

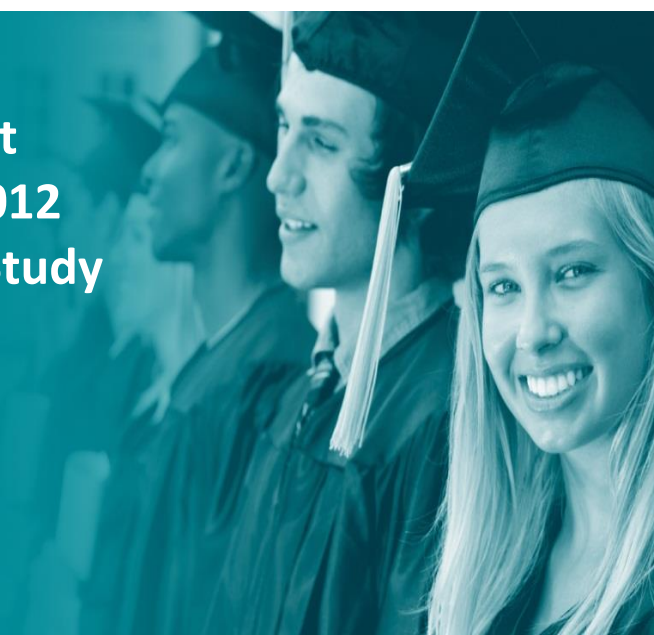


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Skills, Signals and Labour Market Outcomes: An Analysis of the 2012 Longitudinal and International Study of Adults

Roger Pizarro Milian, Brad Seward,
David Zarifa and Scott Davies



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1 Yonge Street, Suite 2402
Toronto, ON Canada, M5E 1E5

Phone: (416) 212-3893
Fax: (416) 212-3899
Web: www.heqco.ca
E-mail: info@heqco.ca



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Introduction

Postsecondary education has traditionally been perceived as a golden ticket to economic prosperity (Ford, 2018; Hu, Ortagus & Kramer, 2017). The widespread belief among academics, policy-makers and the public alike that education improves individual and societal level economic outcomes (e.g., Gullason, 1999; Rosenbaum, 2011; Wolf, 2004) has served as justification for sizable government investments into the expansion of educational access around the world (Marginson, 2016; Meyer, Ramirez, Frank & Schofer, 2007; Schofer & Meyer, 2005). It is also responsible for the growing amounts of time and energy devoted by families into ensuring the educational success of their children (Friedman, 2013; Hamilton, 2016; Ramey & Ramey, 2010).

Despite such collective faith in education, ongoing societal transformations have likely altered the value of both educational credentials (e.g., degrees, diplomas) and competencies (e.g., literacy, numeracy) within our labour markets. First, the number of young Canadians who view PSE as a given has led to a vast expansion in Canadian PSE, with over 2 million students enrolled in public colleges and universities as of 2016–17 (Statistics Canada, 2018; also see Usher, 2018; See Rosenbaum, 2011 for more on the similar phenomenon in the US).¹ As the number of students rises, scholars forecast a decrease in the economic value of credentials (Brown, 2001; Collins, 2011).² Though PSE completion still undoubtedly provides healthy financial returns (Boudarbat, Lemieux & Riddell, 2010; Psacharopoulos & Patrinos, 2018), some lament that degrees no longer serve as passports for entry into high-ranking positions. Indeed, PSE credentials now serve as basic requirements for entry-level positions (Burning Glass Technologies, 2014; Fuller & Raman, 2017) that may not leverage graduates' skills (Barone & Ortiz, 2011; Capsada-Munsech, 2017).

Second, as Canada continues its transition toward a knowledge-based economy (Florida, Shutter & Spencer, 2016; Florida & Spencer, 2015), commentators claim that industries associated with science, technology, engineering and mathematics are particularly underserved by our PSE system (Cukier, 2019).³ Disruptive technologies, like artificial intelligence, robotics and the rampant automation they facilitate, are said to be rapidly reshaping the skills needed in our economy (Arntz, Gregory & Zierahn, 2016; Frey & Osborne, 2017; Lamb, 2016), prompting shortages (Munro, MacLaine & Stuckey, 2014; Stuckey & Munro, 2013; Sullivan, 2017) that force employers to look beyond formally credentialed applicants when filling

¹ To our knowledge, this figure excludes students enrolled in certain areas of the system such as for-profit career colleges and Indigenous institutes.

² Research in Brazil supports this narrative, noting that returns to lower-level credentials have vanished as the system expanded, and those to higher-level credentials decreased (see Crespo & Reis, 2015). Research suggest this dilution in value prompts further credentialism, as students migrate to toward higher and more prestigious credentials in order to maintain their labour market advantage (Lucas, 2001; Raftery & Hout, 1993).

³ A sizeable body of literature examines how rising uses of artificial intelligence, robotics and other technology may be potentially intensifying changes in our economy. For brevity, we do not review this body of work.

vacancies (Glassdoor, 2018; Lane & Christensen, 2015). Some interpret these shifts as a sign that our credential-based hiring system is coming to an end (Colagrossi, 2019).

The aforementioned trends and their associated debates have produced great uncertainty about our labour market, and the pathways to success within it. In this context, the federal government has invested over \$300 million in a Future Skills Centre that will forecast skill needs, and evaluate innovative training strategies to meet them. The Ontario government has also vowed to inject skills metrics into the PSE system's performance-based funding model, aiming to boost graduates' economic outcomes (Ontario, 2019). In light of these developments, empirically measuring the economic returns to skills and credentials is a key exercise that can inform both educational reforms and skill-development strategies. If, for example, basic skills prove to be significant predictors of individual economic outcomes — independent of credentialing effects — this would justify heavy investment in short-term skill-development programs (e.g., “boot camps,” workshops, microcredentials etc.).

We wish to enter this debate empirically, addressing the need for studies that examine the net economic returns of direct measures of skills and earned credentials using recent Canadian data. Our strategy is to compare labour market returns to basic skills — such as literacy and numeracy — rather than formal credentials, net of a host of demographic controls. A critical advantage of our data source is that it contains skill metrics necessary to adequately test competing theories (human capital, signalling and credentialing) about how education influences labour market outcomes (van der Gaag & Vijverberg, 1989). We argue that the existing Canadian literature on this topic (e.g., Hunter & Leiper, 1993; Ferrer & Riddell, 2008; Green & Riddell, 2007; 2015; Riddell, 2008) can no longer inform contemporary debates since it uses now-dated data sources that no longer reflect present labour markets. Moreover, recent international studies that include Canada as a case (e.g., Hanushek, Schwerdt, Wiederhold & Woessmann, 2015) lack controls for known correlates of labour market outcomes, including provincial, rural-urban, field of study and other sociodemographic controls. To alleviate this situation, we use Statistics Canada's 2012 Longitudinal and International Study of Adults (LISA) to compare the relative impact of skills and credentials on labour market outcomes. Our empirical analyses — described further below — can inform policies for skill development using labour markets outcomes to assess PSE performance and curriculum design in PSE. Our analyses can also inform student decisions about PSE and other forms of training.

Explanations of the Education and Labour Market Link

While there is evidence that schooling translates into improved labour market outcomes, there are several competing perspectives on how and why this process plays out (Davies & Guppy, 2013; Green & Riddell, 2015; Barone & van de Werfhorst, 2011). In this section we provide a brief overview of their underlying logic (for longer reviews see Bills, 2003; Brint, 2017).

Human Capital Theory (HCT) posits that education transmits useful skills that boost individuals' eventual workplace productivity (Becker, 1962; Mincer, 1958; Schultz, 1961). It presumes three things: that youth enter PSE as a strategic investment to boost their skills, that employers anticipate that highly educated candidates will be more productive workers, and that this eventual productivity will be rewarded on the job and will produce financial returns to schooling. HCT thus holds that skills provide the prime mechanism that links education to economic success. This perspective dominates educational policy discourse in Canada, and is endorsed by numerous international organizations (e.g., OECD, World Bank) (Resnik, 2006).

In the discipline of economics, “signalling” theories provide an alternative perspective (e.g., Arrow, 1973; Spence, 1974; Stiglitz, 1975). Signalling theorists also assume that employers prefer candidates with PSE degrees. But rather than assume that employers equate schooling with workplace productivity, they see employers treating credentials as rough proxies of valuable personal traits, such as determination, trustworthiness and persistence.⁴ Within this perspective, employers assume that these traits are preconditions for PSE program completion, and thus, that earning a credential signals those underlying abilities.

In further contrast to HCT, “credentialism” is a major perspective from the discipline of sociology that emphasizes the often loose connections between education and workplace productivity (Berg, 1970; 1972; Collins, 2019).⁵ Rather than focusing on employer demand for skills, credentialists proclaim that the growing supply of educated labour is a function of various demand- and supply-side pressures (Brown, 2001). Some credentialists see PSE expansion as a function of intensifying competition for good jobs, with individuals and groups seeking to secure an advantage by accumulating credentials (Collins, 2019). Others see occupational dynamics as driving PSE expansion, with elite professions (e.g., medicine, law) using credentials to regulate entry into their ranks (Abbott, 1988), and prestigious employers interpreting credentials as a sign of cultural fit, rather than skill level per se (Rivera, 2011; 2015). From this perspective, the growing prevalence of degrees and their value in the labour market is not strongly driven by rising needs for technical skills.

Overall, these frameworks tout different mechanisms that link educational attainment to economic success: HCT emphasizes that schooling renders individuals more productive, and thus posits that skills are primary predictors of labour market outcomes. Signalling emphasizes that credentials represent non-technical attributes like determination, and thus predicts that formal credentials should account for the lion's share of variation in those outcomes. Credentialism emphasizes demand- and supply-side dynamics that drive people to seek further credentials, and also predicts that the possession of credentials should be a primary predictor of outcomes.

⁴ See Psacharopoulos (1979) for a discussion of the different assumptions of “weak” versus “strong” versions of signalling.

⁵ Also see Beer, Finnstrom & Schrader (2016) on critical business management perspectives on this issue.

Alternatively, a hybrid of these perspectives could posit that both skills and credentials could each exert some degree of influence, albeit in different points in the hiring process and in different sectors of the economy. For instance, one might reason that credentials are important for entry-level hiring, and thus among early-career workers, credentials would have more explanatory power than would skills. However, one could further reason that among later-career workers, the effects of credentials should soon weaken after employees are hired, and that skills would become more powerful predictors of outcomes if workers are indeed rewarded for their job performance. Also, one could reason that formal credentials would have more explanatory power in sectors of the labour market that are highly regulated by professions and that often demand degrees or diplomas, and far less power in sectors that are less regulated.

Existing Empirical Research

Early studies in the field of economics mostly supported HCT (e.g., Layard & Psacharopoulos, 1974; Psacharopoulos, 1977; 1979; 1994). But since the 1970s, there has been growing support for credentialist and signalling theories (Faia, 1981; Goodman, 1979; Katz & Ziderman, 1980; Belman & Heywood, 1991; 1997; Hungerford & Solon, 1987; Jaeger & Page, 1996; Park, 1999). Indeed, recent reviews (e.g., Mora Rodríguez & Muro, 2015) of the international literature reveal that credentialist and signalling perspectives have widespread empirical support. This has led several scholars to consider opportunities for hybridizing the perspectives (Blaug, 1976; Riley, 1976; Weiss, 1995).

One key limitation of many studies comparing the returns to human capital and credentials is their lack of direct measures of skills (Bills, 2003; Flores-Lagunes & Light, 2010). Many studies use years of education as a proxy, but this measure is a crude indicator of the quantity or quality of skills learned in school for several reasons (see also Angrist, Djankov, Goldberg & Patrinos, 2019; Bills, 2003; Hanushek & Woessmann, 2008; Wright & McMahan, 2011):

1. **System Differentiation** – Different tracks in both K-12 and PSE systems expose students to qualitatively distinct learning opportunities, even though they may have similar years of schooling (Gerber & Cheung, 2008).
2. **Variations in School Quality** – Years of schooling also paints over differences in the quality of education (Angrist, Djankov, Goldberg & Patrinos, 2019; Filmer, Rogers, Angrist & Sabarwal, 2018; Perez-Alvarez, 2017) that may stem from disparities in funding, physical facilities and teacher-to-student ratios between public and private schools, and rural versus urban areas (Echazarra & Radinger, 2019), or affluent versus poor neighborhoods (Baker & Corcoran, 2012).
3. **Variations in Student Learning** – Even among students exposed to identical educational treatments, researchers also find large variances in individual outcomes (Angrist et al., 2019; Perez-Alvarez, 2017). Some claim that many students drift through their studies (Côté & Allahar, 2007; 2011)

without making detectable gains in their reasoning, critical thinking and writing abilities (Arum & Roksa, 2011).⁶

4. **Non-educational Influences on Learning** – Skills can be also nurtured outside of schooling — by parents; by information technology; and in workplaces, summer programs, libraries and museums (Davies & Aurini, 2013; Desjardins, 2003; Park & Kyei, 2011; Barro & Lee, 2001).

Despite these limits to using years of education as a proxy for human capital (Hungerford & Solon, 1987, p. 177; Silles, 2008, p. 217; van der Gaag & Vijverberg, 1989, p. 377; Riddell, 2008, p. 17), our review found only a small number of studies that contrast the returns to credentials and human capital using refined skills metrics. In Canada, an early academic study by Hunter and Leiper (1993), found that accounting for occupational skills reduced the economic returns to credentials by 14%–77%, depending on the configuration of gender and credential level (for more details, see Hunter & Leiper, 1993, p. 34). More recently, Riddell (2008), using the Adult Literacy and Skills Survey, found that accounting for literacy proficiency reduced the return to high school completion by 22%, and returns to college and university credentials by 6%–8%. Outside of Canada, recent work in Australia by Barrett (2012), using the Adult Literacy and Life Skills Survey, reported that cognitive skill measures explained 19% of the effect of completing PSE diplomas and bachelor’s degrees, while not affecting returns to post-graduate credentials. Shomos and Forbes (2014), drawing on the most recent data from the Programme for the International Assessment of Adult Competencies (PIAAC), found that 40% of the relationship between educational attainment and employment status (e.g., employed, unemployed) was explained by measures of literacy. In Germany, Antoni and Heineck (2012) analyzed the Working and Learning in a Changing World survey, finding that including metrics for numeracy and literacy decreased the returns to vocational and academic degrees by 15%.

Research Questions and Hypotheses

Our basic empirical question is: do measures of skills and credentials each predict income and employment status after we account for other known correlates, like geographical region, field of study and sociodemographics? HCT would hypothesize that direct measures of skills ought to be prime predictors of labour market outcomes. In contrast, both signalling and credentialist theories would predict that credentials bring larger returns.

⁶ Flores-Lagunes and Light (2010) find that years of education have inconsistent effects, and reason that within credential tiers, those who take longer to complete their studies may be weaker students (also see Bound, Lovenheim & Turner, 2012), which would serve to dilute the impact of years of schooling on learning/productivity.

Data and Methods

The LISA is the optimal data set for this analysis. It includes the PIAAC standardized skill measures for literacy and numeracy proficiency. These two metrics are not available in other commonly used Canada-representative data sets (e.g., NGS). LISA has also been linked to tax filer data (e.g., T1FF, T4 earnings), which avoids underreporting and other biases attributable to self-reports of earnings. The sample (without restrictions) in the integrated PIAAC-LISA data file consists of 8,500 respondents. After restrictions, our final analytic samples are 8,278 for employment status and 6,201 for earnings.

To investigate human capital and signalling effects, we employ a combination of descriptive statistics, Ordinary Least Squares (OLS) regressions, and multinomial logistic regressions (Long & Freese, 2014).⁷ To examine earnings we use OLS, regressing the natural logarithm of income on our predictor variables. For employment status differences, we estimate a series of multinomial logistic regressions. Due to collinearity between literacy and numeracy measures, separate models are fitted using each metric.⁸ Since our primary goal is to examine changes in coefficients for skills after controlling for credentials, our models add successive blocks of predictor variables, beginning with skill metrics, then adding measures of formal credentials, and then other known correlates of labour market outcomes — work experience, field of study, family background, regional and other variables. For brevity, we mainly discuss findings from our initial two models and the final “saturated” models. Interested readers can consult descriptive tables and regression models in the Appendix for additional details.

Limitations

Our analyses use available demographic variables only as controls, and do not explore varying returns to skills and credentials across sociodemographic groups (Belman & Heywood, 1991; Bitzan, 2009; De Silva, 2009; Gibson, 2000; Jaeger & Page, 1996). Nor do we compare rewards to credentials and skills across industry sectors, which may be a key source of variation (Dougherty & Jimenez, 1991; Heywood, 1994; München, Svejnar & Terrell, 2005; Olfindo, 2018; Pons & Blanco, 2005; Schady, 2001; Xiu & Gunderson, 2013). Further, we only have access to skill proficiencies at one point in time. As new data sources become available, future work should examine the impact of longitudinal changes in skills and credentials on labour market outcomes, and use methods for causal inference to account for likely patterns of self-selection.

⁷ Given the multiple plausible values across skill measures, and the complexity of the LISA and PIAAC surveys, we estimate all models with STATA’s REPEST package (Avvisati & Kessler, 2014).

⁸ This corresponds with the approach employed by Zarifa and Greenberg (2011).

Findings

Both Skills and Credentials Matter: Our first set of models determines whether skills and credentials have an influence on income. We find that both skills and credentials exert some degree of influence. Income rises in a generally linear fashion alongside literacy and numeracy proficiencies. When credentials are introduced into models, the impact of skills shrinks slightly, suggesting that some economic returns to skills are associated with the possession of higher-level credentials. However, despite this noticeable reduction, skills continue to possess an independent and statistically significant effect on earnings, one that persists even after introducing controls in our saturated models. The same is true for credentials. What this means is that both skills and credentials independently explain variations in individuals' incomes.

A different story emerges when we examine employment status — full time, part time, not in the labour force or unemployed (as the reference category) — as the dependent variable.⁹ Higher levels of literacy and numeracy improve the odds that an individual will be employed full time rather than be unemployed. However, more skilled individuals are not more likely to be employed part time relative to being unemployed. Interestingly, numeracy increases the likelihood of an individual not being in the labour force versus being unemployed. As in our income models, the effects of skills on employment status remain statistically significant, though they weaken after credentials and sociodemographic factors are added to the equation. Interestingly, credentials no longer have statistically significant effects on employment status in our full models. This pattern of changing coefficients suggests that skills play a stronger role in determining employment status than do credentials.

These findings could be interpreted as illustrating that credentials and skills operate differently during the job acquisition and promotion processes (e.g., Weiss, 1995). However, our data does not allow us to identify which of these processes may be at play. Further research is needed to shed light on the differential effects of credentials and skills.

The Numeracy Edge: Another important takeaway from our analysis is that numeracy skills appear to be stronger predictors of earnings and employment status than literacy skills, even controlling for other variables. Increasing numeracy proficiency from level 1 to 2 brings higher earnings, while only higher levels of literacy (3+) boost earnings. Similarly, increasing numeracy across any level (1 to 4) improves the odds of full-time employment relative to being unemployed. Meanwhile, only higher-level increases (3 to 4) of literacy trigger similar results. We interpret this pattern of results as suggesting that Canadian labour markets offer better rewards to individuals with proficiency in numeracy. This effect may represent that high-level numeracy is a rarer skill than is high-level literacy, and hence fetches larger premiums in labour

⁹ As a reminder, these models estimate the odds that individuals will be in each of the first three categories (FT, PT, NILF), relative to being unemployed.

markets. But additional research is needed to further untangle the processes that underlie these varying returns to skills.

Areas for Future Inquiry

While our analysis offers some insight into the relationships between skills, credentials and labour market outcomes, it is by no means the final word on the subject. We next identify possible avenues for future research by discussing the effects of control variables in our models. These variables were not the focal point of our analysis, and their examination would require alternative modelling strategies.

First, in our models women had lower earnings even after accounting for skill proficiency, credentials and other demographics, a finding consistent with other recent research (Fernandez & Umbricht, 2016; Schirle, 2015). Further inquiry can untangle relationships between skills and wage gaps, such as examining gender differences in fields of study, hours worked, career interruptions and sectors of employment. Some of this work is being carried out by Pullman, Sweetman and Finnie (2019) in another report funded by the Research Initiative on Education + Skills (RIES), where it was found that economic returns to cognitive skills vary considerably across the wage distribution.

Second, our models do not detect any notable differences in the labour market outcomes of individuals with varying levels of parental education or number of books in the home (our proxies for socioeconomic status). This is inconsistent with both qualitative and quantitative research on the effects of family background on life outcomes (Armstrong & Hamilton, 2013; Lareau, 2011; Childs, Finnie & Mueller, 2018; Finnie, Lascelles & Sweetman, 2005). Future research should examine the extent to which skills and credentials mediate parental socioeconomic status effects on graduate outcomes.

Third, our models indicate that immigrants have an earnings advantage over domestic-born respondents. This runs counter to other studies (Banerjee, Verma & Zhang, 2018; Esmaeilzadeh, Ahmad & Naveed, 2018; Smith & Fernandez, 2017). Our finding may stem from our lack of controls for immigration class, length of time in Canada, Canadian work experience or where immigrants' schooling was completed. Another RIES report by Cukier and Stolarick (2019) controls for some of these factors, and finds that immigrants were more than three times more likely to be unemployed than Canadian-born counterparts.

Lastly, we found earnings differences across provinces, with individuals in Alberta outperforming and those in New Brunswick underperforming relative to respondents in Ontario. Individuals across the eastern provinces of Newfoundland, New Brunswick and Prince Edward Island were also less likely to be employed full time, while those in Saskatchewan were more likely to be employed full time relative to their Ontario counterparts. Surprisingly, despite such provincial differences, we observed no rural/urban differences in income or employment status. Further research is needed on the impacts of regional labour markets on returns to skills, since small sample sizes in LISA prevent us from running regressions by province.

Discussion

We find that literacy and numeracy are strongly related to both earnings and employment status, even after controlling for a series of key variables. Credentials also provide an earnings boost, but have non-significant effects on employment status once a series of controls are taken into account. These findings lend support to government policies aimed at both expanding access to formal credentials and boosting numeracy, literacy and other skills within the general population.¹⁰ To research the latter, we recommend the development of a robust data infrastructure to track skill development. As of late 2019, LISA remains Canada's single contemporary data source with adult skill metrics. While very useful, the 2012 LISA does have important limitations. In particular, its small sample sizes prevent more detailed analysis at provincial or sub-provincial levels that could inform planning at those levels. The LISA also lacks metrics for other important skills (e.g., soft skills, digital literacy), which may be in demand across different occupations or industries. Federal and provincial governments and other stakeholders need to explore ways to develop more robust data sources to inform research and policy on skill development. It would be particularly promising to introduce student-level skills data into Statistics Canada's Education and Labour Market Longitudinal Linkage Platform (ELMLP), and to facilitate linkages to the Postsecondary Student Information System (PSIS), T1 Family File (T1FF), Canada Student Loans Program (CSLP) and other data sets within that environment.

From a training standpoint, innovative skill development strategies need not be confined to traditional credential-granting institutions, such as public colleges and universities. Research-intensive universities in particular can be expensive bodies for educating students (Clark, Moran, Skolnik & Trick, 2009; Clark, Trick & Van Loon, 2011). It would be worthwhile for future research to rigorously evaluate the utility of skill workshops offered by non-profits (e.g., Canada Learning Code), industry-led badging systems (e.g., CanCred Pro), self-directed learning (e.g., via libraries), online learning platforms (e.g., eCampusOntario, Contact North, OntarioLearn) and non-credentialed professional development courses offered by employers. Indeed, we believe such evaluations should be a strategic priority of the federally funded Future Skills Centre.

Further, governments and other stakeholders should rigorously evaluate skills outcomes across different institutions and programs throughout our education system, but also recognize qualitative differences in skills. Differential returns to vocational versus general degrees may vary across careers with the former likely providing better immediate dividends, and the latter paying off in later years. These possible differentials need to be recognized in any performance-based educational reform, such as those currently taking place in Ontario, along with a broader suite of indicators.

¹⁰ The latter, of course, will require ongoing empirical work to monitor which skill sets are presently in demand, given the dynamic nature of skills needs.

Finally, our findings might make students more mindful of their skill profiles. Students may wish to not only orient themselves to fulfilling their degree or diploma requirements, but also attempt to seize additional opportunities to develop skills that align with their career aspirations, be they literacy and numeracy skills, or other proficiencies like verbal communication and teamwork. Such competencies could be acquired not only within classrooms, but also through other forums like internships, self-learning and work-integrated learning opportunities. In turn, institutions should continue to be mindful of in-demand skills, and establish procedures to synchronize some of their offerings with both labour market and other societal goals.

Conclusion

This report contributes to ongoing conversations about the relationship between PSE and labour markets, both within academe and the public sphere. We hope this report inspires further empirically informed studies through the future waves of the Research Initiative on Skills + Education (RIES), as well as future work by independent scholars working in this space. In these ensuing discussions over the coming years, it is important to not lose sight of the fact that PSE systems perform many other valuable social functions beyond labor market preparation. Keeping this broader context in mind will ensure that discourses about the economic returns to education remain grounded in a broader appreciation of PSE's contributions to society.

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