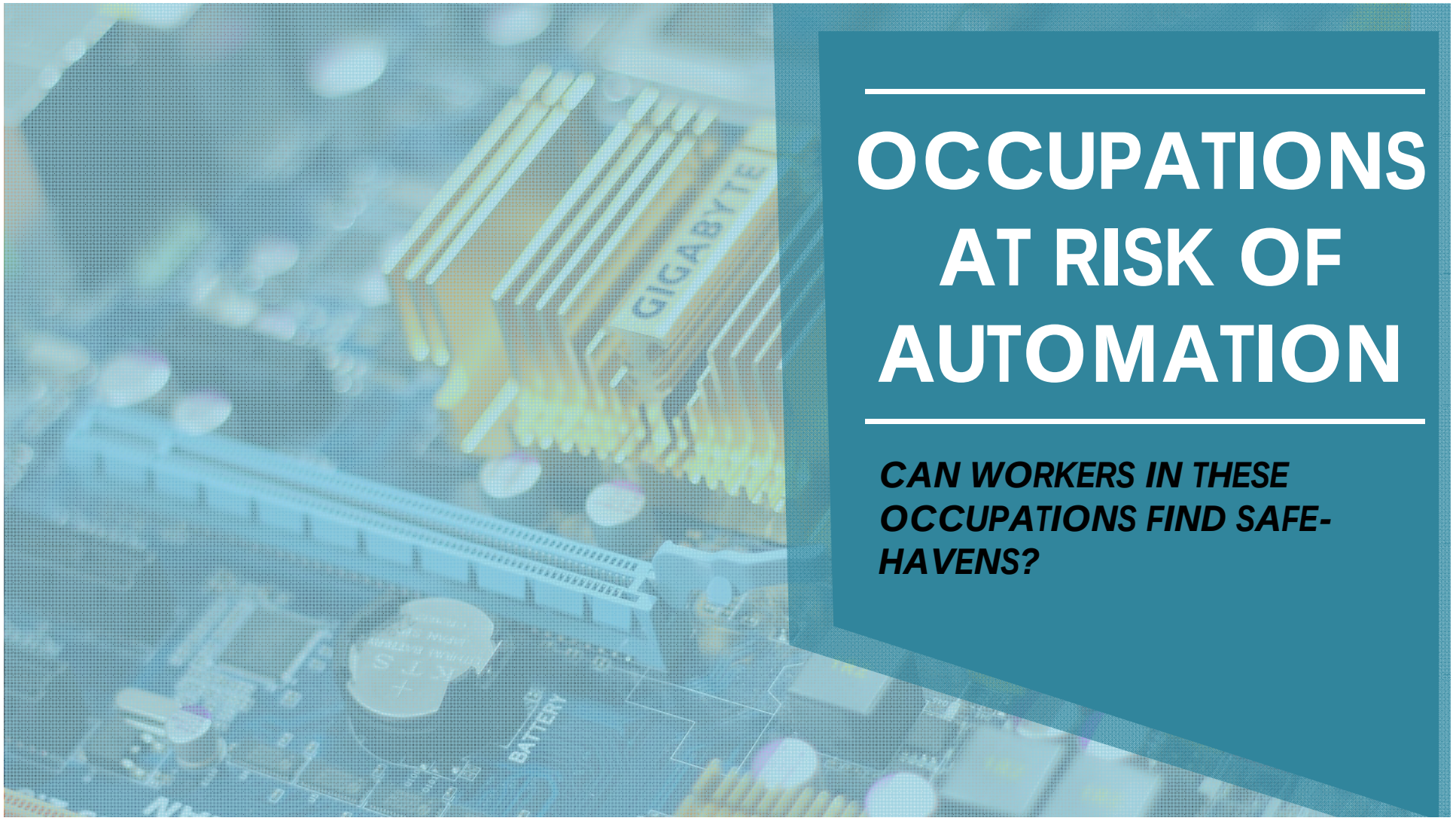
Source: Survey of Adult Skills (2012, 2015)

WHERE ARE OCCUPATIONS' ACCEPTABLE TRANSITIONS?



Source: Survey of Adult Skills (2012, 2015)

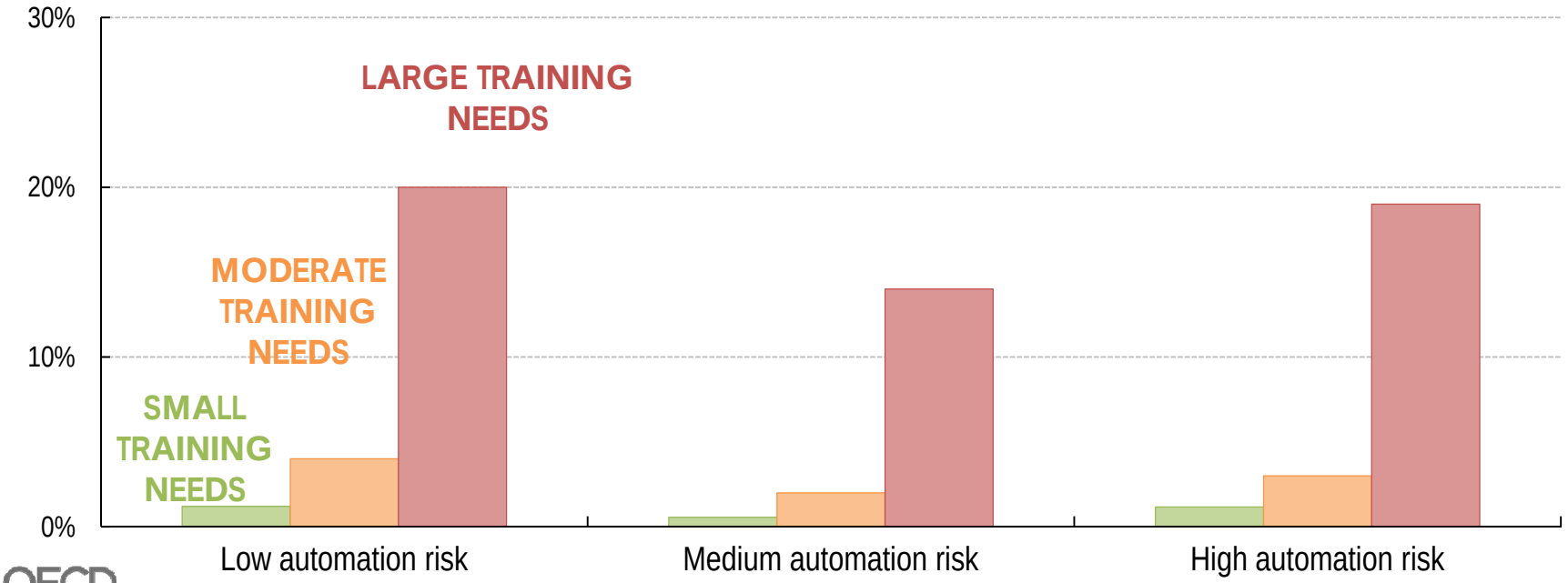


OCCUPATIONS AT RISK OF AUTOMATION

CAN WORKERS IN THESE OCCUPATIONS FIND SAFE-HAVENS?

NO DIFFERENCES IN THE SHARE OF ACCEPTABLE TRANSITIONS

AVERAGE SHARE OF ACCEPTABLE TRANSITIONS BY RISK OF AUTOMATION OF ORIGIN OCCUPATIONS AND BY SCENARIO



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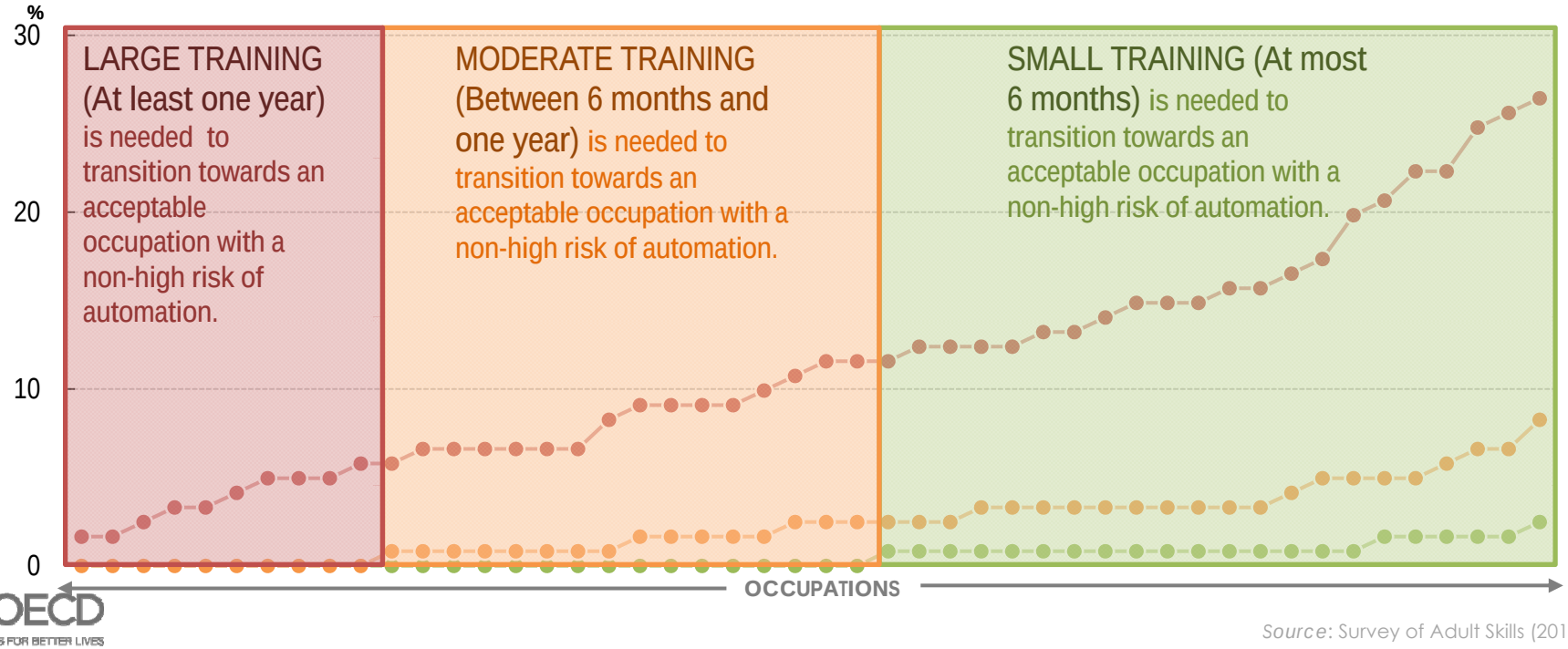
Source: Survey of Adult Skills (2012, 2015)

MOST OCCUPATIONS AT HIGH RISK CAN TRANSITION WITH MODERATE TRAINING

SHARE OF ACCEPTABLE TRANSITIONS towards occupations with a LOW OR MEDIUM RISK OF AUTOMATION FOR ORIGIN occupation with a HIGH RISK OF AUTOMATION (SAFE HAVEN)



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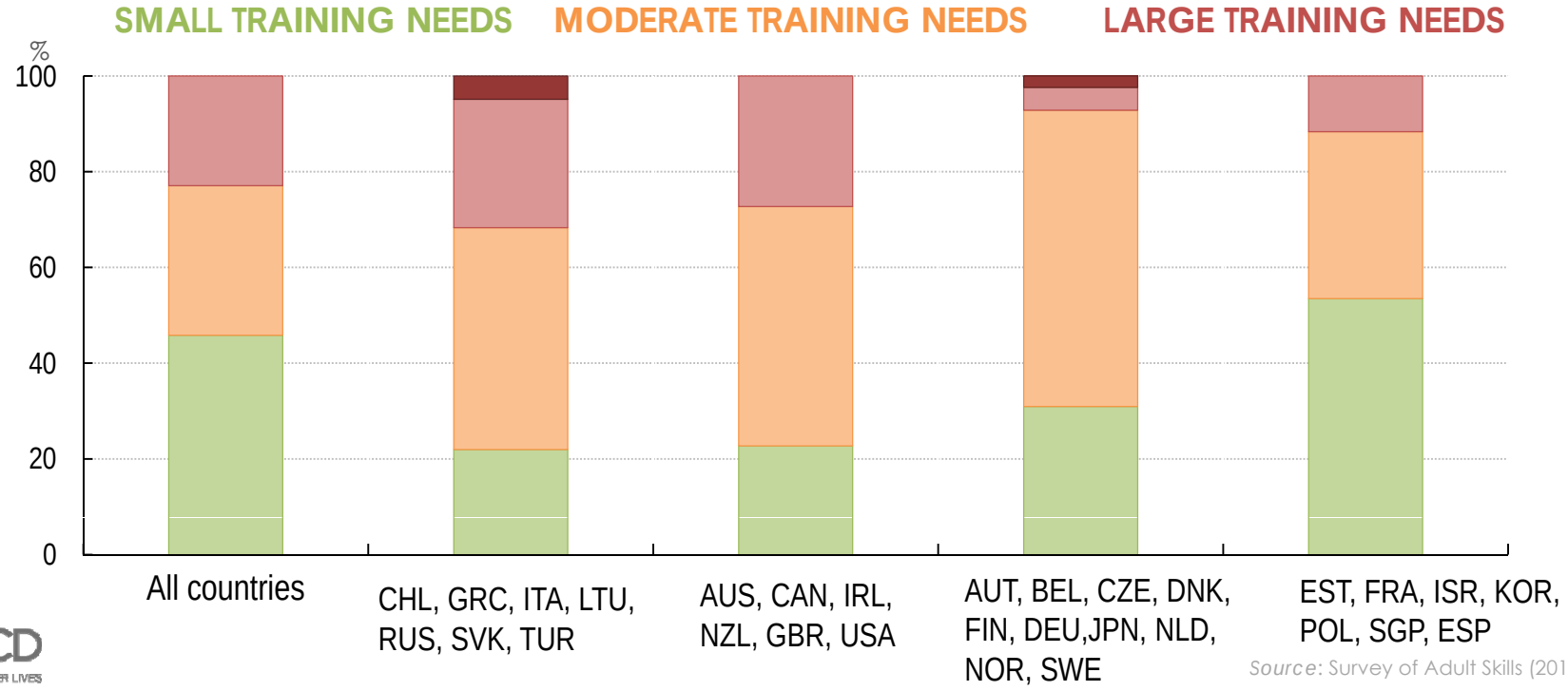
Source: Survey of Adult Skills (2012, 2015)

NUMBER OF OCCUPATIONS TO BE TARGETED BY POLICIES VARY BETWEEN CLUSTERS

SHARE OF OCCUPATIONS AT HIGH RISK OF AUTOMATION BY SMALLEST TRAINING NEED FOR WHICH AT LEAST ONE SAFE HAVEN CAN BE FOUND



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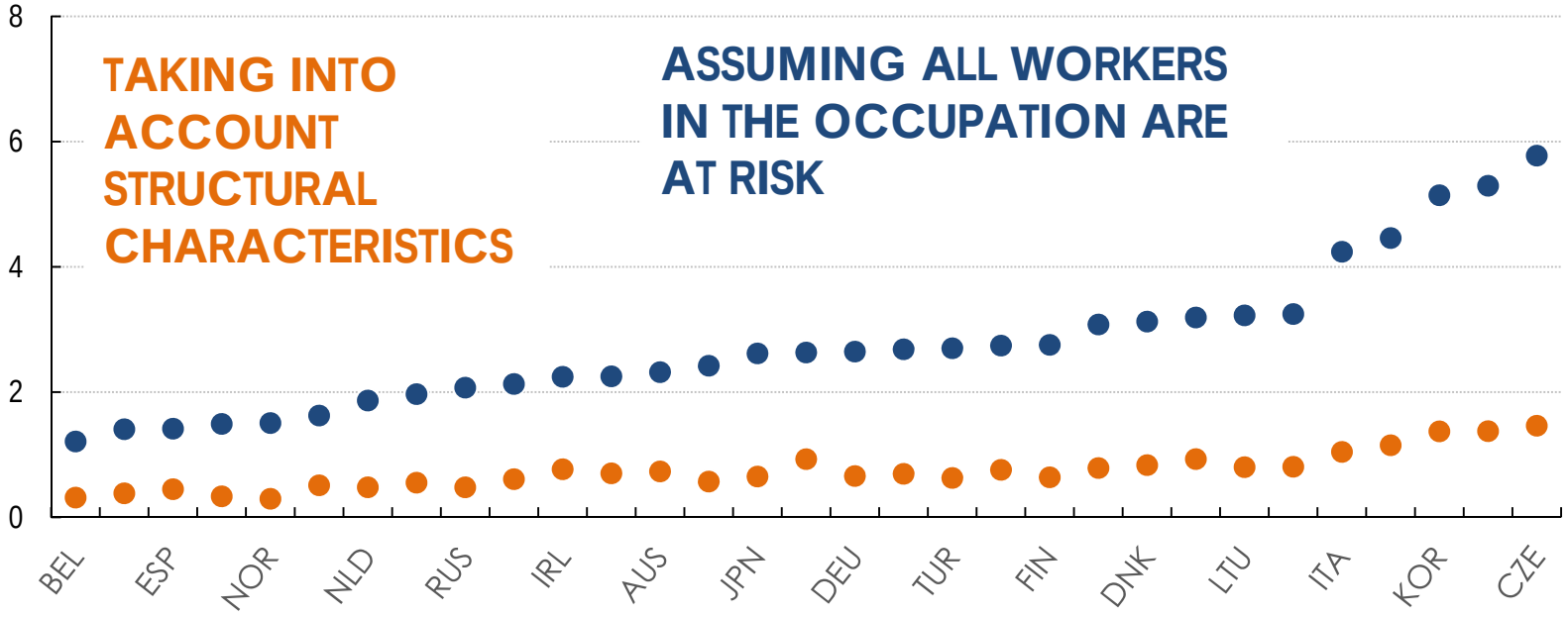
Source: Survey of Adult Skills (2012, 2015)

SHARE OF EMPLOYMENT IN OCCUPATIONS TO BE TARGETED BY POLICIES

SHARE OF WORKERS IN HIGH RISK OCCUPATIONS WITHOUT A SAFE HAVEN
UNDER 1 YEAR OF TRAINING (%)



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Source: Survey of Adult Skills (2012, 2015)

HIGH RISK OCCUPATIONS NEED A MIX OF COGNITIVE AND SOFT SKILLS

RELATIVE TRAINING NEEDS INVOLVED IN ACCEPTABLE TRANSITIONS for occupations at HIGH RISK OF AUTOMATION towards occupations at LOW or MEDIUM RISK OF AUTOMATION

Low training effort — High training effort

	ICT Skills	Advanced Numeracy Skills	Accountancy and Selling Skills	Managing and Communication Skills	Self-Organisation Skills
Cluster 1: CHL, GRC, ITA, LTU, RUS, SVK, TUR	16%	12%	14%	29%	29%
Cluster 2: AUS, CAN, IRL, NZL, GBR, USA	23%	13%	12%	33%	19%
Cluster 3: AUT, BEL, CZE, DNK, FIN, DEU,JPN, NLD, NOR, SWE	20%	7%	11%	38%	24%
Cluster 4: EST, FRA, ISR, KOR, POL, SGP, ESP	22%	9%	15%	31%	23%
All countries	22%	10%	16%	33%	20%

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Source: Survey of Adult Skills (2012, 2015)

SUMMING UP

All occupations

- **Possible transitions** entailing **small retraining needs** for almost **all** occupations…
- But **few acceptable transitions** with **small retraining effort**

Occupations at high risk of automation

- For a **subset** of occupations (10) at high risk of automation, **large re-training effort needed to identify acceptable transition:** occupations in a critical situation
- **Training in cognitive skills** (literacy, numeracy) and **soft skills appears to be crucial**

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OCCUPATIONAL TRANSITIONS:
the Cost of Moving to a “Safe Haven”

The context

- Digitalisation (among others) changes the nature of work.
- With the changing nature of work, tasks change.
  - Especially true if occupations display tasks at high risk of automation.
  - => Focus on cross-occupation transitions.
- Transitions may require reskilling or upskilling.
- Objective: what is the cost of reskilling required by these transitions?

Source: Survey of Adult Skills (2012, 2015)

The framework

- Starting point:
  - Measure of **COGNITIVE DISTANCE** between origin and destination occupations.
  - Considers only **acceptable** transitions.
  - 3 scenarios depending on re-training length.

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- Starting point:
  - Measure of **COGNITIVE DISTANCE** between origin and destination occupations.
  - Considers only **acceptable** transitions.
  - 3 scenarios depending on re-training length.
- BUT simplifying assumptions:
  - Transitions are successful: workers are able to learn;
  - job to training to job transitions, i.e. no unemployment spell;
  - Does not say anything about preferences in location, contract type, etc

    ➡ Not a prediction of transition patterns !!!

The cost of transitions

- **TOTAL** COST of moving = **direct + indirect/opportunity.**
  - Indirect: *cluster-specific* average worker's wage from PIAAC.
  - Direct: Per student, *country specific* cost. Education at a Glance (2017).

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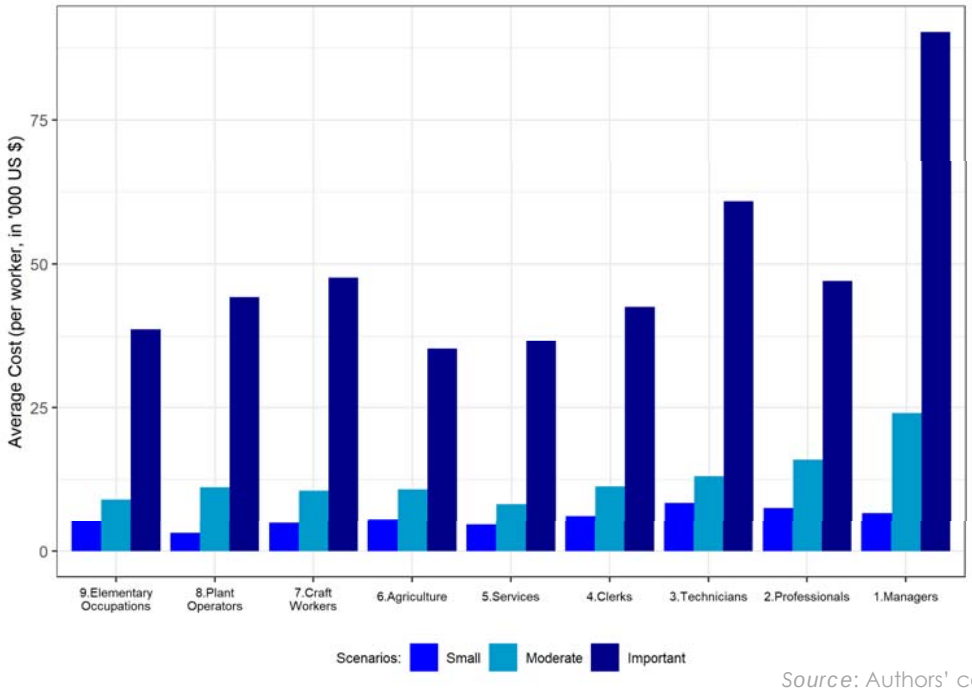
- One estimate per 123 ISCO-08 occupations, 31 countries and 3 scenarios.
- Estimates presented for :
  - **Overall** sample, pooling over countries.
  - Restricted sample: occupations of origin at **high Risk Of Automation.**

The cost of upskilling and (re)training

Average cost per person

Average per-person total cost,
by occupation and training effort ('000 USD)

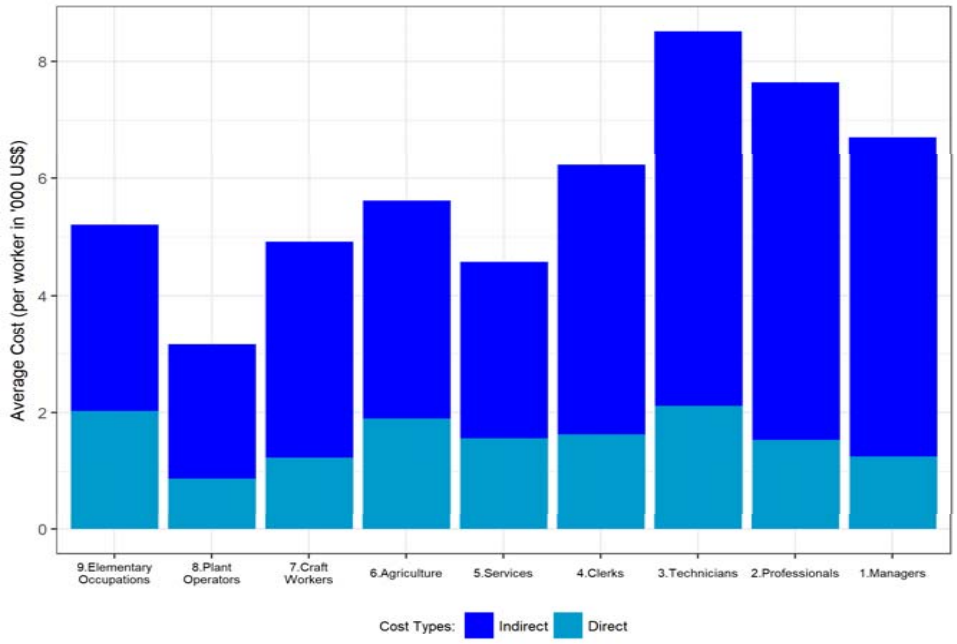


- Cost increases with the training effort.
- Average per-person cost:
  - Small: $ [1; 15,000] → $7,000
  - Moderate: $[2,000; 35,000] → $13,000
  - Important: $[24,000; 98,000] → $50,000

Source: Authors' calculations based on Survey of Adult Skills (2012, 2015) and Education at a Glance (2018)

Average cost per person

Average per-person cost, by occupation
(**Small training effort**, '000 USD)



- Direct vs indirect cost
  - Indirect cost more important than direct
- High-skill vs low-skill occupations
  - Differences are statistically significant

Source: Authors' calculations based on Survey of Adult Skills (2012, 2015) and Education at a Glance (2018)

Moving to a “Safe Haven”

Country-level estimates

The cost to safe haven

- **Minimum cost** of moving to a safe haven:
  - Focus on occupations of destinations at low/medium Risk of Automation
  - Average cost of moving to the nearest scenario

    (does not say anything about the « quality » or « security » of the job).

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  - (Average cost per occupation)*(# employees in the occupation of origin), then sum over all occupations in the country.

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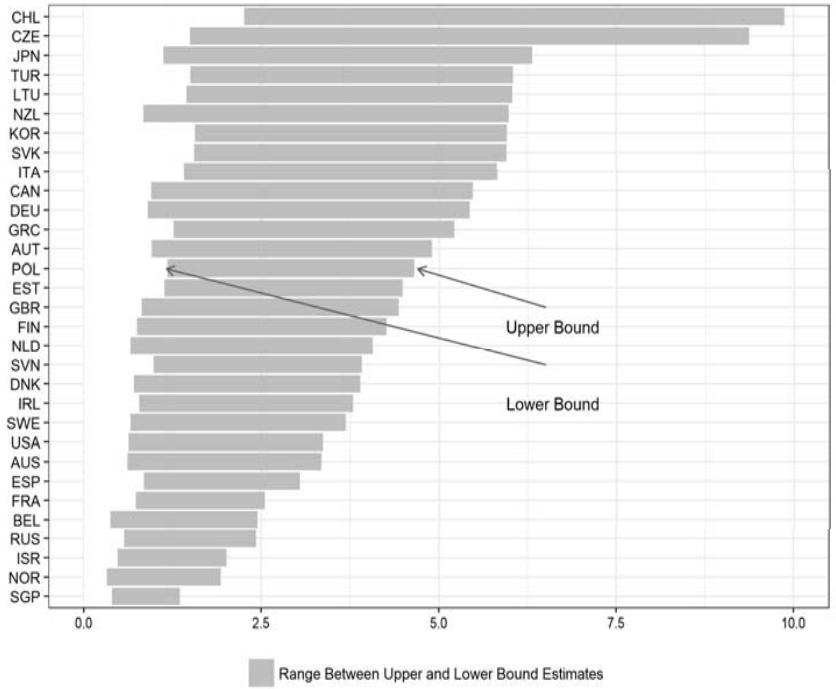
  - (Average cost per occupation)*(# employees in the occupation of origin), then sum over all occupations in the country.
  - **Upper bound**: all individuals employed in the occupation are at high ROA.
  - **Lower bound**: only a share* of employed workers are at high ROA.

** Computed by Nedelkoska and Quintini (2018), based on PIAAC.*

The cost to safe haven

Country-level **total** cost to nearest available destinations
(% GDP, Lower and Upper bounds)



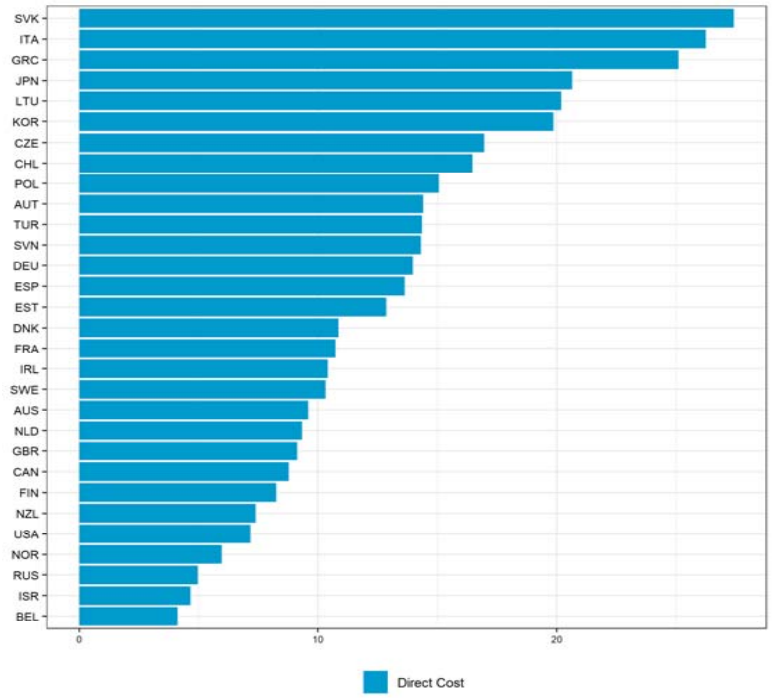
- Approximate magnitude:
  - Lower bound average: 1%
  - Upper bound average: 4.6%
- Heterogeneity between countries: multiple channels at play.

NOT to be sustained in one year only!

alculations based on Survey of Adult Skills (2012, 2015), Education at a Glance (2018) and OECD STAN

… in terms of education expenditure

County-level **direct** cost to "safe haven" – lower bound
(% education expenditure – levels 3 to 8)



- Opportunity cost is larger part
- Yet, heterogeneity between PIAAC countries remains.
  - Average (lower bound): 12.7%

Source: Authors' calculations based on Survey of Adult Skills (2012, 2015), Education at a Glance (2018)

The cost in an ageing society

Correlations of per-worker total cost and age

(a) All occupations with acceptable transitions				
	Min	Small	Moderate	Important
Average Age	0.113***	0.148***	0.039***	0.056***
% young (25-35)	-3.657***	-5.495***	-1.460***	-1.453***
% elderly (55-65)	2.582***	3.239***	0.757**	1.838***
Median Wage control	YES	YES	YES	YES
Country FE	YES	YES	YES	YES
(b) Only high ROA occupations with acceptable, low-ROA transitions				
	Min	Small	Moderate	Important
Average Age	0.097***	0.111**	0.065**	0.012***
% young (25-35)	-3.377***	-6.101***	-0.823	-0.469***
% elderly (55-65)	1.06	0.777	-0.655	0.381***
Median Wage control	YES	YES	YES	YES
Country FE	YES	YES	YES	YES

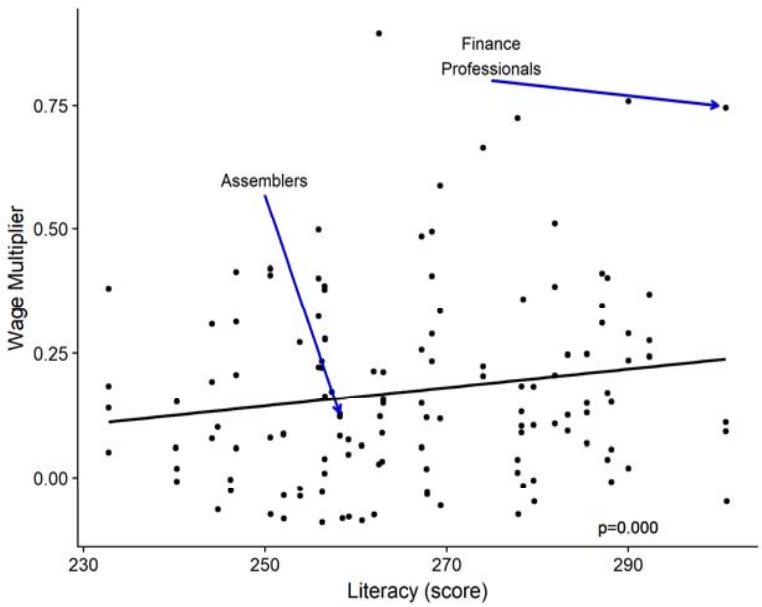
- Higher average age of workers in the occupation associated to a higher total cost of moving.
- BUT correlation disappears if controlling for occupation of employment.

  ⇒ Correlation explained by the age composition of occupations,

- OLS regressions estimated on the sample of country-occupation pairs
- Robust standard errors in parentheses.
- *** p<0.01, ** p<0.05, * p<0.1.

Wage gains

Median skills and gains in median hourly wage
(0 = same wage before and after transition)



- Higher cognitive skills are associated to higher total costs
  - OLS regressions with a non-linear effect and controlling for wage
- BUT they may also gain more from the transition (see graph).
  - Positive and statistically significant correlation

Source: Survey of Adult Skills (2012, 2015) and Education at a Glance (2018)

Conclusions

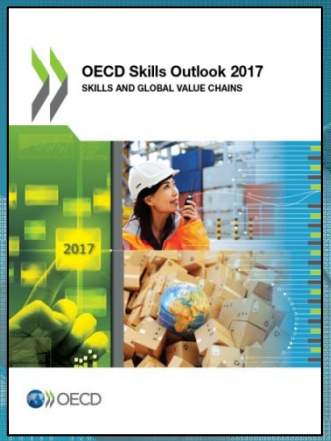
- 1st estimates of occupation&country specific cost of retraining.
- Important caveats (in some cases, no data available)
  - Differences in effectiveness of education and training systems? (Cross-country and within-country).
  - Individual (and adult) ability to learn.
  - RoA: technology diffusion and adoption across occupations, sectors, firms, etc....
  - Differences in costs if training is firm- vs government- provided?
  - Work and learn at the same time? importance of learning on the job?
  - Role of technology in shaping opportunity to learn and effectiveness of learning (MOOCs)?

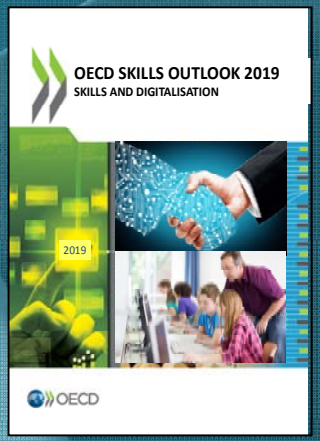
Policy discussion

- Are currently available resources sufficient? Are education and training systems ready or suitable for lifelong learning?
  - Efficiency & effectiveness of training systems: how to factor this in?
- Who should bear the cost of transition? How to best split it?
  - In-school, in vocational training, on the job, all?
- Cost of retraining vs cost of unemployment.
- How to make life-wide learning the new normal: a *"learning & working"* system?

THANK YOU!

mariagrazia.squicciarini@oecd.org





THE TEAM

Elodie Andrieu, Nagui Bechichi, Robert Grundke, Stéphanie Jamet, Gustave Kenedi, Luca Marcolin, Mariagrazia Squicciarini