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The effect of overeducation on unemployment in OECD countries

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Ben Lockwood (Head of the Department of Economics, University of Warwick) and Michael Ward (Head of the Department of Economics, Monash University)

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The effect of overeducation on unemployment in OECD countries

Connor McGrath

Abstract

The optimal allocation of human resources into different areas of the economy is vital for the growth and productivity of countries, particularly in a rapidly changing workforce environment. Previous literature and statistics indicate that overeducation (when an individual is overqualified for their career) lengthens unemployment at the individual level after graduation, among other negative outcomes. This study aimed to assess whether increasing the proportion of higher degree graduates affected the unemployment rate of countries in the subsequent year, using a differences in differences model. The study used graduation data from 2013-2018 in 23 countries. The results suggest that having more bachelor's and master's degree graduates increases the next year's unemployment rate in countries with higher relative levels of overeducation, while increasing graduates from other degree types did not have this effect. This study was severely limited by a small sample size, but the results suggest further research on this issue is warranted.

JEL Classification Codes: I21, I26, J6

Keywords: Educational Attainment, Returns to Education, Unemployment

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1. Introduction

As we move further into the twenty-first century, the nature of employment and the demographics of our population are simultaneously undergoing rapid shifts. Technological advances in areas such as artificial intelligence and automation are leading to major changes in the types of jobs which are available. A meta-analysis in the Australian National Outlook (ANO) (CSIRO, 2019) suggested that by 2030-35, 15-45% of current jobs will have been made obsolete, with up to 20% of employment being in newly created jobs. This change in the demand for jobs in various industries may increase frictional unemployment, as individuals must gain new skills to shift careers. In addition, the populations of advanced countries are ageing steadily due to advances in medicine and a decreased fertility rate, a trend predicted to continue for the foreseeable future (Ofori-Asenso, Zomer, Curtis, Zoungas, & Gambhir, 2018). This will lead to an ageing of the workforce, meaning a lower proportion of the workforce is made up of new entrants who have recently experienced mandatory childhood education.

This combination of factors means that there will be a greater requirement for individuals to switch career paths for the economy to function at optimal levels in the future. The Foundation for Young Australians (2017) predicted that the average Australian born in 2002 will have 17 jobs in 5 careers over their lifetime. This will likely cause an increase in unemployment due to mismatch between the skills required by firms and those learned by the workforce, which could be mitigated by effective education/retraining.

For this reason, it is more important than ever that the allocation of workers to different jobs through education is done optimally. For this allocation to be optimal and efficient at the societal level, individuals must pursue education pathways such that there is an optimal spread of graduates through different professions.

1.1 Education and Productivity

Previous research on the economic effect of education has primarily been focused on growth or individual unemployment. A review by Woessmann (2016) discussed the effect of education on economic growth and unemployment, finding substantial evidence that education and the associated skills acquired are major determinants of economic growth. This relationship has been studied since the 1970s, with most early studies finding a substantial positive effect of education rates on growth, particularly for higher education (Agiomirgianakis, Asteriou, & Monastiriotis, 2002).

More recent analysis has moderated this finding. A review by Hanushek (2016) finds that the knowledge capital of 15 year olds, measured through Program for International Student Assessment (PISA) scores, is a substantial contributor to growth, but that schooling (including tertiary schooling) has only a small, statistically insignificant effect on growth when accounting for this knowledge capital. This result may sound self-evident, but it indicates two things. One is that the quality, content, and relevance of what is taught is vitally important for schooling to have a positive economic effect. The second is that after students gain these basic skills additional schooling has surprisingly little additional effect on economic growth. Holmes (2013) finds a similar result, using multiple models to measure the effect of schooling on growth across countries from 1966-2006. While positive growth effects are found for primary

and secondary schooling, PISA scores and researchers, when controlling for these factors, tertiary education has only a small, insignificant positive effect on growth. Holmes suggests that while some specific areas of higher education related to research and development might improve growth significantly, there is no evidence that general expansion of higher education has a large effect on growth absent this subsection.

Other recent research by Tsai, Hung, and Harriott (2010) models the effect of tertiary education and finds it does have a significant impact on growth, but that this is primarily through its effect on research and development and high-tech human capital, rather than being a more general effect. Agasisti and Bertoletti (2022) look at the regional effect of university expansion in Europe and find that while it does positively effect growth, this is again primarily through science and technology research effects.

The literature is largely in agreement that while tertiary education does affect growth, this effect is primarily through its effect on research and development. Early studies likely overestimated the general effect of tertiary education by not controlling for research, the quality of primary and secondary schooling and the reverse causality of higher incomes leading to more young people being able to go to college. General tertiary education likely has a positive effect absent this, but it is likely not as large as the early literature suggested. What is found to be important for education in general is that it is functional (in terms of skills) for students and the economy.

1.2 Relative Effects of Post-Secondary Education Types

There are multiple tertiary schooling options for high school graduates to pursue, both in terms of field and education type. Individuals choose between no education, non-tertiary post-secondary education (largely vocational education), short-cycle tertiary education (diplomas, etc.), bachelor's degrees and more. Each path offers different value for both the individual and society.

At the individual level, Woessmann (2016) found that relative to general post-secondary education, vocational education was associated with lower unemployment early in an individual's career but higher unemployment later in their career. This pattern could be the result of many factors, but suggests that at least in the short term, there are more readily available jobs for new graduates from vocational degrees compared to graduates from tertiary degrees. Despite students understanding this they generally still choose to go to university, potentially due to societal pressure or a lack of understanding of employment pathways from post-secondary education (McKinsey, 2012). This difference in short term outcomes may be particularly important in the future given that there will be more career moves than ever before. It also may be reflective of a broader issue of mismatch between training and careers.

Research in Australia suggests there is already a mismatch between skills gained through tertiary education and those required in the workforce. In 2013, between 24 and 37% of recent bachelor's degree graduates were 'overqualified' for their subsequent jobs (Carroll & Tani, 2013). A report by the OECD (2019) found that Australia should incentivise more education and retraining for individuals already in the workforce and reduce deadweight loss attributed to subsidising degrees which individuals can already afford. Evidence suggests financial incentives do affect study decisions. Previous studies have found that financial factors such as increased access to financial aid increase enrolments (Kim, 2012; Lovenheim & Owens, 2014),

and that increases in tuition fees decrease enrolments (Hemelt & Marcotte, 2011; Hübner, 2012; Nguyen, 2020), although the effect of changes in tuition fees is quite small.

The effects of education programs may be different for marginal individuals who are affected by these changes compared to average individuals. While higher degrees may be associated with lower levels of career unemployment and higher pay for the individual (Woessmann, 2016), these outcomes represent the average individual in a degree, not the marginal individuals that might switch their studying decision when education system structures (such as tuition fees or entry scores) change. Marginal individuals are likely to be less motivated/capable than the average individual who enters a degree if their study decisions are affected by these factors. For these reasons, marginal individuals likely receive lower returns to education than other individuals. It is also important to note that increasing the number of graduates in already competitive fields, such as increasing the number of higher degree graduates in Australia, increases competition and lowers the expected value of other individual's degrees. Employment found in these fields may also crowd out other candidates, rather than adding to the workforce. For these reasons, the marginal benefits to society of different education types are not properly represented by simply looking at the average return to a degree at the individual level. Individuals who enter higher degrees with an oversupply of graduates have a negative externality for the other individuals in these fields and would likely provide more productive value to society by entering a field where there is a skill shortage. They also cost more to the taxpayer as higher degrees require a higher investment of time and resources.

Research comparing the effectiveness of various forms of post-secondary education at the country level is sparse. A study focusing on Canada (Skolnik, 2021) noted the high rate of short-cycle tertiary education there compared to other countries, and that by some measures the education system there is more effective. Short-cycle tertiary education, which is generally skills based, job-focused and more accessible than bachelors/master's degrees, might be more efficient than other forms of tertiary education in the 21st century environment.

1.3 Overeducation

As many OECD countries have developed and education has become more accessible, there has been a large rise in the proportion of individuals completing tertiary degrees, which has fuelled the rise in overeducation that exists now. Overeducation has been noted to be a regular occurrence in developed countries for at least 40 years. Rumberger (1981) defined overeducation as the situation where an individual is educated to perform skills over and above that which they use in their job. He found that from 1960 to 1976 the rate of overeducation rose significantly in the US, particularly among college graduates. This was driven by a large increase in the number of individuals completing college degrees, without a concurrent increase in the number of high-skilled jobs available. A review by Tsang and Levin (1985) confirms this result in the US and notes that overeducation leads to job dissatisfaction, which decreases productivity. A more recent review also found evidence that there are significant individual wage and productivity costs to being overeducated (McGuinness, 2006), and suggested that increasing the number of graduates from overeducated fields is unlikely to be a good investment. The following table is sourced from the OECD stats database and shows overeducation is common among developed countries. The data is from 2019 for almost all countries (2016-2018 for four countries).

Table 1. Overeducation Rate in OECD countries in 2019.

Country	Overeducation rate	Country	Overeducation Rate
Australia	20.2	Luxembourg	14.6
Austria	20	Mexico	38.7
Belgium	10.8	Netherlands	15
Canada	15.5	New Zealand	13.3
Czech Republic	8.1	Norway	12
Denmark	17.1	Poland	9.5
Estonia	17.5	Portugal	27.7
Finland	8.39	Slovak Republic	13
France	12.5	Slovenia	11.6
Germany	18.8	Spain	21.6
Greece	25.1	Sweden	15
Hungary	8.39	Switzerland	15
Iceland	23.2	Türkiye	29.1
Ireland	10.6	United Kingdom	14.5
Italy	20.2	United States	15.8
Korea	12.1	European Union	15.3
Latvia	18.2	OECD - Total	16.5
Lithuania	22.3		

Table 1. Overeducation in OECD countries, measured as the percentage of individuals who were overqualified for their job in 2019. This data was taken from various labour force surveys, with the majority coming from the European Labour Force Survey.

Whether overeducation is an issue depends on the degree to which it leads to positive or negative outcomes. Education in all forms has historically been viewed as having a societal economic benefit as it raises human capital. Country level studies have historically indicated that having more education leads to greater growth, but as discussed above, more recent research indicates that this is primarily through its effect on research and development, with only a small effect for general workforce upskilling.

Another negative side of overeducation is that it may lead to higher levels of frictional unemployment due to the mismatch between skills and jobs. If individuals who are overeducated spend more time looking for jobs which match their skills, before ultimately settling for jobs which they are overqualified for, then their education could be viewed as a negative in two ways: both as an investment which has brought no benefit, and as a factor which raises frictional unemployment and consequently lowers total productivity.

Recent studies have shown some evidence that overeducation does raise frictional unemployment. Rose and Ordine (2010) use data from Italy and show that individuals who have completed a bachelor's degree that ultimately accept jobs they are overeducated for have significantly longer unemployment spells then those who enter jobs they are well matched for.

Interestingly, overeducated bachelor's degree graduates are more likely to have an unemployment duration lasting longer than 20 months than job-mismatched individuals without Bachelor's degrees. Hsu, Chi-Jung, and Lin (2013) found that in Taiwan, overeducated individuals with bachelor's degrees were unemployed on average 78% longer during employment gaps than those with appropriate jobs. Sam (2018) found that overeducation had caused a significant increase in unemployment duration in Cambodia, although this effect varied depending on an individual's job preferences and degree type. Barros, Guironnet, and Peypoch (2011) found a similar result in France, with overeducation causing a lengthening of unemployment duration. These studies used Hazard survival models to account for the non-normal error distribution (skewed right). They also found that overeducated individuals, when they did find a job, tended to crowd out individuals with less education from these jobs.

Specifically in Australia, Carroll and Tani (2013) found that between 24 and 37% of recent higher degree graduates (depending on their field) were overeducated, and that these individuals had longer spells of unemployment than others. This result was also notable because despite the variation in overeducation rate by field, a high rate of individuals in all fields were overeducated. They also found that the overeducation rate depended on the demand for graduate labour.

A report by the consulting firm McKinsey (2012) also found evidence that overeducation increases unemployment duration in OECD countries, and found that graduates who accept jobs they are overeducated for intend to leave these jobs quickly. This may also raise unemployment as employers have to go through the hiring process multiple times quickly if/when these individuals do quit.

These results suggest that individuals who cannot find a job which matches the skills they have developed in their degrees spend longer unemployed then those that find such a job, and in many cases even longer than less educated individuals. When they do find a job, they often crowd out individuals who are less educated. They are also often dissatisfied with their job, lowering productivity, and struggle to ultimately find a job in a matching career despite intending to. It is important to note that individuals balance many factors when deciding which post-secondary pathway to pursue. These include the cost of the degree in terms of both time and debt, and the benefits in terms of enjoyment, skills, and employment opportunities. If individuals still gain utility from higher education even when accounting for overeducation costs, then it is not necessary to reduce the incidence of overeducation from an individual perspective.

This evidence, however, only looks at the individual effects of education. Another relevant question is how increasing overeducation effects the job market at the country level. If a country already has a high level of overeducation, increasing this by having more higher degree graduates might increase frictional unemployment, as more individuals with higher degrees spend time trying to find a suitable job when there already are not enough of these jobs.

When a country experiences an increase/decrease in its number of higher education graduates (presumably caused by changes in subsidies, entry scores etc.) it can be assumed that these individuals are not representative of the whole sample of graduates. They are likely the individuals who value the degree the least (as they are the ones whose binary decision to complete/not complete a degree has changed as its marginal benefit/marginal cost/entry criteria has changed) and as such might be less motivated/skilled at the degree's conclusion than the

average graduate. If this is the case, the marginal effect of changes in the number of graduates might be especially large, even relative to the individual effects found in previous literature.

1.4 Aim

The gap this study aims to fill in the literature is what the short-term effect of changes in the proportion of a country graduating from different types of post-secondary education is on the short-term unemployment rate at the country level. The degree to which various types of post-secondary education are prioritised through public investment is an important question, particularly given the future need for career switches. The ideal balance between education types depends on which skills are required in the labour market and the investment required for individuals to gain these skills. If overeducation causes a significant increase in frictional unemployment, it provides further evidence that it may be optimal to reorganise the education system and associated subsidies in a way which encourages fewer people to complete certain types of higher degrees, or to reorganise the skills taught in higher degrees to be more applicable to jobs.

Using, first differences, fixed effects and differences in differences models with important macroeconomic controls, the central aim of this paper is to determine whether the number of graduates of different degree types affects short run unemployment.

1.5 Modelling Unemployment

Many efforts have been made to model growth and unemployment in the past. These attempts are limited by the complex nature of the relationships between macroeconomic variables, and the fact that these relationships are not necessarily stable over time.

Short-term unemployment has been theorised to be directly related to growth through Okun's Law, which suggests that changes in output caused by changes in aggregate demand cause firms to hire/fire workers. This relationship should be negative (higher growth leads to lower unemployment) and generally holds in the literature. The degree to which growth affects unemployment varies by country, which has been theorised to be due to differences in the labour market such as in the length of contracts (Ball, Leigh, & Loungani, 2017; Lee, 2000). Sahnoun and Abdennadher (2019) find that in North Africa, causality runs from growth and inflation to unemployment.

Ball et al. (2017) use two models, one in which yearly changes in employment are a function of changes in growth due to changes in aggregate demand, and another where quarterly changes in unemployment are a function of changes in aggregate demand in the current quarter and the previous two quarters. They use a first differences model and find that using lags in the quarterly model better fits the data. The quarterly model is $\Delta unemployment_t = \Delta\log(gdp_t) + \Delta\log(gdp_{t-1}) + \Delta\log(gdp_{t-2})$. In some cases, a smoothed value of output is used to estimate the output relative to equilibrium, although both models fit the data well. While the dataset I will use is yearly, the unemployment rate used is the average over the whole year, meaning it would be affected by growth late in the previous year. For this reason, I have chosen to include controls for both growth and lagged growth in the model.

Unemployment has also been shown to vary significantly based on monetary factors such as inflation (Berentsen, Menzio, & Wright, 2011). Karanassou, Sala, and Snower (2005) use an autoregressive distributed lagged model and find that inflation causes changes in unemployment over an extended period. They estimate multiple equations from microeconomic foundations and find that monetary shocks which increase inflation decrease unemployment, with the effect starting immediately and stretching over years. They model a linear relationship and include an in-year capital stock variable with a significant value in their estimation of unemployment.

Capital stock has also been found to be an important determinant of unemployment, theorised to be due to the positive effect of increased capital on labour productivity. A negative relationship between capital stock and unemployment was found in many of the European countries included in this analysis in previous research (Arestis, Baddeley, & Sawyer, 2007; Arestis & Biefang-Frisancho Mariscal, 2000). These studies use autoregressive lagged models where unemployment is a function of previous unemployment, lagged capital, lagged imports and other variables related to imports and investment. I chose to use only capital stock due to data restraints, both in terms of availability/reliability and the limited significance of the other variables, and because with a limited sample size, limited controls need to be used to preserve degrees of freedom. Capital stock is also included in a study by Apergis and Salim (2015) as a control variable, which they find has a positive effect on unemployment. The procedure of this study closely mirrors my study, as they use country level fixed effects and try to estimate the effect of renewable energy consumption on unemployment over time across 80 countries, splitting them into regions.

These studies measuring the effect of various factors on the unemployment rate generally use autoregressive lagged models to model unemployment in specific countries. They use distributed lags over multiple years, but due to the data constraints of this study, only one lag is used for the relevant control variables.

It could be argued that unemployment and some of the variables used as controls in this study are determined simultaneously to some degree, which is why some of the papers cited test for cointegration and some use multiple equations with different dependent variables to eventually model unemployment. The small size of the dataset (in particular) and my limited prior econometric training limited the degree to which more advanced econometric techniques could be used. Testing and adjusting for cointegration requires large datasets with many variables included, which was impossible due to the limited data available for the variables of interest. While there may be some degree of endogeneity for the control estimates (due to potential simultaneity and omitted variable bias) which renders interpretations of them invalid, the model used in this paper is aimed at estimating the effects of graduate numbers on unemployment. I also addressed this issue by varying the lags and controls used, as well as the linearity of their effect, and found that the results were largely robust to changing the controls and model specification.

It is assumed that these graduate variables are not determined simultaneously to other variables in the study. Given student's graduation dates are largely determined well in advance of their actual graduation, and are individual decisions likely made with many factors considered, this seems a valid assumption. It is therefore my view that the coefficient estimates for the

graduate's variables should not be biased significantly by these issues, and that the results of the analysis are valid to be interpreted (with some caution).

2. Data

The data was available to estimate unemployment from years 2014-2020. However, 2020 was not used due to the COVID-19 pandemic being a potential confounding variable. Therefore, the results reported are for unemployment in years 2014-2019.

2.1 Independent Variable

The data for the education variables for this analysis comes from the OECD.Stat database (OECD, 2022). This database includes detailed data about the number of students graduating from each ISCED education level from years 2013-2019. There are six such levels included in the dataset (see Table 2 below for definitions). Levels 4 (post-secondary vocational education) and 5 (short cycle tertiary education) have been combined in this analysis, as many countries only measure one of the two, likely due to them defining all short courses by one level. These areas include short degrees such as diplomas, as well as post-secondary vocational education. These numbers of graduates are divided by population data sourced from the World Bank database (WorldBank, 2022) to account for differences in country size, giving the proportion on individuals in a country who graduated from each degree type. These variables are the main independent variables for the empirical analysis, where the effect of changes in the percentage of a country graduating from each degree type on unemployment is estimated. They are included as lagged variables, to allow time for graduates to enter the job market and for the potential effects of overeducation to have an effect.

Table 2. Definitions of ISCED degree levels

International Standard Classification of Education (ISCED) Level	Definition
ISCED-3	Upper Secondary education
ISCED-4	Post-secondary non-tertiary education
ISCED-5	Short-cycle tertiary education
ISCED-6	Bachelor's degree or equivalent
ISCED-7	Master's degree or equivalent

ISCED-8	Doctorate or equivalent

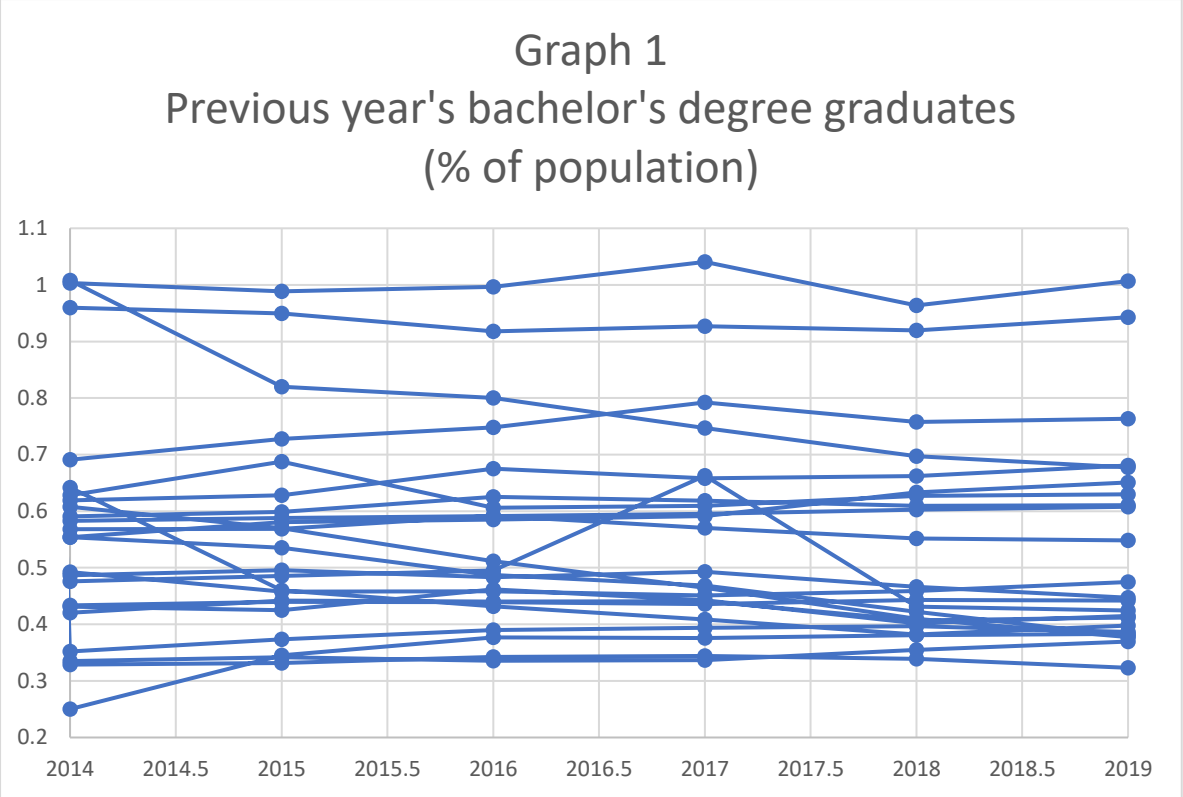
Table 2. Definitions of ISCED degree levels. Retrieved from OECD stats database (OECD, 2022). Levels 4 and 5 were combined for the analysis.

The education variables were divided by population and multiplied by 100 to give the percentage of the population completing a given degree type in each year, allowing for an even comparison between countries. The mean of the bachelor's degree graduates variable was 0.55%, meaning on average 0.55% of the population completed a bachelor's degree per country per year in the whole sample. For short form education (levels 4 and 5 combined) the mean was 0.29%. The variation in country over time was substantial, and was likely due to changes in policies, entry requirements or other factors which changed either the incentives or the difficulty for an individual to enter a certain degree type. This is the main identifying variation for the analysis. There were two countries (Slovenia and the United Kingdom) who had outlier trends in one or more graduate percentage variables. The analysis was checked for robustness upon removal of these values. Graphs 1, 2 and 3 show the percentage of graduates for bachelor's (Graph 1), short-cycle tertiary/post-secondary non-tertiary (Graph 2) and master's (Graph 3) graduate percentages. Upper secondary and doctorate graduates' data are shown in the Appendix. The average year to year percentage change in each variable is shown below (excluding Slovenia and the United Kingdom).

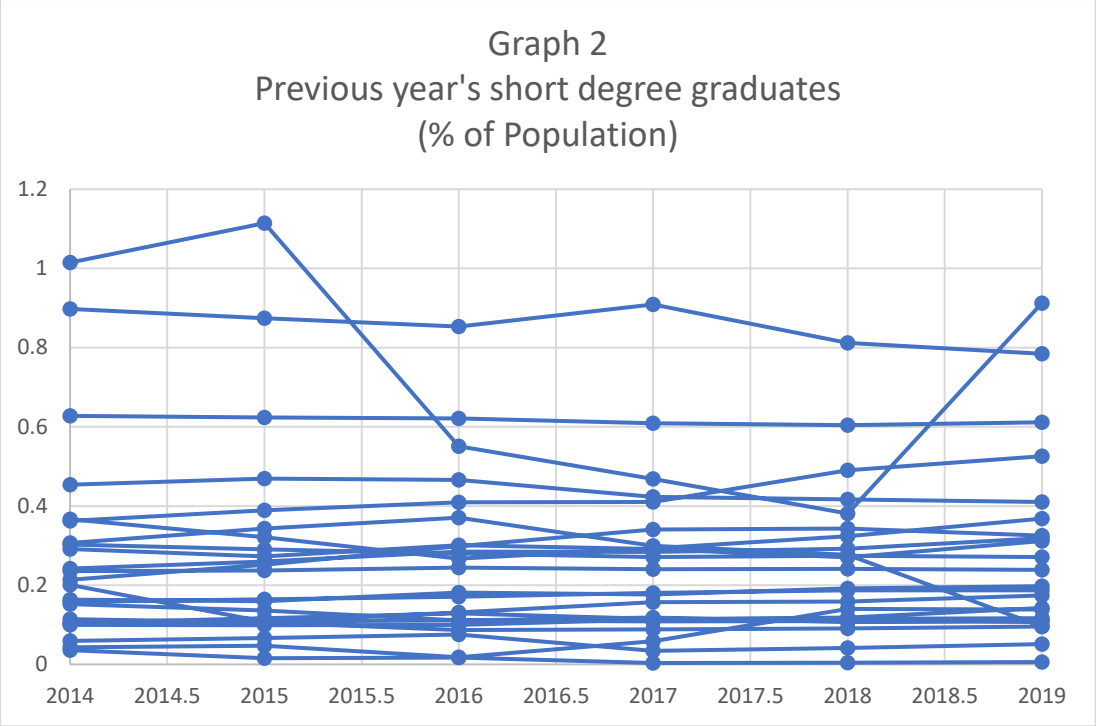
Table 3. Mean absolute year to year percent change in number of graduates from ISCED degree types in OECD countries

Education level	Mean percent change from previous year (absolute value)
Upper secondary	3.86%
Short-cycle tertiary + post-secondary non-tertiary	12.20% (median 4.07%)
Bachelor's	4.13%
Master's	5.70%
Doctorate	5.56%

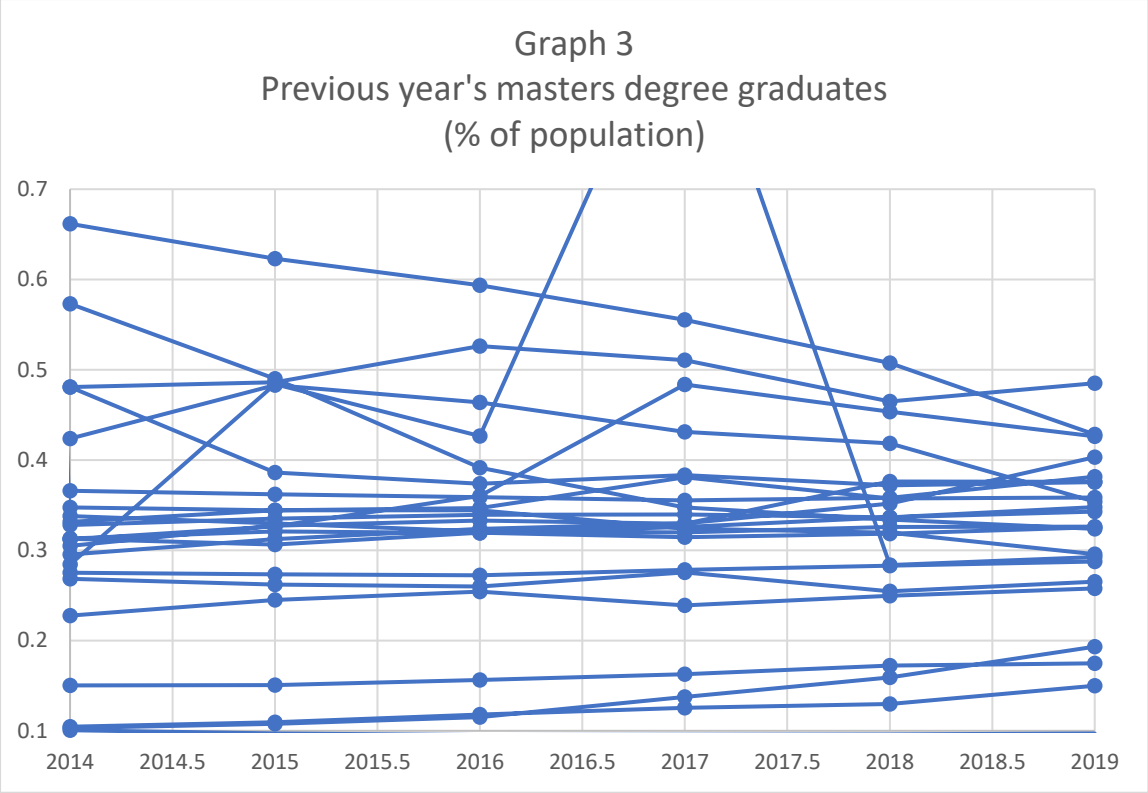
Table 3. Mean absolute yearly percentage change in the percentage of a country's population graduating from different ISCED degree types from years 2013 to 2019 for 21 OECD countries. Slovenia and the United Kingdom were not included as they were outliers for at least one degree type.



Graph 1. Shows the percentage of the population who completed a bachelor's degree each year for the 23 countries included in the empirical analysis of this study.



Graph 2. Shows the percentage of the population who completed short-cycle tertiary or post-secondary non-tertiary education each year for the 23 countries included in the empirical analysis of this study. Data was taken from the OECD stats database (OECD, 2022).



Graph 3. Shows the percentage of the population who completed a master's degree each year for the 23 countries included in the empirical analysis of this study. Slovenia had an outlier value in 2017 and was removed to check for robustness in the empirical analysis. Data was taken from the OECD stats database (OECD, 2022).

2.2 Overeducation

The overeducation data (Table 1) was taken from the OECD database. This measure was equal to the percentage of workers in a country found to be overqualified for their job in 2019, and was calculated from various labour force surveys, including: the European Union Labour Force Survey (LFS: EU), the Permanent Household Survey (EPH: ARG), the Australian Labour Force Survey (AUS), the Household, Income and Labour Dynamics in Australia Survey (HILDA: AUS), Pesquisa Nacional por Amostra de Domicílios (PNAD: BRA), the Canadian Labour Force Survey (CAN) the Socio-Economic Characterization Survey (CASEN: CHL), the National Survey of Occupation and Employment (ENOE: MEX), the New Zealand Labour Force Survey (NZL), the New Zealand Income Survey (NZL), Encuesta Nacional de Hogares (ENAHO: PER), the Turkish Labour Force Survey (TUR), the Current Population Survey (CPS: USA), the South African Labour Force Survey (OECD, 2022).

The fact that some of the data comes from different sources means that it would be inappropriate to use as a variable in the empirical analysis. However, it was only used for categorisation purposes to split the countries with the lowest overeducation rates out of the analysis for one section. The majority of the data was from the European Union Labour Force Survey, which uses a common methodology across countries to ask quarterly questions to individuals regarding their labour force status (Survey, 2022). The average overeducation rate was similar between this survey and the OECD total. The only countries whose included in the

analysis whose overeducation rates come from other sources were Australia, Canada, New Zealand and Japan. Japan was defined as overeducated based on a study by Verhaest and Van der Velden (2012) which compared Japan's overeducation rate in 2011 to some of the European countries in this analysis using a survey with common methodology. The other non-European countries were based on their own labour force surveys. The overeducated results were robust to the exclusion of Japan. While this measure of overeducation is not perfect, it is suitable to perform a cursory comparison of overeducated countries versus all countries. The countries included in the analysis, and whether they were defined as overeducated, are included below.

Table 4. Overeducation status for statistical analysis of the 23 countries in this study

Country	Overeducated (Y or N)
Australia	Y
Austria	Y
Belgium	N
Canada	Y
Czech Republic	N
Denmark	Y
Finland	N
Germany	Y
Greece	Y
Hungary	N
Italy	Y
Japan	Y
Latvia	Y
Lithuania	Y
New Zealand	N
Norway	N
Portugal	Y
Slovak Republic	N
Slovenia	N
Spain	Y
Sweden	Y
United Kingdom	Y
United States	Y

Table 4. Shows the countries included in the analysis, as well as whether they were included in the overeducated group. Countries were excluded from the overeducated group if their OECD overeducation rate was below 14%. Note that Japan was not excluded from the overeducation group because it did not have data available, and a study by Verhaest and Van der Velden (2012) found it had a high overeducation rate relative to other countries in this analysis. The results of the overeducated analysis were robust to its exclusion.

2.3 Dependent Variable

The dependent variable for the analysis was the average unemployment rate over a given year. This was taken from the World Bank database (WorldBank, 2022), which sourced it from the International Labour Organisation (Organization, 2022). It is taken from the labour force surveys in different countries, with adjustments made when necessary to increase comparability. For the countries measured the national estimate was always very close to the ILO estimate. Any baseline differences in measurement would be accounted for by the country fixed effects in the model used in this paper, with variation year to year being the variation of interest. Macroeconomic variables such as this are not always well reported, but for OECD countries the values should be reliable.

2.4 Controls

Real GDP (measured in US dollars) and inflation (as a percentage, using the consumer price index) were used to control for broader macroeconomic conditions and aggregate demand and were taken from the World Development Indicators database (WorldBank, 2022). The unemployment rate from the year prior was also used as a control, following the procedure of previous studies which have used autoregressive models to model unemployment.

Capital accumulation (as a percentage of the reference year 2015) was also used as a control and was sourced from the OECD stats database (OECD, 2022).

Due to the limited nature of the dataset the use of lags was limited to 1 year, as the full dataset was only available from 2013-2019.

3. Empirical Strategy

I use multiple models to estimate the effect of graduates on unemployment.

My preferred model follows the general procedure of (Ball et al., 2017) and (Lee, 2000) who use first differences models to estimate how unemployment changes based on changes in the log of growth. I use least squares estimation and a linear model in line with Ball et al. (2017). These estimates are made for specific countries, so I include country level fixed effects, which follows the procedure of Karanassou et al. (2005). As a robustness check I allow for the effect of GDP growth on unemployment to vary based on country, which was found in the studies by Ball et al. (2017) and Lee (2000), and find that the results are robust to this specification, although this minimises the degrees of freedom in the estimation and results in large standard errors for the coefficients.

I also use an autoregressive fixed effects model to preserve greater variation in the data. Fixed effects and first differences estimators generally provide similar results (identical over two time periods), with fixed effects preserving more variation in the data and leading to more efficient estimates. Because of this, I use a fixed effects estimation allowing the effect of changes in the log of GDP to vary by country. Fixed effects estimates can be biased by serial correlation, but as previously discussed the lagged graduates variables are likely primarily determined by different factors and considerably earlier than unemployment, so they are unlikely to be significantly affected by serial correlation. In any case, the estimates using fixed effects with specific country growth effects are very similar to the first differences estimates.

Finally, I use a differences in differences model, with fixed effects for country and year, and a single growth effect. This model is the least supported by the literature but preserves the greatest number of degrees of freedom for the estimates. The results of this model are slightly different in magnitude but similar in sign and relative strength of graduate variable effects.

I use multiple controls in all the model specifications to control for important variables which might affect unemployment in order to prevent omitted variable bias affecting the estimates of the coefficients of interest. Aggregate demand has been shown to affect unemployment, as changes in the log of GDP are strongly predictive of unemployment rate (Ball et al., 2017). As discussed, I use the logs of GDP and lagged GDP as control variables and allow the effect of

the log of GDP to vary by country in some specifications. Controls are also included for the previous year's unemployment (in the fixed effects and differences in differences models), as well as lagged inflation and lagged capital stock, which have been shown to be important factors which affect unemployment (Arestis et al., 2007; Arestis & Biefang-Frisancho Mariscal, 2000; Karanassou et al., 2005). These models estimate unemployment using lagged capital stock, while in year capital stock was included in the studies by Ball et al. (2017), Apergis and Salim (2015) and Karanassou et al. (2005). I found that both forms were significant and chose to include lagged capital stock, as it was a better fit in the model.

There are multiple limitations to this model. One of these is that this model does not account for time and country variant factors which might affect unemployment and be correlated with the percentage of graduates of each degree type. This may induce an omitted variable bias in the model that would make any causal inference inappropriate. However, there is reason to think this is unlikely due to the nature of this independent variable. The proportion of graduates in each degree type is largely determined prior to the year that individuals graduate. Individuals make the decision to pursue a particular degree and enter the degree at least 3 years (for bachelor's graduates) or 1-2 years (for other degrees) prior to graduating, which itself is a lagged variable. It is therefore unlikely that any economic factors that would affect the current unemployment would be systematically correlated with these variables. They might be correlated with the macroeconomic controls used but should not bias the estimates of the coefficients of interest.

The prior determination of the graduate percentage variables also largely removes any possible simultaneity issues with the independent variables and controls/independent variables, another possible source of endogeneity bias in the model. It is possible that there might be spurious correlations between the independent variables and other omitted variables, particularly considering there are only 138 total observations in the dataset, but there is little that can be done about this without a greater sample size.

The lack of the use of some of the more advanced econometric techniques used in prior research (such as cointegration and autoregressive distributed lag models) is also a limitation of the model, as previously discussed, but the chosen model specifications are suitable for the sample size of this study. Cointegration tests were important for many of the previous studies because they were trying to measure causal effects of macroeconomic variables which are simultaneously determined, and which could plausibly have two-way causality. This is unlikely to be an issue for the graduate percentage variables which are the main focus of this paper.

Because of the limited sample size (and resulting limits to the econometric techniques used) the results of this study should be interpreted as those of a pilot study. However, the main first differences model is directly co-opted from previous literature (Ball et al., 2017; Lee, 2000) and the fixed effects model is also similar to these studies and other autoregressive lagged models used to estimate unemployment (Karanassou et al., 2005).

The full equations for the three models are shown below. The 'grads' variables refer to the percentage of the population in a country graduating from each ISCED education level in each year, and the subscripts c and t refer to country and year varying variables, respectively. Δ is a difference operator, with the value of the variable equal to the difference between it and its previous year's value. The $\beta_c \log(GDP_{ct}) * country_c$ term is a set of country specific controls

for the log of GDP which allows the effect of GDP changes on unemployment to vary by country.

First differences: $\Delta unemployment_{ct} = \alpha + \beta_1 \Delta\log(GDP_{ct}) + \beta_2 \Delta\log(GDP_{c(t-1)}) + \beta_3 \Delta inflation_{c(t-1)} + \beta_4 \Delta capitalstock_{c(t-1)} + \beta_5 \Delta grads3_{c(t-1)} + \beta_6 \Delta grads45_{c(t-1)} + \beta_7 \Delta grads6_{c(t-1)} + \beta_8 \Delta grads7_{c(t-1)} + \beta_9 \Delta grads8_{c(t-1)} + country_c + \varepsilon_{it}$

Fixed effects with country specific growth: $unemployment_{ct} = \alpha + \beta_1 unemployment_{c(t-1)} + \beta_2\log(GDP_{ct}) + \beta_3\log(GDP_{c(t-1)}) + \beta_4 inflation_{c(t-1)} + \beta_5 capitalstock_{c(t-1)} + \beta_6 grads3_{c(t-1)} + \beta_7 grads45_{c(t-1)} + \beta_8 grads6_{c(t-1)} + \beta_9 grads7_{c(t-1)} + \beta_{10} grads8_{c(t-1)} + country_c + \beta_c\log(GDP_{ct}) * country_c + \varepsilon_{it}$

Differences in differences: $unemployment_{ct} = \alpha + \beta_1 unemployment_{c(t-1)} + \beta_2\log(GDP_{ct}) + \beta_3\log(GDP_{c(t-1)}) + \beta_4 inflation_{c(t-1)} + \beta_5 capitalstock_{c(t-1)} + \beta_6 grads3_{c(t-1)} + \beta_7 grads45_{c(t-1)} + \beta_8 grads6_{c(t-1)} + \beta_9 grads7_{c(t-1)} + \beta_{10} grads8_{c(t-1)} + country_c + year_t + \varepsilon_{it}$

3.1 Overeducated subset

The dataset was also be split into overeducated and non-overeducated economies, with the same model run for each to see if overeducation mediates any education effects on unemployment. The definition of an overeducated country was a workforce overeducation percentage greater than 14% in 2019. This value was chosen arbitrarily with the aim of maintaining a higher sample of countries in the overeducated group, as this was the group of interest of the study and the sample size is already small. The average overeducation percentage was 16.2% for all OECD countries in 2015, the measurement year.

The model was run with various specifications to check for the robustness of the results. A variable for population change was included, as were in year variables for inflation and capital stock. Some of the controls were also removed in some specifications. I report the results for the models with the best fit.

4. Results

4.1 Full sample

The first differences model for the full sample had a sample size of 115 country years (23 countries). All the variables of interest (post-secondary graduate percentages) had insignificant coefficient values at the 15% significance level (see Table 4 below). In both the fixed effects and differences in differences models, upper secondary graduates percentage had a significant effect at the 15% significance level, although these effects had opposite signs (positive for fixed effects with country-specific growth, negative for differences in differences), which limits any inferences which can be made from this.

When comparing tertiary education types, bachelor's and master's degree graduate percentage increases (those which are generally associated with overeducation) increased unemployment in all models, sometimes substantially, while short-cycle tertiary/post-secondary non-tertiary degree graduate percentage had small positive/negative effects on unemployment. The magnitude of the effects for master's degree graduate percentage in particular were substantial, as in the first differences and differences in differences model the effect of master's graduate percentage was approximately one, with p values of 0.48 and 0.2. For context, this value implies that a 0.1% rise in the proportion of the population who graduated from a master's degree the previous year was associated with a 0.1% rise in the unemployment rate. If all the individuals who finished a master's degree entered the labour force, this implies that only half of these individuals entered jobs that would not have been filled by another person. Assuming there were no major issues with causal inference this value suggests that there was an oversupply of master's degree graduates in the countries measured which caused greater frictional unemployment.

However, the small sample size and relatively small effects of these variables render any conclusions based on these results very limited, as the p values for these variables were all quite large. These results do not refute the hypothesis of this paper but provide little statistical evidence to support it, despite the graduate percentage coefficients having the sign and relative magnitudes expected.

Also worth noting is that doctorate graduates percentage had a strong negative effect on unemployment in these estimates. Research level graduates have been shown in previous research to have a positive effect on growth (Tsai et al., 2010), so the sign of this effect is unsurprising. However, it is of far too great of a magnitude to be causal, and likely is either a chance result or a reflection of an omitted variable bias related to research and development.

Table 5. The effect of graduate percentages on unemployment in OECD countries, all models

Graduates' effects on unemployment and p values	First Differences	Fixed effects, country-specific growth effect	Differences in Differences
Upper Secondary (ISCED-3)	0.93 (0.28)	1.60 (0.11) ^	0.64 (0.07) ^
Vocational/Short-cycle tertiary (ISCED-4 and ISCED-5)	-0.16 (0.79)	-0.36 (0.57)	0.17 (0.73)
Bachelors (ISCED-6)	0.64 (0.62)	0.12 (0.93)	0.43 (0.73)
Masters (ISCED-7)	0.88 (0.48)	0.05 (0.97)	1.24 (0.20)
Doctorates (ISCED-8)	-4.45 (0.42)	-3.03 (0.64)	-6.34 (0.19)
Model Adjusted R^2	0.6414	0.9956	0.9946
Degrees of freedom	83 (n= 115)	83 (n=130)	100 (n=130)

Table 5. The estimated effect of changes in graduation rates (measured as the percentage of a country's total population) of ISCED degree types on unemployment in 23 OECD countries. ^ Indicates significance at 15% significance level.

Table 6. First Differences Model, OECD countries

	First Differences (All Countries)
Upper Secondary	0.94
	(0.86)
SC/Non-tertiary	−0.17
	(0.63)
Bachelor's	0.65
	(1.33)
Master's	0.89
	(1.26)
Doctorates	−4.45
	(5.50)
Log(GDP)	−6.86
	(12.35)
Log(GDPL)	−18.72
	(12.21)
InflationL	−0.05
	(0.04)
CapitalL	0.27*
	(0.12)
R^2	0.74
Adj. R^2	0.64
Num. obs.	115

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$

Table 6. Shows coefficient estimates for a first differences, least squares estimation of the effect of changes in the percentage of a country's population graduating from various ISCED degree types on unemployment in 23 OECD countries. SC stand for short-cycle tertiary education. All graduates variables are lagged, as are the controls with an L.

4.2 Overeducated Sample

When the analysis was split by overeducation, the results found support the hypothesis that overeducation increases unemployment (see Table 7 below). In the overeducated group of countries (15 countries, 90 country years) there was a large positive effect of increases in either the master's and bachelor's degree graduates on unemployment when estimated using either of the preferred model specifications (first differences and fixed effects with variable country growth). Neither value was statistically significant at the 10% level, although given the small sample size this is not surprising, and both were significant at the 15% significance level. An increase of 0.1% in percentage of the population completing master's degrees in the previous year was associated with an increase of 0.273% (p=0.15) in the unemployment rate, while an

increase of 0.1% in the proportion of the population completing bachelor's degrees was associated with a 0.188% in the unemployment (p=0.15).

However, I do note that these coefficient estimates are just below (bachelor's) or just above (master's) the upper bound of realism/causality. Approximately 50% of the individuals in the average country in this analysis were in the labour force (WorldBank, 2022). If all the marginal individuals completing these degrees entered the labour force, and none added to the number of jobs held during the next year in their country, this would imply a positive effect on unemployment of approximately 0.2% for each 0.1% of the population graduating from these degrees (as each 0.1% of the population is equal to 0.2% of the labour force). The effect size could possibly rise slightly higher than this if the individuals also extended the hiring process for jobs that were filled, or if they entered and then left jobs. The standard errors for these estimates are quite large and the effect size for master's graduates only very slightly above a realistic level, so I do not see this as a major issue for the analysis.

Table 7. The effect of graduates on unemployment in overeducated OECD countries, all models

Effects of a 1% increase in graduates percentage on unemployment and p values	First Differences	Fixed Effects with separate growth effects	Differences in Differences
High School (ISCED-3)	-0.36 (0.68)	0.61 (0.59)	-0.35 (0.31)
Vocational/Short-cycle tertiary (ISCED-4 and ISCED-5)	0.31 (0.61)	0.14 (0.83)	0.25 (0.61)
Bachelors (ISCED-6)	1.88 (0.15) ^	1.60 (0.34)	0.55 (0.62)
Masters (ISCED-7)	2.73 (0.14) ^	2.39 (0.34)	1.54 (0.19)
Doctorates (ISCED-8)	4.40 (0.82)	7.30 (0.79)	-22.55 (0.25)
Model Adjusted R^2	0.7608	0.9968	0.9968
Degrees of freedom	51 (n=75)	51 (n=90)	60 (n=90)

Table 7. The estimated effect of changes in graduation rates (measured as the percentage of a country's total population) of ISCED degree types on unemployment in 15 overeducated (workforce overeducation rate greater than 14%) OECD countries. ^ indicates significance at 15% significance level.

Table 8. First differences model, overeducated OECD countries

	First Differences (Overeducated Countries)
Upper Secondary	−0.37
	(0.89)
SC/Non-tertiary	0.32
	(0.62)
Bachelor's	1.89
	(1.28)
Master's	2.73
	(1.85)
Doctorate	4.40
	(20.14)
Log(GDP)	−17.26
	(14.80)
Log(GDPL)	−23.99
	(14.83)
InflationL	−0.07
	(0.04)
CapitalL	0.43**
	(0.14)
R^2	0.84
Adj. R^2	0.76
Num. obs.	75

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$

Table 8. Shows coefficient estimates for a first differences, least squares estimation of the effect of changes in the percentage of a country's population graduating from various ISCED degree types on unemployment in 15 overeducated (overeducation rate greater than 14%) OECD countries. SC stand for short-cycle tertiary education. All graduates variables are lagged, as are the controls with an L.

Overall, the analysis suggested that countries having more individuals complete higher degrees is associated with higher frictional unemployment, particularly in countries where overeducation is an issue. Upper secondary graduates and shorter degree graduates (vocational/short cycle tertiary education) did not have any positive effects on unemployment that were close to significance in any model specification. In the non-overeducated subsample shorter degree graduates percentage had a negative effect on unemployment. Higher degree graduates, on the other hand, had consistently positive effects on unemployment. Having more master's degree graduates raised unemployment rates in all subsamples, while in the overeducated group having more bachelor's degree graduates raised unemployment. These effects were generally at or near their plausible upper bound and had p values between 0.1 and

0.4. Given the small sample size, this is as much evidence as such a small dataset (a pilot study) could have been expected to provide.

The models were quite accurate in predicting unemployment. The R^2 values for the fixed effects and differences in differences models were over 99% for both samples. Interestingly, the overeducated sample had a significantly better fit in all specifications despite having a smaller sample size. This may be due to the countries in this sample having more similarity to each other in terms of their labour market, which makes sense given they had more similar overeducation values.

The controls also generally had the effects that would be expected based on economic theory in the two preferred model specifications (first differences and fixed effect with country specific growth), although due to covariance between them they did not always have significant values. Growth (both in year and lagged) and lagged inflation both had negative effects on unemployment, which is consistent with the literature and the idea that greater aggregate demand lowers unemployment. Lagged capital stock had a statistically significant positive effect in almost all model specifications, with its effect in the literature varying depending on the study. Although this does not match the theory that greater capital accumulation leads to a higher marginal product of labour and higher efficiency wage, and therefore a higher level of employment (Arestis et al., 2007), this result is likely affected by the inclusion of the growth controls. Once growth is accounted for, higher capital accumulation has a positive effect in this analysis, which suggests that when growth is related to capital accumulation it does not lower unemployment as much (which makes intuitive sense).

The lagged controls in the differences in differences model had effects that were not consistent with the literature (lagged growth and inflation had positive effects). I expect this was due to a combination of covariance with the year fixed effects and poor model fit. Although this model had a high R^2, it is not used in the literature to model unemployment, and these issues suggest it is the least interpretable of the three models used.

4.3 Robustness checks

Two countries in the full sample had significant outlier values in one or more years for one or more graduates variables. Slovenia (not in the overeducated group) had outlier values for masters and doctorate graduates in 2017. The United Kingdom (in the overeducated group) had high, highly variable values for upper secondary graduate percentage over the years measured. The models were run without these countries as a robustness check. They were included in the final analysis as the results were not significantly different when they were excluded, and they improved the models' fits.

Population change was included as a robustness check in the model and had no significant effect on the results. It is conceivable that population change may have affected unemployment rate and been correlated with the number of graduates from the various degree types, but the results were robust to its inclusion. The results were similarly robust to the inclusion of in-year capital stock and inflation variables and year fixed effects (for the non-differences in differences models), with the inclusion of these variables not changing the sign of any coefficients of interest, and not affecting their magnitudes or p values to any significant degree.

The results were also generally robust to the exclusion of the controls for lagged growth, lagged capital stock and lagged inflation, although these variables significantly improved the fit of the model (measured by adjusted R^2) so were kept in the reported results.

It is also worth noting that the short cycle/post-secondary non-tertiary graduate percentage variables not having any effect close to significance acts as a placebo check for the other results. In the overeducated sample, the effect of upper secondary graduates was also never close to significance. The masters' and bachelors' variable coefficients were also quite consistent across all three models (considering the sample size). This provides further evidence of the robustness of the results.

4.4 Limitations

There are multiple, substantial limitations to any inferences that can be made from these results. The first and major issue is that the sample was quite small. The graduates data was only available for 7 years, and one of these was 2019. Due to the Covid-19 pandemic acting as a potential confounder, it was decided that this data would not be used, as it would have been included as a lagged variable for 2020 unemployment. This left graduate data for 6 years for 30 countries, for a total sample size of 180 country-years. This was further cut due to issues finding data for control variables and overeducation, leaving a total of 138 country-years as a further 7 countries were cut. These countries were generally less developed and had less available data, so it may have been beneficial to remove them solely for the purposes of comparability. There was also limited in-country variation for these variables, as shown in the graphs in the data section. This sample size and variation was enough to give some information but led to a low level of statistical power that made statistical significance hard to reach.

The sample size was also reduced when using the first differences model taken from the literature. This left the degrees of freedom at 51 for the subsample of greatest interest (overeducated countries). I would have preferred to report the results of a first differences model allowing different growth effects across countries (as in the fixed effects model) but given this estimation only had 37 degrees of freedom, it was excluded from the analysis. The signs of the effects were preserved from the general first differences model, and the bachelor's and master's graduates variables had values of close to 1 that are much higher than the other graduates variables, but the p values were quite high due to the limited degrees of freedom.

The other major limitation of the study, beyond the econometric limitations already discussed in the data/empirical strategy section, is that I assume the marginal effects of graduates are constant across countries. This is necessary due to the small dataset, but is likely a false assumption, as the labour market, graduation rates and other factors which would moderate this effect vary across countries. It is also possible that measurement differences affected how much the graduates variables changed in each country. Including only developed OECD countries with all data available, and splitting the countries by overeducation, aimed to address this issue.

5. Discussion

5.1 Overeducation likely increases frictional unemployment

The results of this study are not completely reliable for the reasons discussed above but suggest that overeducation increases short-term unemployment at the country level.

It makes intuitive sense that when a country with a high overeducation rate has an increase in graduates from higher degrees it may raise the unemployment rate. If it is assumed that job openings are exogenous, and that individuals compete for jobs based on their assumptions about which jobs they might receive, then it can be seen how higher degrees might increase frictional unemployment. When individuals complete higher degrees, it signals to them that they will be able to get a more attractive job. They are more willing to remain unemployed while waiting to get one of these jobs, and less willing to take a job of lower attractiveness. However, as they remain unemployed, they are receiving a signal that they may not be able to receive such a job (as well as potentially losing money while unemployed) and become more willing to accept a job they are overeducated for. This fits previous research on the effect of overeducation of higher graduates on unemployment (Barros et al., 2011) and job satisfaction (Rumberger, 1981). Even when they accept a job they are overeducated for, they still crowd out individuals from lower degrees (Rose & Ordine, 2010), lengthening their unemployment spells, and potentially leave these jobs quickly (McKinsey, 2012).

This process of job-matching might therefore be lengthened at the whole market level when individuals have incorrect signals about their likelihood of entering a certain career. When more individuals think they will receive jobs in more competitive fields (because they have a higher degree), it lengthens the average unemployment spells of individuals in this field, and potentially in the fields where overeducated individuals settle in. This provides a mechanism for overeducation to raise the frictional unemployment rate. In countries where there is a large oversaturation of graduates, the data from this study indicates this effect is large, although further research is needed to confirm this effect.

5.2 Policy Recommendations

This result, and the literature examined, bring into question the benefits for society of the expansion of the higher education system in its current form. While individuals are likely to receive positive value from higher education (McKinsey, 2012; Woessmann, 2016), current data on growth (Hanushek, 2016; Holmes, 2013) and overeducation suggest that simply funnelling more individuals into higher education may be inefficient. The primary and secondary school development of basic literacy and numeracy skills, as well as the development of a country's research and development apparatus through tertiary education, are the main education drivers of growth.

It is important to note, however, that general tertiary education (not in research) plays an important role in intergenerational class mobility and still likely has at least a small positive effect on growth at the country level (Agasisti & Bertoletti, 2022; Holmes, 2013). In many cases, regional changes in higher education do provide a benefit to regional growth (Agasisti

& Bertoletti, 2022; Howell, 2020). Individuals may also gain value from knowledge without it having to translate into improved measurable economic outcomes for society. For these reasons, I do not suggest (particularly based on this research paper) that the higher education system be dramatically scaled back.

What is important, and is highlighted in reports by McKinsey (2012) and the British Council (Howell, 2020) and growth research by Holmes (2013) and Hanushek (2016), is that education is focused on life and career-relevant skills. Most employers and students surveyed in the McKinsey report (in nine OECD countries) stated that while on-the-job training was most important for student development, this was not adequately provided by education providers. Less than 50% of both employers and students felt that graduates were well-prepared for work. The same issue was found in the British Council report. Significant mismatch between the skills required by employers and those taught to students was often present and significantly limited the benefits of higher education.

The main policy recommendations I make, based primarily on the literature reviewed (and supported by the results of this paper), are that:

Employment signalling to students is improved: Governments should ensure individuals entering degrees are better educated on the potential employment outcomes associated with them. This is in line with the recommendations of the McKinsey (2012) report, which found that most students enter their tertiary degrees with little idea of potential employment outcomes for their specific degree. This may include publishing and disseminating graduate employment data for different degrees and fields to students. This would likely improve the self-allocation of students to areas and degree types where greater numbers of graduates are needed. It might also improve the speed of matching of students after degrees, as students who enter more competitive fields have a greater understanding of their likelihood of employment. These factors would likely minimise the effect of overeducation on frictional unemployment.

This data should be presented to individuals deciding what to study in the future. At present this issue is largely ignored by universities, who do not have the data and when asked to guess generally overestimate the graduate employment rates of their courses substantially (McKinsey, 2012). This may require government intervention, as publishing this data is unlikely to benefit universities. This would likely most strongly affect the marginal individuals who are least motivated to complete a degree, who this paper suggests are a significant source of short-term labour mismatch. It would allow these individuals to make a more informed decision about which post-secondary pathway is best for them, accounting for all factors.

Direct government subsidies and funding toward areas with a greater need for graduates/greater effects on growth: Previous research has shown that government support does affect the numbers of individuals entering degrees. Currently, subsidies are provided for almost all undergraduate courses in Australia. For the market to operate efficiently, subsidies should be provided based on the positive externality associated with a given degree, which has been shown to vary significantly. It would improve efficiency to target different degrees with more jobs available more heavily with subsidies, as well as STEM degrees and research-based degrees. The Australian Federal Government recently made changes to subsidies in line with this recommendation by increasing their contribution to undergraduate degrees in fields such as nursing and veterinary science, while decreasing their contribution to undergraduate degrees in fields such as society and culture and undergraduate psychology ("2021 Indexed Rates,"

2021). Further changes are likely warranted. This would also likely have the greatest effect on marginal individuals and as such improve outcomes significantly.

Better match the skills taught at tertiary institutions to those required in the labour market: This recommendation was also made in the McKinsey and British Council reports, as most employers and students suggest that there is substantial mismatch between the skills taught at university and those required by employers. Universities tend to prioritise theoretical knowledge, while employers require application-based skills. The best way to do this would be to encourage more communication between the various stakeholders (students, tertiary institutions, and employers) on what skills universities should prioritise teaching. Employers who are involved in tertiary education experience substantial benefits in terms of graduate recruitment (McKinsey, 2012), which should be made clear by industry organisations and the government and might encourage employers to more actively involve themselves in tertiary education. Governments could also intervene by requiring universities to offer application-based courses such as job placements in their degrees, although this might be difficult to enforce.

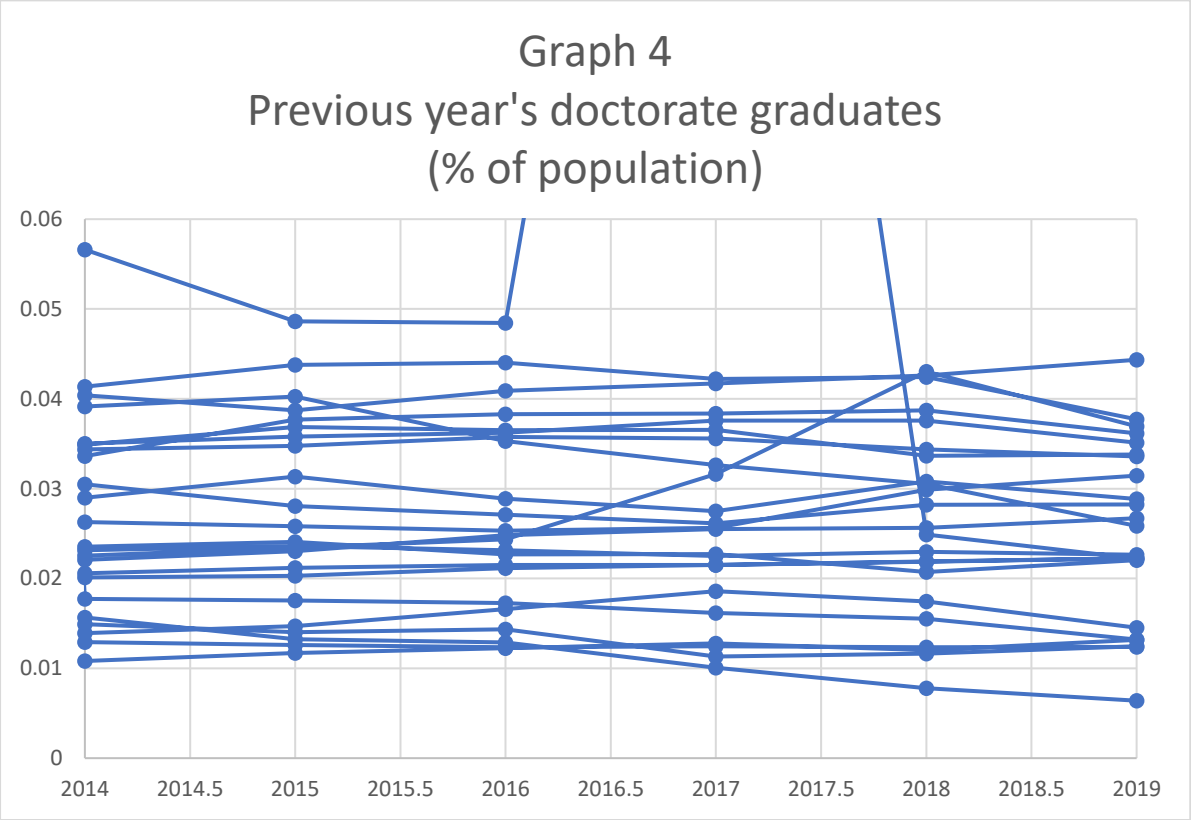
5.3 Conclusion

As tertiary education rates have risen extensively over the last 50 years, the rate of overeducation has risen in parallel in developed countries. This happened partially because of a rise in government funding of post-secondary degrees in these countries (among other factors), with the aim to increase growth by increasing human capital. While this was a reasonable goal, the positive effect of increasing general tertiary education on growth was likely overstated in early studies which did not control for the quality of secondary schooling, the type of tertiary education and the research contributions of universities. More recent studies indicate that many areas of tertiary education do not contribute heavily to growth, and that higher degrees are associated with negative short-term employment outcomes for those who are overeducated for their subsequent careers. This study builds on the previous literature by examining the relative effects of changes in the number of graduates of upper secondary school and various post-secondary education pathways on unemployment at the country level. I find that increasing the marginal number of graduates of higher degrees (bachelor's and master's) increases unemployment in overeducated countries in the following year, with no such effect for upper secondary or shorter post-secondary degrees. In countries without overeducation there is no such effect. While the small sample size of this study and associated lack of statistical power heavily limit the strength of this conclusion, these results suggest that this topic warrants further research, as the magnitudes of the effects found were large.

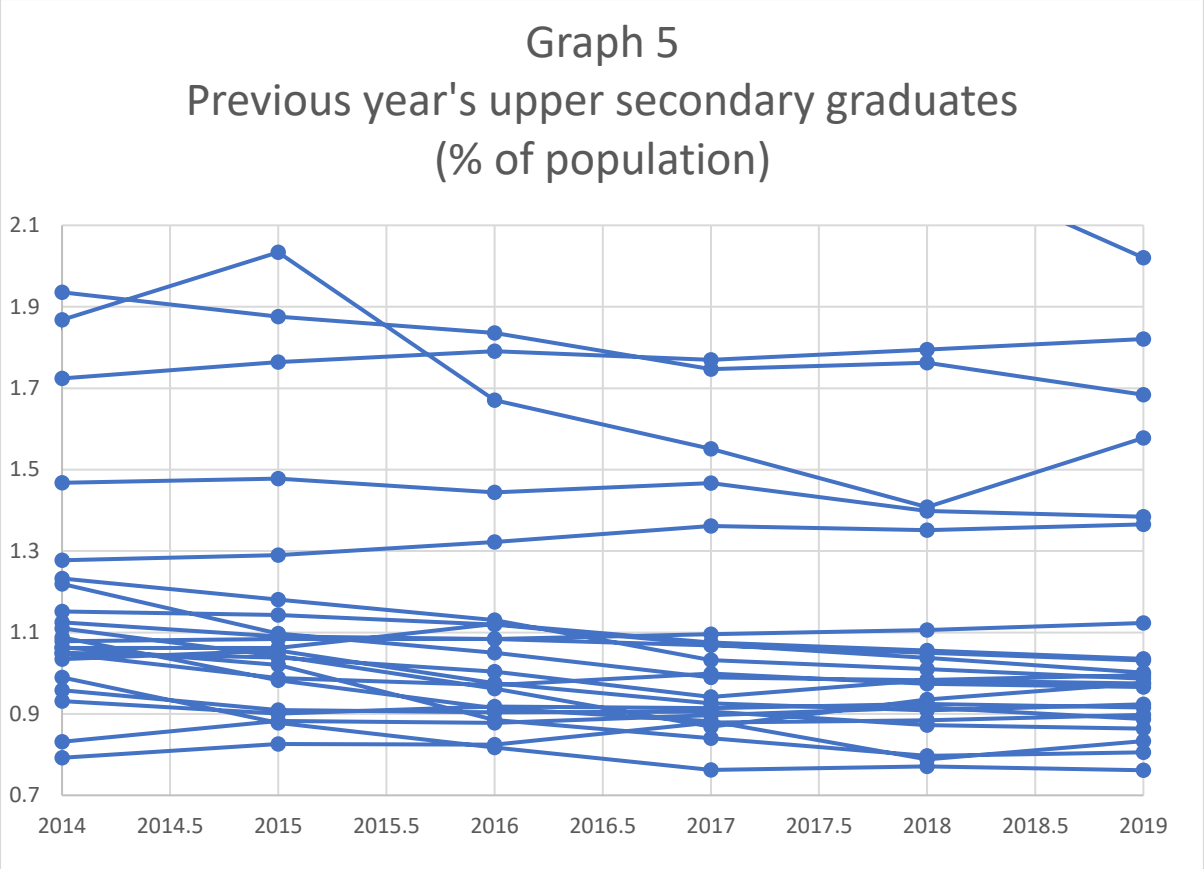
These results, along with the previous literature, suggest that governments, universities and employers should implement policies to better match the allocation and skill development of post-secondary students to gaps in the labour market, as well as better educate upper secondary graduates on the employment outcomes of their degree options. While education has a positive effect on human capital, this effect is highly dependent on the matching of the skills and fields taught to the needs of the labour market. For the education market to operate efficiently, governments should subsidise individual degrees in line with the positive externality they provide. Individuals making decisions about post-secondary study should be provided full information about the employment outcomes of the degrees they are considering so they can

make a welfare-maximising pathway choice. The short-term unemployment effect of overeducation is unlikely to have a major efficiency cost but may be a signal of larger issues of labour supply and demand mismatch and wasteful government spending in the economy.

6. Appendix



Graph 4. Shows the percentage of the population who completed a PhD degree each year for the 23 countries included in the empirical analysis of this study. Slovenia has an outlier year in 2017 and was removed from the analysis during robustness checks. Data was taken from the OECD stats database (OECD, 2022).



Graph 5. Shows the percentage of the population who graduated from high school each year for the 23 countries included in the empirical analysis of this study. The United Kingdom had higher reported values with more variability than other countries for upper secondary graduates and was removed from the analysis during robustness checks. Data was taken from the OECD stats database (OECD, 2022).

Table 9. Fixed Effects Model, OECD Countries

	Fixed Effects (All Countries)
Upper Secondary	1.60
	(0.98)
SC/Non-tertiary	−0.36
	(0.62)
Bachelor's	0.12
	(1.43)
Master's	0.05
	(1.46)
Doctorate	−3.03
	(6.46)
UnemploymentL	0.64***
	(0.09)
Log(GDPL)	−16.16
	(13.87)
InflationL	−0.01
	(0.04)
CapitalL	0.19**
	(0.06)
Log(GDP)	−23.01
	(16.29)
R^2	1.00
Adj. R^2	1.00
Num. obs.	138

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$

Table 9. Shows coefficient estimates for a fixed effects, least squares estimation of the effect of changes in the percentage of a country's population graduating from various ISCED degree types on unemployment in 23 OECD countries. Additional variables were included for log(GDP)*Country, which allowed the effect of growth to vary by country, but these variables were removed for the analysis. SC stand for short-cycle tertiary education. All graduates variables are lagged, as are the controls with an L.

Table 10. Fixed Effects Model, Overeducated OECD Countries

	Fixed Effects (Overeducated Countries)
Upper Secondary	0.61
	(1.14)
SC/Non-tertiary	−0.15
	(0.71)
Bachelor's	1.60
	(1.65)
Master's	2.39
	(2.46)
Doctorate	7.30
	(27.26)
UnemploymentL	0.62***
	(0.13)
Log(GDPL)	−13.25
	(20.11)
InflationL	−0.04
	(0.06)
CapitalL	0.26**
	(0.09)
Log(GDP)	−51.55*
	(20.15)
Log(GDP)*Austria	1.58
	(16.53)
Log(GDP)*Canada	−11.24
	(14.58)
Log(GDP)*Denmark	7.13
	(12.60)
Log(GDP)*Germany	23.56
	(17.37)
Log(GDP)*Greece	−14.10
	(45.75)
Log(GDP)*Italy	10.68
	(27.37)
Log(GDP)*Japan	26.23
	(24.14)
Log(GDP)*Latvia	54.22*
	(23.31)
lLog(GDP)*Lithuania	20.85
	(15.89)
Log(GDP)*Portugal	30.84
	(21.41)
Log(GDP)*Spain	−7.36
	(30.69)
Log(GDP)*Sweden	0.97
	(13.63)
Log(GDP)*United Kingdom	32.49
	(26.67)
Log(GDP)*United States	19.21
	(16.47)
R^2	1.00
Adj. R^2	1.00
Num. obs.	90

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$

Table 10. Shows coefficient estimates for a fixed effects, least squares estimation of the effect of changes in the percentage of a country's population graduating from various ISCED degree types on unemployment in 15 overeducated (overeducation rate greater than 14%) OECD countries. SC stand for short-cycle tertiary education. All graduates variables are lagged, as are the controls with an L.

Table 11. Differences in Differences Model, OECD Countries

	Differences in Differences (All Countries)
Upper Secondary	−0.64
	(0.35)
SC/Non-tertiary	0.17
	(0.50)
Bachelor's	0.44
	(0.96)
Master's	1.24
	(0.96)
Doctorate	−6.35
	(4.81)
Log(GDP)	−5.62
	(10.81)
Log(GDPL)	11.04
	(11.61)
InflationL	0.05
	(0.06)
CapitalL	0.07**
	(0.02)
UnemploymentL	0.79***
	(0.04)
R^2	1.00
Adj. R^2	0.99
Num. obs.	138

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$

Table 11. Shows coefficient estimates for a differences in differences, least squares estimation of the effect of changes in the percentage of a country's population graduating from various ISCED degree types on unemployment in 23 OECD countries. SC stand for short-cycle tertiary education. All graduates variables are lagged, as are the controls with an L.

Table 12. Differences in Differences Model, Overeducated OECD Countries

	Differences in Differences (Overeducated Countries)
Upper Secondary	−0.35
	(0.34)
SC/Non-tertiary	0.25
	(0.49)
Bachelor's	0.54
	(1.08)
Master's	1.54
	(1.16)
Doctorate	−22.55
	(19.34)
Log(GDP)	−21.17
	(14.38)
Log(GDPL)	22.90
	(14.34)
InflationL	0.02
	(0.07)
CapitalL	0.09**
	(0.03)
UnemploymentL	0.78***
	(0.06)
R^2	1.00
Adj. R^2	1.00
Num. obs.	90

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$

Table 12. Shows coefficient estimates for a differences in differences, least squares estimation of the effect of changes in the percentage of a country's population graduating from various ISCED degree types on unemployment in 15 overeducated (overeducation rate greater than 14%) OECD countries. SC stand for short-cycle tertiary education. All graduates variables are lagged, as are the controls with an L.

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