

Determinants of youth unemployment: evidence from 18 OECD countries

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Abstract

Youth unemployment rates are significantly and consistently higher than total unemployment rates, hitting especially high values in a crisis context. The aim of this work is to assess the determinants of youth unemployment in developed countries, relying on a youth to total unemployment ratio. Using data from 18 OECD countries from 1990 to 2019, the results of the estimations indicate that labor market flexibilization and economic growth have a widening effect on the gap between youth and total unemployment rates, while post-secondary educational attainment contributes to reduce the gap.

Keywords: Youth Unemployment; Determinants; Labor market flexibilization.

JEL codes: E24, I24, J41.

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1. Introduction

When a crisis comes along, such as the recent Covid-19 pandemic or the Great Recession, young people are among those who pay the heaviest toll, being disproportionately affected by unemployment (ILO, 2021b; OECD, 2021). This is consistent with studies showing a higher sensitivity of the youth unemployment rate – when compared to the total unemployment rate – to business cycles (Bal-Domańska, 2022; Butkus and Seputiene, 2019; Verd, Barranco, and Bolívar, 2019; OECD, 2008). Additionally, the disparity between youth and total unemployment rates is not restricted to recession periods but is a persistent phenomenon in developed countries (OECD, 2020; OECD, 2019; ILO, 2021b; ILO, 2017). Studies have also shown that the consequences of unemployment for young people on future income are of greater magnitude, and more long lasting than those of adult unemployment, representing a “scarring” effect (Ayllón, Valbuena and Plum, 2021; De Fraja, Lemos and Rockey, 2021; Mroz and Savage, 2006; Gregg and Tominey, 2005).

There are several studies empirically assessing the determinants of youth unemployment, or the impact on it of a specific factor. The flexibilization of the labor market is one of the factors often mentioned as contributing to youth unemployment, which leads to a higher rate of fixed-term and temporary contracts, especially among young workers (O’Reilly, Eichhorst, Gábos, Hadjivassiliou, Lain, Leschke, McGuinness, Kureková, Nazio, Ortlieb, Russell, and Villa, 2015), making them the first to be laid off when companies need to, and lower wages, which can represent a risk to future unemployment (Stewart, 2007).

Liotti (2021) studied the relationship between youth unemployment and labor market regulation in 28 European countries, concluding that labor market flexibility is unlikely to help these countries reduce their youth unemployment rates. In Italy, given the specific context of the great recession, labor market regulation had a positive effect on unemployment, with a greater magnitude on youth unemployment (Liotti, 2020). In the case of high minimum wages, it is possible that they negatively influence the ease of entry in the labor market, influencing the ability of young people to gain experience (Gorry, 2013), with labor market flexibility playing a role on how minimum wages can have an impact on youth unemployment (Neumark and Wascher, 2004). However, labor market reforms toward deregulation are also thought to help reduce total unemployment in developed countries (Nickell, Nunziata, and Ochel, 2005; Belot and Von Ours, 2000), and Breen (2005) points out that countries with more flexible labor markets seem to have lower levels of youth unemployment. The literature also reports that economic growth

has a substantial impact on youth unemployment, as well as education, considering that if young people remain longer in education, they will not be unemployed, and that those who are more educated are more likely to have a smooth school-to-work transition, reducing the risk of future unemployment (Pompei, 2021; ILO, 2017).

Our work assesses the determinants of youth unemployment, accounting for fluctuations that affect young people strictly or significantly more than others. In all the articles mentioned above the indicator used for youth unemployment is the youth unemployment rate, with some authors using the rate of young people not engaged in education, employment, or training (NEET). We did not find any article in which the dependent variable used for assessing the determinants of youth unemployment is the ratio between youth and total unemployment rates. Using this ratio as the dependent variable allows us to determine the factors that affect youth unemployment specifically in comparison to total unemployment, which is new in the literature.

We find that the ratio between youth and total unemployment rates deteriorates with the flexibilization of labor markets and economic growth. Regarding labor market regulations, those regulating fixed-term contracts (*i.e.*, how permissive the legislation is with permanent tasks being associated with fixed-term contracts and how many consecutive fixed-term contracts are allowed before tenure) and the minimum wages of trainees and first-job employees have the greatest impact on the gap between youth and total unemployment. We also find that education levels, especially post-secondary educational attainment, plays a relevant role in lowering the youth to total unemployment ratio.

The present work is structured as follows. In Section 2 we present a brief literature review on the determinants and consequences of youth unemployment, with the latter focusing on income losses. Section 3 describes the data and the estimation methods used. In Section 4 we present and discuss the estimation results of our estimations. Section 5 concludes.

2. Literature review

In the first part of this literature review, we focus on the consequences of youth unemployment, showing the importance of this issue. The second part exploits the determinants of youth unemployment according to the literature.

2.1. The “scarring” effect of youth unemployment

Someone who is unemployed at a given time is more likely to be unemployed once again in the next year, with a similar effect from low-wage employment (Stewart, 2007). Considering that one of the characteristics of working young people is the precariousness of their jobs (Liotti, 2020) and their role in the growing polarization of the labor market, where young workers are joining more low and high-skilled jobs with the middle-skilled jobs being mostly held by prime-age workers (OECD, 2020; ILO, 2017), Stewart’s (2007) conclusions are especially worrying for young people. Also, youth unemployment results in permanent income losses, in addition to the obvious temporary ones that come directly from the loss of a job (Arulampalam et al., 2001; De Fraga et al., 2021; Gregg and Tominey, 2005). As the first works focusing on this “scarring” effect were performed using data from the United States of America (USA), there was a concern that this effect, intensity, and/or durability might be specific to the country, or perhaps less prominent in countries with stronger welfare systems (Arulampalam et al., 2001; Eliason and Storrie, 2006). This is because the more flexible labor market in the USA is expected to promote a fast re-employment of unemployed people, unlike in the European countries, where there is stronger regulation and unemployment protection.

Eliason and Storrie (2006) studied this phenomenon in Sweden, a country with a robust Welfare system, obtaining results that support the idea that in a substantially different context from the USA, there are also significant long-term income losses for unemployed people, particularly for those aged 21-30, and 41-50 years old. Using data from the United Kingdom (UK), De Fraja et al. (2021) narrowed the age groups to 18-20, 21-23 and 24-26 years old, allowing for a more accurate interpretation of the results. The authors found that unemployment at ages of 18-20 years old results in a lifetime income loss of 1.2%/year for each month of unemployment, an effect that is lower when unemployment occurs at ages of 21-23 years old and seems to be temporary when it occurs from 24 to 26 years. These conclusions may imply that by using an age interval from 21 to 30 years old, the impact of youth unemployment on future income in Sweden (Eliason and Storrie, 2006) is underestimated, since the results with narrower groups in the UK

show that from 24 years old forward the “scarring” effect seems to be null or negligible (De Fraja et al., 2021). The “scarring” effect is the most covered economic consequence of youth unemployment among a vast array of repercussions, such as the worsening of health, well-being and job satisfaction, and the transmission of disadvantages through generations (O’Reilly et al., 2015).

Global inequality has been rising in recent decades, not only in developing countries, but also in developed ones. The growth of income and wealth inequality in developed countries has been sharper in the USA and Canada, and comparably slower in Europe, where we find the lowest inequality levels. However, even the inequality levels and trends in Europe are far from desirable (Alvaredo et al., 2018). Since youth unemployment permanently damages employment prospects and income, as detailed in the previous paragraph, there could be a relationship between youth unemployment and income inequality – first via the manifest loss of income that comes with unemployment, potentially mitigated by unemployment benefits, then through the permanent loss of income and future unemployment spells.

2.2. What influences youth unemployment?

O’Reilly et al. (2015) address a range of factors influencing youth unemployment, including labor market flexibility and education. Regarding labor market flexibility, the authors evoke the idea dominant in the 1990s that the strictness of labor market regulations in Europe was dampening European economies’ ability to create jobs, leading to policy decisions aiming to make labor markets more flexible. This led to a growth in atypical contracts, such as temporary and part-time work contracts, especially among young people, with a high share of young workers involuntarily hired on temporary contracts. Although temporary contracts may represent an opportunity for young people to enter the labor market and then transition to more stable employment forms, studies find that these contracts represent a way of replacing more protected workers with cheaper and less protected workers (Barbieri and Scherer, 2009), and the transition rates to be low and getting lower, prolonging young people’s job insecurity (O’Reilly et al., 2015; Chung, Bekker, and Houwing, 2012).

Analyzing data from 28 European countries, Liotti (2022) evaluated the hypothesis that the deregulation of labor markets reduces youth unemployment, using the labor market regulation index (LMRI) (Fraser Institute, 2021) as a measure of the degree of regulation

of labor markets. The relationship between youth unemployment and labor market regulation was studied in both the short and long run, finding no considerable evidence that the flexibilization of labor markets helps these countries reduce their youth unemployment rates, suggesting a high turnover and a detrimental effect on aggregate demand as possible explanations for the results. Extending the high turnover explanation, the loosening of labor market regulations is thought to allow companies to continuously hire and fire, reducing their labor costs and creating a cycle of precariousness and unemployment for young people. Liotti (2020) also studied the effect of labor market regulation on unemployment in Italian regions, in the specific context of the Great Recession, concluding that the deregulation of the labor market plays a significant role in the rise of youth and adult unemployment, with a more pronounced effect on young people.

Nickell, Nunziata, and Ochel (2005) reach different conclusions when analyzing data from OECD countries ranging from 1960 to 1990, considering five aspects of labor market regulation: the unemployment benefit system; systems of wage determination; employment protection; labor taxes; and barriers to labor mobility. Accounting for shocks that have an impact on unemployment and on the real interest rate, their results show that, overall, the labor market rigidities positively correlate with the unemployment rate. Also studying data from OECD countries in a similar time horizon (1960-1995), Belot and van Ours (2000) empirically analyze the impact of labor tax rates, replacement rates, employment protection, union density, and coverage on the unemployment rate, additionally assessing how the interaction between policies shaped the outcomes. The authors mention labor tax rates, replacement rates, union density, and a strong workers' bargaining position as contributing to rising unemployment rates.

Concerning the mandated minimum wage (a specific labor market regulation present in several developed countries), Gorry (2013) assesses its impact on unemployment rates in the United States of America between 2007 and 2009, considering young workers with low education levels, concluding that the increase in the minimum wage is connected to a rise in both the youth and total unemployment rates. This was achieved with a model that accounts for experienced and inexperienced workers, assuming that young people's wages increase as they gain experience. Neumark and Wascher (2004) also present evidence suggesting that, on average, minimum wages have a disemployment effect on young people, although this effect is more pronounced in countries with flexible labor markets, and can be smoothed by employment protection laws. Liotti's (2020) results for

Italy support the argument that mandated minimum wages lead to an increase in unemployment, but this interaction was not observed with youth unemployment, which could be a consequence of the previously mentioned substitution effect, with the replacement of adult workers with young workers with atypical contracts.

The high incidence of atypical contracts (specifically temporary ones) among young workers plays a key role in exacerbating young people's sensitivity to business cycles (Scarpetta, Sonnet, and Manfredi, 2010). The relationship between economic growth and the unemployment rate has been thoroughly studied in recent decades, largely confirming Okun's (1962) pioneering conclusions of a negative correlation between economic growth and the unemployment rate (Butkus and Seputiene, 2019). However, Bal-Domańska (2022) shows that this relationship has a small magnitude for youth unemployment when there is economic expansion, concluding that economic fluctuations affect unemployment more than twice as much for youth. Therefore, economic downturns affect young people harder, who additionally do not benefit from economic growth as much as the adult population does, potentially widening the gap between young people and the general population. Tomić (2018) refers to this specific issue as well, explaining that if youth unemployment has a pronounced procyclical behavior, it should be expected that this would translate into a strong response when economies are growing, allowing for a recovery of the deficit between youth and adult unemployment, which is not empirically observed.

Education and skills have an immediate interaction with work, especially regarding young workers, who frequently transition from school to work, and often have their expectations shaped by their educational background. O'Reilly et al. (2015) distinguish clearly the over-education problem from the over-skilling problem, with the main difference being that educational attainment usually represents a job entry requirement, while skills refer to all the expertise needed to perform the job. However, most of the works focusing on these subjects rely on the over-education measure because of data availability. These studies are mostly focused on the general population, although the education and skill mismatch problem is particularly important for young people, as a mismatched worker on a first job is highly likely to still be mismatched later in life (O'Reilly et al., 2015). Education on its own is an important factor for young people to avoid unemployment in a crisis scenario, with a reduced probability of being unemployed for highly educated people (Pompei and Selezneva, 2021), and vocational education potentially helping match young workers' skills to those expected by the employers (Breen, 2005).

3. Data and Methodology

In this section we first present the model, variables, and data used in our estimations. We then present an overview of the evolution of youth unemployment since 1990 in different OECD countries. Finally, we perform the diagnostic tests that justify the choice of the estimation methods.

3.1. Model, variables, and data sources

To assess the determinants of youth unemployment in developed countries, the following equation is estimated:

$$YUR_{i,t} = \alpha + \beta_1 EG_{i,t} + \beta_2 AW_{i,t} + \beta_3 EAR_{i,t} + \beta_4 LMRI_{i,t} + \mu_{i,t} \quad (1)$$

where $YUR_{i,t}$ is the youth to total unemployment ratio for the country i at time t , $EG_{i,t}$ the economic growth rate, $AW_{i,t}$ the average wage, $EAR_{i,t}$ the youth to total educational attainment ratio, $LMRI_{i,t}$ the labor market regulation index, and $\mu_{i,t}$ the disturbance.

As mentioned in the previous section, we have not found in the literature works that empirically assess the determinants of youth unemployment using the youth to total unemployment ratio as the dependent variable. This ratio suppresses the fluctuations that occur simultaneously for youth and total unemployment, thereby capturing solely the disparities between young people and the global population. This approach allows us to focus on the relative position of young people in the labor market and capture the aspects that are specific to the youth unemployment.

The choice of the independent variables is based on the elements mentioned in the literature review. First, the consensus around the impact of economic growth on the unemployment rate, with a smaller magnitude for youth unemployment, makes the rate of economic growth a natural candidate to be included as explanatory variable. Second, in the literature review we also describe the impact of educational attainment on youth unemployment. Since our dependent variable is the youth to total unemployment ratio, we also rely on the youth to total educational attainment ratio, thereby obtaining the relative position of young people regarding educational attainment. Third, the literature review also covers the relationship between labor market regulations and youth and total unemployment, where there are divergent views on whether the correlation is negative or positive, although the literature points toward a strong connection. Fourth, the average wage has a theoretical impact on the unemployment rates, with Liotti (2020) empirically

showing a significant relationship between this variable and both youth and total unemployment.

Since our focus is on developed countries, panel data from 18 OECD countries (Austria, Australia, Belgium, Canada, Denmark, Finland, France, Italy, Japan, South Korea, Netherlands, Norway, Spain, Sweden, Switzerland, Great Britain, United States of America, and New Zealand) were used in the period between 1990 and 2019. This time span was determined by data availability. Variables are used considering periods of five years resulting in a balanced panel with 108 observations from 1990 to 2015. For each five-year period, the average of the available values was considered.

The youth to total unemployment ratio (YUR) was obtained using the youth and total unemployment rates available at the World Bank, considering youth to include people between 15 and 24 years old. The economic growth rates (EG) were calculated with the output-side real gross domestic product (GDP) at chained purchasing power parity (PPP) per capita available at the Penn World Table 10.0 (Feenstra, Inklaar, and Timmer, 2015). The average wages were obtained from OECD (2022a). The educational attainment ratio results from the educational attainment considering post-secondary education of population aged between 15 and 24, and the educational attainment of the total population. For the robustness check we also use the mean years of schooling ratio, using the same age interval (Wittgenstein Centre for Demography and Global Human Capital, 2018). The labor market regulation index (LMRI) consists of the labor market regulations component (area 5B) of the economic freedom index (EFI) developed by the Fraser Institute (2021). This index and its components and sub-components assume values that range from 0 (strict) to 10 (flexible).

Since the sub-components of the LMRI will be used for additional regressions, it is relevant to describe each of these six components for a better evaluation of the results presented in Section 4:

1. The first component (LMRI1) accounts for hiring regulations and minimum wage, more specifically regulation regarding fixed term contracts.
2. The second component (LMRI2) aims to measure the flexibility (or strictness) of hiring and firing regulations.
3. The third component (LMRI3) measures the centralization of the bargaining power.
4. The fourth component (LMRI4) measures restrictions to night, holiday, and overtime work, as well as the length of the work week and the average paid annual leave.

5. The fifth component (LMRI5) measures the mandated cost of worker dismissal, considering the dismissal of a redundant worker with 10-years tenure.
6. The sixth component (LMRI6) considers different military conscription regulations, accounting for different lengths of conscription, the strictness of its enforcement, and the non-military options available.

For a detailed description of each of these components, please refer to the Economic Freedom of The World: Appendix (Fraser Institute, 2019).

3.2. Youth unemployment: overview and trends

The trends of youth unemployment generally follow those of total unemployment, both resulting in a similar behavior over time. Figure 1 illustrates this for the average values in the countries included in our sample, also showing that what noticeably differs between youth and total unemployment is the magnitude of the fluctuations, and the levels of unemployment, both being markedly higher for young people.

The average youth unemployment rate has seen several fluctuations in the period analyzed, with fast rises from 1990 to 1993, and from 2008 to 2009, and significant reductions from 1996 to 2000, and from 2013 to 2019. The reductions led to two recoveries to levels similar to those registered in 1990, below 14%. The variations in the total unemployment rate have a smaller amplitude, with recoveries in the same periods as those for young people. Despite these reductions, the level of youth unemployment is still more than twice the level of total unemployment, and Figure 2 helps us understand how the disparity between young people and the global population rose steadily from 1990 (when the youth to total unemployment ratio was above 2.0) to 2008 (surpassing 2.5). Since then, this ratio has been slowly falling, but maintaining its high levels.

Figure 3 shows the youth to total unemployment ratios by country, with countries split by region. In our data, with 5 year averages, Japan and South Korea are the only countries with a lower youth to total unemployment ratio in 2015 than in 1990, although the starting points and trajectories are quite different. While Japan was close to the average in 1990, South Korea had the highest ratio in the whole sample. Both countries decreased the ratio in the early 1990s, and Japan from 2005 onward, having no significant rises in the youth to total unemployment ratio between 1990 and 2015, despite the Asian financial crisis of 1997.

In the European countries, Australia, New Zealand, and the United States of America, from 1990 until the Great Recession there is a clear increasing trend in the ratio, with most of these countries stagnating or slightly recovering in the following years, regarding this indicator. Countries from Northern Europe have youth to total unemployment ratios above the average, with the exception of Denmark, known for its flexicurity model. Norway's fast rise between 1990 and 1995 may be related to the Norwegian banking crisis, making them the country with the highest ratio in 1995 and 2000. Although there are similarities in the labor markets among Northern European countries, the levels of the youth to total unemployment ratio and its behavior throughout the analyzed time period have a wide range, nearing minimums (Denmark) and hitting maximums (Norway). The two countries from Southern Europe in our sample (Italy and Spain) have the highest youth unemployment rates, persistently above 20%, with Italy reaching 42.7% in 2014, and Spain 55.5% in 2013, in the context of the sovereign debt crisis. However, Spain has a youth to total unemployment ratio below the average in our time horizon, while Italy is consistently close to the higher values until 2010, when it became the country with the highest ratio. Western Europe represents one third of the countries in our sample, with Austria, Switzerland, and Netherlands closer to the minimum than to the average, and France close to the average. All the countries in this region have similar trends, comparable to the average trend, with the exception of Great Britain, which sees its ratio rise continually, at a slower rate from 2005, switching from a position between minimum and average in 1990 to a position between the average and the maximum. Canada stands with Japan and South Korea with distinct patterns, with a fairly stable youth to unemployment ratio in the period studied.

Overall, countries with a ratio below the average show few and slow decreases, despite the singular case of Japan, which had significant reductions in the last decade.

3.3. Methods of estimation

We perform now some diagnostic tests with the aim of choosing the most suitable methods to estimate equation (1)

First, the correlation matrix and variance inflation factor (VIF) values for the regression variables show that there are no multicollinearity problems.

Performing the Hausman test (1978) to choose between the fixed effects and the random effects models, we reject the null hypothesis that the random effects model is consistent at a significance level of 5% (Table 3).

Since our number of time periods ($T = 6$) is smaller than the number of countries ($N = 18$), the Breusch-Pagan test is not adequate to test for cross-sectional dependence. Therefore, we rely on the Frees' (1995), Friedman's (1937), and Pesaran's (2004) tests (Hoyos and Sarafidis, 2006). The Pesaran's and Friedman's tests do not reject the null hypothesis of cross-sectional independence, although the Frees' test rejects the same null hypothesis at a 1% significance level. Since both Pesaran's and Friedman present P-values above 90% (Table 3), we will consider this result – that is, cross sectional independence.

To test for the presence of heteroskedasticity we ran the test developed by Baum (2000), which calculates a modified Wald statistic, testing for the null hypothesis of homoskedasticity. The null hypothesis was rejected at a significance level of 1%.

As for autocorrelation, the Wooldridge test is adequate for detecting first-order autocorrelation (Drukker, 2003). In our case this test leads to the rejection of the null hypothesis of no first-order autocorrelation at a significance level of 1%.

Finally, we ran the fixed effects model with time dummies for each period and tested for the null hypothesis that the coefficients for those time dummies are jointly equal to zero. Since the P-value is higher than 5%, we failed to reject that hypothesis, and therefore we do not use time dummies.

Considering the results presented in Table 3, we conclude that our panel has cross-sectional independence, heteroskedasticity, and first-order autocorrelation, which, together with the Hausman test result and the time dummies test, leads us to the use of fixed effects with clustered standard errors (Hoechle, 2007) and no time dummies to estimate equation (1).

4. Results

In this section we present and discuss the main results of this study. In addition to the estimation of the baseline equation (1), we run complementary regressions, by replacing the LMRI by each of its components and conducting several robustness checks.

The results of the estimation of equation (1) using fixed effects with clustered robust standard errors are presented in Table 4.

The results show that economic growth and labor market deregulation have a positive and significant effect on the youth to unemployment ratio, while the ratio of education attainment has a negative effect. That is, higher economic growth rates and labor market flexibilization levels contribute significantly to increase the gap between youth and total unemployment, while a higher level of educational attainment of young people relative to total population contributes (albeit less strongly) to reduce it.

Since the LMRI is an index covering six components, it is important to evaluate which of categories of regulations are most important in influencing youth to total unemployment. Thus, we ran additional regressions replacing LMRI by each of the six components, the results of which are presented in Table 5.

Table 5 shows that hiring regulations and minimum wage (LMRI1), particularly regulations on fixed-term contracts, are some of the most important regulatory aspects of the labor market in explaining the gap between young people and the overall population. It is noteworthy that the minimum wage in component LMRI1 corresponds to the minimum wage for trainees and first-time employees (Fraser Institute, 2019), since a great number of these will be young workers. Therefore, this component captures two characteristics of youth unemployment addressed in the literature review that have an impact on the stability of youth jobs and probability of being unemployed in the future: contracts that ease the firing of workers; and low wages.

Military conscription and its duration (LMRI6) also shows a significant relationship with the youth to total unemployment ratio, and although this is not a labor market regulation *per se*, conscription affects distinctly young people. The positive sign indicates that countries with at least some degree of military conscription have a smaller discrepancy between young people and the total population, despite conscription keeping them from

either education or the labor market. Two possible explanations for this may be that conscription would help young people engaging in steady military careers, or that young conscripted people acquire skills that are useful in reaching a better relative position in the labor market (Aleksynska and Cazes, 2014).

Hours regulations (LMRI4) have a less significant impact on the youth to total unemployment ratio, probably because this component measures restrictions to night or holiday work, work week length, overtime, and annual paid leave time, which have the potential to affect young people the most, but also affect adult workers.

To check the robustness of the results of the main regression, we ran four additional regressions, the results of which are presented in Table 6. First, we replaced the educational attainment ratio by the educational attainment of people aged between 15 and 24 years old (EA), and the mean years of schooling ratio (MYSR) between youth and total population (columns 1 and 2). Then we split our sample according to the real GDP *per capita* in 2019, resulting in two balanced panels (columns 3 and 4): the first one consists of data from 10 countries with a real GDP *per capita* of less than 50,000 dollars (Belgium, Canada, Finland, France, Italy, Japan, South Korea, Spain, Great Britain, and New Zealand), and the second one includes countries with a real GDP *per capita* higher than 50,000 (Austria, Australia, Denmark, Netherlands, Norway, Sweden, Switzerland, and United States of America). Since this implies a significant change to the data, we ran new diagnostic tests for cross sectional dependence, heteroskedasticity, first-order autocorrelation, and the Hausman test (see Appendix), leading us to a random effects model with clustered standard errors in both subsamples.

Regarding the first robustness regression, the results are quite similar to those of the main estimates, with the economic growth and LMRI variables keeping significance and magnitude, and the educational attainment for young people also significant with a value that suggests that educational attainment on its own, *i.e.* regardless of its distance to the educational attainment of the total population, helps reducing the youth to total unemployment ratio. Regarding the second regression, the first thing that stands out is the mean years of schooling ratio variable, which is significant and has a positive coefficient. While the educational attainment and the educational attainment ratio account for those who are beyond a specified threshold (post-secondary education), the mean years schooling ratio measures the ratio between the mean years spent in school by youth and the total population, not accounting for different types or degrees of

education. This shows that while post-secondary education contributes to the reduction of the disparity between youth and the total unemployment, studying for a longer time ignoring different characteristics of education may actually aggravate this disparity. These estimates also show a significant value for LMRI, with a result similar to those obtained in the previous estimations, reinforcing the positive impact of labor market flexibilization on the youth to total unemployment ratio.

The results for the estimations with countries separated by GDP are, in general terms, consonant with the main estimates. The educational attainment ratio lacks significance for both samples, while economic growth remains significant only for countries with lower GDP levels (third column in Table 7). The LMRI is significant for both groups, but its magnitude is considerably greater in countries with higher GDP levels (fourth column in Table 7). Since we split out the original panel into two, it is possible that the way the educational attainment ratio interacts with the youth to total unemployment ratio has no connection with the output levels when considering developed countries, losing significance with this data division. These results show economic growth to be strongly connected to the disparity between youth and total unemployment in countries with lower GDP levels, while countries with higher GDP levels seem to be more able to mitigate the effects of growth on young people. Labor market flexibilization positively affects the youth to total unemployment ratio in both groups of countries, with a considerable magnitude for countries with lower GDP levels, and a high coefficient for countries with higher GDP levels. For the latter, considering these estimates, a rise of 1 standard deviation (1.6332) in the LMRI, would result in a 0.6743 increase in the youth to total unemployment ratio, which is more than the total amplitude of the average ratio in the time horizon analyzed (Figure 2).

Overall, the robustness check presents results that do not conflict with those obtained in the main regression, additionally allowing for a finer analysis of the determinants of youth unemployment.

5. Conclusion

The goal of this work was to assess the determinants of youth unemployment in developed countries, relying on a youth to total unemployment ratio as the dependent variable. One of the main conclusions is that labor market flexibilization has played an important role in the widening of the gap between the unemployment rates of young people and those of the overall population, as the variable LMRI consistently presents a significant and positive impact on the ratio over the different regressions we ran, with a stronger effect in countries with higher GDP. Specifically, hiring regulations and minimum wages among trainees and first-employment workers have been shown to have a particularly strong influence on youth unemployment, followed by legislation regulating night and weekend work, extra-hours, and the amount of yearly paid-leave days. Military conscription, on the other hand, seems to be connected to lower youth to total unemployment rates, although this particular aspect deserves further research allowing for a better understanding of the mechanisms through which it affects youth unemployment.

In addition to labor market regulation and its components, economic growth also enhances the disparity between youth and total unemployment, showing that the benefits of economic expansion are mostly reaped by older age groups. On the other hand, post-secondary educational attainment helps young people secure a better position in the labor market, lowering the youth to total unemployment ratio.

The use of a youth to total unemployment ratio to assess the determinants of youth unemployment is, to the best of our knowledge, new in the literature, and allows for a different understanding of how these determinants widen (or narrow) the gap between young people and adults. The conclusions of this work underscore the importance for policy makers to account for the high vulnerability of young people to regulatory changes and business cycles, with permanent long-term consequences. It becomes clear that policies pursuing economic growth and particularly labor market flexibility are lacking balancing policies that protect young people, or are even detrimental for young people. Promoting higher first-job salaries, including trainees, and more secure contracts for young people are the most important objectives for developed countries to pursue, according to our results.

References

- Aleksynska, M., & Cazes, S. (2014). Comparing Indicators of Labour Market Regulations Across Databases: A Post Scriptum to the Employing Workers Debate. *Conditions of Work and Employment Series No. 50*. Inclusive Labour Markets, Labour Relations and Working Conditions Branch of the International Labour Organization.
- Alvaredo, F., Chancel, L., Piketty, T., Saez, E., Zucman, G. (2018). World Inequality Report 2018. World Inequality Lab.
- Arulampalam, W., Gregg, P., & Gregory, M. (2001). Unemployment Scarring. *The Economic Journal* 111(475), pp. 577-584.
- Asterio, D., & Hall, S. G. (2011). *Applied Econometrics* (2nd edition). Palgrave Macmillan.
- Ayllón, S., Valbuena, J., & Plum, A. (2022). Youth Unemployment and Stigmatization Over the Business Cycle in Europe. *Oxford Bulletin of Economics and Statistics* 84(1), pp. 103-129.
- Bal-Domańska, B. (2022). The Impact of Macroeconomic and Structural Factors on the Unemployment of Young Women and Men. *Economic Change and Restructuring* 55, pp. 1141-1172.
- Barbieri, P., & Scherer, S. (2009). Labour Market Flexibilization and its Consequences in Italy. *European Sociological Review* 25(6), pp. 677-692.
- Baum, C. (2000). XTTEST3: Stata Module to Compute Modified Wald Statistic for Groupwise Heteroskedasticity. *Statistical Software Components* S414801.
- Belot, M., & van Ours, J. C. (2000). Does the Recent Success of Some OECD Countries in Lowering their Unemployment Rates Lie in the Clever Design of their Labour Market Reform? *Oxford Economic Papers* 56(4), pp. 621-642.
- Berglund, B., Aho, S., Furåker, B., Madsen, P. K., Nergaard, K., Rasmussen, S., & Virjo, I. (2010). Labour Market Mobility in Nordic Welfare States. *TemaNord 2010:515*, Copenhagen: Nordic Council of Ministers.
- Breen, R. (2005). Explaining Cross-National Variation in Youth Unemployment: Market and Institutional Factors. *European Sociological Review* 21(2), pp. 125-134.

Breusch, T. S., & Pagan, A. R. (1980). The Lagrange Multiplier Test and its Applications to Model Specification in Econometrics. *The Review of Economic Studies* 47(1), pp. 239-253.

Butkus, M., & Seputiene, J. (2019). The Output Gap and Youth Unemployment: An Analysis Based on Okun's Law. *Economies* 7(4).

Chung, H., Bekker, S., & Houwing, H. (2012). Young People and the Post-Recession Labour Market in the Context of Europe 2020. *Transfer* 18(3), pp. 299-315.

De Fraja, G., Lemos, S., & Rockey, J. The Wounds That Do Not Heal: The Lifetime Scar of Youth Unemployment. *Economica* 88(352), pp. 896-941.

Drukker, D. M. (2003). Testing for Serial Correlation in Linear Panel-Data Models. *Stata Journal* 3(2), pp. 168-177.

Eliason, M., Storrie, D. (2006). Lasting or Latent Scars? Swedish Evidence on the Long-Term Effects of Job Displacement. *Journal of Labor Economics* 24(4), pp. 831-856.

Feenstra, R. C., Inklaar, R., & Timmer, M. P. (2015), The Next Generation of the Penn World Table. *American Economic Review* 105(10), pp. 3150-3182.

Fraser Institute (2021). Economic Freedom of the World: 2021 Annual Report. <https://www.fraserinstitute.org/economic-freedom/dataset>

Fraser Institute (2019). Economic Freedom of the World: Appendix, Explanatory Notes and Data Sources. <https://www.fraserinstitute.org/economic-freedom/approach>

Frees, E. W. (1995). Assessing Cross-Sectional Correlation in Panel Data. *Journal of Econometrics* 69(2), pp. 393-414.

Friedman, M. (1937). The Use of Ranks to Avoid the Assumption of Normality Implicit in the Analysis of Variance. *Journal of the American Statistical Association* 32(200), pp. 675-701.

Gil-Alana, L. A., Škare, M., & Pržiklas-Družeta, R. (2019). Measuring Inequality Persistence in OECD 1963-2008 Using Fractional Integration and Cointegration. *The Quarterly Review of Economics and Finance* 72(May 2019), pp. 65-72.

- Gorry, A. (2013). Minimum Wages and Youth Unemployment. *European Economic Review* 64, pp. 57-75.
- Gregg, P., & Tominey, E. (2005). The wage scar from male youth unemployment. *Labour Economics* 12(4), pp. 487-509.
- Hausman, J. (1978). Specification Tests in Econometrics. *Econometrica* 46(6), pp. 1251-1271.
- Hoechle, D. (2007). Robust Standard Errors for Panel Regressions with Cross-Sectional Dependence. *Stata Journal* 7(3), pp. 281-312.
- Hoyos, R. E. D., & Sarafidis, V. (2006). Testing for Cross-Sectional Dependence in Panel-Data Models. *The Stata Journal* 6(4), pp. 482-496.
- ILO (2021b). World Employment and Social Outlook: Trends 2021. Publications Production, Printing and Distribution Branch (PRODOC) of the ILO.
- ILO (2017). Global Employment Trends for Youth 2017: Paths to a Better Working Future. Publications Production, Printing and Distribution Branch (PRODOC) of the ILO.
- Liotti, G. (2022). Labour Market Regulation and Youth Unemployment in the EU-28. *Italian Economic Journal* 8, pp. 77-103.
- Liotti, G. (2020). Labour Market Flexibility, Economic Crisis and Youth Unemployment in Italy. *Structural Change and Economic Dynamics* 54, pp. 150-162.
- Malerba, G., & Spreafico, M. (2013). Income Inequality in the European Union: Evidence from a Panel Analysis. *Quaderni del Dipartimento di Politica Economica, Università Cattolica del Sacro Cuore* 65.
- Mroz, T. A., & Savage, T. H. (2006). The Long-Term Effects of Youth Unemployment. *Journal of Human Resources* XLI(2), pp.259-293.
- Neumark, D., & Wascher, W. (2004) Minimum Wages, Labor Market Institutions, and Youth Unemployment: A Cross-National Analysis. *ILR Review* 57(2), pp. 223-248.
- Nickell, S., Nunziata, L., & Ochel, W. (2005). Unemployment in the OECD Since the 1960s. What Do We Know? *The Economic Journal* 115(500), pp. 1-27.

O'Reilly, J., Eichhorst, W., Gábos, A., Hadjivassiliou, K., Lain, D., Leschke, J., McGuinness, S., Kureková, L. M., Nazio, T., Ortlieb, R., Russell, H., & Villa, P. (2015). Five Characteristics of Youth Unemployment in Europe: Flexibility, Education, Migration, Family Legacies, and EU Policy. *SAGE Open* 5(1), pp. 1-19.

OECD (2022a). Average wages (indicator). <https://doi.org/10.1787/cc3e1387-en>

OECD (2022b). Fertility rates (indicator). <https://doi.org/10.1787/8272fbo1-en>

OECD (2022c). Social spending (indicator). <https://doi.org/10.1787/7497563b-en>

OECD (2021). OECD Employment Outlook 2021: Navigating the COVID-19 Crisis and Recovery. OECD Publishing, Paris.

OECD (2020). OECD Employment Outlook 2020: Worker Security and the COVID-19 Crisis. OECD Publishing, Paris.

OECD (2019). OECD Employment Outlook 2019: The Future of Work. OECD Publishing, Paris.

OECD (2008). OECD Employment Outlook 2008. OECD Publishing, Paris.

Okun, A. M. (1962). Potential GNP: Its Measurement and Significance. *Proceedings of the Business and Economic Statistics Section of the American Statistical Association*, pp. 98-104.

Pérez-Moreno, S., & Angulo-Guerrero, M. J. (2016). Does Economic Freedom Increase Income Inequality? Evidence From the EU Countries. *Journal of Economic Policy Reform* 19(4), pp. 327-347.

Pesaran, M. H. (2004). General Diagnostic Tests for Cross Section Dependence in Panels. *Cambridge Working Papers in Econometrics* 0435. University of Cambridge.

Pompei, F., & Selezneva, E. (2021). Unemployment and Education Mismatch in the EU Before and After the Financial Crisis. *Journal of Policy Modeling* 43(2), pp. 448-473.

Rodríguez-Pose, A., Tselios, V. (2009). Education and Income Inequality in the Regions of the European Union. *Journal of Regional Science* 49(3), pp. 411-437.

Sánchez, Á., Pérez-Corral, A. L. (2018). Government Social Expenditure and Income Inequalities in the European Union. *Hacienda Pública Española / Review of Public Economics* 227(4/2018), pp. 133-156.

Scarpetta, S., Sonnet, A., & Manfredi, T. (2010). Rising Youth Unemployment During the Crisis: How to Prevent Negative Long-Term Consequences on a Generation? *OECD Social, Employment and Migration Papers, N° 106*.

Stewart, M. B. (2007). The Interrelated Dynamics of Unemployment and Low-Wage Employment. *Journal of Applied Econometrics* 22(3), pp. 511-531.

Tomić, I. (2018). What Drives Youth Unemployment in Europe? Economic vs Non-Economic Determinants. *International Labour Review* 157(3), pp. 379-408.

Tridico, P. (2018). The Determinants of Income Inequality in OECD Countries. *Cambridge Journal of Economics* 42(4), pp. 1009-1042.

UNU-WIDER (2021). World Income Inequality Database (WIID) Companion dataset (wiidcountry). Version 31 May 2021.

Verd, J. M., Barranco, O., Bolívar, M. (2019). Youth Unemployment and Employment Trajectories in Spain During the Great Recession: What are the Determinants? *Journal for Labour Market Research* 53.

Wittgenstein Centre for Demography and Global Human Capital (2018). Wittgenstein Centre Data Explorer Version 2.0.

Tables and figures

Table 1. Descriptive Statistics – equation (1).

Variable	Obs.	Mean	Standard Deviation	Min.	Max.	Source
YUR	108	2.2284	0.4634	1.1810	3.3606	World Bank
EG	108	0.0162	0.0176	-0.0213	0.0991	Penn World Table version 10.0 (Feenstra, Inklaar, and Timmer, 2015)
AW	108	44914.6	8769.4	23872.0	65476.6	OECD (2022a)
EAR	108	0.4427	0.1610	0.0550	0.9194	Wittgenstein Centre for Demography and Global Human Capital (2018)
LMRI	108	6.0695	1.6611	2.8321	9.1403	Fraser Institute (2021)

Table 2. Correlation matrix and variance inflation factor (VIF) – equation (1).

Variables	YUR	EG	AW	EAR	LMRI
YUR	1.0000				
EG	-0.1323	1.0000			
AW	-0.0519	-0.1956	1.0000		
EAR	-0.1762	0.2743	-0.3860	1.0000	
LMRI	-0.1376	-0.1900	0.3989	-0.1459	1.0000
VIF = 1.26					

Table 3. Hausman and diagnostic tests – equation (1).

Test	Test statistic	Prob	Ho	Outcome
Hausman	$\chi^2 = 9.08^{**}$	0.0283	The random effects model is consistent	Rejected
Frees	CD-test = 1.709 ^{***}	-		Rejected
Friedman	CD-test = 5.206	0.9971	Cross-sectional independence	Not rejected
Pesaran	CD-test = 0.119	0.9053		Not rejected
Modified Wald	$\chi^2 = 866.51^{***}$	0.0000	Homoskedasticity	Rejected
Wooldridge	F = 38.160 ^{***}	0.0000	No first-order autocorrelation	Rejected
Time dummies	F=2.03 [*]	0.0828	The coefficients for all years are jointly equal to zero	Not rejected

Note: ^{***}, ^{**}, and ^{*} represent statistical significance at 1%, 5%, and 10%, respectively.

Table 4. Regression with the determinants of youth unemployment.

	(1)
EG	3.3872 ^{**} (1.4652)
AW	6.11e-06 (1.24e-05)
EAR	-0.8027 [*] (0.4273)

LMRI	0.1163** (0.0413)
Constant	1.5487*** (0.4846)
Observations	108
R ²	0.4088
No. of groups	18

Note: ***, **, and * represent statistical significance at 1%, 5%, and 10%, respectively.

Table 5. Regressions with each of the LMRI components.

	(1)	(2)	(3)	(4)	(5)	(6)
EG	-0.5308 (1.2292)	2.8455* (1.4350)	2.6108* (1.3937)	2.4261 (1.9919)	1.8179 (1.4975)	2.5230* (1.2721)
AW	8.86e-07 (1.52e-05)	2.20e-05** (1.00e-05)	2.19e-05** (9.67e-06)	9.08e-06 (1.31e-05)	1.03e-05 (4.12e-05)	1.96e-05* (1.00e-05)
EAR	-0.6215 (0.4187)	-0.8950 (0.5256)	-0.9704* (0.5306)	-1.1783** (0.4873)	-0.6895 (0.4943)	-0.5909 (0.4946)
LMRI1	0.0426** (0.0193)					
LMRI2		-0.0401 (0.0282)				
LMRI3			0.0155 (0.0438)			
LMRI4				0.0484* (0.0248)		
LMRI5					-0.0232 (0.0201)	
LMRI6						0.0315** (0.0145)
Const.	2.2462*** (0.6269)	1.7714*** (0.5715)	1.5477** (0.6750)	2.0061*** (0.6030)	2.2928*** (0.6011)	1.3689** (0.5160)
Obs.	90	108	108	106	72	108
R ²	0.2261	0.3061	0.2938	0.4045	0.0034	0.3641
No. of groups	18	18	18	18	18	18

Note: ***, **, and * represent statistical significance at 1%, 5%, and 10%, respectively.

Table 6. Robustness check regressions.

	(1)	(2)	(3)	(4)
EG	2.6828* (1.4776)	2.4357 (1.4695)	3.0773** (1.2277)	2.6539 (3.2813)
AW	1.35e-05 (1.18e-05)	1.08e-05 (1.29e-05)	2.41e-05 (1.95e-05)	-8.22e-06 (9.97e-06)
EAR			-0.4893 (0.5640)	-0.7102 (0.8434)
LMRI	0.1329*** (0.0408)	0.1252** (0.0434)	0.0692* (0.0418)	0.4129*** (0.0516)
EA	-1.1602* (0.6189)			
MYSR		0.6688** (0.3129)		
Const.	1.0189*** (0.3398)	0.3397 (0.5768)	1.1144 (0.0418)	1.8871** (0.8570)
Obs.	108	108	60	48
R ²	0.3911	0.3972	0.5012	0.4345
No. of groups	18	18	10	8

Note: ***, **, and * represent statistical significance at 1%, 5%, and 10%, respectively.

Figure 1. Average youth and total unemployment rates from 1990 to 2019. Source: World Bank

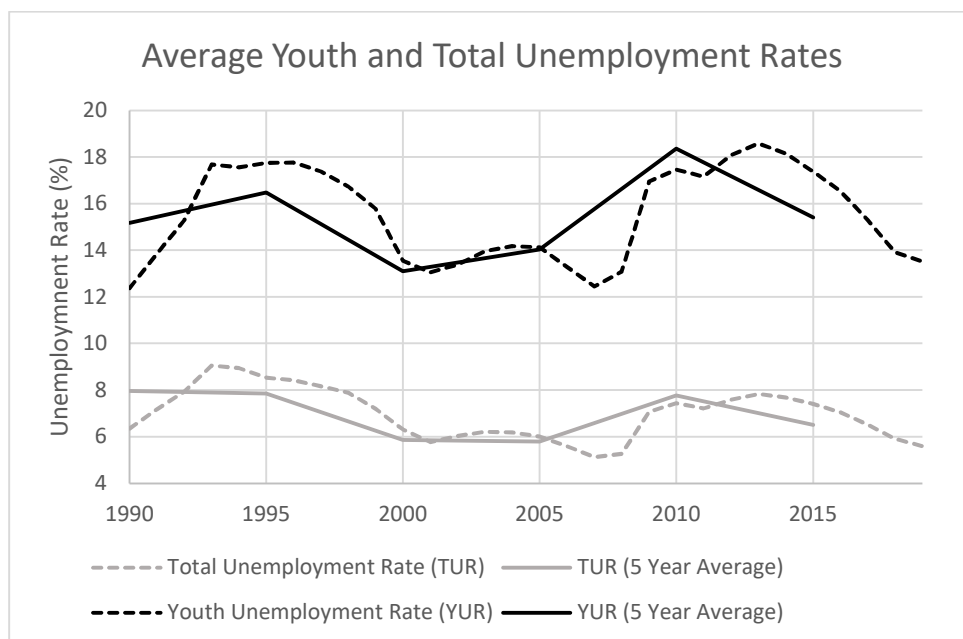


Figure 2. Youth to total unemployment ratio from 1990 to 2019. Source: World Bank

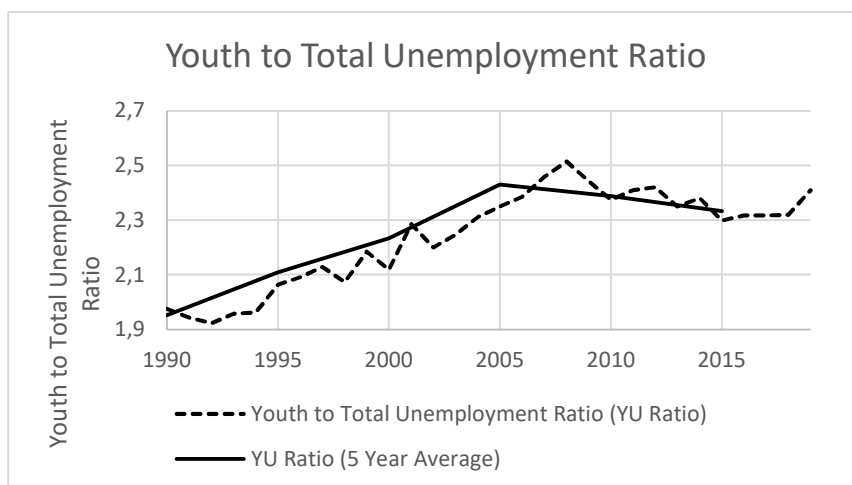
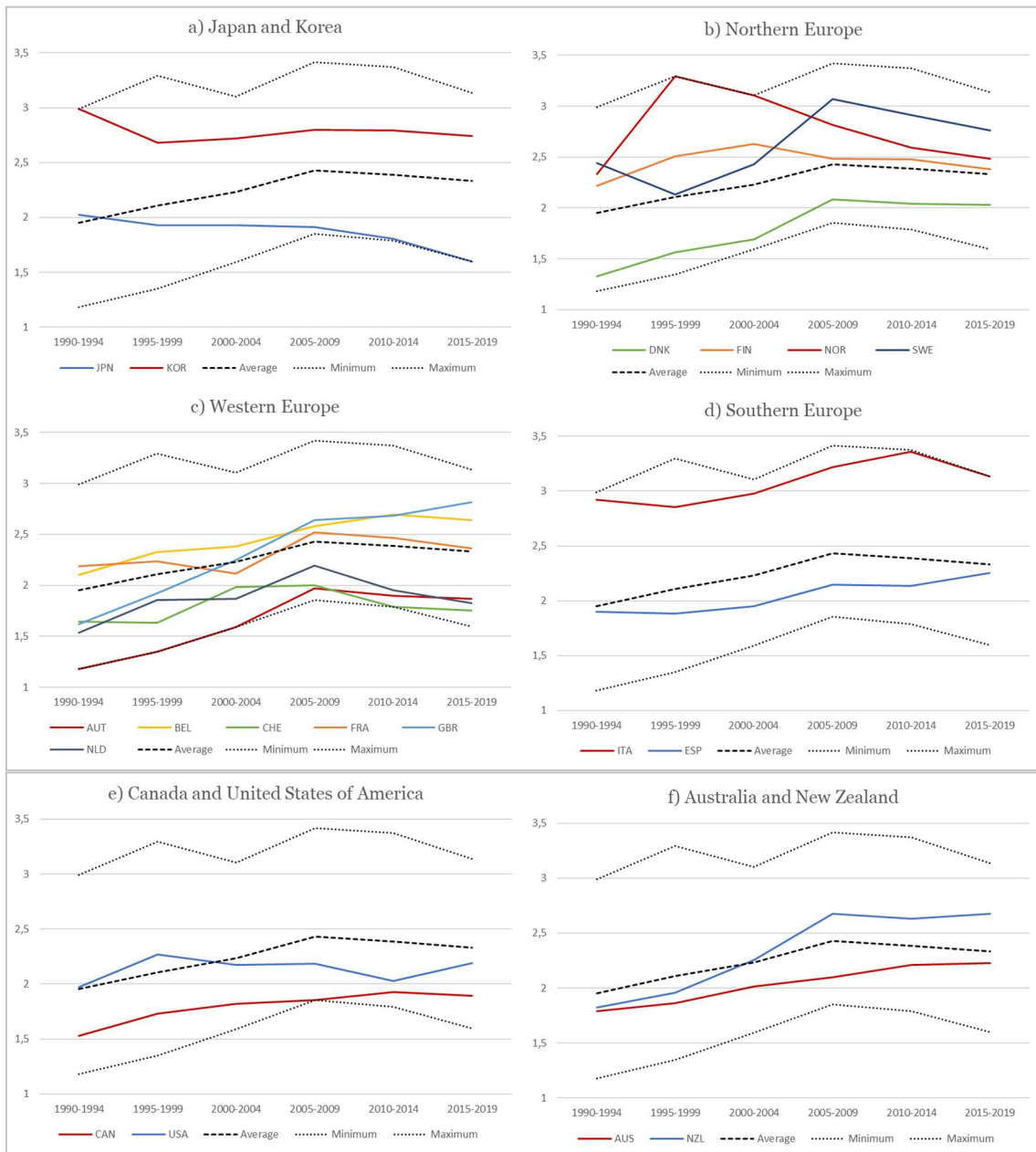


Figure 3. Youth to total unemployment ratio from 1990 to 2019. Source: World Bank.



Appendix

Table A. Hausman and diagnostic tests for countries with GDP below 50,000\$.

Test	Test statistic	Prob.	Ho	Outcome
Hausman	$\chi^2 = 2.11$	0.5498	The random effects model is consistent	Not rejected
Frees	CD-test = 1.355***	-	Cross-sectional independence	Rejected
Friedman	CD-test = 6.971	0.6401		Not rejected
Pesaran	CD-test = 0.050	0.9599		Not rejected
Breusch-Pagan Lagrange Multiplier	$\chi^2 = 57.57$ ***	0.0000	Variance is equal to zero across countries	Rejected
Wooldridge	F = 11.703***	0.0076	No first-order autocorrelation	Rejected

Note: ***, **, and * represent statistical significance at 1%, 5%, and 10%, respectively.

Table B. Hausman and diagnostic tests for countries with GDP above 50,000\$.

Test	Test statistic	Prob.	Ho	Outcome
Hausman	$\chi^2 = 2.16$	0.5398	The random effects model is consistent	Not rejected
Frees	CD-test = 0.138	-	Cross-sectional independence	Not rejected
Friedman	CD-test = 5.143	0.6425		Not rejected
Pesaran	CD-test = 0.813	0.4159		Not rejected
Breusch-Pagan Lagrange Multiplier	$\chi^2 = 28.84$ ***	0.0000	Variance is equal to zero across countries	Rejected
Wooldridge	F = 25.178***	0.0015	No first-order autocorrelation	Rejected

Note: ***, **, and * represent statistical significance at 1%, 5%, and 10%, respectively.