

THE IMPACT OF DIGITIZATION OF PRODUCTION ON EMPLOYMENT IN CHILE

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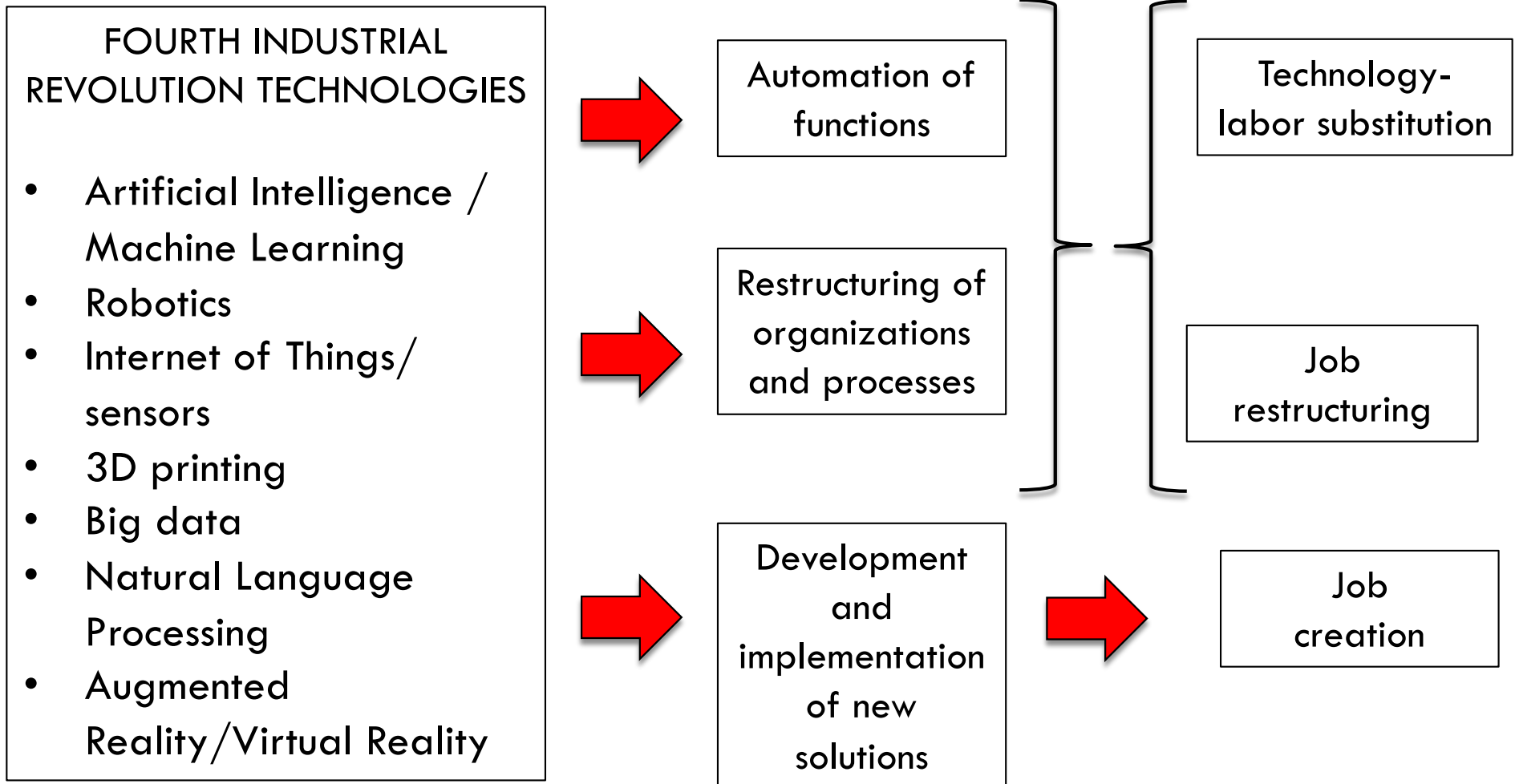
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PURPOSE OF THE STUDY

- Assess the disruption of technologies linked to Industry 4.0 in the labor market
- Forecast the timing of impact of said technologies
- Estimate the level of disruption resulting from the potential imbalance between the level of education of the labor force and the needs emerging from the production side of the economy
- Determine the potential public policy implications
- Study was funded by the German Cooperation through the Economic Commission for Latin America and the Caribbean

THE FOURTH INDUSTRIAL REVOLUTION WILL HAVE THREE CONCURRING EFFECTS ON THE LABOR MARKET: JOB DESTRUCTION, JOB CREATION AND JOB RESTRUCTURING

LABOR IMPACT OF FOURTH INDUSTRIAL REVOLUTION TECHNOLOGIES



TWO THEORETICAL FRAMEWORKS TO ASSESS THE IMPACT OF AUTOMATION ON LABOR RESTRUCTURING AND DESTRUCTION

OCCUPATIONAL ANALYSIS

- Estimate probability of automation
- Focused only on machine learning and robotics
- Identify repetitive and routine-based occupations likely to be replaced by platforms and algorithms
- Assign a subjective probability of automation for each occupation



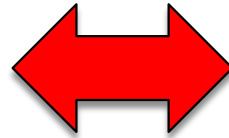
- Frey and Osborne (2013)
- Replications in Finland, Germany, UK and Latin America

ANALYSIS OF TASKS

- Automation only impacts specific tasks contained in the entire occupation
- Estimation of subjective task automation probabilities
- The elimination of a whole occupation depends on the percentage of tasks that can be automated
- The impact is always lower than in occupational analysis

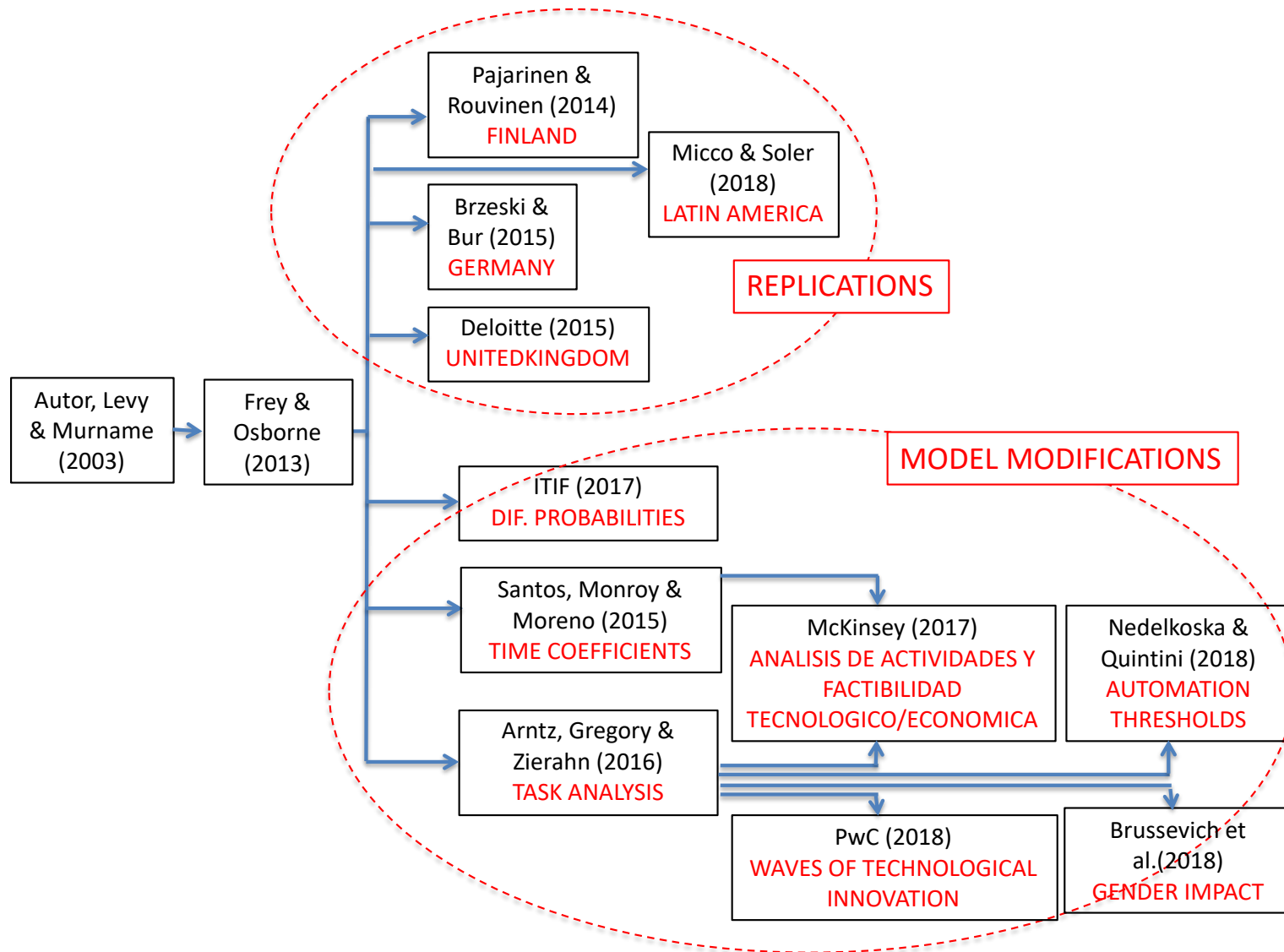


- Arntz, Gregory y Zierahn (2016)
- Nedelkoska y Quintini (2018)
- Modification de McKinsey



FREY AND OSBORNE (2013) LAUNCHED A SERIES OF REFINEMENTS AND REPLICATIONS OF ANALYSIS OF IMPACT OF AUTOMATION ON OCCUPATIONS

EVOLUTION OF RESEARCH LITERATURE ON OCCUPATIONAL IMPACT OF AUTOMATION



RESEARCH HYPOTHESES

- The impact of automation is higher in emerging countries, which means that the effect in Chile should be higher than in advanced economies
- The educational level of the labor force has an inverse relation with the proportion of vulnerable Jobs (in other words, the likelihood of automation diminishes with educational level)
- Considering the importance of education and training in reducing the probability of automation, the growing percentage of occupations with high educational requirement reduces automation disruption
- The proportion of female workers with automation probability will be lower than male workers
- The most vulnerable social groups (e.g. first income quintile, aboriginal population) hold jobs with the highest likelihood of automation

METHODOLOGY: APPLY THE PROBABILITY OF AUTOMATION BY OCCUPATION FROM FREY AND OSBORNE (2013) TO THE ENCUESTA DE CARACTERIZACIÓN SOCIOECONÓMICA NACIONAL (CASEN)

- Survey conducted every two years with roughly 200,000 observations, representing through the expansion codes the whole of Chile's labor force, except unemployed and military
- Data had to be translated from the ILO CIUO-88 to SOC (Standard Occupation Classification of the US Census)
- This allows to generate a probability for each occupation according to the following formula:

$$\text{Probabilidad de automatización} = \frac{((\text{probabilidad de registro}_1 * \text{factor de expansión}_1)) + \dots + ((\text{probabilidad de registro}_n * \text{factor de expansión}_n))}{\text{Total fuerza laboral ocupada a nivel nacional}}$$

- The analysis is repeated for categories such as gender, socio-economic level, education for 2013, 2015 and 2017

RESEARCH FINAL RESULTS

	2017			2015			2013		
Estadísticas Chile 2017	Observaciones	Probabilidad	Std. Dev.	Observaciones	Probabilidad	Std. Dev.	Observaciones	Probabilidad	Std. Dev.
Toda la población	7,830,958	57.81%	0.2917	7,504,430	58.53%	0.2926	7,237,068	58.91%	0.2854
Hombres	4,416,021	59.51%	0.2763	4,252,737	60.01%	0.2804	4,188,566	60.26%	0.2735
Mujeres	3,414,937	55.60%	0.3090	3,251,693	56.58%	0.3066	3,048,502	57.04%	0.2999
No indígena	7,160,263	57.48%	0.2931	6,897,057	58.16%	0.2943	N/D	N/D	N/D
Indígena	664,360	61.27%	0.2740	606,480	62.70%	0.2691	N/D	N/D	N/D
Chilenos	7,362,673	57.65%	0.2936	7,259,892	58.49%	0.2929	7,051,004	58.95%	0.2853
Extranjeros	468,285	60.23%	0.2587	243,278	59.69%	0.2827	181,412	57.01%	0.2891
Sin educación básica	715,636	72.48%	0.1881	728,346	70.83%	0.2034	781,835	72.37%	0.1812
Educación básica	1,582,376	68.87%	0.2042	1,631,610	68.24%	0.2092	1,685,709	68.81%	0.2001
Educación media	2,925,729	65.38%	0.2274	2,870,278	66.03%	0.2281	2,691,382	65.94%	0.2201
Educación superior	2,560,806	38.22%	0.3246	2,261,823	38.01%	0.3343	2,045,242	36.34%	0.3242
1er quintil de ingreso	859,226	69.81%	0.2185	877,983	69.09%	0.2242	N/D	N/D	N/D
2do quintil de ingreso	1,477,662	67.39%	0.2244	1,391,858	66.72%	0.2302	N/D	N/D	N/D
3er quintil de ingreso	1,739,900	63.59%	0.2516	1,657,429	63.99%	0.2519	N/D	N/D	N/D
4to quintil de ingreso	1,900,947	58.29%	0.2810	1,825,251	59.06%	0.2844	N/D	N/D	N/D
5to quintil de ingreso	1,833,716	38.42%	0.3216	1,729,400	40.69%	0.3335	N/D	N/D	N/D

DISCUSSION: THE ANALYSIS OF AUTOMATION PROBABILITY BY EDUCATIONAL BACKGROUND PROVIDES AN INDICATION OF THE IMPORTANCE OF HUMAN CAPITAL

PERCENTAGE OF LABOR FORCE WITH HIGH AUTOMATION PROBABILITY BY EDUCATIONAL LEVEL (2013-17)

	2013	2015	2017
Labor force	7,237,068	7,504,430	7,830,9358
Probability	58.91%	58.53%	57.81 %
Standard deviation	0.2854	0.2926	0.2917
No basic education	72.37%	70.83%	72.48%
Basic education	68.81%	68.24%	68.87%
High school	65.94%	66.03%	65.38%
Tertiary education	36.34%	38.01%	38.22%



The proportion of labor force with high education increases faster than the probability of automation

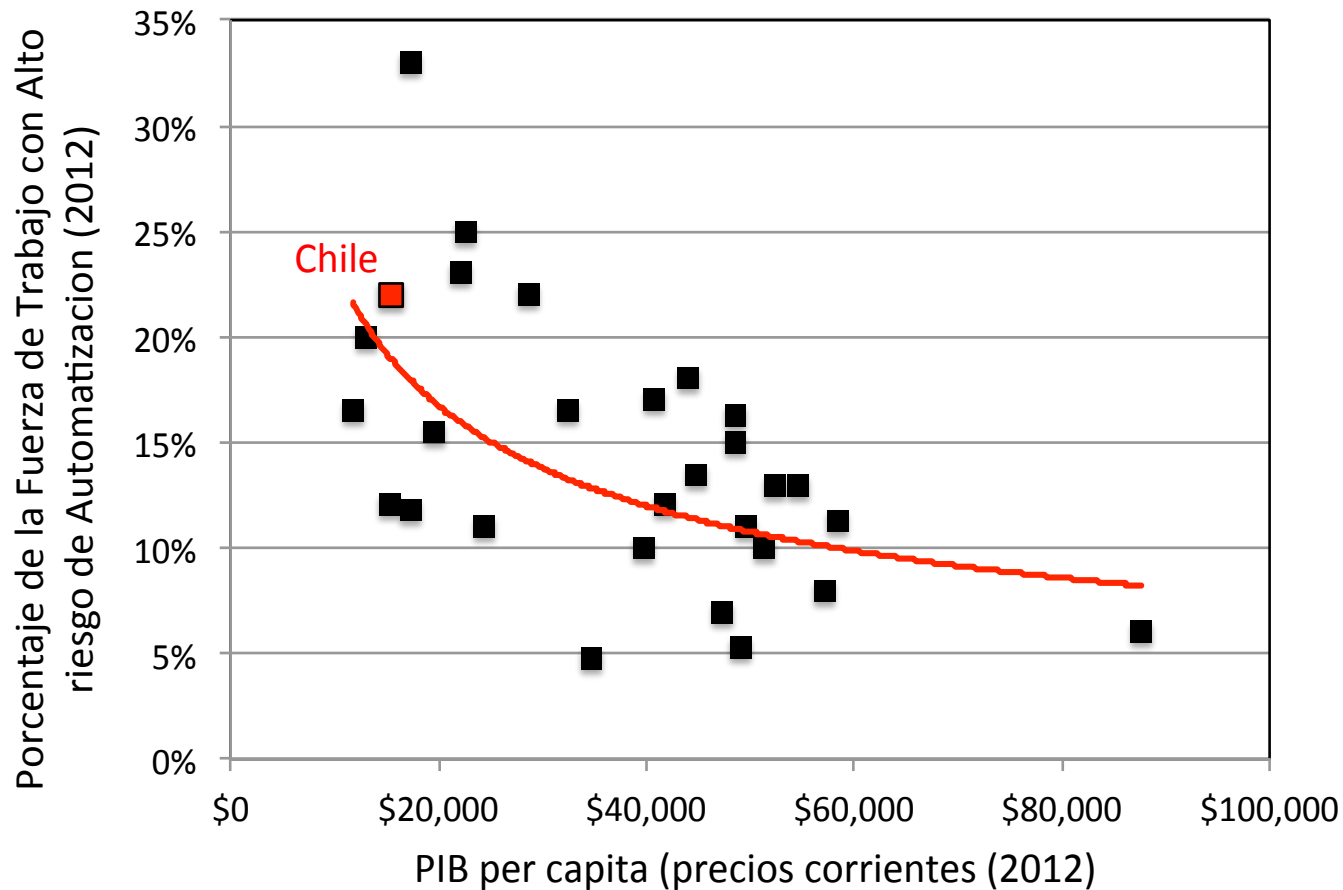


The automation probability diminishes with educational level

Sources: *CASEN; Katz (2018)*

DISCUSSION: THE IMPACT OF AUTOMATION ON JOBS IS HIGHER IN EMERGING COUNTRIES THAN IN ADVANCED ECONOMIES

OECD COUNTRIES: PER CAPITA GDP VS. PERCENTAGE OF JOBS WITH HIGH RISK OF AUTOMATION



Fuentes: IMF; Nedelkoska y Quintini (2018); authors

DISCUSSION: TIME EXTRAPOLATION OF RESULTS

- 57.81% of labor force will either disappear (22.5%) or be significantly restructured by 2048
- Automation in Chile has already yielded the elimination of 35,000 jobs, with impact concentrated in most vulnerable sectors
- On the other hand, 32,000 new jobs have been created with occupations concentrated in Business Operations, Finance, Business Administration, Computer Science, Engineering, and Education, all of which require high education
- Tendency towards job polarization and acceleration of social exclusion
- In the future, job destruction will increase (in ten years, 282,000 will disappear)
- If future annual job creation does not increase beyond the current 32,000 value, in five years a net decrease of 57,000 Jobs and a restructuring of 132,000 will take place

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