PHD THESIS

HIDDEN UNEMPLOYMENT:

A CRITICAL REVIEW AND ANALYSIS ACROSS COUNTRIES

by

FRANCIS AMOASAH

This is a Thesis submitted to the Department of Economics and Law of the University of Cassino and Southern Lazio in fulfillment of the requirements for the Award of a Doctor of Philosophy (PhD) Degree

in

Economics

(Institutions, Markets and Behaviors)

Due: October 2019

Supervisor: Professor Gennaro Zezza

UNIVERSITÀ DEGLI STUDI DI
CASSINO E DEL LAZIO MERIDIONALE

Corso di Dottorato in
Istituzioni, Mercati e Comportamenti

Curriculum: Applied Economics

Ciclo XXXII

A. A. 2016/2017

Hidden Unemployment:
A Critical Review and Analysis across the World

SSD: (SECS – P/01)

Coordinatore del Corso
Chiar.mo Prof. (Rosella Tomassoni)

Dottorando
(Francis Amoasah)

Supervisore
Chiar.mo Prof. (Gennaro Zezza)

Table of Contents

Extended Abstract of thesis ..... **iv**

Acknowledgements ..... **v**

List of abbreviations vii

CHAPTER I ***1***

Introduction **1**

Statement of the problem **2**

Motivation for the study **4**

Chapter II ***7***

Overview of concepts, definitions and the nature of unemployment 7

Definitions by the International Labour Office 10

Measurement of broader rates of unemployment 15

A short history of statistics on the labour market **16**

Informality in employment 18

Prominent Institutions - The major statistical organizations **20**

International Labour Organization (ILO) 20

The Statistical Office for European Communities (Eurostat) 24

The Organization for Economic Co-operation and Development (OECD) 25

Country measures and studies on labour underutilization **30**

The United States 30

Canada 32

Some individuals' studies 33

Dynamics in unemployment and measurement 35

CHAPTER III ***39***

Hidden unemployment in the United States ***39***

3.1 Introduction **39**

3.2 Unemployment and under-employment in the United States **41**

The US unemployment situation **43**

Economy 43

Labour force participation 45

Part-time (for economic reasons), marginal attachment and job-seeker discouragement, and gender 48

Unemployment rate by youth, women, part-time, U3 and U6 52

Recession in the United States 54

Methodology **56**

Determining the determinants of U6: a systematic approach 59

Proceeding from Autoregressive distributive lag model (ARDL) 67

Johansen cointegration Analysis 71

Conclusion **75**

CHAPTER IV ***77***

An analysis of the world's hidden unemployment ***77***

Introduction **77**
Data challenges 83
Global trends in unemployment 86
A note on the labour underutilization in the least developed countries 94
Complementary statistics of the ILO 97
Conclusion to the chapter **100**
CHAPTER V ***102***
Underemployment among European countries ***102***
Analysis of the dynamics of unemployment over time in European countries 108
Further analysis using OECD countries 113
Marginally attached labour in the OECD 115
Conclusion to the chapter **117**
General conclusion and policy recommendation ***118***
APPENDICES ***120***
References ***153***

List of Tables

Figure 2. 1 Employment quantity and labour market slack (2015) 28

Table 3. 1 Description of variables 58
Table 3. 2 Ordinary Least Squares (our general model) 60
Table 3. 3 OLS Restricted model 62
Table 3. 4 GLS Restricted ECM model 3.4 63
Table 3. 5 GLS Restricted ECM model 3.5 64
Table 3. 6 GLS Alternative Restricted ECM model 3.6 66
Table 3. 7 ARDL model 69
Table 3. 8 ARDL long run form and bounds test 70
Table 3. 9 Comparison of models 74

Table 4. 1 ILO modelled estimates for 2017 (Figures are in thousands) 78
Table 4. 2 Correlation between variables 90
Table 4. 3 Model estimation 93

Table 5. 1 The unemployment statistics for EU28 (for 2016) 103

List of Figures

Figure 2. 1 Employment quantity and labour market slack (2015) 28

Figure 3. 1 Measures of Labour Underutilization from the Current Population Survey, US Bureau of Labour Statistics 42
Figure 3. 2 Working-age population, employment, and the labour force 44

Figure 3. 3 Employment-population ratio 45
Figure 3. 4 Civilian labour force participation rate: by gender and age 46
Figure 3. 5 Unemployment, employed part-time for economic reasons, discouraged and marginally attached labour 50
Figure 3. 6 Ratio of part-time for economic reasons to total employment vs ratio of unemployment to working-age population 51
Figure 3. 7 Trends in U3, U6, Women unemployment rate, Youth unemployment rate, and Part-time unemployment rate 53
Figure 3. 8 Gap between U6 and U3 vs Number of unemployed persons per job opening 55
Figure 3. 9 XY plot of U6 on U3 57
Figure 3. 10 United States Extended Unemployment 67
Figure 3. 11 U6 backcast 72

Figure 4. 1 Youth employment and unemployment rate 81
Figure 4. 2 Status in Employment: World 83
Figure 4. 3 Unemployment vs the Potential labour force (World's regions) 87
Figure 4. 4 Unemployment rate vs combined rate of unemployment and potential labour force, world's regions 88
Figure 4. 5 Relationship between the LU4 and its determinants 90
Figure 4. 6 Traditional unemployment rates, groups 95
Figure 4. 7 Traditional unemployment rates, countries 97
Figure 4. 8 The labour dependency ratio for the world and its regions 98

Figure 5. 1 Trends in unemployment (EU28 and EA19) 108
Figure 5. 2 Time series of U, ANS, SNA and UEP (% of ELF) 109
Figure 5. 3 Movements in the rates among some European countries 110
Figure 5. 4 Increasing U6-U3 gap among some of the countries 111
Figure 5. 5 Persons employed part time for economic reasons 112
Figure 5. 6 Youth not in education, employment or training (NEET) OECD average, estimate for 2018 115

List of Appendices

Appendix 1. 1 Synopsis of coverage and concepts of unemployment in labour force surveys 120
Appendix 1. 2 Schematic presentation of operational definitions of Hauser's labour underutilization framework 121

Appendix 3. 1 Current Alternative measures of labour underutilization (Percent), US 121
Appendix 3. 2 Old Measures (U1 - U7) of labour underutilization (Percent), United States 122
Appendix 3. 3 Supplementary unemployment rates, Canada 122
Appendix 3. 4 Descriptive stats our variables 123
Appendix 3. 5 Correlation matrix 124
Appendix 3. 6 Johansen cointegration between U6 and U3 125
Appendix 3. 7 Redundant Variables Test 127
Appendix 3. 8 Wald test 128
Appendix 3. 9 Determining the number of lags 128
Appendix 3. 10 ARDL Error Correction Regression 129

Appendix 3. 11 Battery of tests Model 6 130
Appendix 3. 12 Battery of tests Model 3.7 133
Appendix 3. 13 Battery of tests VECM 136
Appendix 3. 14 Results of Johansen cointegration test 138
Appendix 3. 15 Plot of residuals of ARDL model 138
Appendix 3. 16 Granger causality 139
Appendix 3. 17 Recession in the US: dates and duration 139
Appendix 3. 18 Breakpoint unit root test (Sample 1994 – 2018) 141
Appendix 3. 19 VECM estimates 141
Appendix 3. 20 Additional test on structural break (ARDL 4, 3, 3) 143

Appendix 4. 1 Test of multicollinearity 144
Appendix 4. 2 Filtering system for data processing: labour underutilization 145

Appendix 5. 1 Dispersion of measures of labour underutilization for European countries 145
Appendix 5. 2 Hypothetical change in measured unemployment rate after reclassification of persons working short hours from a 1-hour minimum to 10-hour during reference week into "unemployed" or "not economically active" 146
Appendix 5. 3 Traditional unemployment rate among European countries (%) 147
Appendix 5. 4 U3 through U6 for European countries 148
Appendix 5. 5 Unemployment, underemployment, worker discouragement, and unavailable jobseekers for European countries 149
Appendix 5. 6 Unemployment, underemployment, worker discouragement, and unavailable jobseekers as a share of the extended labour force for European countries 150
Appendix 5. 7 Unemployment rates by education level, 2018 estimates 151
Appendix 5. 8 Marginally attached workers, by gender and age. OECD countries not in EU and Italy 151

Extended Abstract of thesis

A broader measure of unemployment by the United States' Bureau of Labour Statistics (U6), expands the official unemployment measurement (U3) by considering a number of categories of persons who are not included in U3 either because they are not searching for job (discouraged workers) or because they are working, but under-employed (part-time workers for economic reasons). However, the U6 measure is available only for a relatively short period of time (from 1994), compared to U3 which is available from 1948. Starting from a general to specific approach, we explore the determinants of the U6 rate using the cointegrating relationship between U6 and its determinants. Due to limitation in the data availability required to project U6 backwards to the same date as the U3, we examine the cointegrating relationship between the US BLS U6 rate as left-hand-side variable and many possible explanatory variables in chapter III. We find that besides the traditional unemployment rate (U3), the confidence of consumers is significant in influencing unemployment in its extension in the United States. The business cycle also plays an instrument part in the analysis. We explored using the autoregressive redistributive lag framework including a vector error correction model of the variables exploring the short- and long-run relationship among them. We also include an assessment of the stability of our model parameters and tests of structural breaks.

Prior to chapter III, we do a critical review of the world's hidden unemployment; i.e., the global labour underutilization. We introduce key concepts and definitions of the ILO as they relate to the study. We begin chapter IV with a cursory look at the global unemployment statistics in the world's regions. Basing on the unemployment rate in its extension, namely the Hauser labour underutilization indicator LU4 adopted in the ILO statistics, we find that time-related underemployment, worker discouragement, vulnerable employment and informality determine much of the world's hidden unemployment. One problem in the estimation, however, lies in data unavailability for the fact that two countries who contain much of the world's total population, namely china and India as well as many developing countries lack the data on discouraged jobseekers. In chapter V, we extend our study to exploring further the dynamics of the extended unemployment for European countries and OECD countries. We find that business cycle influences significantly impact the total unemployment situation among European countries. And the patterns are heterogeneities associated with cross country idiosyncrasies, labour programs and policies affecting the individual countries.

Acknowledgements

Words cannot express all the joy in my heart for achieving the highest qualification in academic laurels; the qualification of a Doctor in Philosophy (PhD). I am extremely overwhelmed and happy for this success. The ups and downs of the journey has taught me an important life lesson: resilience. Like an iceberg, people are accustomed to seeing the tip of it, but I glad to be among the few who dare to see the great mass of ice that lies beneath. I dreamt, I dared, I did, and I made it!

I give thanks first to God Almighty, maker of all things, for making this dream a reality.

I express my sincere gratitude to my Thesis Advisor, Prof. Gennaro Zezza for his support and guidance that saw me through the whole research process and my studies. I owe him a great deal of thanks for his professional astuteness and kindness. I would not have completed this journey without him. I am grateful also to Prof. Anwar Shaikh who I had the opportunity to work under during my stay at The New School for Social Research in New York, USA. It was such a breakthrough and a pleasant experience. That was where I had the inspiration for the first part of work on the US – a very crucial topic worth exploring, thanks to Prof. Shaikh, and I'm glad I did.

I am grateful to my mother, Mrs. Margaret Amoasah, my father, Mr. Joseph Amoasah who I believe has been watching from afar (may his soul rest in peace). I am also grateful to my siblings for their cares and support.

I would like to say thank you to the staff and members of the University of Cassino and Southern Lazio where I submit this thesis in fulfillment to earning my degree. I thank the Italian government for the PhD scholarship award; I cannot imagine how my study would been without the financial support – I am grateful. Thank you also to the University of Naples Federico II where I attended advanced courses and seminar as part of my first year PhD training in Economics and Finance. I cannot forget the pleasant memories also at The New School for Social Research where I was visiting student during the second year of studies. Receiving tuition in n I benefitted from lectures and weekly seminars in the heterodox tradition in the state-of-the-art study university environment while working on my thesis.

I am grateful also to the Head and the members of the Department of Economics of the University of Cape Coast, Ghana, where I got the opportunity to present a chapter of my work related to the United States during the Winter break in January 2019. I benefitted from useful comments and suggestions members of staff including the HOD and the students present who were pursuing their PhD and master's degrees.

Last, I am glad for the opportunity to attend additional seminars and summer schools during my training, thanks to the scholarship funding of the Italian government disbursed via the University of Cassino. I say thank you to the Austrian Institute of Economic Research (WIFO) for publishing my earlier work on trade liberalization from my master's thesis (which is not a part of the study) online on the 11th FIW-research conference in International Economics in Vienna, and at Econstor.

I appreciate also all my friends and loved ones, near and far, who provided some emotional support.

Disclaimer

I am solely responsible for the content of this report as well as for any remaining errors of omission or commission that may have escaped final correction, by oversight.

List of abbreviations

CONSCONF	US Consumer confidence
FRED	Federal Reserve Economic Database, Federal Reserve Bank of St. Louis, U.S.
Eurostat	Statistical Office for European Communities
EA 19	19 countries of the eurozone (euro area)
EFTA	European Free Trade Association
EU 28	28 countries of the European Union
ICLS	International Conferences of Labour Statisticians
ILO	International Labour Organization
LU1	Traditional unemployment rate by the ILO, Hauser's framework
LU4	Unemployment rate in its extension by the ILO, Hauser's framework
NBER	National Bureau of Economic Research of the United States
OECD	Organization for Economic Cooperation and Development
OLS	Ordinary least squares
PRW	Participation rate of females
SSA	Sub-Sahara Africa
G7	Group of Seven
U3	Traditional unemployment rate for the United States
U6	Unemployment rate in its extension for the United States
(US) BLS	US Bureau of Labour Statistics
US	United States
UK	United Kingdom

CHAPTER I

Introduction

The study of unemployment is crucial not only with regard to the intrinsic importance of the concept in relation to labour slack but also with regard to the socio-economic implications of the idleness from joblessness. As "one cannot catch a butterfly while lying on his or her bed", unemployment is defined to give indication of the number of persons without job who are taking practical steps within the past four weeks (or in the past month) during a specified reference period to find a job, or waiting to start a new one or on a temporary layoff looking forward to a recall.

Many concerns are raised against the conventional way of assessing the labour slack. Keen followers of the measurement of unemployment observe that the indicator, measured in rate, tells only a partial story from the whole of the economic reality. A change in the unemployment rate[1] could mean that people are finding jobs (hence leaving unemployment) or that they are leaving the labour force altogether due to a prolonged period of unemployment. Changes in the unemployment rate could be due to reasons that have nothing to do with (actual) changes in the employment or in the number of jobs in a country, but may be due only to reasons linked to the people's *beliefs* or to their confidence in a brighter (or gloomier) economic or jobs prospects. This comes from renewed perceptions of the economic fundamentals, which causes the people to intensify or reduce their job search efforts in attempts to finding job. Conversely, changes in the unemployment rate may be due to actual increases or decreases in the job counts in the economy (affecting the

[1] The conventional unemployment rate is measured as the ratio of the unemployed to the labour force.

likelihood of employment) which is not based on sheer beliefs, perception or on the confidence in the prevailing economic progress.

The Business Cycle Dating Committee of the National Bureau of Economic Research (NBER) of the United States, for instance, falls on a few economic indicators including the household-based employment in the economy, while assessing the date(s) of occurrence of a recession. Why the Committee falls on employment (among others) as one of the indicators of the economic activity – in assessing the dates of occurrence of a recession – but not directly on the unemployment rate even though the unemployment rate is a more popular economic indicator is a *question of fact*. A plausible reasoning could be that many people seem to have less doubts (or disagreements) on the employment to population ratio (a.k.a. the employment rate) than on the unemployment rate.

Statement of the problem

As one in every three of all working-aged persons does not participate to the overall world's labour market activities (and is in fact deemed inactive), one common question is: *Does the official unemployment statistics give us a clear picture of the situation of the labour market?* The answer is always in the negative because of segments of the working age population disguised in the labour market statistics. In line with social goals such as "ending extreme poverty and promoting shared prosperity in a sustainable way [the World Bank's mission]", an accurate evaluation of the unemployment situation is indeed a must!

Since its inception, the concept of unemployment has not been without quibble due essentially to how it is measured. Unemployment is defined traditionally by the number of persons[2] of working

[2]In the United States, they comprise persons in the civilian non-institutional working-age population. "Civilian" refers to persons who are not on active duty in the military. "Non-

age[3] who are: (1) without work, (2) available for work, and (3) seeking work. This masks important groups of persons who are (1) without work but (2) do not satisfy one of the remaining other conditions in its definition criteria. It also conceals significant intricacies of the realities of the labour markets pertaining to the total unemployment situation. While it is reasonable[4] to characterize unemployment using those three conditions above, it is not to say that measuring unemployment in this way is without problems. Due to its problematic measurement criteria, many authors have suggested complementing the traditional measure with broader measures. Bienefield and Godfrey (1975) identify that measuring unemployment is not spared from statistical and conceptual problems. And untapped labour resources is a problem not only because it is a waste on the economic growth and development, it is also that it causes economic distress which has substantial costs on a person's morale, dignity, and productivity, which could induce political and social instability.

institutional" refers to persons who are not in institutions, such as nursing homes, prison inmates or those in mental institution. The BLS excludes members of the armed forces but Eurostat, for example, includes career military personnel residing in private residencies.

[3] The ILO does not state what the age limit should be. For many countries, the working age is understood to be 15 years and above, like for the ILO. Countries may adopt different upper bound or lower bound; for example, it is specified to be 16 years and above for the United States. Countries typically adopt an upper age limit, e.g. the working-age is from 15 to 64 years for the OECD. For its economic outlook, however, the OECD defines the working age to be 15 to 74 years and same age range for the labour force participation for the same report. For further information, see Sorrentino (2000) or Table of synopsis of coverage and concepts referred to in Appendix 1.1. Also see ILOSTAT spotlight on work statistics, issue n°8 – August 2019 on *Persons outside the labour force: How inactive are they really? Delving into the potential labour force with ILO harmonized estimates* for details.

[4] See Dunn, Haugen and Kang (2018).

One primary goal of government and policy is increasing employment to the maximum possible level while keeping unemployment to the barest minimum, ceteris paribus. While (being in) employment has a more direct bearing on people's incomes or earnings (Haugen 2009), it is suggested using "joblessness or underemployment" as a satisfactory gauge of the economic hardship since much of many people's income come from employment (ibid, ILO 2013). What is less debated is that the unemployment rate is useful for tracking the cyclical shifts in the economy through time although it does not completely reflect of the overall hardship in an economy. Partly, this stems from the fact that the unemployment rate centers on persons belonging to the labour force without considering the whole of the working-age population. Yet, it is surprising that only a few countries, in North America and Europe, strive to provide additional labour statistics on the overall unemployment situation. The problem, while not new to the ILO, bogs down to challenges relating to the data availability for a significant number of countries.

Motivation for the study

The concept of unemployment is a fuzzy one. While useful for assessing the labour market slack, many people have expressed doubts on the aptness of a single indicator to serve as a complete gauge of the overall labour situation of countries (e.g. Bienefeld and Godfrey (1975), Jones and Riddle's (1999, 2000, 2002), Brandolini et al (2006), Sengenberger (2011), Shimer (2012), Bell and Blanchflower (2013)). While structural factors are fundamental to analyzing unemployment in different parts of the world, much of the problem point to where there is significant degree of job non-formalism and vulnerable forms of employment; for example, in the economies of Africa, Asia, and the Americas. The measurement of unemployment, however, centers usually on the overt side of the economy relatively easy to measure in the statistics while much of what goes on in the shadow economy (i.e. the covert) is most often overlooked. Understanding unemployment in its extension for the world's countries would help reaching a better understanding of the broader

unemployment and the nuanced labour market processes for the countries and regions. A world-oriented view of the unemployment faces serious limitation principally because two of the world's countries with the greater share of the world's population (namely China and India) are lacking in the ILO data on the broad unemployment rate statistics, i.e. the ILO's labour underutilization rate LU4 (discussed later).

In this study, we assess whether the unemployment rate tells a story different from the whole and if so, how close is it from the complete story. Using statistical data available from publicly-available sources, principally the International Labour Organization (ILO) and also the World Bank, the Statistical Organization for European Communities (Eurostat), the Organization for Economic Cooperation and Development (OECD), the US Bureau of Labour Statistics, the FRED database, etc., we go into the matter of verifying to what degree a broader measure can be reproduced for countries based on the available data. With a focus on the world's hidden unemployment, we will start (in chapter III) by assessing the labour (under)utilization in the United States, a pioneer in providing extended (broad) unemployment rate statistics. We will continue with a wholesome approach to reviewing the state of the total labour (under)utilization for the world. Complementary indicators to the measurement of unemployment adopted in the United States Bureau of Labour Statistics, in ILO statistics and in Eurostat statistics will be emphasized.

The rest of the work is organised as follows: Chapter two provides an overview of concepts and definitions, the background and relevant literature review of the study. Chapter three will look at unemployment in the United States with a special focus on the determinants of the gap between the traditional unemployment rate and an extended definition of unemployment (U6), in order to project the U6 rate – which has become available only more recently – backwards. Chapter four extends the analysis to countries across the world, with attention to investigating the overall

unemployment situation in the world. Chapter five extends the analysis to Europe and among OECD countries. We provide an overall conclusion to the thesis in the final chapter. Useful conclusions will also be provided for each chapter.

Chapter II

Overview of concepts, definitions and the nature of unemployment

In order to spell out the problems in obtaining a complete picture of the situation of the labour market in a country, it is useful to start from a logical decomposition of the population in different groups, on the basis of their activity (Table 2.1).

Table 2. 1 Decomposition of population in working age (WAP)

<table>
<tr><td colspan="6">Table 1.1 Decomposition of population in working age (WAP)</td></tr>
<tr><td rowspan="8">WAP = LF + IN
15+ years</td><td rowspan="4">Labor force
LF = E + U</td><td rowspan="3">Employed
(E=RE+VPT+PTER)</td><td>Regular</td><td>For pay or profit</td><td>RE</td></tr>
<tr><td rowspan="2">Part-time
(PT=VPT+PTER)</td><td>Voluntary</td><td>VPT</td></tr>
<tr><td>Economic reasons</td><td>PTER</td></tr>
<tr><td rowspan="2">Unemployed
(U = ULT+UST)</td><td>Long-term unemployed
(Unemployed over a threshold, e.g. 3 months or 6 months)</td><td rowspan="2">Available and seeking</td><td>ULT</td></tr>
<tr><td>Short-term unemployed
(Unemployed for a period less than threshold)</td><td>UST</td></tr>
<tr><td colspan="2" rowspan="4">Out of Labor Force:
Inactive (IN = MA + NA)</td><td rowspan="2">Marginally attached
(PALF=ANS+SNA)</td><td>Available not seeking</td><td>ANS</td></tr>
<tr><td>Seeking not available</td><td>SNA</td></tr>
<tr><td rowspan="3">Not available Not seeking
(NA=IN1+IN2+RET)</td><td>In schooling or home activities</td><td>IN1</td></tr>
<tr><td>Other inactive</td><td>IN2</td></tr>
<tr><td>Retired</td><td>RET</td></tr>
</table>

Source: Author's elaboration

The logic behind the distinction in Table 1.1 is straightforward: people may be working, looking for a job, or inactive. However, as we shall discuss in the following, when we move from a logical distinction to the problem of measuring the number of people in each group we have to rely on arbitrary assumptions and definitions, which will be translated in specific questions in the survey aimed at measuring such phenomena, and unless the definitions are shared across countries, and

everyone adopts the same questionnaire, international comparisons of employment, under-employment and unemployment becomes problematic.

The first decomposition is between the population in working age (Working Age Population, WAP from now on) and other persons. The "other persons" will include children below working age, and old people who have retired. As we will see in more detail below, there is no universal agreement on when people become of "working age", and in some countries children below working age are – sometime illegally – exploited in the labour market, so that such factors have to be taken into account in international comparisons. Similarly, the retirement age varies across countries, and in many cases people above the retirement age are allowed to work. Therefore, both the lower and the upper age limits needed to define persons belonging to the WAP will depend on institutional arrangements, habits, etc., and need to be harmonized for international comparisons.

In the next logical step, the population in working age is split between the Labor Force (LF) and the inactives (IN), where the LF is composed of the employed (E) and those looking for a job: the unemployed (U). While the inactives can be defined residually, both the Employed and the Unemployed require an exact definition in order to be counted. Are you employed if you worked for only one hour last week, but you currently have no job? Are you unemployed if you would like to work, but you are not searching for a job every day? If two countries have the same number of employed people, but in the first country everyone has a full-time job at 40 hours per week, and in the other country half of the employed have part-time jobs at 20 hours per week, is employment the same in both countries?

It is clear that international comparisons for labour market statistics require a harmonization of such concepts, which has been achieved, and modified from time to time, in International Labour Conferences (ILC) and International Conferences of Labour Statisticians (ICLS) organized by the

ILO. ILC Conventions "are legally binding instruments for countries that choose to ratify them":[5] two such conventions have taken place, in 1938 and 1985. ICLS are organized every year, and produce international guidelines, which are not legally binding. Labour market statistics across countries therefore follow the same principles, but do not necessarily adopt the same definitions for identifying each sub-group of the active population.

For our purposes, it is useful to introduce some further sub-groups in the Employed, Unemployed and Inactive categories, that will be discussed in more detailed below.

Among those classified as Employed, we will distinguish those who have a part-time job, but would like to work more hours, usually defined as Part-Time for Economic Reasons (PTER). This is not an exhaustive measure of under-employment since, for instance, people may be employed full-time for a job for which they are over-qualified. There are many other cases where labour is not allocated efficiently (as it is often the case in rural areas in developing countries), but measures of these type of under-employment are difficult to obtain comparatively across countries and will not be considered here.

The current definition of unemployment requires that the person should be actively searching for a job and be available to work immediately. This rules out people who are available for work but have not searched for a job in the reference period, that we will label as Available Not Seeking (ANS), and people who are actively looking for a job but are not available to work immediately, that we will label as Seeking Not Available (SNA).

While most countries run surveys aiming at measuring the level of employment and unemployment, the measurement of the other categories requires specific questions to be introduced in a survey, which have been implemented only recently in North America and Europe, and are missing for many other countries.

[5] See https://ilostat.ilo.org/resources/methods/standards/

In the following sections we will provide a further discussion of the problem, along with more details on the different measures obtained by the institutions producing statistics on the Labour market.

Definitions by the International Labour Office

By activity principle, the ILO defines the labour force[6] as consisting of the employed (engaged in economic activity even if for one hour) plus the unemployed. In determining the labour force, the ILO gives precedence to employment over unemployment in accordance with its priority rule. Employment is defined in relation to activities performed for pay or profit or for use by others. In its definition, the ILO does not provide any specifications on the job quality (ILO 2019) neither does it provide a lower bound on the number of job-hours or the job-activities required to be deemed in employment.[7] Needless to say, a decrease in the unemployment rate does not amount necessarily to an increase in the employment rate and vice versa, the reason being that the employment-to-population ratio (a.k.a. the employment rate) is the proportion of *working-age persons* employed while the unemployment rate is the proportion of the *labour force* who are unemployed. Likewise, low unemployment rates do not necessarily coincide with high employment rates. This is because the unemployment rate excludes other persons irrespective of

[6] The labour force is also referred to as the economically active population. I submit that the term *economically active population* is a misnomer because it is sometimes confusing to the lay man for having unemployed persons as a subset of persons in them.

[7] The ILO standard does not set a minimum threshold on the number of hours of job activities to be classified as employment but recognizes that countries may prefer to set one. For example, Canada adopts no threshold in the minimum number of hours if engaged in unpaid family work, but the United States has a 15-hour minimum if a person works as unpaid family worker. See Sorrentino (2000) or Table of synopsis in the Appendix 1.1.

whether they had desired and are willing or *available* to take up employment opportunities if they came up and if they had in fact looked for or sought job but over four weeks (i.e. the reference period set by the ILO).

High employment rates do not always correspond with higher well-being. High incidence of vulnerable job activities, for instance, increases employment but says nothing about people's income(s) from employment or their level of satisfaction derived the job. In effect, vulnerable job activities increase the total labour force (i.e. the denominator for computing the unemployment rate), implicitly reducing the unemployment rate. The reason follows intuitively: many people are employed but in less- or undesirable jobs. A low unemployment rate, therefore, often a delight to hear, does not give enough or rich information to its audience about essential traits that define a job, such as the level of social protection that comes with it, how formal the job is, or the degree of autonomy or flexibility inherent in the job. These are contained in broad social goals of the United Nations termed *Sustainable Development Goals* (SDGs[8]) intersecting with the objectives of the ILO.

The unemployment rate is influenced by (1) changes in (ins and outs of) employment, (2) changes in unemployment, and by (3) changes in the labour force participation. This blurs the distinction between two important groups – the unemployed (in the labour force) and the jobless out of the labour force. Unemployment, however, is not the exact complement of employment. The *potential labour force* is an important gap between members of the labour force and persons out of it. Persons belonging here are not necessarily unproductive as they may be engaged in some forms of activities such as volunteering, producing for own-use or in training without pay, which are worth the while in undertaking them or for the time being. These activities are indeed valuable

[8] See ILO 2013a or ILO 2019d. Also see https://www.ilo.org/global/topics/sdg-2030/goal-8/lang--en/index.htm or https://www.ilo.org/global/topics/decent-work/lang--en/index.htm

undertaken by those persons out of job but by the nature of those activities, do not make those persons to be deemed in employment (though not be idle). Nevertheless, persons out of the labour force are deemed "*economically inactive*" and were previously actually referred to by that phrase term by the ILO (ILO 2019b). Like members of the labour force, persons out-of-the-labour force[9] do vary by gender, age, race, and geographical boundaries.

Among persons out of the labour force, there is a "potential available labour force" who are mainly (i.e. by their numbers) persons "available for job but not seeking", a.k.a. "discouraged jobseekers" by reason of (they) being discouraged from the labour market prospects. Unsuccessful past tries basically cause them to believe in such 'gloomy' predisposition that there are non-existent job opportunities. Not all inactive persons are discouraged; the complement to this group (i.e. among persons "out of the labour force" or the "inactive") represent persons "seeking but not available", relatively smaller in number than the discouraged. "Seeking[10]", according to the ILO and for the purpose of this study, is defined as looking for job within a four-week relevant reference period. In any case, it is inferred from the intensity of search such as one deemed capable of landing the job seeker onto a job if available. Due to prevalence of information technology today, the definition of what goes into a search activity has become numerous as newer modes of assessing information add to the already accessible modes each day.

[9] See ILO 2019b.

[10] Looking or seeking is defined by making job search effort. Examples of search activities include making contacts in employment offices, conducting internet search, sending out resumes, etc. Some search efforts are more passive while some are active. The ILO standard (and that of the United States) is based on active search while Canada and Europe require any kind of search even if passive (e.g. just looking at internet ads). All two modes of search adopted by individual countries are sanctioned by the ILO.

In less formalized economies, a significant number of persons "looking but not out of work" blur the distinction between who is active (in the labour force) and who is not i.e. out of the labour force (ILO 2013b, Sengenberger 2010; Howell 2004). While unemployment rates are relatively low in less developed and low-income countries, the overall joblessness in those countries is much higher. In developing economies, apart from low job creation capabilities hence lower employment opportunities (compared to the developed countries) there are information bottlenecks. For example, in many less developed countries and regions of the world, employment office services are usually non-existent, and literacy rates low while in the developed countries, not only is there adequate infrastructure for job searching (notably the services of jobs centers and employment offices). The services of these employment offices are more organized, making them more capable in linking up peoples with jobs. The unemployment statistics of developed countries against the developing counterparts therefore reflects this upward bias as job opportunities and job-searching-and-finding assistance imply greater incentives for searching by the unemployed and the remaining other jobless persons (i.e. discouraged jobseekers). While it makes sense to suppose that a time span of four-weeks (or one month) period is reasonably indicative of active job search, it is questionable to say that persons available and searching but beyond the short reference period are inactive. We submit that the ILO's yardstick of one-month reference time for "seeking" is *too tight* because many persons insofar as they do not suffer any incapacity would want to work but are not able to do so due to reasons of economic nature. "Discouragement" sets in when the persons have made reasonable search efforts but found no job. Then, they decide to "relax" or give up the search altogether. Likewise, not all non-working persons 'conventionally' termed "discouraged" are "actually discouraged". That is, although they are without work (and may not be seeking), they are not reluctant or adamant in their desire to embrace employment offers should they come up, and may in fact be as determined as the "unemployed".

Not only does unemployment vary across time and regions, it results from a combination of frictional, structural (including technological), cyclical, seasonal, and hidden forces influenced by broad fundamental, systemic and idiosyncratic factors affecting the individual countries. The conventional measure captures a mix of these forces at work in influencing the joblessness. Information flow adjusted for labour market imperfections determine the likelihood of finding and filling up job vacancies by prospective job seekers. In the matching model, *frictional unemployment* is the residual of the interaction between employers and employees. Some of the determinants of unemployment are rather long-term in nature, correlated with the strength of the economic fundamentals of the countries, referred to as *structural unemployment*. There are also trends in employment and unemployment which comove with the ups and downs of the business cycle popularly known as *cyclical unemployment*. Yet, in crisis or no crisis, the traditional unemployment rate is said to be a potent indicator of the abundance or not of jobs. While employment is deemed procyclical, unemployment could be both countercyclical and lagging in nature. The average hourly earnings, the level of employment, the number of hours of work and the degree of productivity, however, are procyclical, responding favorably in good times but decreasing in bad economic times such as during recessions. On the converse, unemployment and work disguised in the shadow economy are countercyclical, going up during ailing economic times. Apart from rises and falls in unemployment, documented historical trends indicate that economies' growth rates are punctuated by recessions in different points in time[11]. While this is well-documented for the United States and Europe a recent study affiliated to the World Bank notes, for instance, that cyclical fluctuations in real GDP per capita explains about one-half (or 48%) of the variability in the world's unemployment and about three-quarters (or 74%) for countries of Latin America and the Caribbean (LAC) (Vegh et al, 2019).

[11] See, for example, Dunn at al (2018).

While different (broad) unemployment rate measures are useful for cyclical analysis, the officially measured rate is, nonetheless, "the most objective overall best cyclical indicator of the labour underutilization" (Haugen, 2009). Nonetheless, the impact of the financial crises impact on the shadow economy adversely affects official countries' output and unemployment, as workers are displaced from the formal to the informal sectors of the economy (Martin, 2000; Abdel-Latif et al, 2017). Moreover, while fluctuations in unemployment happen with or without crises, marked increases in unemployment become magnified during times of recession, e.g. in the most recent global economic crisis of 2008. Also enlarged are the discouraged jobseeker phenomenon and time-related underemployment (a.k.a. involuntary part-time). For the countries that measure the unemployment in its extension using broader measures (such as the United States), we observe increases in the gap between broader rates of unemployment and the traditional measure during recession. Last, there are *seasonal fluctuations* correlated with unemployment over time such as over periods of one year or during certain quarters or months. One way of adjusting for the seasonal fluctuations in the statistics is performing standard procedures imbibed in modern statistical software packages (such as the X-12 procedure in EViews, for example).

Measurement of broader rates of unemployment

Beyond the employed (E) and the unemployed (U), when we collect data on persons *available for employment but not seeking (ANS)* a.k.a. discouraged workers, persons *seeking employment but not available (SNA)*, and *underemployed part-time workers for economic reasons (PTER)*, we can construct alternative measures of labour underutilization for countries. The sum of E and U make up persons in the labour force (LF), referred to as economically active population. The complement of the economically active population is the economically inactive population. Economically inactive persons are persons out of the labour force (POLF), consisting of potential additional

labour force (PALF) deemed marginally attached to the labour force (MA). PALF is the sum of ANS and SNA. The sum of LF and MA gives an extended labour force (ELF). The PTER (in E) and the MA (or PALF) make up an additional pool of labour which give supplementary indication to unemployment. PTER is defined with respect to a person's willingness to work more hours if offered the opportunity to do so within the next two weeks of the specified relevant reference period of the labour survey. Stated elsewhere, while the sum of E and U equals LF, the sum of the employment rate (*e*) and the unemployment rate (*u*) does not equal unity. This is because *e* is E expressed as a percentage of the working age population (WAP) while the *u* is U expressed as percentage of LF, i.e. the two variables are computed using different denominators, the former being larger than the latter.

A short history of statistics on the labour market

The world's unemployment statistics is facilitated by the ILO, aided by the periodic provision of guidelines, resolutions and recommendations to the labour statistics and practices. Prior to the 1940s, the practice of collecting labour statistics is perceived to have been in existence somewhere in France around the late 19th century (Sengenberger 2010) and around the same time (i.e. in 1890) in the United States (Card 2011). A systematic collection of unemployment statistics is documented to have emerged from the United States through periodic household survey presently known as the Current Population Survey (CPS[12]) of the US BLS. Beginning in the 1940s, the practice became the custom for other countries to follow suit (Haugen, 2009).

[12] The CPS is a sample survey of about 60,000 eligible households selected to represent the entire U.S. civilian noninstitutional population. On the basis of responses to a series of questions on work and job search activities, each person of working age, i.e. 16 years and over in a sample household, is classified as *employed*, *unemployed*, or *not in the labor force*.

From ancient and medieval times through the periods of industrial revolution to date, work has played vital part in the livelihood of man. The Industrial Revolution in the second half of the 18th century brought several innovations to manufacturing process, and the prevailing production methods received the introduction of newer technologies as at the time. The period, however, coincided with a rapid population growth. As more people means many mouths to feed, many jobs were required to make their livelihood sustainable. The 19th century German economist and philosopher, Karl Marx, understood as at the time and postulated that a greater level of population creates a surplus in the labour supply which he refers popularly to as a "reserve army of labour". In Marx's view, where the supply of labour exceeds its demand, the excess pool in the labour supply (i.e. the reserve army) would exert a downward pressure on the wages capital owners (a.k.a. bourgeoisies) are willing to offer the suppliers of the firm's labour input to the production process (referred to as proletariats) in order to maintain the capitalists profit margin. The logic of Marx's analysis seems to hold true even today particularly among developing countries[13]. A substantial

[13] According to Levrero, Marx's theory of the industrial reserve army as used here is not so straightforward and holds true only when it is (mistakenly) assumed that wages are set necessarily at a subsistence level. See Levrero (2013a and b) for a critique of the idea. Shaikh puts it this way: "Like the real wage, the rate of unemployment also has two sides. From the point of view of workers, it is the gauge of the relative demand for their capacities. As such, it plays a critical role in the economic life of a nation. But the unemployment rate is also a key factor regulating the strength of the link between productivity growth and real wages: the higher the unemployment rate, the weaker the strength of labor vis-à-vis capital, and the less likely that productivity growth will be associated with real wage growth. This is not only because persistent high unemployment weakens the relative bargaining position of labor but also because it erodes the institutions that support labor".

part of the problem is linked to organizational informality of enterprises as well as in vulnerable forms of employment that abound in developing countries[14].

Informality in employment

In 2016, about 2 billion people were in informal employment and by shares, 77% and 59% of youths and of adults respectively. Whereas a majority of informal employment (80%) are in the world's developing communities, employment in the informal sector is characterised by jobs which are less decent, of low productivity, less income and high risk to poverty than jobs of formal nature (ILO, 2018c). Observed evidence exists for hidden unemployment in developed countries also. Howell (2004) (also cited in Sengenberger 2011) observes, for instance, that a majority of youth (ages 20 to 24) in Spain and Italy (89 and 87 percent respectively) live with their parents and although they may be engaged in family businesses, "they see themselves as not in 'real employment'" (ibid, pp 83 – 84, Howell, 2004). In a vein similar to saying that the unemployment rate is relatively low among low-income countries but does not imply a high economic welfare in those regions (ILO, 2009), the unemployment rate about some developed countries may be underestimated or confounded as illustrated by Spain and Italy.

The labour market in Europe, for instance, is said to be less flexible and job tenure more secure compared to the United States' linked to difference in the labour market institutions and the labour

[14] For the purpose of simplicity in the analysis, we limit it to developing countries and we do not to take into account the supply of labor in a complex relationship with wages in developed economies which is highly elastic with respect to labor demand.

law rigidity[15]. Consequently, European economies lag behind the United States in terms of the structural capacity to creating jobs in both economies[16]. Sengenberger (2011) links this basically to the labour markets' responsiveness to incentives. This results in a dichotomy between mainstream economics versus heterodox summarized as follows:

From the viewpoint of Keynesian economics, limited or absent social protection engenders "disguised unemployment" so that measured unemployment in countries with low levels of protection is underestimated. This view turns around the position of neo-classical economics according to which social protection raises the unemployment level… As early as 1937, Joan Robinson argued that the failure to provide unemployment compensation will lead to "disguised unemployment", defined as the absorption of workers in low productivity jobs, either because these jobs are protected [from product market competition. WS] or, more typically, because no other means of subsistence are available - Sengenberger 2011.

Over 60% of employees derive their livelihood from the informal economy (ILO, 2018c). This manifests in three ways: in enterprises in the informal sector, employment in the informal sector as well as in informal employment (ILO 2013, Fleck & Sorrentino 1994). A high prevalence of vulnerable employment restrains persons in unemployment from holding on their zeal when their desired job opportunities are not forthcoming. Akin to "forcing the lion to eat grass or go hungry", the people in low-income economies must struggle to make ends meet at all cost as they resort to the shadow economy for jobs when the jobs are not forthcoming from the open economy. In most

[15] See detailed description of employment protection legislation, 2012-2013 OECD countries at https://www.oecd.org/els/emp/All.pdf

[16] We do not neglect the contribution of fiscal and monetary policies to job creation in the two geographical areas.

of the case, the employment in these deprived regions lack social protection, e.g. replacement incomes, unemployment benefits, social security benefits, etc., depriving the workers of insulation from income losses when jobless they become (ibid) say, for 6 months or 1 year (i.e. long-term unemployed).

Prominent Institutions - The major statistical organizations

International Labour Organization (ILO)

The ILO serves as the United Nations specialized agency on labour, decent work and related statistics. With data coverage on close to 200 countries, the ILO is the most authoritative source of international labour statistics, providing comprehensive statistics on labour across the world. Major world's statistical organizations look at different countries pertaining to their statistical territories. However, because they differ in goals, their statistical scope and country-coverage differ also. The reason is not far-fetched. The overall assessment of the world's labour (under)utilization fits best the goals of the ILO. With a global perspective and statistical jurisdiction[17], the ILO as mother organization of the labour statistics, provides the needed statistical guidelines to the other organizations interested in specific regions, e.g. the OECD, Eurostat, etc. and to individual countries. Needless to say but for emphasis, the interest of the OECD does not completely intersect with that of Eurostat, neither is their statistical scope and coverage the same. Besides, the statistical interest of individual countries may go beyond the ILO

[17] See a recent report of ILO's *ILOSTAT Spotlight on work statistics nº 8 – August 2019* dubbed "Persons outside the labour force: How inactive are they really? Delving into the labour force with ILO harmonized estimates".

to looking at additional groups of persons (marginally) attached to the labour force (e.g. the extra statistics in the US BLS or Canada's mentioned a couple of times).

Labour underutilization measures adopted by the ILO

The ILO[18] urges countries to provide statistics on "headline indicators of labour underutilization (from among LU1, LU2, LU3 and LU4) for the population as a whole, by sex, by urban/rural areas and, to the extent possible, by broad levels of educational attainment and by standard age ranges" (ILO 2013b p.64). The different measures of labour utilization are provided in line with "… producing headline indicators for labour market monitoring… that can be used with other indicators relating to the labour market such as skill-related inadequate employment and income-related inadequate employment as per the relevant international statistical standards" (Report of the 19th ICLS, 2013b).

It is more straightforward and easier using the ILO estimates to assess or compare countries' unemployment rates. The big challenge is to measure unemployment in its broad definition for many countries across sufficient time periods. ILO statistics provides some measures of labour underutilization from LU1 through LU4, organized from narrow to broad, referred to in the Hauser's labour underutilization framework (Table 1.2). Different categorizations of the utilization of labour are needed to properly take care of different groups of non-working persons (Elmeskov & Pichelmann, 1994; Sorrentino (1993, 1995), Gray et al, 2005; Brandolini et al, 2006; ILO, 2008; Tronti & Gatto, 2012). However, consulting statistics of different categories of labour underemployment leads to overlap which we could avoid by resorting to a formula that integrates multiple statistics into a single indicator. This evades the difficulty as to which denominator (e.g.

[18] See the ILO Room Document 13, 18th International Conference of Labour Statisticians. Also see www.ilo.org for some statistics on the measures.

the labour force or the total working age population) to go by. It helps also to attain better harmony in the statistics; hence, ease of comprehension and comparability of the measures (African Development Bank 2012). This presents a convincing case for adopting indicators such as the Hauser's underutilization framework for analytical purpose.

In the present study, we will adopt the Hauser's broadest measure known as Labour Underutilization rate LU4 against the tradition unemployment rate LU1 (later) to explain the determinants of the gap between them. LU4 is a composite rate composed of three ingredients, (1) the total traditional unemployment, (2) total part time unemployment and (3) the total potential labour force (i.e. made up of the persons available for job but not presently seeking termed discouraged job-seekers, and persons seeking job but not presently available, stated earlier).

Where the statistics are provided in modelled estimates and in national estimates, the ILO modelled estimates are preferred over the national estimates for purpose of international comparability. The ILO modelled estimates adjust for differences in the national statistics correlated with the individual countries by applying some econometric techniques to the nationally sourced data.

The ILO also identifies and provides data for *time-related underemployment*. "Underlying regional differences, the level of economic development is clearly an important factor: in 82 per cent of low-income countries with available data, the time-related underemployment rate is larger than the unemployment rate" (ILO 2019a). Among the employed, persons in time-related underemployment[19] are engaged in part-time not by their own choosing but due to reasons of economic nature. Given the opportunity, these persons would like to work some more hours. Categories of part-time employment are based on labour survey questions, determined by the usual working-hours of the employee or on a benchmark number of hours (e.g. 35 hours or less than

[19] The time-related underemployment rate is computed as persons in time-related underemployment as a percentage of the total number of persons employed.

full-time working hours). In other words, while the ILO measures some other forms of part-time employment, for example, by a stated threshold of working hours, let's say 35 hours or using some other standard criteria say a certain number of hours less than full-time working hours among the countries we refer to time-related underemployment in this study when mention is made of part-time for economic reasons. Thus, time-related underemployment is one category of the ILO statistics based on people willing to work more than they are presently engaged.

The ILO further recognizes three other sorts of underemployment, namely skill-related underemployment, income related underemployment, and inadequate employment[20]. Inadequate employment situations encompass persons within the labour force who believe they could be more adequately employed, utilized or compensated than their current employment situation. Persons in *skill-related underemployment* lack the required skills for the available jobs or are essentially underqualified. On the other hand, workers may meet more than the required qualification for the job which they are presently engaged (i.e. over-qualified) and this also constitutes skill-related underemployment. Persons in *income-related underemployment*, believe that given their qualification, they should receive a remuneration higher than their present remuneration whereas persons in *inadequate employment* work excessive hours than what is deemed normal (see for example Africa Development Bank, 2012; ILO 1998, ILO 2013b).

[20] See Resolution concerning the measurement of underemployment and inadequate employment situations, adopted by the Sixteenth International Conference of Labour Statisticians (October 1998). Also see Appendix 1.2 for schematic presentation of operational definitions of Hauser's labour underutilization framework.

Table 2. 2 Overlapping measures in the Hauser's underutilization framework

Measure	Indicator	Calculated as	Dispersion for 58 countries with data (latest year available*)
LU1	Unemployment rate	LU1 = [persons in unemployment / labour force] x 100	Mean = 7.7 Median = 6.1
LU2	Combined rate of time-related underemployment and unemployment	LU2 = [(persons in time-related underemployment + persons in unemployment) / labour force] x 100	Mean = 13.5 Median = 12.1
LU3	Combined rate of unemployment and potential labour force:	LU3 = [(persons in unemployment + potential labour force) / (extended labour force)] x 100	Mean = 12.3 Median = 10.1
LU4	Composite measure of labour underutilization:	LU4 = [(persons in time-related underemployment + persons in unemployment + potential labour force) / (extended labour force)] x 100	Mean = 17.8 Median = 15.4

Sources: Indicators, draft resolutions sections 57 – 63 (19th ICLS, 2 - 11 October 2013) and ILO, 2018b. *Spotlight on work statistics ILO, 2018b. Note: As the components of the LU4 are the same as the US BLS's U6 rate, its computation arrives at a value equivalent or close to the US U6 rate.

The Statistical Office for European Communities (Eurostat)

The statistical office for European communities, Eurostat, is the principal statistical database for the labour market among European countries available online. Its data covers 28 countries of the European Union (EU28, including the United Kingdom which had been in process of exiting the Union since June 2017). The statistics include 19 countries of the euro area (eurozone). The coverage is presented as aggregates for EU28 and EA19 and for the individual countries and includes a few non-member countries of the Union or of the EFTA, e.g. US, Japan, etc. in few instances toward international comparability of the unemployment statistics. It extends to include

"underemployment and potential additional labour force statistics[21]" available from 1983, largely inadequate, however, for many of the countries prior to 2008. The statistical definitions[22] of Eurostat are based largely on the ILO's, which is based on periodic resolutions of the International Conference of Labour Statisticians and amended accordingly from time to time. Data are collected from periodic survey of the citizens in private households referred to as the European labour force survey.

According to the specific Eurostat's definitions, an employed person is a person of working age (age 15 and above, or 16 and above in the case of Iceland and Norway) who during the reference week worked for at least one hour as employee, for self or family; for remuneration or reward in the form of cash (e.g. pay or profit) or kind (e.g. family gain); or is temporarily not at work due to illness, holiday, vacation, industrial dispute, education, training, etc. during the relevant week. An unemployed person is a person from 15 to 74 years (or 16 to 74 years for Italy, Spain, the United Kingdom, Iceland, and Norway) who within the relevant reference week is without work, available for work (within two weeks, or has already found a job to start within the next three months); and has actively sought work during the last four weeks.

The Organization for Economic Co-operation and Development (OECD)

In 1993, the need for complementing the OECD statistics with additional indicators had become strong, and by 1995 *the OECD Employment Outlook* had looked to additional measures of the labour slack. Discouraged workers and involuntary part-time had been presented in one article which represented the parallel of the US BLS complementary measures of unemployment which

[21] For a recent article on this, see http://ec.europa.eu/eurostat/statistics-explained/index.php/Underemployment_and_potential_additional_labour_force_statistics
[22] See http://ec.europa.eu/eurostat/statistics-explained/index.php/Category:Labour_market_glossary

had been introduced in 1995[23] (Bednarzik & Sorrentino, 2012). While the OECD depends on Eurostat for unemployment statistics of member-countries (and the countries' aggregates) which are European, including Iceland Norway, Switzerland (EFTA members) and Turkey, the OECD collects the data and calculates the unemployment rates for the rest of its member-countries[24].

The OECD, like Eurostat, derive statistical guidelines on labour from the ILO. According to recent OECD estimates,[25] the labour underutilization rate as percentage of the labour force is highly positively correlated with the unemployment rate (a correlation coefficient of 0.88). The correlation between long-term unemployment and the normal unemployment is a higher of 0.95 for the member countries, the majority of which are European. However, there is a negative relationship between the unemployment rate and job creation, between the unemployment rate and the participation rate as well as between the employment rate and the unemployment rate (OECD, 2017). According to Elmeskov et al., "the fall in participation rate in the 1960s among OECD countries may result from school attendance, rising real incomes leading to increased demand for leisure, increase in the coverage as well as in the generosity of tax-financed public pension schemes. However, the subsequent rise in the aggregate participation rate from 1970 can be fully accounted for by the increase in female participation, shift cultural norms, developments coinciding with increased availability of publicly-financed day-care institutions, changing traditional family roles of women, reform of tax systems, including a shift from the family to the individual as the basic income tax unit" (Elmeskov et al (1994). The inverse relationship between unemployment and labour force participation is quite natural. Unemployment rate is not low for

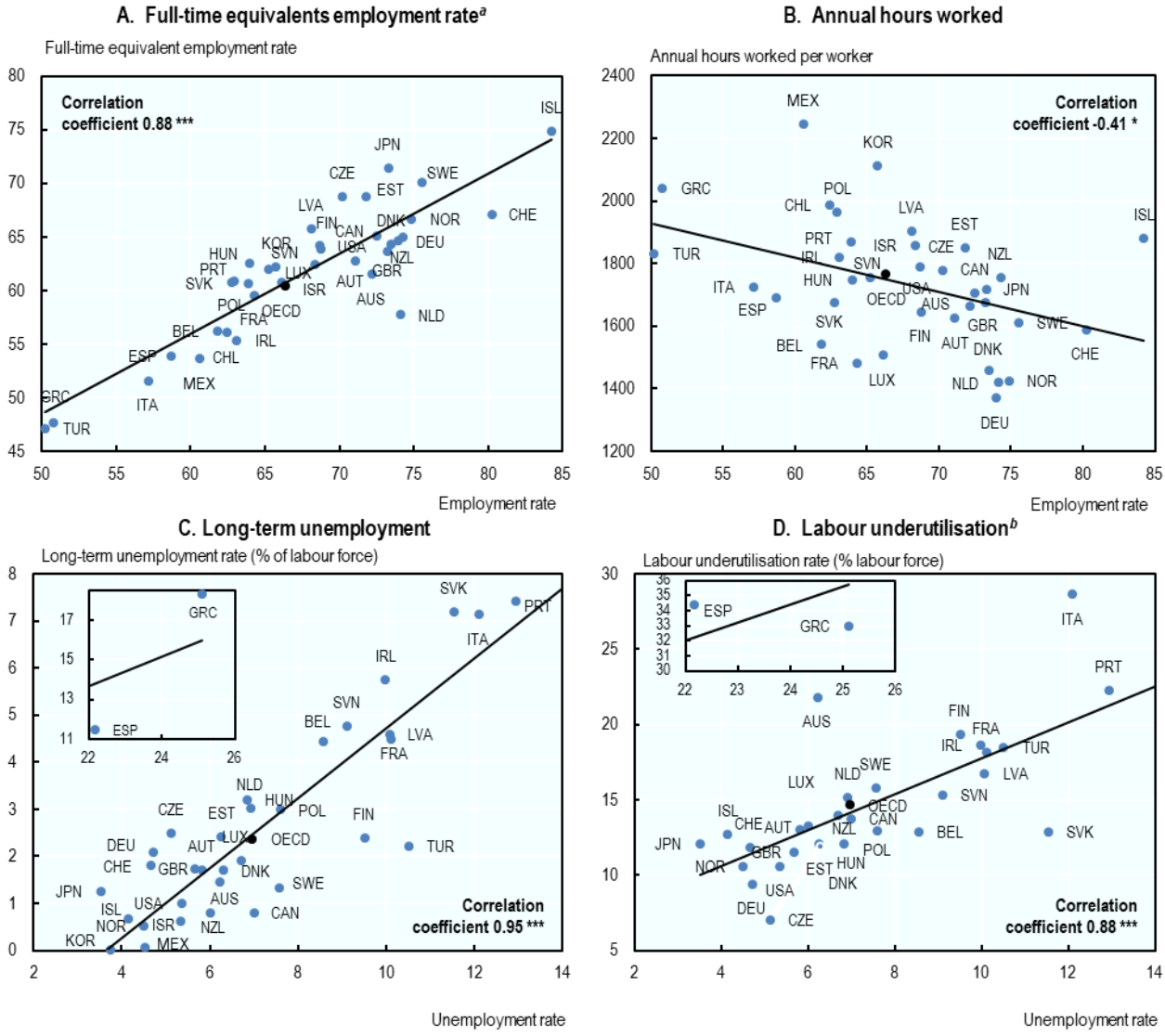
[23] See Bregger and Haugen (1995).

[24] See Methodological Notes, OECD Harmonized Unemployment Rates News Release (December 2018) at https://www.oecd.org/sdd/labour-stats/44743407.pdf

[25] OECD Employment Outlook 2017 p. 26 http://dx.doi.org/10.1787/empl_outlook-2017-en

reasons linked to the structural pointers of the labour market only, positive beliefs and sentiments in the labour market driven by a confident economic outlook by the workforce participants increases their participation while and a negative outlook induces the converse. Among select OECD countries, hidden unemployment represents untapped labour resources which can be explained by their economic growth and labour market policy reforms (Agbola, 2005).

Figure 2. 1 Employment quantity and labour market slack (2015[26])



[26] See OECD Employment Outlook 2017. Notes: a) Employment rate in full-time equivalent units is defined as employment rate of the working age population adjusted by a ratio of average usual weekly hours worked by all workers and average weekly hours worked by full-time workers (according to national definition of full-time employment).b) The labour underutilization rate is defined as the combined number of persons who are unemployed, marginally attached (i.e. persons not in the labour force who did not look for work during the past four weeks but who wish and are available to work) or underemployed (full-time workers working less than usual during the survey reference week for economic reasons and part-time workers who wanted but could not find full-time work), expressed as a percentage of the labour force.

Note: Correlation coefficient is statistically significant at 0.1% level (***), at 1% level (**) or at 5% level (*). Data for the OECD are weighted averages.
Source: OECD calculations based on labour force survey results for labour underutilization: **www.oecd.org/employment/emp/onlineoecdemploymentdatabase.htm**

The fact that the employment rate and the full-time equivalent employment rate is highly positively correlated but the annual hours worked and the employment rate negatively correlated is a reasonable indication of labour slack among the countries. Besides, this confirms that the employment rate alone although providing a useful accompaniment to the unemployment rate, suffers a limitation inherent in the definition of employment based on the one-hour criterion. Nevertheless, the two indicators provide useful analytical companionship to the data user.

Country measures and studies on labour underutilization

The United States

Measures of labour underutilization employed by the United States to measure broader unemployment by extension, particularly the U6 rate, play a useful analytical role in this thesis. The U6 rate (the broadest among alternative measures of labour utilization) is the exact match of the Hauser's broadest measure (i.e. LU4) adopted by the ILO. As mentioned in the introductory chapter, many eyebrows have been raised on the traditional rate since the inception of unemployment as a concept and many of these point to the fact that the traditional measure fails to take complete account of the nuanced labour attachments of persons to the labour force.

Apart from the United States, a few countries (e.g. Canada and Mexico) strive to provide some additional unemployment indicators to complement the official rate. Specifically, the United States adopts U1 through U6 unemployment rate statistics, Canada adopts R1 through R8 rates while Mexico adopts R1 through R10. In a narrow to broad framework the three countries respectively include the official unemployment rate among the list of other indicators. This is a meaningful way of allowing data users the discretion to consult the measure that best suits their interest. The remaining other countries which are by far the majority in terms of the share of the world's population depend, however, on the traditional ILO rate only while assessing their overall unemployment situation. While the present study does not suggest that one country's labour market indicators is superior to that of another (e.g. that of the US over Canada), we place special emphasis on the US'. This is partly because the US's broadest measure (U6) matches the broadest rate adopted by the ILO (the LU4 rate).

One cannot discuss the international unemployment statistics which includes the United States without making a reference to the work(s) of Constance Sorrentino, formerly of the Division of

Foreign Labour Statistics (Division of International Labour Comparison) of the US BLS. We find it particularly prudent to review briefly the findings on three studies of hers relating to the topic. Sorrentino (1993) analyses U1 through U7[27] unemployment rates in the then US BLS's fashion (prior to the year 1994) among nine countries across the world: France, Italy, Germany [former West Germany], Netherlands, Sweden, and the United Kingdom (Europe), United States and Canada (North America) and Japan (Asia) using a cross-section for 1989 [February 1990 for Japan]. She identifies that Italy and Japan have the highest share of discouraged workers (of the labour force plus discourage workers), at 6.1% and 4.4% respectively, against less than 1% for the remainder of the countries, after adjusting the rates upward for some persons waiting on their previous job application and passive job seekers. Sweden and Japan, she observes, although had the lowest official unemployment rates, experienced the largest percentage increases when we extend the U5 (the then traditionally unemployed) to U7 by including discouraged workers and persons employed part time for economic reasons. She noted, however, that Sweden's unemployment remained low thanks to its labour market program which serves as skill-

[27] In the previous set of measures adopted by the BLS, U6 comprised *total full-time jobseekers plus 1/2 part-time jobseekers plus 1/2 total on part-time for economic reasons as a percent of the civilian labour force less 1/2 of the part-time labour force* while U7 comprised *total full-time jobseekers plus 1/2 part-time jobseekers plus 1/2 total on part-time for economic reasons plus discouraged workers as a percent of the civilian labour force plus discouraged workers less 1/2 of the part-time labour force*. Apart from U1 and the official unemployment rate (namely U3 in the present measurement set or U5 in the old set respectively) which are identical in the old and the new sets of measures, the rest of the measures in both the old and the new are not identical, inequivalent and non-comparable. Because of this, the U1 rate and the official rates in the new and the old sets are available from 1948 while the remainder of the measures in both sets are available from more recent periods (discussed later in chapter III). See Appendices 3.1 and 3.2 for tables defining the measures. Also see Appendix 3.3 for unemployment measures for Canada.

enhancement-cum-employment opportunity for the people. Sorrentino (1995) looks from 1983 to 1993 for the same countries and Australia. It confirms from her previous study that Italy ranks highest in labour underutilization but did not rank the highest in the conventional unemployment rate. Likewise, it reiterates that Sweden and Japan which were countries with the lowest conventional unemployment rates had by far the largest increases when we include respectively persons working part-time for economic reasons in the case of Sweden and discouraged workers in the case of Japan. Last, Sorrentino (2000) highlights differences in the international unemployment statistics touching on how they affect comparability, and whether those differences should be taken at face value or ascribed to the measurement differences from the BLS, ILO, OECD, and Eurostat statistics. She finds for the same countries (but omitting Japan and Australia) in the latter analysis, that the unemployment rates among the countries do not change markedly when adjusted to the US concepts; i.e. decreasing only by one percentage point or less, respectively, for Canada and the European countries overall.

Canada

Using a unique longitudinal dataset from Canada, Jones and Riddle's (1999) paper appears to be the first to test empirically the issue of the difficulty in the classification of non-employed persons marginally attached to the labour force as to whether they should be classified as unemployed or non-participants of the labour force. They posit that it is inexpedient to classify non-employed persons into only two distinct states of labour, namely the unemployed and the marginally attached because there are important heterogeneities in their labour force attachment forms. While they do not oppose distinguishing between active and passive job search (because it is useful for analyzing the future job finding prospects among the two groups), they do not support the practice of restricting search exclusively to active search. They observe a higher chance of getting a job (and

of course a lower chance of withdrawal) among active job seekers than among the passive job seekers but a higher chance also among the passive than non-searchers. They argue, however, that in the range from active search to non-search, passive seekers in the middle of the continuum display traits closer to active seekers than to non-seekers. They depart, therefore, from the US (in the latter) who treat passive job seekers as non-participants excluded from the labour force because it is baseless, they propose, to do so. Every search is a search, so to say. They propose, however, that persons in waiting (e.g. those on temporary layoff, future starters, etc.) in Canada be classified as unemployed in agreement with the US style, rather than as out of the labour force. (Jones and Riddle, 1999, 2000; Jones, 2002).

In its different rates for measuring different unemployment categories (namely R1 through R8 Canada with R4 being the official rate), the R3 rate, for instance, enables a person to have direct translation of the official rate into the US's official rate (i.e. the U3). While also the Canadian official rate tends to underestimate its unemployment when compared to the US', it makes sense for the basis of the difference between them – attributable to differences in treatment in specific groups in and out of the labour force for each country.

Some individuals' studies

In their study of unemployment in Europe, Taylor and Bradley (1997) citing Bean (1994), points out five main determinants of unemployment, namely "real wage rigidities, aggregate demand fluctuations, labour demand and supply mismatch, dwindling skill levels of the long term unemployed, and capital constraints". Yamagami (2002) computes revised labour force statistics for Japan in the US concept definitions of the BLS and finds that the U3 rate and the U6 rate, when computed as annual averages from 1994 to 2000 for the two countries, are lower in both rates for Japan than for US. He finds, however, a higher share of the ratio of U6 to U3 for Japan than for

US when looking at it for the both countries, and more so for women. In other words, when we consider the marginally attached to labour and persons employed part time for economic reasons, the unemployment rate increases more than proportionately for Japan than for the US especially for women. Kudlyak and Lange (2014) reveal a significant heterogeneity in the job finding rates which elude the conventional distinction between unemployment and the out-of-labour-force, using the labour force status histories in the BLS. They propose a new measure of labour underutilization, named the non-employment index (NEI), which behaves in the manner of the standard unemployment rate. This index, according to the authors, incorporates the effects of the business cycle, thus making it a better indicator to the cyclicality of unemployment compared to the traditional measure(s) of unemployment for the United States. While the standard measures do not give weights to the probabilities of exit from (or entry into) unemployment among the different labour categories, the Kudlyak and Lange NEI takes into account all non-employed persons, regardless of whether they are active jobseekers or passive. Since different categories of the non-employed have different probabilities of transitioning into employment, their NEI index tends to jump over this hurdle by assigning less weight to the long-term unemployed (26 weeks and above) and more to the short-term unemployed (<26 weeks) (Hornstein et al, 2014; Kudlyak & Lange, 2014). Elsewhere, we mention also that a higher probability exists for persons making transition from being without job to being employed among the "unemployed" than among the "out of the labour force" population (Sorrento 1993, Brandolini et al 2006, citing Jones and Riddell 1999).

Using latent variables approach, Feng and Hu (2013) show that the unemployment rate in the US is underestimated on average by 2.1 percentage points for the period from January 1996 to August 2011 due to measurement errors, resulting from a misclassification of categories of persons usually masked into labour force statuses but are actually distinguishable. Their monthly estimates are higher in the range from 1 to 4.4 points in response to the business cycle. Beyond the ceaseless

complaints as expressed on the unemployment rate, Shiskin is of the opinion that *employment* is a "firmer and more objective concept than *unemployment*" and hence, easier and more straightforward to define and measure, giving it statistical advantages over unemployment. He suggests further that the former has less measurement error due to the high number of persons in employment versus the unemployed, and more accurate application of seasonal adjustment to employment (Shiskin 1976). The author recommends, therefore, completing the unemployment rate with the employment rate (i.e. the employment-to-population ratio) as "economic performance and cyclical indicators" in metaphorical way popularly couched as using both the *doughnut and the whole* in his conclusion instead of either of them.

Dynamics in unemployment and measurement

Shimer challenges the conventional understanding that exits from unemployment explains the volatility in unemployment, arguing that unemployment volatility is influenced much more (about three-fourths) by fluctuations in the probability of flows into employment than by worker separations from *un*employment having accounting for cyclical shocks (Shimer, 2008, 2012). Being first to use the British Household Panel Survey, Smith (2011) explores the dynamics of unemployment in the UK from 1988 to 2008, emphasizing that the changes over time in UK's unemployment is influenced both by the flows into and the separations from unemployment. He compares the changes in unemployment in UK with that of US and reveals that the transition rate in UK is slower than the that of the US (i.e. about a quarter of that of US) and that unemployment in UK is affected more by the *ins into* than by the *outs of* employment during recession. Russell and O'Connell (2001) explore, using the European Community Household Panel among nine member-countries of the EU, the dynamics from unemployment to employment among young persons over a short period of two-years, looking at variables such as their personal characteristics, age, gender, country of origin, past work experience, parenthood and unemployment duration.

They confirm such claims as Sorrentino (1993) and Nickell (1997) that areas with generous unemployment insurance in Europe are more correlated with high unemployment rate in the continent.

New entrants and reentrants unemployed on long duration have lower probability of transitioning into employment. During economic recessions generally, not only does unemployment go up, the various forms of attachment to the labour force also increase. The gap between U3 and U6 using the US BLS data, for example, widened in the aftermaths of the recession in 2007/8 which affected many areas of the globe. Economic crisis not only displaces a wide range of labour from full-time work in organizational reorganizational arrangements such as corporate retrenchments, redundancy, resizing, etc., its impact on part-time work is also felt. There is some evidence in the literature: Euwals and Hogerbrugge (2004) and Ehrenberg et al (1988), for instance, support that the part-time phenomenon is determined by shifts in the business cycle as well as the sectoral engagement of the labour force. While the former draws much inspiration from the latter which studies part time unemployment in the United States, it finds that the part-time unemployment situation in the Netherlands (the country with the largest number of part-time unemployed from 1991 to 2001 among the OECD) is strongly influenced by the female composition of the labour force participation as well as the sectoral shift from manufacturing to service. Ehrenberg et al (1988) also serves as a foundation for Euwals and Hogerbrugge (2006) which studies part-time unemployment in the Netherlands. Using data from the Dutch labour force survey from 1991 to 2001, the authors find that part-time employment in the Netherlands (leading member among OECD countries as at the time by part-time employment) is influenced strongly by female participation in the labour force as well as by demand side factors, mentioning the turn from manufacturing to service and the demand for flexible labour.

Country studies (e.g. Rettore et al, 1990; Russell & O'Connell, 2001 and Tronti & Gatto, 2012) on Italy are based on micro data analysis, perhaps due to the general non-availability of sufficient longitudinal data that confront the statistics for the large number of countries across the world. According to Tronti and Gatto (2012), "if we count as underutilized labour, on top of the unemployed, those out of work but receiving short time working benefits and the discouraged, the number of persons underutilized in the third quarter of 2007 would be 105.2% greater than the unemployed alone". The authors go on to assert in their excellent analysis of *unemployment in Italy during and after the crises* that unemployment in the south of Italy is underestimated in the official statistics, attributing this to low confidence among the discouraged from job-searching which they believed none existed at the time of the recession.

Persistent unemployment is identified to be associated with weakened labour employability. While discouragement is a great share of the potential labour force, Brandolini et al (2006) finds that the annual probability of transition to employment among the discouraged is in fact higher than the unemployed for the Netherlands and close to the unemployed for Germany but clearly different from other inactive persons for all countries in their study which involves 14 European countries and based on the European Community Household Panel (ECHP). Persons unable to maintain the job search within the relevant period, i.e. four weeks into the reference survey period, however, are written off from the labour force in the statistics.

Displacement from work related to the ILO conceptual framework is highlighted during economic downtimes. Bell and Blanchflower (2013) finds that using the traditional measure of unemployment as a measure of labour slack is misleading. They identify significant number of underemployments in UK's labour market as persons willing to supply more labour input increased in the aftermath of the recent recession due to strain on the market's demand for labour. They construct an underemployment indicator providing evidence that spare capacity exists in the

labour market such that increasing the aggregate demand through fiscal and monetary policies does not cause inflationary strain on the economy. Besides challenging the notion that UK's output is close to full employment level, their underemployment indicator provides a needed complement to the official unemployment rate while providing a more accurate picture of the labour market during recession.

CHAPTER III

Hidden unemployment in the United States

3.1 Introduction

The United States' Bureau of Labour Statistics adopts a range of unemployment statistics in rates categorized from U1 through U6, including the official rate as U3. The practice helps provide data users with richer (hence more reasonable) statistics on the unemployment situation of the country. As noted above, the measurement of unemployment has not been without flaws since inception. The then Commissioner of Labor Statistics in the 1970s referred to as Julius Shiskin, observing that the traditional unemployment rate "could not satisfy all analytical or ideological interests", came up with a maiden form[28] of categorization for unemployment in rates. Setting out in narrow-to-broad format from U1 to U7 with definitions of who go into which category of the unemployed, this provided the framework on labour utilization for the country (Haugen 2009).

The definitions of who go into what category have evolved over the years, and the current measures of labour utilization is the 1994 set of measures which replaced the previous forms. The data on U3 (the official and traditional unemployment rate) is available as far back as 1948 but U6 (the broadest measure) is available only more recently, from 1994. To restate, while there have been older forms of categorization of the labour under(utilization) and the definitions of who go into what category, the current form for the United States today is the one that came into effect in 1994 to replace the Shiskin's. It is on the new set of measures our discussion will be based.

[28] See Appendix 3.2 for the old set measures. The old U5 provided for two groups; U5a and U5b. The U5a included the resident armed forces population in the overall unemployment rate but the U5b did not.

There is no doubt that the 2007/8 economic crisis had a great impact on the US economy. Prior to that, the economy had suffered series of crisis since World War II. This included the one in 2001 crisis though not as great as the 2007/8 crisis which impact was felt the world over. Crisis or no crisis, the unemployment rate remains a key tracking variable of the severity of the economic conditions. Not only does unemployment go up during recession, the forms of labour force attachment[29] increase including the gap between official unemployment and unemployment in its broadness, such as the gap between the U3 and the U6. This is what we see in the aftermath of the recent crisis of 2007/8 (Figure 1). Economic crisis displaces a wide range of labour from full-time job and makes it more difficult for persons seeking to find a job. Discouraged persons get more deterred from joining the labour force (i.e. changing status from out-of-labour force to unemployed). This increases the part-time working phenomenon and worker discouragement, hence the widening gap between the two rates.

According to the literature, increase in involuntary part-time employment is influenced by the business cycle and the sectoral engagement of the labour force. Ehrenberg et al (1988) agree with the prevailing literature as at the time that as opposed to supply side factors, part-time employment in US is a demand side phenomenon dictated by labour cost differential between part-time workers and full-time workers albeit adjusting for the cyclical elements. The authors make a case for their assertion empirically, adding that increase in part employment is explained by increases in the

[29] "Persons marginally attached to the labour force are those who currently are neither working nor looking for work but indicate that they want and are available for a job and have looked for work sometime in the past 12 months (*but > 4 weeks*). Discouraged workers, a subset of the marginally attached, have given a job-market related reason for not currently looking for work. Persons employed part time (less than 35 hours) for economic reasons are those who want and are available for full-time work but have had to settle for a part-time schedule"
(see https://www.bls.gov/news.release/empsit.t15.htm).

number of involuntary part-time workers rather than the voluntary part-timers. While the literature on unemployment focusing on specific groups in the labour force is extensive (e.g. Signorelli et al 2012 on "financial crisis and female labour", and Choudhry et al 2012 on "youth unemployment rate and the impact of financial crises", and Ehrenberg et al (1988) on part-time work and what explains its phenomenon), we find no work explaining the determinants of the wide gap between U6 and U3, i.e. the excess of the U6 rate over the U3. In this chapter, our aim is not so much to explain the determinants of the gap between U6 and U3, but to have a robust estimate which allows us to estimate the components of the enlarged measure of labour under-utilization for the pre-1994 period. This is our contribution to the literature.

The rest of the chapter is organized as follows: Section two of the chapter provides a background to the study. It also provides some statistics on the United States' labour force and how cyclical influences affect unemployment in its extension in the US. We proceed by assessing empirically through least squares and autoregressive redistributive lag procedure of what determines the components of U6 besides the movements in U3 in section three.

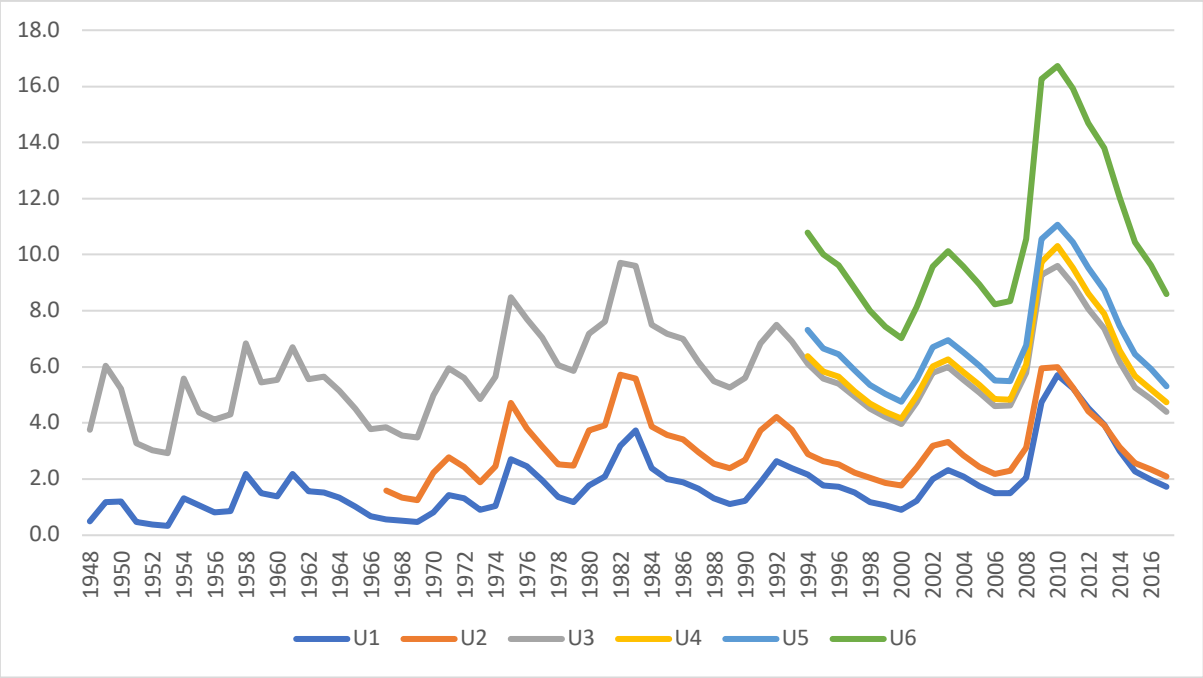
3.2 Unemployment and under-employment in the United States

In the current set of measures of unemployment for the United States, the official unemployment rate (U3) and the narrowest of the measures (U1) are available from 1948, U2 from 1967 while U4 through U6 (the broadest of the measures) are available only from 1994. Against the backdrop of a problematic ILO definition of what is meant by job searching activity[30] and of the meaning of

[30] There is controversy on what is meant by job searching activity; US goes by *active search* while elsewhere e.g. Canada and in Eurostat statistics (European countries), a search could be any form,

"discouraged" labour, providing additional statistics to complement the official unemployment is helpful in extricating the intricacies of the various forms of attachment to the US labour force (Figure 3.1), besides the unemployed who are in the labour force.

Figure 3. 1 Measures of Labour Underutilization from the Current Population Survey, US Bureau of Labour Statistics



Source: Author's elaboration based on data from the US Bureau of Labour Statistics

passive or not. For US, persons on layoff expecting a recall need not be searching to be deemed unemployed but persons must be searching to be deemed unemployed in the case of those waiting to start a new job (see Sorrentino 2000 and Appendix 1.1).

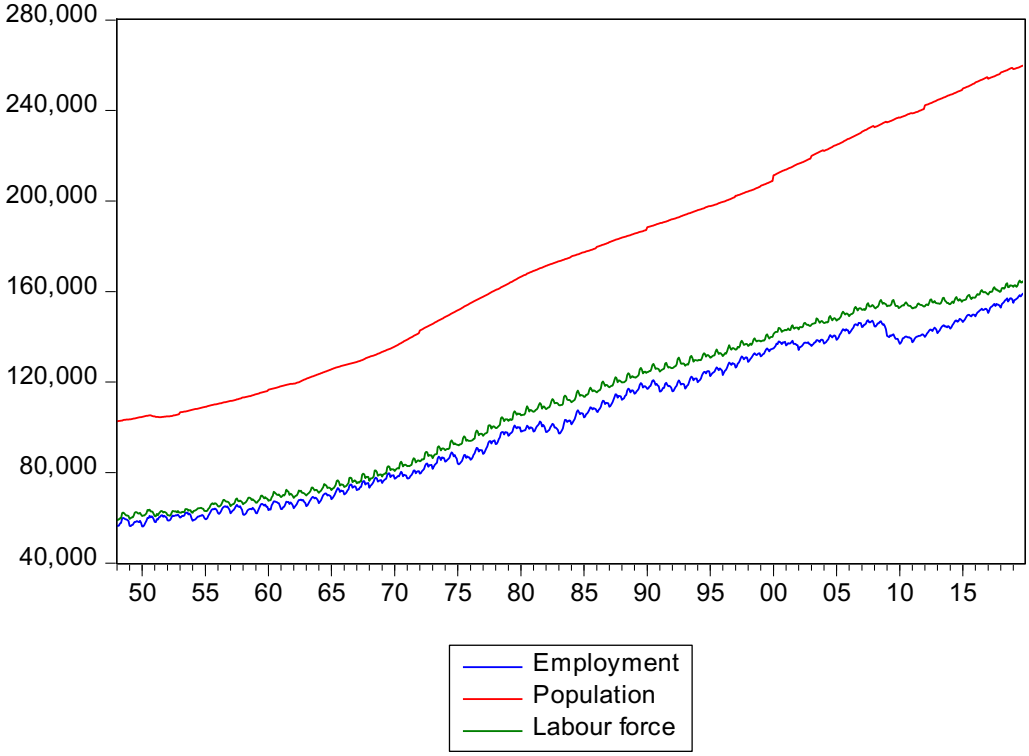
The US unemployment situation

Economy

The US economy under Trump has been quite healthy albeit amidst trade wars, e.g. with China, and immigration and wall building disputes in the southern border of the country against Mexico. Like many advanced countries, unemployment in the United States have been on the low after a decade of recovery from the 2008 economic crisis. In December 2018, 157 million people were in employment while some 6.3 million were unemployed translating into an unemployment rate of 3.9 percent of the civilian labour force (referred to as U3 rate). When we look at the U6 rate, however, about 7.6 percent were (broadly) unemployed in the same period, i.e. roughly double of the U3 rate. While industrial production increased by over 7 folds from the mid-20th century from a production index of 15 in the beginning of 1948 to 105 by the end of 2017, services (value added) as a percentage of GDP increased from 72% in 1997 to 77% as at 2016, with the latter sector being the driver of the economy at least in the last two decades, according to estimates of the World Bank.

While also the level of employment increased from some 146.3 million jobs to 158.5 million jobs in December 2019, the total unemployment increased from 7.4 million persons to 16 million by February 2010 before decreasing to 5.5 million around the same period. The working-age population, however, has increased continuously, for example, from 102 million in the middle of the 20th century to 260 million by December 2019.

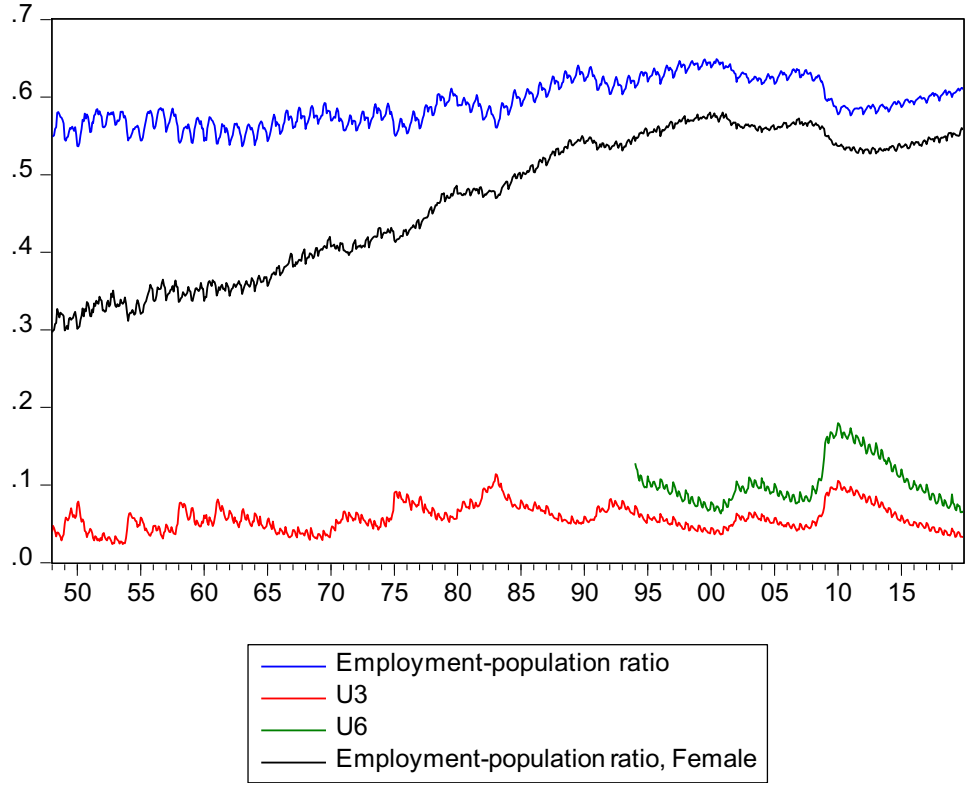
Figure 3. 2 Working-age population, employment, and the labour force



Source: Author's elaboration based on BLS data

One characteristic of economic downturns is a fall in the employment-to-(working-age) population ratio (i.e. in the total and by gender). During the last two economic recessions, for instance, there were budges in the employment rate which reflected also in opposite direction in the movement of the unemployment rate though the two have different denominators (Figure 3.3). At recovery, however, there is a reverse of direction in both measures. The female labour force participation rate seem to have a role to play.

Figure 3. 3 Employment-population ratio



Source: Author's elaboration based on BLS data

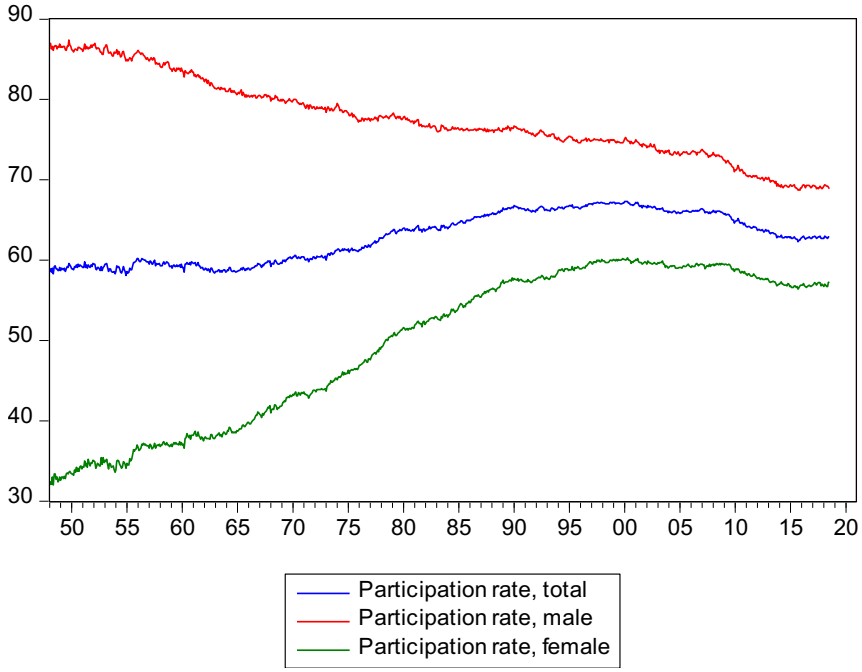
Labour force participation

The overall participation in the civilian labour force of the United States, having inched up by some five percentages points over some seven decades from 1948 to 2018, presents an interesting converging gender gap. The male civilian labour force participation rate has decreased over the years against the females' which experienced increase, albeit below the males' participation rate at level. As the civilian labour force participation rates of the two genders converge over time, the civilian participation rate of persons aged 16 to 19 (teenagers) has decreased by about 20 percentage points, i.e. from about 54.5% in March 1949 to 35.2% in July 2018, counter to the participation rate of the young adult population (of ages 20 to 24) which increased by 12% (from 63% to 75%) around the same period. What's more striking is the males' participation rate decreasing by some twenty percentage points from 87% in February 1948 to 68.9% in July 2018.

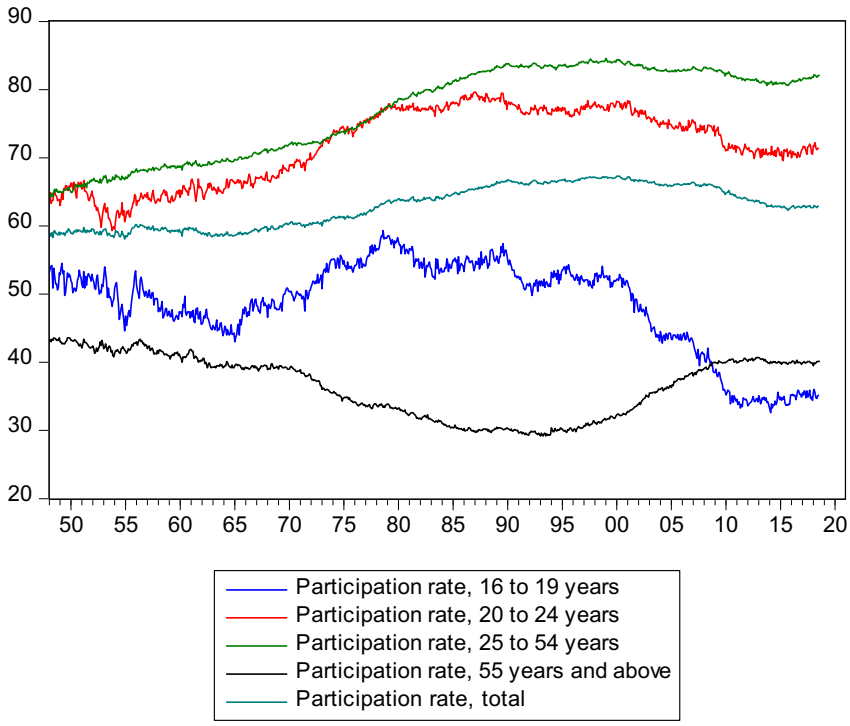
Fujita (2014) ascribes the declining labour force population since 2000 through 2013 to aging labour force generally (i.e. increasing share of senior citizens in the labour force), and (1) retirement, disability and schooling, as well as (2) job seeking discouragement especially through and after the very recent crisis of 2008. A decreasing unemployment rate coinciding also with a decreasing labour force participation intensifies people's suspicion of the inadequacy of the U3 and "arise a renewed interest in alternative measures of labor underutilization" (Dunn, Haugen & Kang, 2018).

Figure 3. 4 Civilian labour force participation rate: by (a) gender and (b) age

(a)



(b)



Source: Author's elaboration on FRED data, 2018

Much of the participation, however, is explained by active participation of prime-aged adult population from 25 to 54 years (Figure 3.2), as well as the active women involvement in the labour force (from 32% in 1948 to 60% in the 2000s, i.e., almost double). Prior to the world wars, women were more into housekeeping and family care responsibilities. The situation of women has changed very much over time. During the time of the first world war, women were engaged in the manufacture of ammunitions and war equipment. From after the second world war, women have been active participants of the labour force. Even more so today are more females career women, advancing their education[31] and engaging more in commercial activities which extend beyond

[31] The ratio of female to male secondary school enrollment for the United States increased from 0.56 in 1972 to 1.0 or above 1.0 for the period from 1978 through 2017 for the dates with available data (in years). See https://fred.stlouisfed.org. Also see https://www.bls.gov/opub/reports/womens-databook/2018/home.htm

domestic chores and responsibilities. While their share of educational enrollment has also enlarged, the sectoral share of manufacturing where more male hands are mainly required continues decreasing against an ever-increasing service sector notably services in trade, transportation, and utilities and education and health services where more females are employed[32]. It is further projected that women are more like to occupy openings in occupations (13 out of 20 occupations) in the ten-year period spanning from 2016 to 2026, according to a recent BLS report in 2018[33].

Part-time (for economic reasons), marginal attachment and job-seeker discouragement, and gender

From the 70s, the part time unemployment rate has decreased from 9.5% in 1976 to around 4.5% in 2018 while part time employment increases across gender and race in the United States. As voluntary part time rate is more prevalent among women than men, this makes the women more vulnerable to layoffs when the companies decide to cut production cost through downsizing during hard economic times. Beginning in the 21st century where the data becomes available, the variability of unemployment rate among manufacturing private wage and salary workers has been wider than the variability of the unemployment rate in service occupations. Like many developed countries, the contribution to GDP by sector[34] is driven by services by a wide margin above 70%, followed by the industrial sector before agriculture operating less than 3%. The female gender in

[32] See https://www.bls.gov/spotlight/2017/women-at-work/

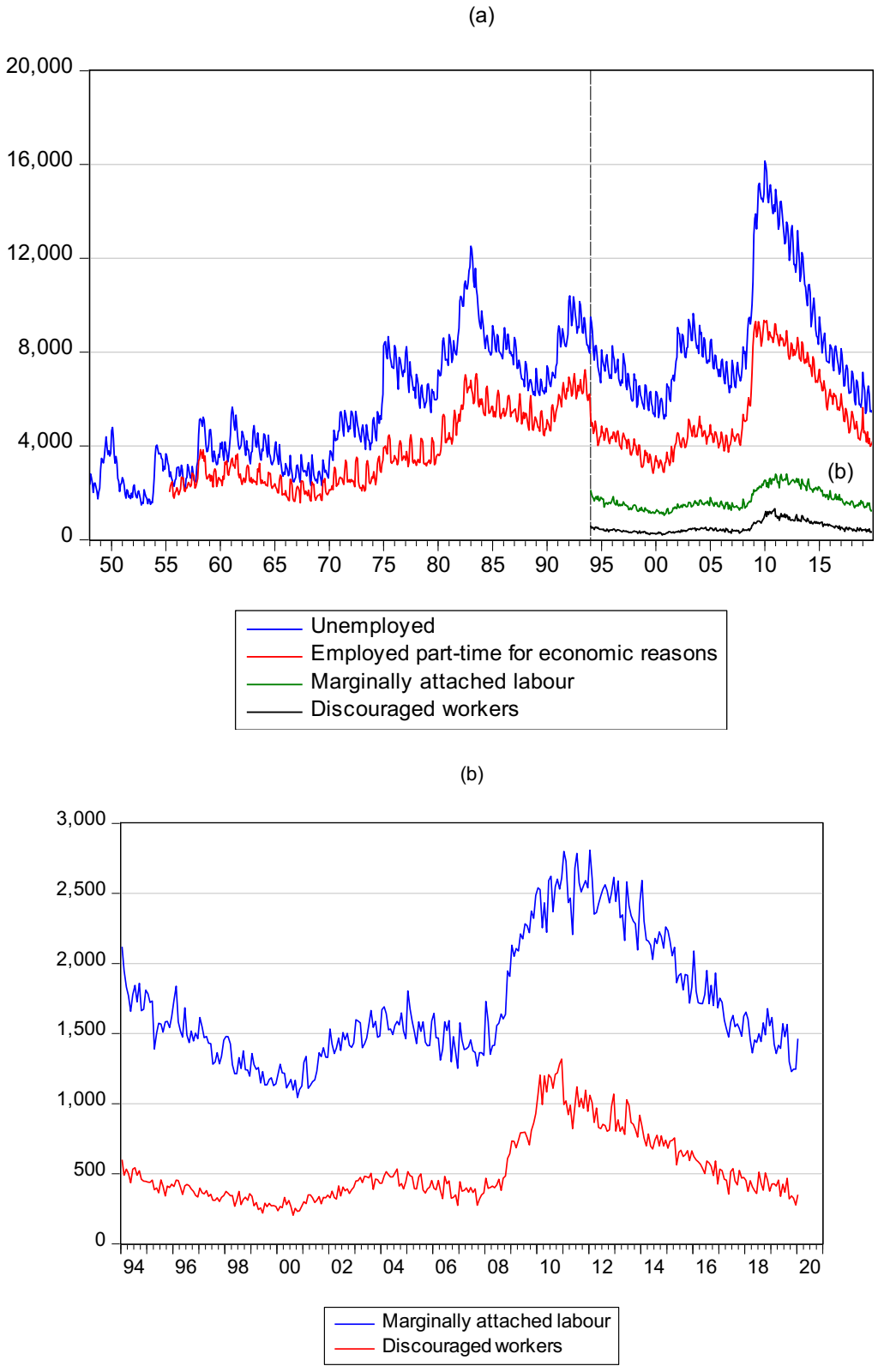
[33] See Domingo Angeles, "Share of women in occupations with many projected openings, 2016–26," Career Outlook, U.S. Bureau of Labor Statistics, March 2018 at https://www.bls.gov/careeroutlook/2018/data-on-display/dod-women-in-labor-force.htm?view_full

[34] https://www.statista.com/statistics/270001/distribution-of-gross-domestic-product-gdp-across-economic-sectors-in-the-us/

the United States today is fast approaching equal eminence as the male counterparts than it was in the past. Persons working part-time for economic reasons, known as involuntary part-time workers, refer to persons who work less than 35 hours due to reasons of economic nature such as not being able to find full-time employment or due to unfavorable business conditions. They are distinguished from voluntary part-time workers who work part-time (<35 hours) due to non-economic reasons such as personal commitments, home or family care, schooling, being on retirement, or facing social security earnings limits. While not all the reasons of persons in voluntary part-time are voluntary, they are largely so. By August 2018, about 4.4million persons were in part-time employment for economic reasons, 6.2 million in unemployment and about 1.5 million marginally attached to the labour force. During economic crisis, much interest goes to the situation of persons working part-time for economic reasons rather than on persons in voluntary part-time. We see a sharp increase[35] of more than double in the number of part-timers in this category from around 4 million to over 9 million after the 2008 crisis. Around the same time, a significant but milder surge in the numbers is recorded also for marginally attached labour from around 1.5million to 2.7 million (i.e. a growth of 80%) in 2011. Principally, discouraged jobseekers (i.e. available but not looking) form a sizeable share of the marginally attached labour (who are looking and available), while unavailable jobseekers (e.g. providing childcare, in school attendance, etc) make up the remaining share. All other persons not looking for work in the four-weeks preceding the labour survey after 1994 redesign are deemed *out of the labour force*. The supplementary group of persons neither in employment nor in unemployment add to the U3 to make up the U6.

[35] Numbers for persons employed part-time for economic reasons are seasonally adjusted by the BLS. We provide estimates for the marginally attached labour force manually adjusted using the X-12 procedure in EViews.

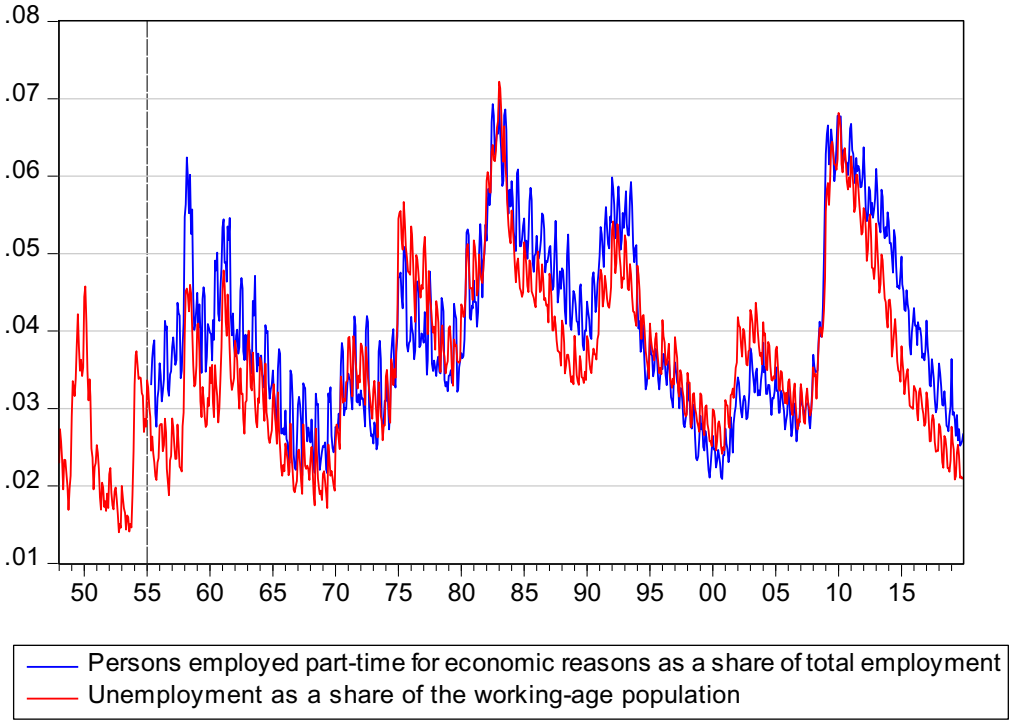
Figure 3. 5 Unemployment, employed part-time for economic reasons, discouraged and marginally attached labour



Source: Author's elaboration based in BLS and FRED data

From the year 2000, part-time employment increases from around 3 million persons to close to 5 million in September 2003 and from about 1 million in October 2000 to 1.8 million in January 2005 for persons marginally attached to the labour force. Besides each category of persons, unemployment increases from around 5.5 million in April 2000 to more than 9 million around June 2003 before falling to 6.7 million in October 2006, then to 15.4 million in October 2009 affected by the earlier crises in 2001 and the latter in 2008. Using graphical support, we show that persons employed part-time for economic reasons (available from 1955) as a share of total employment is a close match with the unemployment as a share of the US working-age population rate (Figure 3.6).

Figure 3. 6 Ratio of part-time for economic reasons to total employment vs ratio of unemployment to working-age population



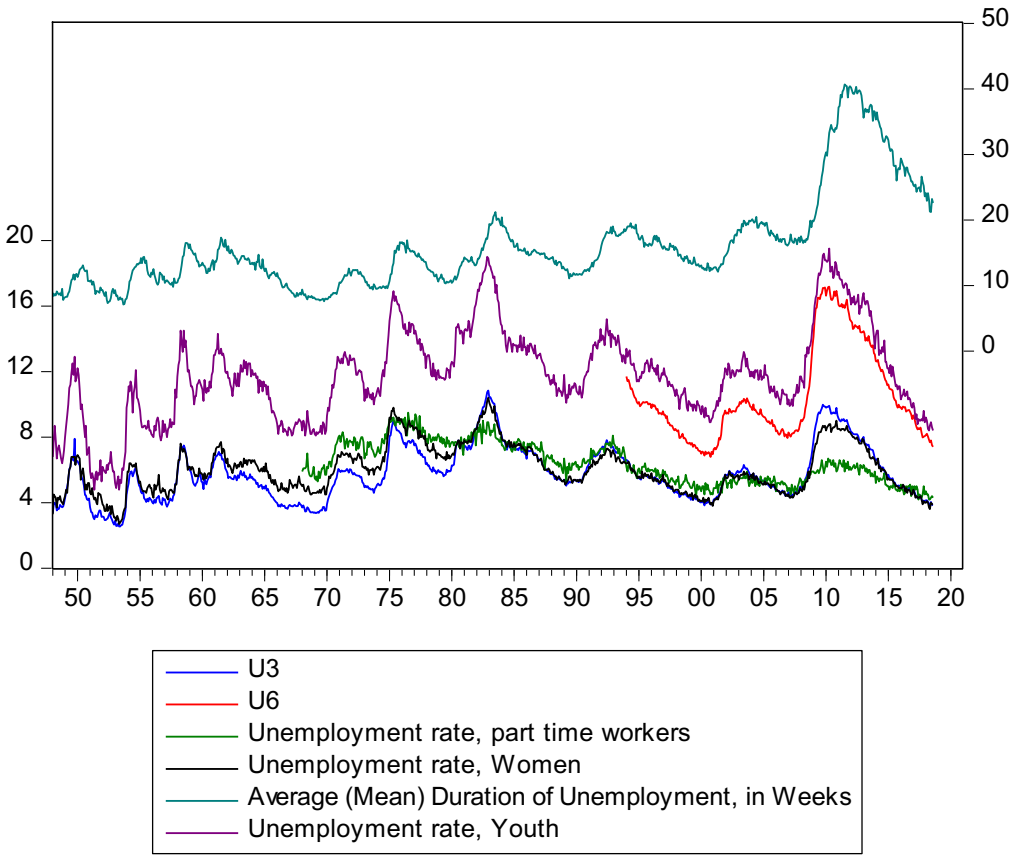
Source: Author's elaboration based in BLS data

Unemployment rate by youth, women, part-time, U3 and U6

The unemployment rate among youth (aged 16 to 24) is the highest among all other age groups, exceeding the unemployment rate for women unemployment rate and the U3 rate by wide margins from 1948, i.e. dating back from the time of availability of the statistics. From 1994 when the U6 become available, the youth unemployment rate exceeding the U6 rate has exceeded it by noticeable margin. Women unemployment rate has moved with the U3 rate closely from 1948 through 1961 and from 1981 till date. Although the variables move together when rising or falling, the women unemployment rate was higher than U3 between the 20-year period from 1961 to 1981 when both rates were falling. It must be said that women and youth are likelier to be underemployed part-time than other gender or age group respectively. The unemployment rate of part-time workers while mildly falling for the period taken as a whole from 1968 moves in tandem between the rate U3 and the women unemployment rate in up-and-down fashion though of lesser variability than the two variables in question. The mean duration of unemployment (in weeks), has moved closely in like up-and-down manner, an indication of a high correlation among the variables.[36]

[36] The correlation coefficient among the variables and U3 and with U6 respectively is very high between 0.70 and 0.99. We investigate this further shortly.

Figure 3. 7 Trends in U3, U6, Women unemployment rate, Youth unemployment rate, and Part-time unemployment rate



Source: Author's elaboration based on BLS and FRED data, monthly seasonally adjusted

According to Choudhry et al. (2012), the reasons for high youth unemployment rate are due to *structural, cyclical, frictional* and *roll-over effects*. First, the youth are generally lacking in on-the-job skills and experience required by prospective employers. From a prediction of the incentive principle, employers would rather hire persons who are experienced and who do not usually belong to the youth population. This is in a bid to cutting high training costs. Similarly, the youth may find it worthwhile furthering their studies than looking for job which may be non-existent for them at the time due to their lack of experience. Many concerns have been raised on college education for inability to equip graduates with skills needed on the job, hence churning out graduates not

well suited for on-the-job demands. Second, cyclical factors are more likely to affect the young persons than the aged. Low level of skills among the youth means (1) they are the ones more likely to not get employed during worse times of the business cycle, and (2) are the ones most likely to face lay off during downsizing from periods of low sales and profitability attributable to recession. Also, labour market frictions from the time gap when graduates finish college fresh to when they find job adds to the youth unemployment rate, and they are the ones most likely to be affected by unemployment during recession in more formal and developed economies, e.g. the economy of the United States. Last is what we term roll-over effect. Not having a job today means lower probability of having one tomorrow than someone who has job. The converse is also true and it affects more youth than adults since they are the ones more likely to lack the required skills and job experience.

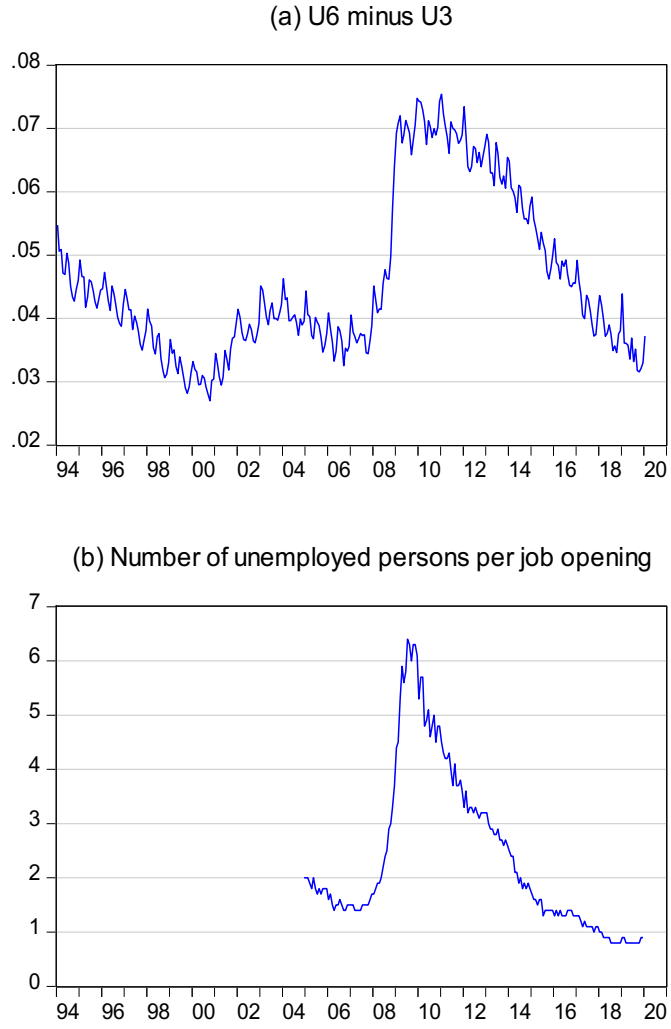
Recession in the United States

Subsequent to the more recent crises of 2008 and 2001, we see a widening gap between U6 and U3 from around the last quarter of 2007 to the last quarter of 2009, from around 3.7% to 7.4% (almost 4 percentage points) and from 2.9% in the last quarter of 2000 to 4.3% in the last quarter of 2003 (i.e. by some 1.4 percentage points). Similarly, having experienced a slight decline from December 2004 through the third quarter of 2007, the number of unemployed persons per job opening increased from 1.5 in June 2007 to 6.4 by July 2009 before decreasing from there to 0.8 by October 2019. In simpler words, if barely two persons were competing for a single job position prior to the 2007/8 recession, about 6 persons were deemed competing for the same position by the peak of the recession in June 2009. Eleven different recessions have occurred since 1948 of different durations (in months), according to the National Bureau of Economic Research[37]. As our

[37] See https://www.nber.org/cycles/cyclesmain.html

interest in on U6 which is available from 1994, we will focus our analysis on the last two recessions of 2008 and 2001. The Business Cycle Dating Committee of the NBER provides the indication to the dates of recession in US. Contrary to popular perception, however, the NBER debunks claims that recession is defined by period of decline in real GDP lasting for two quarters or more. In the definition chosen by the Committee, a recession is a "significant decline in economic activity affecting the whole economy" marked movements in some five select economic indicators which includes employment and real GDP. We have in mind the proper NBER definition of recession when a mention is made of it.

Figure 3. 8 Gap between U6 and U3 vs Number of unemployed persons per job opening



Source: Author's elaboration based on BLS data

Methodology

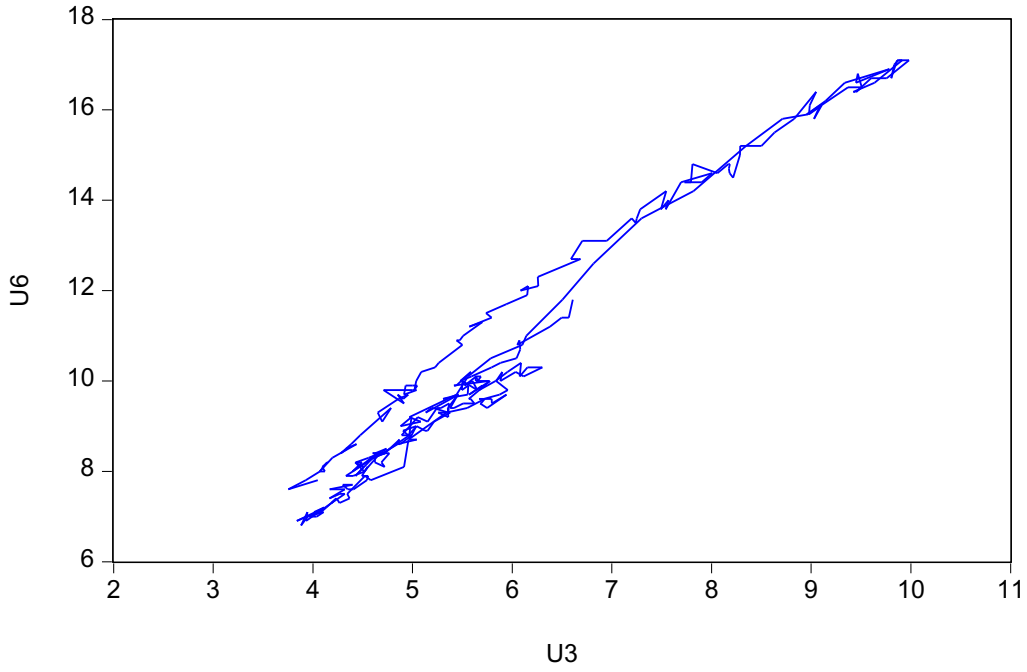
We assess empirically the determinants of the differential between unemployment in its extension (i.e. the U6 rate) over the traditional measure (the U3 rate). Our aim, however, is not so much to explain directly the determinants of the gap between U6 and U3, but to have a robust estimate which allows us to project backwards U6 using only variables that are available for the pre-1994 period. Intuitively, the difference between U6 and U3 could be determined by factors influencing the "marginally-attached phenomenon" of the labour market and part-time job. Using monthly data of the BLS and FRED, we gather all likely variables from the Bureau of Labour Statistics and the FRED database (available at different durations) with a goal of exploring the correlation between "marginal workers" in U6 with social and economic determinants available from 1948 onwards. After, we scrutinize our data in light of econometric lens.

From a correlation matrix of the variables (Appendix 3.5), we see that U3 is highly correlated with U6 (a correlation coefficient of 0.98). If U3 is enough to predict U6, we should be able to establish a cointegrating relationship between the two variables, else we should find additional variable(s) to help us do so. If we run any standard test of cointegration, we see that our test rejects cointegration for the sample from 1994m1 to 2018m08[38]. But, as we are much aware of the 2008 economic recession, we break our sample period into two; (1) from 1994m1 to 2007m12 and (2) from 2008m1 to 2018m08 (the last date of our data sample) and rerun our tests of cointegration, including two lags in our test. Our choice of 2008 as breakpoint is influenced by suggestion of

[38] While our analysis of the long run relationship between U6 and U3 is true using seasonally adjusted data, we find a cointegrating relationship between U3 and U6 for the sample of analysis, i.e. from 1994 to 2019m12 using seasonally unadjusted data (Appendix 3.6). See Jonathan (1989). Also cf. Wallis (1974) and Sims (1974). However, we are not able to proceed with only these two variables due to a high possibility of endogeneity between them.

when the recession began according to Business Cycle Dating Committee[39] of the NBER. We find that there exists a cointegrating relationship between U3 and U6 in the sample before the crisis (i.e. before 2008), but no cointegration in the remainder of the sample after 2008. Using graphical support, we identify that U6 is higher for any level of U3 with respect to previous periods; an indication that there may be some other forces at play in influencing this relationship (Figure 3.9).

Figure 3. 9 XY plot of U6 on U3



Source: Author's elaboration using data from the BLS.

We include many possible explanatory variables for U6 in percentage rates or indices apart from the average duration of unemployment given in weeks (Tables 3.1a and b), having carefully looked

[39] According to the Business Cycle Dating Committee of the NBER, the last recession leading to the most recent crisis counts from December 2007 through the following 18 months until June 2009. December 2017 is said to be the peak of the cycle running from the trough commencing the expansion from November 2001 which marks the end of the preceding cycle. See https://wwwdev.nber.org/cycles/cyclesmain.html

at the correlations of the variables with U6 and among themselves, i.e. our dependent variable (see correlation matrix in Appendix 3.5).

Table 3. 1a Description of variables

Variable	Description	Available from	Order of integration ADF test (Available sample)	Order of integration ADF test (1994 - 2018)
U6	U6 rate	1994m01 to 2018m08	I(1)	I(1)
U3	U3 rate	1948m01 to 2018m08	I(0)	I(1)
BISCONF	Business confidence	1955m01 to 2018m08	I(0)	I(0)
CONSCONF	Consumer confidence	1960m01 to 2018m08	I(0)	I(1)
INDPRO	Industrial Production Index, Index 2012=100	1948m01 to 2018m08	I(1)	I(1)
PR	Civilian labour force participation rate	1948m01 to 2018m08	I(1)	I(1)
PR16TO19	Civilian labour force participation rate, 16 to 19 years	1948m01 to 2018m10	I(1)	I(1)
PR20TO24	Civilian labour force participation rate, 20 to 24 years	1948m01 to 2018m11	I(1)	I(1)
PRW	Civilian labour force participation rate, women	1948m01 to 2018m08	I(1)	I(1)
PTUR	Part time unemployment rate	1968m01 to 2018m08	I(1)	I(1)
TCU	Capacity utilization, total industry (percent of capacity)	1967m01 to 2018m08	I(0)	I(0)
RECNBER	NBER Recession Indicator	1854m12 to 2018m08	-	-
UD	Average duration of unemployment (weeks)	1948m01 to 2018m08	I(1)	I(1)
URW	Unemployment rate, women	1948m01 to 2018m08	I(0)	I(1)
URY	Unemployment rate, youth (16 to 24 years)	1948m01 to 2018m08	I(0)	I(1)

Source: The US Bureau of Labour Statistics and the FRED database.
Notes:

(1) CONSCONF is composite indicator, consumer opinion surveys (confidence indicators): OECD Indicator for US, Normalized (Normal=100). BISCONF is composite indicator, Business tendency surveys for manufacturing (confidence indicators): OECD Indicator for US, Normalized (Normal=100). RECNBER is NBER based recession indicator for US from the period following the peak through the trough, dummy of +1 or 0.

(2) The data are monthly, seasonally adjusted except NBER which is a dummy.

Table 3. 1b Descriptive stats of variables[40]

	U6	U3	UD	URM	URS	URW	URY	TCU	PTUR	PR	PRW	CONSCONF	INDPRO
Mean	10.95	6.06	24.36	5.99	7.11	5.81	12.73	77.01	5.37	64.90	58.49	99.80	98.80
Median	9.75	5.55	21.05	5.24	6.62	5.40	11.85	77.21	5.30	65.70	59.00	100.06	99.78
Maximum	17.19	9.98	40.70	13.01	10.67	9.00	19.50	82.23	6.70	67.30	60.30	102.72	107.65
Minimum	6.80	3.75	12.10	2.78	4.54	3.60	8.40	66.71	4.20	62.30	56.40	96.71	87.07
Std. Dev.	3.06	1.77	8.69	2.39	1.63	1.50	2.96	3.07	0.58	1.57	1.16	1.39	5.00

Source: Author's calculations based on BLS and FRED data

Determining the determinants of U6: a systematic approach

We performed a large number of linear regressions of (possible) determinants of the gap between U6 and U3, trying many combinations of the variables as much as possible for the whole dataset (in Table 3.1). While it is generally agreed and assumed that the unemployment rate is stationary (Perron 1989), we perform Augmented Dickey-Fuller (ADF) unit root tests for the variables nevertheless using (1) the full sample in their originally available size (if available earlier than 1994) and (2) the sample beginning from 1994 (even if available earlier). The essence is to know the order of integration for each variable in the time-restricted sample (i.e. from 1994) and same for each variable using the unrestricted sample (i.e. in their originally available dates).

Our ADF tests suggest that U3, BISCONF, CONSCONF, TCU, URW and URY using the time-unrestricted-sample are I(0) while the rest of the variables are I(1). Use the sample from 1994, BISCONF and TCU remain I(0) while all else are I(1). The reason we perform preliminary unit root exercises on the variables individually is because EViews automatically adjusts the sample size of regression to the date of availability of our dependent variable. This happens when the sample size of the left-hand-side (LHS) variable is lower than the sample size of the right-hand-side (RHS) variables. Since U6 is available from 1994, we avoid the problem of assuming

[40] See full descriptive statistics of variables in Appendix 3.4.

arbitrarily that the variables are stationary, instead of I(1) which happen to be the case when we perform actual tests of stationarity on them one by one. Having established that the variables are integrated of order one except BISCONF and TCU, we proceed using the first difference of the variables to finding the determinants of U6.

Table 3. 2 Ordinary Least Squares (our general model)

Dependent Variable: D(U6)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.167913	4.378177	0.951975	0.3421
D(U6(-1))	-0.378415	0.110468	-3.425575	**0.0007**
D(U6(-2))	-0.098747	0.105720	-0.934051	0.3512
D(U6(-3))	-0.037353	0.089514	-0.417289	0.6769
D(U3(-1))	0.590492	0.226531	2.606674	**0.0097**
D(U3(-2))	0.352300	0.215620	1.633897	**0.1036**
D(U3(-3))	0.271907	0.193747	1.403411	0.1618
D(BISCONF(-1))	-0.258118	0.122849	-2.101099	**0.0367**
D(BISCONF(-2))	0.125552	0.189025	0.664208	0.5072
D(BISCONF(-3))	-0.187843	0.130792	-1.436198	0.1523
D(CONSCONF(-1))	-0.034862	0.115127	-0.302815	0.7623
D(CONSCONF(-2))	-0.143032	0.157005	-0.911003	0.3632
D(CONSCONF(-3))	0.253365	0.118371	2.140422	**0.0334**
D(INDPRO(-1))	-0.018020	0.156753	-0.114956	0.9086
D(INDPRO(-2))	0.029540	0.147481	0.200294	0.8414
D(INDPRO(-3))	0.022025	0.154985	0.142110	0.8871
D(PR(-1))	-0.247553	0.159952	-1.547675	0.1231
D(PR(-2))	-0.208917	0.156313	-1.336532	0.1827
D(PR(-3))	-0.329672	0.147497	-2.235110	**0.0264**
D(PR16TO19(-1))	0.045683	0.024010	1.902683	**0.0583**
D(PR16TO19(-2))	0.046159	0.024866	1.856309	**0.0647**
D(PR16TO19(-3))	0.051584	0.021938	2.351318	**0.0195**
D(PR20TO24(-1))	0.013506	0.035549	0.379907	0.7044
D(PR20TO24(-2))	0.001450	0.032190	0.045056	0.9641
D(PR20TO24(-3))	0.002314	0.026715	0.086629	0.9310
D(PRW(-1))	-0.063785	0.128488	-0.496424	0.6201
D(PRW(-2))	-0.162264	0.126173	-1.286045	0.1997
D(PRW(-3))	0.012589	0.113477	0.110936	0.9118
D(PTUR(-1))	-0.112245	0.090388	-1.241816	0.2156
D(PTUR(-2))	-0.017274	0.076446	-0.225966	0.8214
D(PTUR(-3))	0.011846	0.055415	0.213765	0.8309
D(TCU(-1))	0.090850	0.194537	0.467006	0.6409
D(TCU(-2))	-0.036150	0.182393	-0.198196	0.8431
D(TCU(-3))	-0.050480	0.190260	-0.265322	0.7910
RECNBER	0.230226	0.068875	3.342662	**0.0010**
D(UD(-1))	0.000215	0.018519	0.011595	0.9908
D(UD(-2))	-0.028852	0.018471	-1.562022	0.1196
D(UD(-3))	0.005924	0.017693	0.334793	0.7381
D(URW(-1))	-0.074961	0.144639	-0.518262	0.6048
D(URW(-2))	-0.118978	0.135405	-0.878678	0.3805
D(URW(-3))	-0.260403	0.108638	-2.396983	**0.0173**
D(URY(-1))	-0.065941	0.050813	-1.297710	0.1957
D(URY(-2))	-0.070669	0.046907	-1.506574	0.1333

D(URY(-3))	-0.090858	0.039695	-2.288907	**0.0230**
U6(-1)	-0.023210	0.091666	-0.253208	0.8003
U3(-1)	-0.238980	0.213943	-1.117027	0.2651
BISCONF(-1)	-0.019118	0.024868	-0.768795	0.4428
CONSCONF(-1)	-0.063913	0.030033	-2.128069	**0.0344**
INDPRO(-1)	-0.023529	0.006627	-3.550650	**0.0005**
PR(-1)	0.048619	0.108448	0.448315	0.6543
PR16TO19(-1)	-0.033195	0.016562	-2.004346	**0.0462**
PR20TO24(-1)	-0.017357	0.034794	-0.498862	0.6183
PRW(-1)	0.156852	0.105874	1.481486	0.1398
PTUR(-1)	0.014067	0.105710	0.133075	0.8942
TCU(-1)	-0.035291	0.013042	-2.705980	**0.0073**
UD(-1)	0.013401	0.011236	1.192689	0.2342
URW(-1)	-0.099397	0.141063	-0.704626	0.4817
URY(-1)	0.100148	0.049779	2.011845	**0.0454**

R-squared	0.559604	Mean dependent var	-0.012851
Adjusted R-squared	0.451867	S.D. dependent var	0.233509
S.E. of regression	0.172881	Akaike info criterion	-0.496088
Sum squared resid	6.963854	Schwarz criterion	0.236052
Log likelihood	130.1808	Hannan-Quinn criter.	-0.202789
F-statistic	5.194191	Durbin-Watson stat	2.084120
Prob(F-statistic)	0.000000		

Source: Author's calculations, data from BLS and FRED

We use the first difference of the variables proceeding from a general model which includes three lags each of all the variables. The model is specified as a tentative error-correction mechanism, where the long-run and short-run determinants are estimated simultaneously. For this purpose, the lagged level of all I(1) variables is introduced, along with a sufficient number of lags in their differences. The model would be appropriate if the coefficient of the lagged level of U6 turns out to be negative and smaller than one in absolute term, and statistically significant.

To avoid possible endogeneity in the determinants of U6, we omit the contemporaneous effect of the variables for the short-run determinants, maintaining only the three-lag variables in our model. Our first result (Table 3.2) suggests in a general model that U6 is determined by some lag combinations of U6 itself, U3, BISCONF, CONSCONF, PR, PR16TO19, and RECNBER) in the short run and by CONSCONF(-1), INDPRO(-1), PR16TO19(-1), TCU(-1) and URY(-1) over the long run at 10% significant level. However, the coefficient of the lagged level of U6 is not statistically significant, even though it has the right sign and magnitude. This result could be due

to multicollinearity among the many regressors, but we continue our analysis to try to address the problem. Using our initial OLS estimates based on 291 observations of monthly data after adjustment in EViews above, we explore further the link among the variables which enables us to project U6 backwards using robust estimates of the variables available before 1994. We could see, however, that a considerable number of variables in the general model are non-significant. So, we perform tests of restrictions based on our general model, including the variables bit by bit iteratively until we arrive at a more restricted model of the determinants of U6 at 10% significance level (Table 3.3).

Table 3. 3 OLS Restricted model 3.3

Dependent Variable: D(U6)
Method: Least Squares
Sample (adjusted): 1994M03 2018M08
Included observations: 294 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
U6(-1)	-0.068333	0.023932	-2.855320	0.0046
U3(-1)	0.066145	0.042264	1.565037	0.1187
CONSCONF(-1)	-0.036954	0.016206	-2.280320	0.0233
URW(-1)-U3(-1)	-0.181419	0.060461	-3.000580	0.0029
C	3.959019	1.692525	2.339119	0.0200
D(U6(-1))	-0.244502	0.077522	-3.153981	0.0018
D(U3(-1))	0.246013	0.115227	2.135033	0.0336
D(CONSCONF(-1))	-0.153559	0.058521	-2.624004	0.0092
RECNBER	0.334756	0.055958	5.982246	0.0000

R-squared	0.373237	Mean dependent var	-0.013611
Adjusted R-squared	0.355643	S.D. dependent var	0.232815
S.E. of regression	0.186885	Akaike info criterion	-0.486513
Sum squared resid	9.953909	Schwarz criterion	-0.373750
Log likelihood	80.51739	Hannan-Quinn criter.	-0.441355
F-statistic	21.21464	Durbin-Watson stat	1.987577
Prob(F-statistic)	0.000000		

Source: Author's calculations, data from BLS and FRED

In the restricted model, the variables which survived the selection process are consumer confidence (CONSCONF), the female unemployment rate (URW) which has been introduced as the gap with the unemployment rate (U3) to try to address collinearity, and the recession indicator (RECNBER).

However, in this specification multicollinearity between the female unemployment rate and other variables is still an issue, so we prefer the simpler specification reported in Table 3.4.

Table 3. 4 GLS Restricted ECM model 3.4

Dependent Variable: D(U6)
Method: Least Squares
Sample (adjusted): 1994M03 2018M08
Included observations: 294 after adjustments
Huber-White-Hinkley (HC1) heteroskedasticity consistent standard errors and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
U6(-1)	-0.076005	0.021148	-3.594023	0.0004
U3(-1)	0.107439	0.037492	2.865674	0.0045
CONSCONF(-1)	-0.039604	0.016756	-2.363502	0.0188
C	4.093973	1.749039	2.340698	0.0199
D(U6(-1))	-0.227036	0.090018	-2.522122	0.0122
D(U3(-1))	0.256633	0.129032	1.988914	0.0477
D(CONSCONF(-1))	-0.153533	0.061995	-2.476532	0.0138
RECNBER	0.362902	0.070983	5.112488	0.0000

R-squared	0.353437	Mean dependent var	-0.013611
Adjusted R-squared	0.337612	S.D. dependent var	0.232815
S.E. of regression	0.189482	Akaike info criterion	-0.462213
Sum squared resid	10.26836	Schwarz criterion	-0.361980
Log likelihood	75.94534	Hannan-Quinn criter.	-0.422073
F-statistic	22.33409	Durbin-Watson stat	2.005938
Prob(F-statistic)	0.000000	Wald F-statistic	12.93523
Prob(Wald F-statistic)	0.000000		

Source: Author's calculations, data from BLS and FRED

Model specification passes the test for normality and autocorrelation of residuals, but fails the test for heteroscedasticity, and therefore the reported estimates computed standard errors adopting the Huber-White correction proposed by Eviews.

The specification in Table 3.4 cannot be used as is to estimate the level of U6 backwards, since it includes lagged values for U6 itself, which are obviously not available. However, we can use the implied long-run relation between U6, U3 and CONSCONF which can be derived under the assumptions that variables reach their steady state, so that the changes are zero. In this case, the implied long-run link between our variables is given by

U6 = 1.41*U3 -0.52*CONSCONF +53.8 (eq.LR1

And all long-run coefficients are significant at the 5 percent level.

Since we are interested in a robust estimate which allow us to project backwards the values of U6, rather than establishing a causal relationship among variables, we chose to introduce in our model also the current level of the change in U3. Results are reported in Table 3.5, and all model selection criteria (Akaike, Schwartz, Hannan-Quinn, as well as the adjusted R-square) clearly prefer the new specification over the previous one in Table 3.4.[41]

Table 3. 5 GLS Restricted ECM model 3.5

Dependent Variable: D(U6)
Method: Least Squares
Sample (adjusted): 1994M03 2018M08
Included observations: 294 after adjustments
Huber-White-Hinkley (HC1) heteroskedasticity consistent standard errors and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
U6(-1)	-0.055925	0.014583	-3.835047	0.0002
U3(-1)	0.088668	0.025541	3.471645	0.0006
CONSCONF(-1)	-0.019697	0.011679	-1.686561	0.0928
C	2.028235	1.221770	1.660080	0.0980
D(U6(-1))	-0.311115	0.060136	-5.173539	0.0000
D(U3)	1.036086	0.062944	16.46047	0.0000
D(U3(-1))	0.445776	0.077870	5.724601	0.0000
D(CONSCONF(-1))	-0.093034	0.044776	-2.077738	0.0386
RECNBER	0.134540	0.050476	2.665411	0.0081

R-squared	0.691309	Mean dependent var	-0.013611
Adjusted R-squared	0.682644	S.D. dependent var	0.232815
S.E. of regression	0.131155	Akaike info criterion	-1.194741
Sum squared resid	4.902463	Schwarz criterion	-1.081978
Log likelihood	184.6269	Hannan-Quinn criter.	-1.149583
F-statistic	79.78161	Durbin-Watson stat	2.096618
Prob(F-statistic)	0.000000	Wald F-statistic	58.33932
Prob(Wald F-statistic)	0.000000		

Source: Author's calculations, data from BLS and FRED

The long-run relation between U6, U3 and consumer confidence is now given by
U6 = 1.58*U3 -0.35*CONSCONF +36.27 (eq.LR2

[41] The only drawback is that the residuals of the model do not pass the test of normality. However, this seems a little price to pay for the strong increase in the goodness of fit of the equation.

It has also been said elsewhere that macroeconomic time series are characterised by unit root processes which imply a more permanent shock in them (Vogelsang & Perron, 1998, citing Nelson & Plosser, 1982) while later suggestions indicate, however, that time series may be characterised by temporary (rather than permanent) stochastic shifts (stationary fluctuations) evolving slowly around a deterministic trend. In that case, the traditional test will not be able to appropriately reject unit root when there is a break in the deterministic trend (Perron 1989). Borrowing from the words of Perron who states: "When testing for the presence of a unit root in a time series of data against the hypothesis of stationary fluctuations around a deterministic trend function, the use of a long span of data has definite advantages. It allows tests with larger power compared to using a smaller span, in most cases even if the latter allows more observations… The drawback, however, is that a data set with a large span has more chance to include a major event which one would rather consider as an outlier or as exogenous given its relative importance." (Perron, 1989).

Due to the possibility of a structural break in our variables therefore, we perform the Multiple breakpoint test available in Eviews.[42] While the test performed on the equation in Table 3.4 finds two break dates in 2008 and 2012, the same test on our preferred equation in Table 3.5 yields stable parameters and no breaks.

By performing tests on our model parameters, we see a fair degree of stability. Our tests based on cumulative sum of the recursive residuals (CUSUM) and on cumulative sum of squares of recursive residuals (CUSUM of squares) both suggest model stability at 5% level (i.e. no structural break).

[42] In order to perform the test, we need to drop the dummy variable for NBER recession dates. The test performed by EViews is the Bai-Perron test of L+1 vs L sequentially determined breaks.

The strong collinearity among many of the explanatory variables adopted in the general specification of the model implies that more than one restricted model may exist. An alternative to the model presented in Table 3.5 implies the inclusion of the female participation rate among the regressors. When introducing this variable as a long-run determinant of U6, consumer confidence is only significant in the short-run, and the long-run coefficient is dropped. Results are displayed in Table 3.6.

Table 3. 6 GLS Alternative Restricted ECM model 3.6

Dependent Variable: D(U6)
Method: Least Squares
Sample (adjusted): 1994M03 2018M08
Included observations: 294 after adjustments
Huber-White-Hinkley (HC1) heteroskedasticity consistent standard errors and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
U6(-1)	-0.120456	0.031929	-3.772599	0.0002
U3(-1)	0.207764	0.053023	3.918381	0.0001
PRW(-1)	-0.038037	0.013585	-2.799931	0.0055
C	2.268754	0.825938	2.746883	0.0064
D(U6(-1))	-0.270192	0.058544	-4.615201	0.0000
D(U3)	1.074388	0.062568	17.17162	0.0000
D(U3(-1))	0.411471	0.078163	5.264288	0.0000
D(CONSCONF(-1))	-0.100275	0.044875	-2.234571	0.0262
RECNBER	0.183845	0.043829	4.194590	0.0000

R-squared	0.694501	Mean dependent var	-0.013611
Adjusted R-squared	0.685926	S.D. dependent var	0.232815
S.E. of regression	0.130475	Akaike info criterion	-1.205136
Sum squared resid	4.851765	Schwarz criterion	-1.092373
Log likelihood	186.1549	Hannan-Quinn criter.	-1.159978
F-statistic	80.98753	Durbin-Watson stat	2.078003
Prob(F-statistic)	0.000000	Wald F-statistic	55.54163
Prob(Wald F-statistic)	0.000000		

Source: Author's calculations, data from BLS and FRED

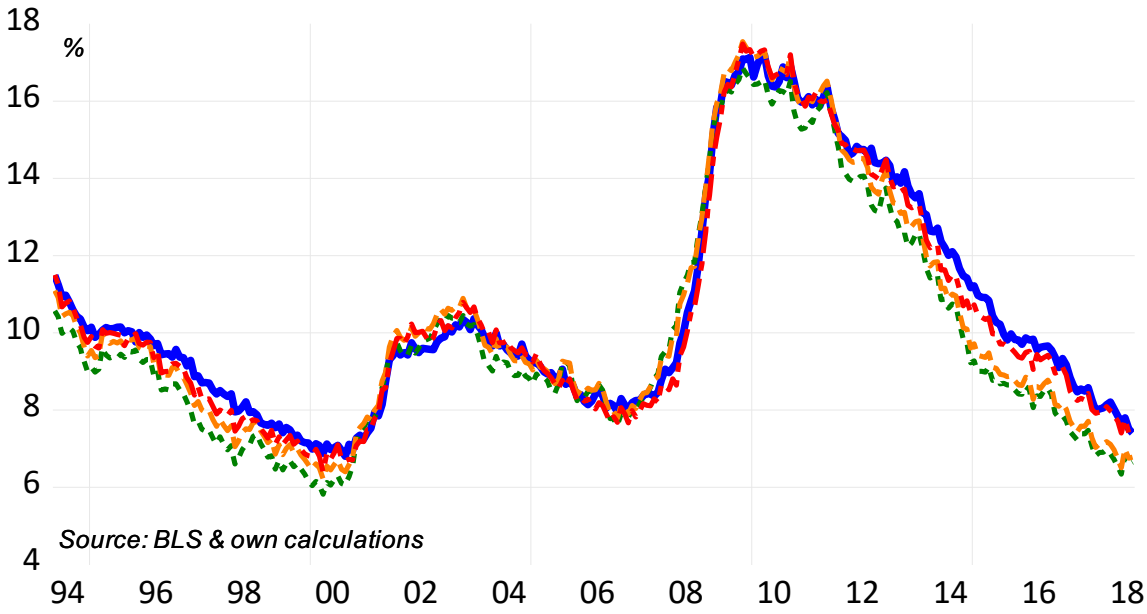
With the new specification, an increase in the female participation rate will imply a lower value for the U6 extended unemployment measure. The new long-run relation is now given by

U6 = 1.72*U3 -0.31*PRW +18.8 (eq.LR3

In order to test the robustness of our results, we adopt two additional approaches to cointegration analysis: (1) the autoregressive distributive lag model (ARDL) and (2) the Vector Error Correction model, based on Johansen cointegration testing.

Before moving to the next step in our estimating procedure we can compare the three estimates of the long-run level of U6 obtained so far, in Figure 3.10. As the chart shows, the estimate from model 3.6 (red line) is closest to the historical data (blue line), while the previous models tend to under-estimate unemployment in the last part of the sample. Indeed, the correlation between the estimates and the original data are equal to 0.97, 0.98, 0.99 for models 3.4, 3.5 and 3.6 respectively.

Figure 3. 10 United States Extended Unemployment



Proceeding from Autoregressive distributive lag model (ARDL)

Our initial more parsimonious OLS regression shows that U6 is explained by the traditional unemployment rate (U3), the confidence of consumers (CONSCONF), and the participation rate of women (PRW) (Table 3.6). This is quite intuitive reading from the data on the US unemployment situation and some literature surveyed earlier. PRW significant at 5% level had

been increasing from 1948 and fast approaching (or converging) with the participation rate of men (PRM). However, it flattened out through our period of analysis (i.e. from 1994 to date) and more specifically decreased from the third quarter of 2009.

ARDL Model specification

Since our overall goal is to find the long long-run determinants of U6 that enable us to project it backwards, we specify in a general-to-specific framework using the autoregressive distributive lag (ARDL) modelling approach by following a systematic procedure.

We take advantage of EViews automatic model selection procedure: considering the variables U6, U3 and CONSCONF, as well as the fixed regressor RECNBER, we have EViews perform a search of the best number of lags for each variable, up to a maximum of six lags. The resulting outcome is reported in Table 3.7.

Table 3. 7 ARDL model

Dependent Variable: U6
Method: ARDL
Sample (adjusted): 1994M05 2018M08
Included observations: 292 after adjustments
Maximum dependent lags: 6 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (6 lags, automatic): U3 CONSCONF
Fixed regressors: RECNBER C
Number of models evalulated: 294
Selected Model: ARDL(4, 3, 3)
Note: final equation sample is larger than selection sample
Huber-White-Hinkley (HC1) heteroskedasticity consistent standard errors and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
U6(-1)	0.564976	0.066389	8.510127	0.0000
U6(-2)	0.197656	0.064753	3.052469	0.0025
U6(-3)	0.108619	0.070735	1.535591	0.1258
U6(-4)	0.069308	0.041066	1.687707	0.0926
U3	1.062938	0.063117	16.84070	0.0000
U3(-1)	-0.416720	0.097603	-4.269540	0.0000
U3(-2)	-0.282090	0.085318	-3.306324	0.0011
U3(-3)	-0.274644	0.086157	-3.187706	0.0016
CONSCONF	0.080486	0.076273	1.055234	0.2922
CONSCONF(-1)	-0.353342	0.200059	-1.766185	0.0785
CONSCONF(-2)	0.395142	0.212204	1.862083	0.0636
CONSCONF(-3)	-0.150845	0.095281	-1.583156	0.1145
RECNBER	0.156498	0.048866	3.202601	0.0015
C	2.945455	1.262011	2.333937	0.0203

R-squared	0.998072	Mean dependent var	10.47396
Adjusted R-squared	0.997981	S.D. dependent var	2.854497
S.E. of regression	0.128252	Akaike info criterion	-1.222889
Sum squared resid	4.572671	Schwarz criterion	-1.046606
Log likelihood	192.5418	Hannan-Quinn criter.	-1.152277
F-statistic	11067.40	Durbin-Watson stat	2.019423
Prob(F-statistic)	0.000000		

Source: Author's calculations, data from BLS and FRED

We also tested a model including the female participation rate PRW, but dropping the consumer confidence indicator, but both models had a worse performance against the model in Table 3.7, contrary to our results above using the ECM approach.

EViews allows for testing the existence of a long-run relation among our variables. Results are reported in Table 3.8.

Table 3. 8 ARDL long run form and bounds test

ARDL Long Run Form and Bounds Test
Dependent Variable: D(U6)
Selected Model: ARDL(4, 3, 3)
Case 2: Restricted Constant and No Trend
Date: 02/27/20 Time: 16:57
Sample: 1948M01 2020M12
Included observations: 292

Conditional Error Correction Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.945455	1.239539	2.376251	0.0182
U6(-1)*	-0.059440	0.016967	-3.503353	0.0005
U3(-1)	0.089484	0.028366	3.154685	0.0018
CONSCONF(-1)	-0.028559	0.011858	-2.408387	0.0167
D(U6(-1))	-0.375583	0.058201	-6.453232	0.0000
D(U6(-2))	-0.177927	0.057778	-3.079522	0.0023
D(U6(-3))	-0.069308	0.038999	-1.777161	0.0766
D(U3)	1.062938	0.059510	17.86159	0.0000
D(U3(-1))	0.556734	0.086875	6.408438	0.0000
D(U3(-2))	0.274644	0.084734	3.241251	0.0013
D(CONSCONF)	0.080486	0.073906	1.089028	0.2771
D(CONSCONF(-1))	-0.244297	0.104518	-2.337371	0.0201
D(CONSCONF(-2))	0.150845	0.076600	1.969260	0.0499
RECNBER	0.156498	0.043046	3.635630	0.0003

* p-value incompatible with t-Bounds distribution.

Levels Equation
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
U3	1.505449	0.169995	8.855840	0.0000
CONSCONF	-0.480466	0.202012	-2.378408	0.0181
C	49.55311	21.07635	2.351124	0.0194

EC = U6 - (1.5054*U3 -0.4805*CONSCONF + 49.5531)

F-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	5.391081	10%	2.63	3.35
k	2	5%	3.1	3.87
		2.5%	3.55	4.38
		1%	4.13	5
			Finite	
Actual Sample Size	292		Sample: n=80	
		10%	2.713	3.453
		5%	3.235	4.053
		1%	4.358	5.393

Source: Author's calculations, data from BLS and FRED

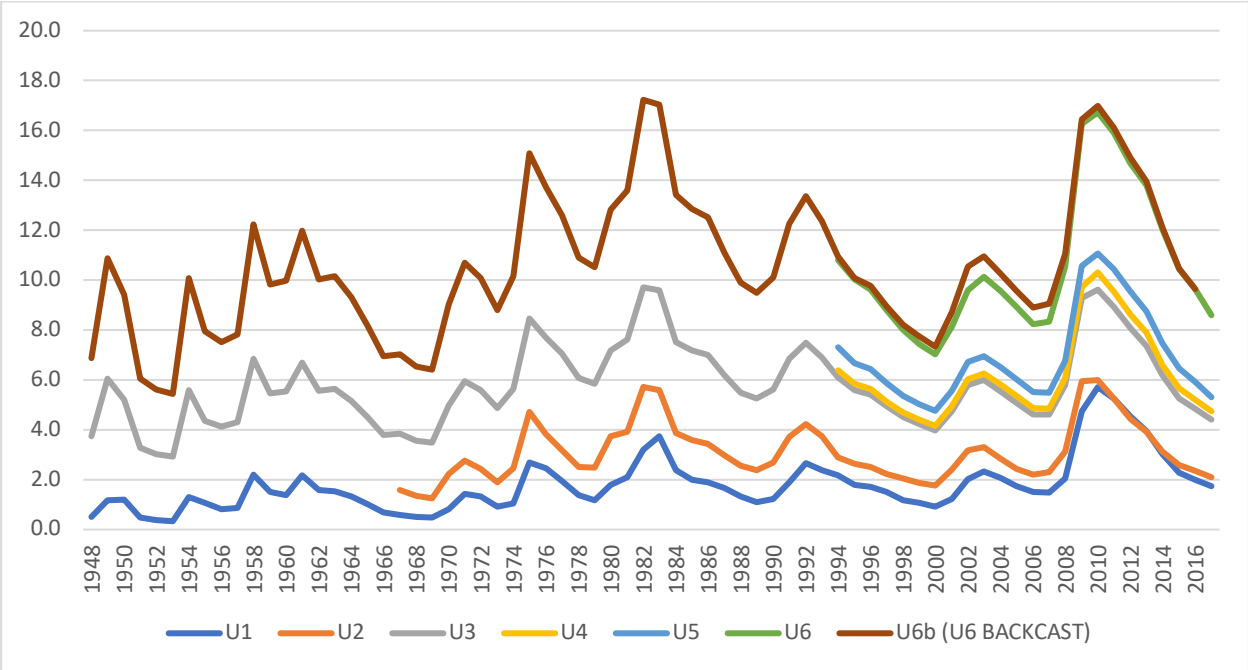
In the first test in this final step, the F-statistic of our test result suggests the existence of long-term cointegrating relationship even at 1% significance level among the variables although the t-stat indicates the existence of a long run relationship at 10% significance level. Our result indicates that the system is restored to long run equilibrium at an adjusting speed of 5.94%. The t- and F-statistics both confirm the existence of such long-run cointegration relationship even at 1% test level of significance.

Johansen cointegration Analysis

We conduct a second test of cointegration using a second and more popular approach – the Johansen cointegration analysis. It is known that where variables are integrated of order one, a cointegrated relationship may be established if their first difference is stationary (Engle & Granger, 1987) and the long- and the short-run dynamics of the variables can be examined through a vector error correction model. In this way, the degree of inertia of the dynamic relationship among the variables may be explained by the inclusion of their lag terms. Our Johansen cointegration test indicates that there exists a genuine long-run relationship among the variables at 5% significance level confirmed by the trace test and the max-eigenvalue test statistics[43].

[43] See vector error correction model in Appendix 3.19.

Figure 3. 11 U6 backcast



Source: Author's elaboration based on data from the US Bureau of Labour Statistics, 2017

From the results in our two cointegration tests, we find that U3 and consumer confidence influence unemployment over the long run. The results of direction of granger causality is confirmed by our Johansen cointegration analysis (Appendix 3.19). We realize that U3 and CONSCONF explain much of movement in the trend of U6 by (1) our VECM estimates and by (2) the relationship among the variables indicated by the correlation coefficients of almost one (i.e. +0.98) for between U6 and U3 and -0.77 for between U6 and CONSCONF. Using information available from 1994, we show the reconstructed dynamics of U6 for the pre-1994 period. Holding all other things constant, we could trace how large the measure of extended unemployment was back then. In Figure 3.11, we show a simple backcast of the U6 rate using U3 and CONSCONF up to 1960 and U3 for the remainder of the sample back in time to 1948.

In our earlier models, model 3.6 seems to be the best among them. Apart from model 3.6, none of the other two earlier models (i.e. models 3.4 and 3.5 respectively) preceding model 7 (i.e. ARDL [4, 4, 3]) make use of the contemporaneous value of U3. In order words, all three initial models give basically the same results except for the inclusion of the contemporaneous value of U3 in model 3.6. Yet while the estimates of model 3.6 are very much better than the rest, we are not sure whether U6 is properly estimated since we do not have the data to enable us to determine so. While all four models estimating backwards move very closely until around July 1990 there seems to be a divergence back through time until 1948. Given the contemporaneous level of the change in U3 and given that U3 and U6 are highly correlated, the problem of weak exogeneity between them may bias the results.

Further analysis with different techniques may be needed. One drawback, however, is in the stability of our model parameters. We assess our final model also on the possibility of structural break, probable due to the occurrence of the last two recessions; for example, U6 earlier was found to have a breakpoint at 2006m12, U3 has a breakpoint at 2006m10, PRW at 2009m07 and CONSCONF at 2000m07, all at their levels respectively. In the final step, we include a battery of tests of structural break on our models. Our tests based on the cumulative sum of the recursive residuals (CUSUM) and on the cumulative sum of squares of recursive residuals (CUSUM of squares) both suggest model stability for model 3.6. While our test based on the cumulative sum of the recursive residuals (CUSUM) suggest model stability, however for model 3.7, the test based on the cumulative sum of squares of recursive residuals (CUSUM of squares) suggests rather a break around the last recessions in 2013. Summary tests for structural break on all three models is presented below (Table 3.9, sample 1994 -2018).[44]

[44] See outputs in Appendices 3.11 to 3.14.

Table 3. 9 Comparison of models

Test	ECM Model 3.6	ARDL Model 3.7	VECM (in Appendix 3.19)
Stability			
Chow breakpoint (Specified breakpoint: 2008)	Break	n.a.	n.a.
Chow forecast (Prediction from 2008)	Good	n.a.	n.a.
CUSUM	Stable	Stable	n.a.
CUSUM of squares	Stable	Break around 2013	n.a.
Ramsey RESET	Model not mis-specified	Model not mis-specified	
Residuals			
Correlogram Q-stat	White noise	White noise	n.a.
Normality	No	No	No (jointly)
Serial correlation	No	No	Yes (Lags 1 and 2)
Heteroskedasticity	Yes	Yes	Yes (jointly)
Autocorrelation	n.a.	n.a.	No (Up to 4 lags)

Source: Author's calculations based in BLS and FRED data. All the tests are conducted at 5% significance level.

While a small sample size may limit our analysis, we find that the cointegration among the variables seem to break down around 2008, the time of the crisis, and 2013, the time of recovery due, perhaps, a possible structural break around those times. There is impact, however, on a good number of our regressors on U6 when we introduce dummy variables to evaluate the impact of the last two recessions on our results[45].

[45] See Appendix 3.20

Conclusion

Economic crisis displaces a wide range of labour from the labour force through worker discouragement and other forms of marginal attachment to the labour force who would prefer to participate in the labour market activities should the economic times been great. Inside the labour force, many persons change status from employment to unemployment, many others exit the unemployment or labour force completely (e.g. to pursue more education or channel their labour to family care) while a significant number of the employed are rendered involuntary part-time workers. This widens the disparity between the traditional unemployment rate and extended unemployment measures notably U6 which captures the broadest marginal attachment to the labour force. We explored the correlation between the "marginal workers" in the extended unemployment rate with social and economic determinants available from 1948 onwards. We find a long run relationship between U6, U3 and the confidence of consumers in the autoregressive distributive lag framework as well as applying the Johansen technique. We verified to what degree the U6 measure could be produced over a wider span, to the same sample date of availability of the BLS U3 rate of unemployment (i.e. from 1948) using information available from BLS, FRED, the World Bank, etc. However, given the non-availability of data prior to 1994 causes a severe technical difficulty. All the variables explored available prior to 1994 apart from U3 and consumer confidence (and later the civilian labour force participation rate using seasonally unadjusted data) failed to explain U6, and hence, were finally dropped from our model. We settle on a simple backcast of U6 using our significant variables notably the U3 rate and consumer confidence having explored the dynamic relationship among the variables. Although U6 may be linearly dependent with the U3 rate, the estimated U6 rate gives (some) account of how wide or narrow the gap between the two rates, holding data challenges and cyclical factors prior to 1994 constant. While we include checks on the robustness of our estimates, data challenge presents us no benchmark to

compare our projected U6 and the gap thereof between U6 and U3 Nevertheless, linking the traditional unemployment rate with unemployment in its extension for the United States through consumer confidence is interesting, similar to what the famous economist of the 20th century, John Maynard Keynes would refer as “animal spirit” which typically propels business firms and enterprises to increase their commitment of resources and investment, and which increases the aggregate demand and employment in a positive spiral, according to Keynes. In our case, an increase in uncertainty signaled by a decrease in consumer confidence seems to determine an increase in the extended unemployment measure, as workers are more willing to accept part-time jobs, and/or drop out of the labor force even though they are still in search of employment.

CHAPTER IV

An analysis of the world's hidden unemployment

Introduction

Approaching the ILO's centenary year of 2019, the ILO released a number of reports providing estimates of the world's unemployment situation. While one of the reports considered an analysis of the size of the world's potential labor force who are section of the persons outside the labour force (see ILO 2019b), one such report provides information about the global labour utilization (see ILO, 2018b). Earlier on the same year, another report highlights the (nature of) employment across sectors and occupations (ILO, 2018d; ILO 2018e) while one other highlights the world's unemployment by demographics – by age, gender, and geographical location (e.g. ILO, 2019a, working poverty (ILO, 2019d), and seniors (ILO, 2018f). The description of how the ILO looks at the labour utilization[46], however, are dispersed in separate documents over the years in many reports, guidelines and resolutions on the ILO concepts. While we provide some analysis of the concepts in the introductory chapter of the study, we touch on a few statistics and trends relevant for this chapter.

About 3.3 billion people are employed across the world according to 2017 ILO estimates[47]. The growth in employment, however, does not match increase in population, decreasing the employment-to-population ratio from 61% in 2000 to 58% in 2018. According to the 2017 estimates, 3.46 billion of the world's population belong to the labour force while 2.1 billion are

[46] See Appendix 4.2 for the ILO filtering system used on the measurement of the labour underutilization.

[47] See ILO modelled estimates, November 2018. Cf. ILO stats sheet on employment https://www.ilo.org/ilostat-files/Documents/Stats_sheet_employment_EN.pdf

outside it. Of over 7.5 billion people in the world, 5.6 billion (74%) are 15 years and above, deemed of working age. Of the world's total labour force, 190 million are unemployed while the remaining majority are in employment for the same year. This translates into a global unemployment rate of 5.5% (Table 4. 1), midway between a high of 11.7% for the Northern Africa region and 2.9% low for South-Eastern Asia and the Pacific. As we mentioned in the introductory chapter, the ILO considers the working age to be 15 years or above but allows countries or the statistical offices or organization to adopt a different threshold[48] such as 14 years as the lower limit or 64 years as upper bound. For uniformity, we maintain a working-age of 15 years and above except in cases where we mention otherwise.

Table 4. 1 ILO modelled estimates for 2017 (Figures are in thousands)

Country	Population	Population 15+	Employment	Unemployment	Labour force	Unemployment rate	Outside the labour force	Inactivity rate	Employment-to-population ratio	Participation rate
World	7548146	5591762	3274897	190029	3464926	5.5	2126836	38	58.6	62
Africa	1255040	742615	440751	37647	478398	7.9	264217	35.6	59.4	64.4
Northern Africa	233604	157796	65186	8668	73854	11.7	83942	53.2	41.3	46.8
Sub-Saharan Africa	1021436	584819	375565	28979	404544	7.2	180276	30.8	64.2	69.2
Americas	1004738	777234	458810	33978	492788	6.9	284446	36.6	59	63.4
Northern America	361084	293850	174511	8371	182882	4.6	110967	37.8	59.4	62.2
Latin America and the Caribbean	643654	483385	284299	25607	309906	8.3	173479	35.9	58.8	64.1
Arab States	160743	108388	51356	4379	55735	7.9	52653	48.6	47.4	51.4
Asia and the Pacific	4206158	3207493	1914799	80912	1995711	4.1	1211783	37.8	59.7	62.2
South-Eastern Asia and the Pacific	689009	509319	336443	9863	346306	2.9	163012	32	66.1	68
Central and Western Asia	177756	130599	70570	6674	77244	8.6	53355	40.9	54	59.2
Eastern Asia	1648165	1365460	886400	41759	928159	4.5	437301	32	64.9	68
Southern Asia	1868985	1332715	691955	29290	721245	4.1	611470	45.9	51.9	54.1
Europe and Central Asia	921468	756032	409182	33113	442295	7.5	313737	41.5	54.1	58.5
Eastern Europe	292454	244500	137382	8033	145415	5.5	99085	40.5	56.2	59.5
Northern, Southern and Western Europe	451257	380933	201229	18407	219636	8.4	161297	42.3	52.8	57.7

Source: Author's elaboration based on ILO modelled estimates, November 2018

[48] This may be based on differences in the school leaving age across countries.

While data on the total number of potential labour force including discouraged jobseekers[49] and persons in time related underemployment is required to compute the extent of the world's total labour underutilization, an important challenge relates to the data on the number of discouraged workers among developing countries. Yet, it is among the developing countries that the bulk of the labour underutilization pertaining to worker discouragement persists including China and India which contain a great share of the world's total population. This represents a big blow to the statistics. In Africa, Asia and the Pacific and the Americas, there are considerable number of jobs existing in the shadow economy. Different from the open economy, jobs in the 'underground' economy are characterized by a large number of small-scale self-employment, marginal and vulnerable forms of employment which sometimes escape the labour statistics. The converse is true for high-income countries where a high proportion of the employees hold formal and overt employment contracts, thus a relatively lower share of vulnerable and informal employment which are associated with a higher share of working poor persons and worker precariousness. This is especially so on the contrary in developing countries and in the agricultural sector. By global sectoral composition of production, the agricultural sector accounts for 30% of economic activity, the service sector, half (50%) while industry accounts for the remaining 20% in 2018 but low income-countries have the agricultural sector accounting for 70% of employment[50].

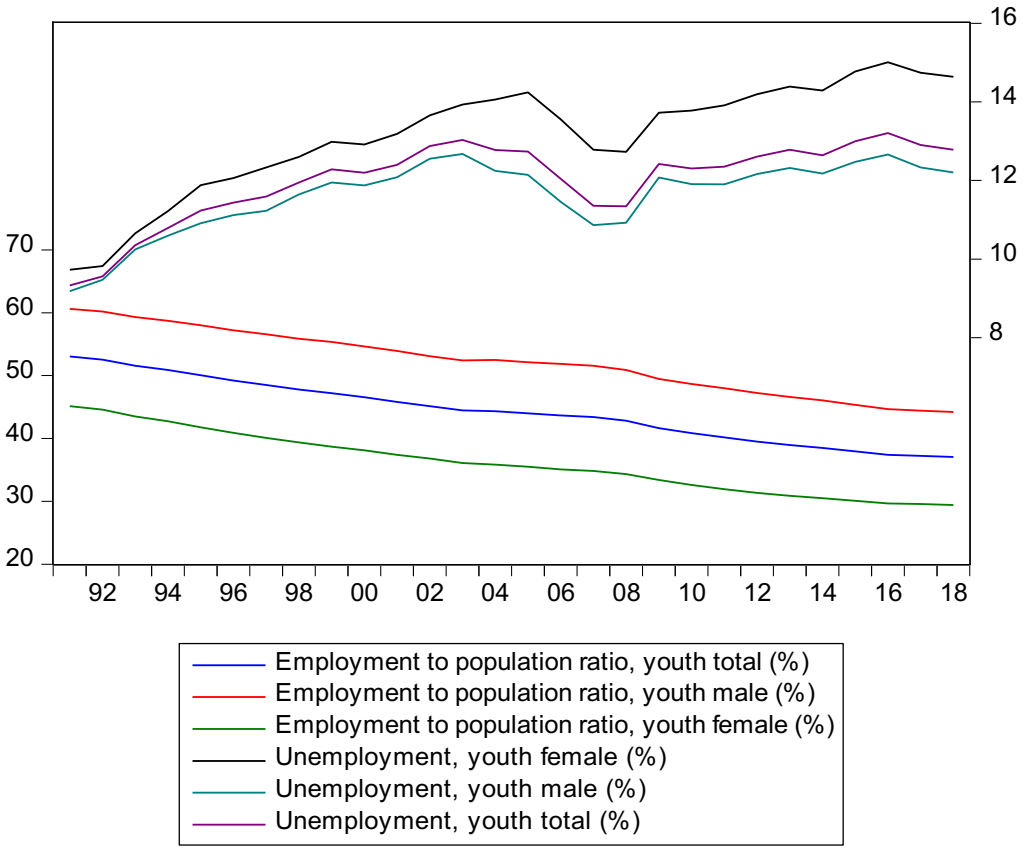
The ILO modelled estimates (November 2018) show that labour force participants are 61 percent of working-age population; 75% of males while only 48% of females are participants of the labour

[49] *Discouraged workers* in ILO statistics is a subgroup of available potential jobseekers in the potential labour force. Unavailable jobseekers constitute another subgroup belonging to the potential labour force.

[50] See https://www.ilo.org/ilostat-files/Documents/Stats_sheet_employment_EN.pdf. Author's calculation using ILO modelled estimates (November 2018) suggests this was 51%, 23% and 26% respectively for services, industry and agriculture.

market. A substantial 39% of both genders together are non-participants. It shows that youths (below 25 years) face relatively high unemployment than adults at 12% against 4% in 2018 and the discrepancy of the combined rate of unemployment and potential labour force against the traditional unemployment rate is much higher for youths than for adults at 20 per cent and 7 per cent respectively (ILO, 2019a). The estimates for 2018 include that 21% of all youth are not in employment, education or training (NEET) of which young women have the greater share (30%) than young men (13%). While a chuck of the youthful population may be in school or in training and thus not looking for employment, the youth unemployment rate has particularly been on the surge in the last three centuries especially for the developed regions of the world. Their employment, however, has been on the decline (Figure 4. 2). In less developed economies, when unable to find jobs in the formal sector shift, many people their labour services to unpaid family help which may not be counted as employment.

Figure 4. 1 Youth employment and unemployment rate



Source: Author's elaboration on ILO modelled estimates November 2018.

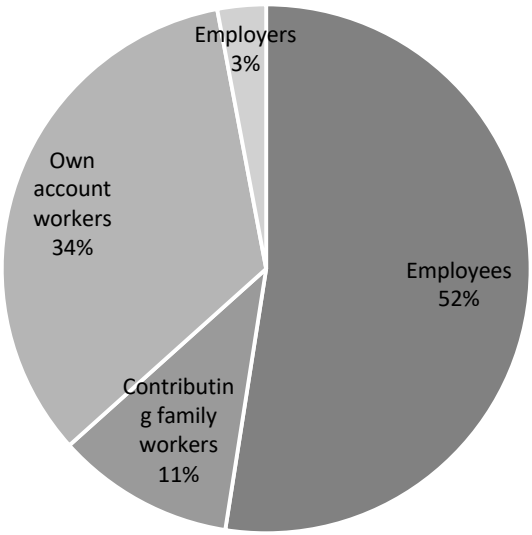
While youths are much more affected by part-time employment and informal employment, women globally have relatively low participation rate in the labour force, linked with home and family care. In continental US and Europe, disadvantaged youth, however, face shortcomings integrating into the labour market irrespective of special targeted labour market programs on them (Martin and Grubb, 2001). Yet, active spending programs on the unemployed tend to produce less-positive results than passive spending programs. This is because they are one-off, implemented to achieve the goal in hand. Passive labour programs, on the other hand, are more universal and tend to co-move with fluctuations in unemployment (ibid). One big challenge also involves a considerable

number of persons in vulnerable employment[51] (45%) consisting of own-account workers and contributing family workers[52]. "In 2017, around 42 per cent of workers worldwide (1.4 billion) are estimated to be in vulnerable forms of employment, the share expected to remain particularly high in developing and emerging countries above 76 per cent and 46 per cent, respectively" (ILO, 2018e). This is not particularly so in Europe and Central Asia, Arab States and the Americas where paid employment 82%, 78% and 73% respectively of persons in employment in those regions. In Asia and the Pacific and Africa, self-employment is the predominant form of employment. For instance, while own-account workers constitute the largest share of employment (44%) in Africa, employees represent less than a third, according to 2017 estimates (ibid). Having stalled in 2012, vulnerable unemployment is on the rise and projected to increase in 2018 and 2019.

[51] Note: "Employees refers to employed persons holding paid employment jobs, and they represent the category of status in employment usually associated with more job security and better working conditions in general, whereas own-account workers and contributing family workers constitute two status in employment categories regarded as vulnerable employment. Although this is true in general terms, it is important to keep in mind that some employees do lack basic elements of decent work (such as not being covered by social security and/or social dialogue) while some own-account workers and contributing family workers are not in a precarious or vulnerable situation. Thus, while the share of own-account workers and contributing family workers is a valuable and reasonable proxy to measure vulnerability, it is nevertheless an imperfect one". See ILO, 2018e.

[52] See ILO stats sheet on employment, here https://www.ilo.org/ilostat-files/Documents/Stats_sheet_employment_EN.pdf

Figure 4. 2 Status in Employment: World



Source: ILO stats sheet number on employment (nº 2) 2018[53]

Data challenges

The ILO depends on labour force surveys (LFS) if available or sources of data[54] close to LFS where the LFS data are unavailable for the countries in question. While the surveys are conducted by the countries themselves, the ILO takes responsibility for collating and presenting the statistics therefrom. Depending on the data, the ILO may apply its statistical techniques based on the data received, where necessary, to ensuring reasonable estimates of the national statistics. In doing so, the prevailing economic conditions in the countries may be factored into. For instance, the ILO modelled estimates factor into the data individual country circumstances which may be preferred over the unadjusted national data. Here are some few challenges of the ILO data.

[53] ibid.

[54] Population censuses and persons' registration at employment centres are used to make up, where labour survey data are unavailable.

(1) **Data availability**: While data on conventional unemployment is always available, the ones required to compute broader estimates (e.g. the LU4 rate) are largely lacking for a significant number of countries. The LU4 rate for age 15 years and above, for example, is available at least for a single year for only 93 countries out of 188 countries. Although data has much improved today than seven decades ago, it remains lacking generally for many developing countries for a sufficiently long time span. In many cases, imputing the data is not possible or very difficult to achieve practically. Furthermore, computing broader unemployment measures for countries lacking in data may imply completely designed harmonized labour force questionnaires[55] for the world to gather information on groups such as discouraged workers for those countries lacking (in Africa, Arab States, the Americas, and Asia including China, and India). Generally, in other words, the data is either available right away in the statistics or the variables required to compute broader estimates is not much of a problem for developed countries in Europe and North America, but this is not the case for many developing countries.

(2) **Difficult to tweak the unemployment statistics among countries to arriving at required estimates due to subtle country-differences in concepts**: A part of the problem arises from the previous mentioned. Significant differences (trivial in some cases) exist in the cross-country unemployment statistics. And the methodological approach adopted by the main statistical organizations is not completely the same. Some statistics on broad measures of unemployment may either be underestimated or overestimated when pertaining to different countries adopting subtle difference in the concept definitions. For instance, as noted by

[55] See Sorrentino 2000 on the comparability of the international unemployment statistics for some developed countries adjusted to US concepts.

Sorrentino, the definition of the age limit definition[56], type of search required, reference period selected, current availability for work criteria and persons on waiting starting a new job (future starters) as well as double counting in some cases (e.g. "a 15-year- old doubling as a passive jobseeker") may underestimate the one country's, e.g. US rates compared to other regions like Canada or Eurostat statistics countries while the treatment of persons on temporary layoff, full-time students, unpaid family workers, and career military persons in the statistics may understate the US' (see Sorrentino 2000). As a result, tweaking the countries' data where the aim is for unified broader estimates is much complicated. Studies (e.g. Sorrentino 1993, 1995, 2000, and Martin, 2000) on how some selected countries compare in their unemployment statistics admit that achieving a complete harmonization of the statistics is very difficult to achieve and impossible, in most cases. Even when using a single form of survey such as the European labour force survey, it is identified that "perfect comparability among countries is difficult to achieve" (Eurostat, 2003). Besides, the conceptual approaches on measurement adopted by the statistical organizations may have evolved considerably over many years; for example, those of the US BLS prior to 1994 and after. It is, therefore, not straightforward making a meaningful overall comparison of the unemployment statistics affecting a considerable number of countries.

(3) **Different coverage areas**: The statistical offices of organizations, (e.g. ILO, OECD, and Eurostat) and the individual countries' statistical offices provide labour statistics relating to their respective statistical jurisdictions. While each organization is interested in providing comparable international labour statistics for the catchment area or countries, their statistical objectives are not completely intersecting despite the fact that they are more converging than

[56] For example, 15 years lower bound or 16 and whether we should apply an upper bound or not, e.g. the countries' retirement age or a standard age for all countries such as 64 years or 75 years.

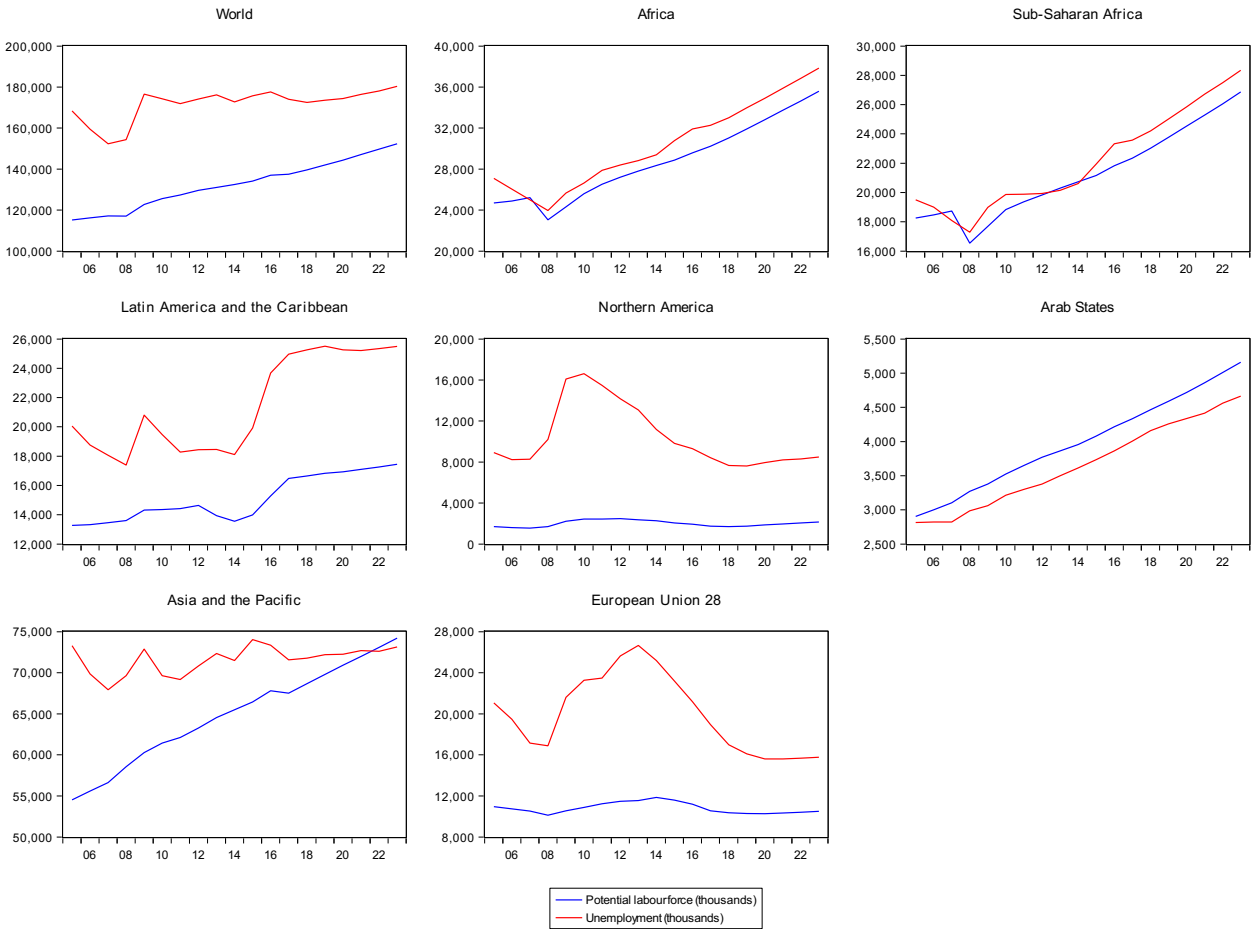
diverging. Needless to say, the objectives of the statistical offices are not the same based on differing coverage, scope, and number of countries. Stated differently, while Eurostat may be interested in the unemployment situation among European countries, the OECD is similarly interested in its member-countries and likewise for the ILO.

Global trends in unemployment

The number of persons in unemployment remained largely flat around 170 million on average since 2005 for the world while the number of potential labour force increased marginally globally from about 115 million to 140 million in 2018, projected to be above 150 million by the year 2023. The patterns, however, are heterogenous across geographical regions. While the number of persons in unemployment was around 70 million for Asia and the Pacific on average, the number of the potential labour force increased from about 55 million to about 69 million in 2018 and projected to be about 75 million by year 2023 for the same region (Figure 4. 3). For Africa, the number of unemployment fairly matched the potential labour force increasing only steadily from 27 million to 33 million and projected to be around 38 million by the year 2023 whereas the latter increased from about 25 million to 31 million in 2018 and projected to increase to about 36 million in 2023. Although we do not have enough longitudinal data preceding the recent economic crises of 2008, we note that the trends in world's unemployment and among the regions especially in Europe and Northern America and to some extend in Latin America and the Caribbean were clearly impacted by the crises. This was not so for Africa and Arab States but slightly so for Asia and the Pacific. The impact of the crisis on the potential labour force followed similar pattern for those regions whose unemployment were exacerbated during crisis. The unemployment and the potential labour force rather decreased for Africa and Asia and the Pacific during those times. The fact that the global downturn did not severely impact Africa and Arab States may imply more structural forces influencing the unemployment and the GDP growth perhaps in those regions than factors

connected with the business cycle. Apart from Europe and Northern America, the trends for the rest of the world's regions as well as the world average show that the potential labour force followed an increasing trend generally since 2005 and expected to remain so through 2023. For Europe and Northern America, while the unemployment increased from 2008 through 2013 and 2010 respectively, it decreased changing course in the trend from those dates through 2018 and expected to remain so through 2023. The effect, however, in these two regions show a lag in the trends of the potential labour force which reverse direction around 2014 and 2012 respectively.

Figure 4. 3 Unemployment vs the Potential labour force (World's regions)



Source: Author's elaboration based on ILO modelled estimates, ILOSTAT database, 2018.

In terms of rates, the global unemployment rate hovers around 5% since 2005.The ILO's combined

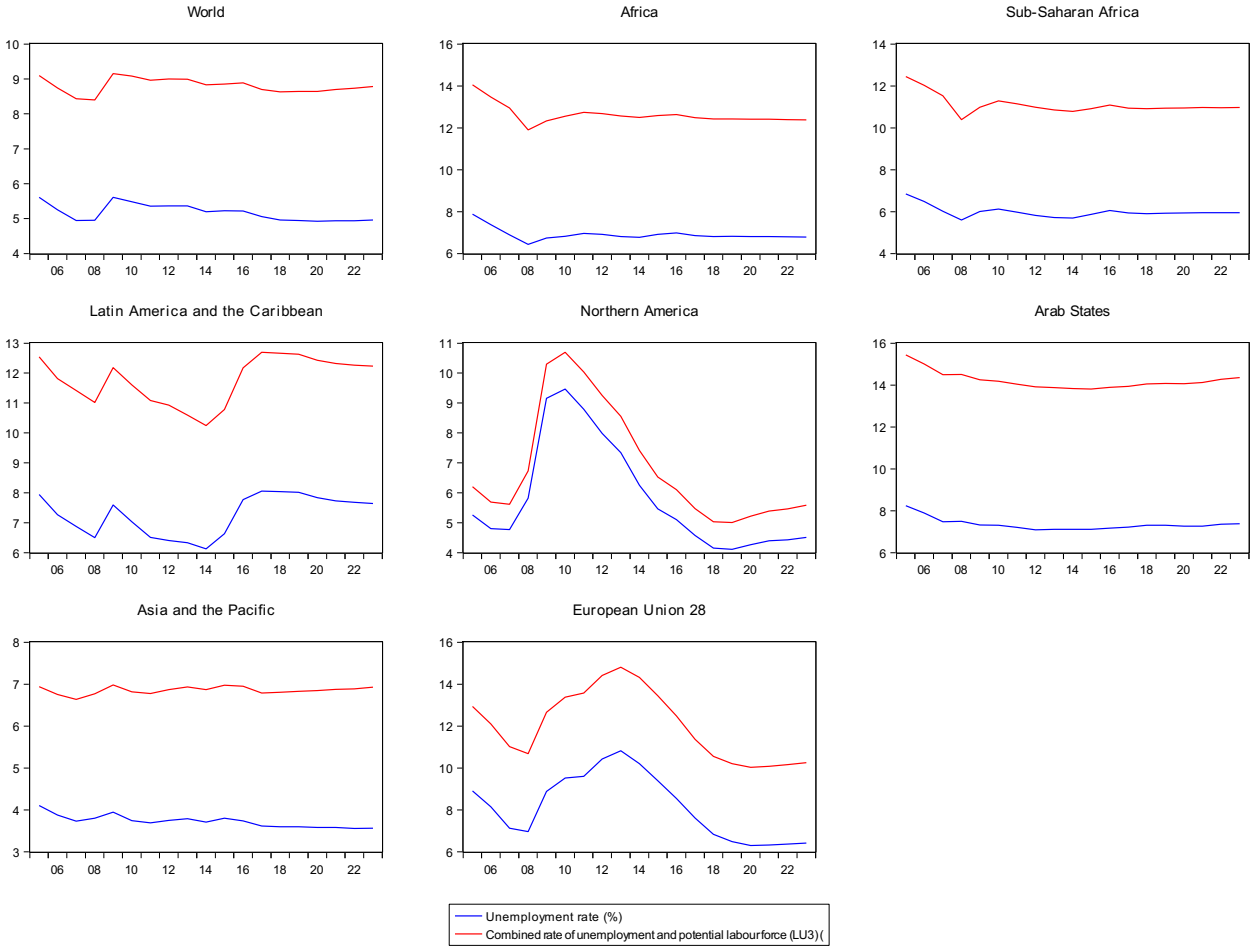
rate of unemployment and potential labour force (LU3) has been much higher, however, around 9%. For every geographical area of the world, the LU3 is clearly higher than the traditional unemployment rate (Figure 4. 4), suggesting a considerable number of people in the pool of potential labour force across the world. This is particularly so for Africa and Arab States; for instance, in 2013, the number of persons in the potential labour force for Sub-Sahara Africa was higher than the persons in unemployment (Figure 4. 3). For Europe and Northern America and less so for Latin America and the Caribbean, we could see much volatility in the movement of the two rates compared to other regions, the recent crisis having a role to play.

In low-income and developing economies, job search procedures do not usually follow a formal procedure. This reflects in making the unemployment rates among the economies relatively low. The converse is the case in high-income and developed countries. As there is higher share of regular employees in these regions, the probability that persons will engage in job search when they fall out of employment is relatively higher. This at least in part explains why the unemployment rate is most often higher in developed countries compared to developing countries. Across the world, however, there is a direct relationship between the unemployment and the potential labour force indicated by a positive relationship between the ILO's LU1 and LU3[57] (Figure 4.4b).

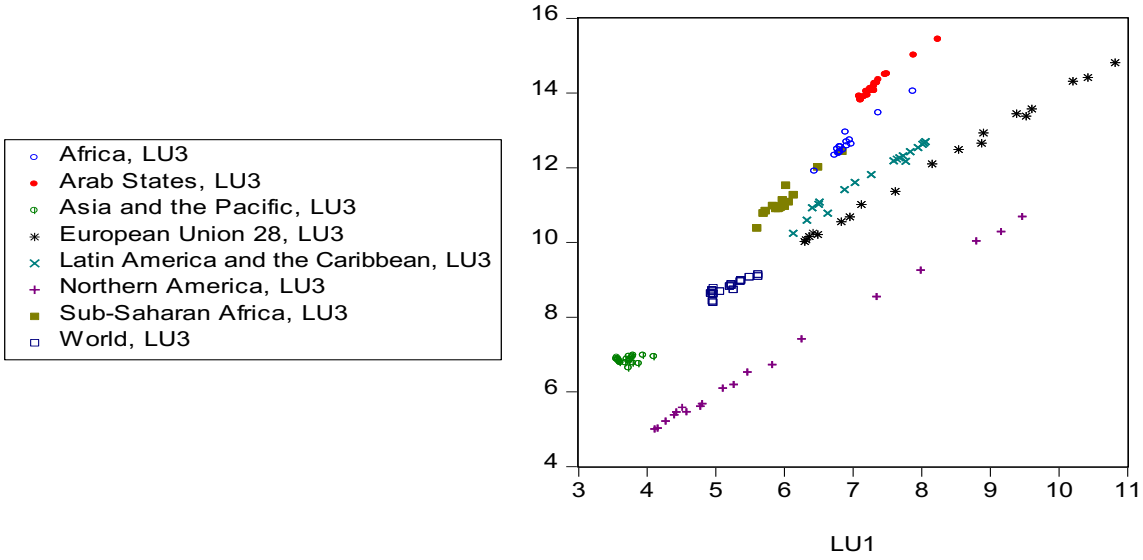
Figure 4. 4 Unemployment rate vs combined rate of unemployment and potential labour force, world's regions

a. Trends in LU1 and LU3, world

[57] The LU1 measure is equivalent to the conventional unemployment rate while LU3 is a broader group encompassing persons in unemployment plus potential labour force, discussed in the introductory chapter.



b. Plot of LU3 rate vs LU1 rate



Source: Author's elaboration based on ILO modelled estimates, ILOSTAT database, 2018.

Labour underutilization using the LU4, the broadest rate adopted by the ILO

When we use the broadest rate of labour underutilization adopted by the ILO to assess the world's unemployment situation using publicly available data, principally ILO and World Bank data, we could analyze the determinants of the ILO's broadest rate of extended unemployment, the LU4 rate mentioned in the introductory chapter. We make use of ILO modelled estimates of the ILO as much as possible when they are available. We explore over 100 variables in our dataset looking out for correlations with our dependent variable, unemployment in its extension (i.e. the LU4 rate), having conducted preliminary checks on the dataset.

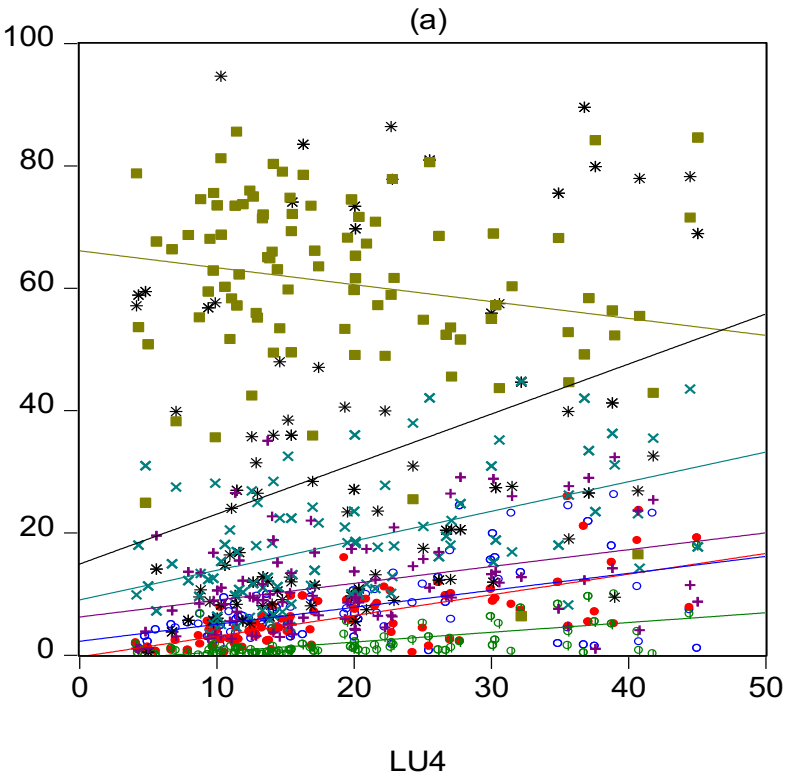
Table 4. 2 Correlation between variables

	LU4	LU1	TRU	DISC	VE	YNEET	EDUBAS	LFPRF
LU4	1.0000	0.4374	0.6722	0.5989	0.3610	0.4948	0.2899	-0.2133
LU1	0.4374	1.0000	-0.0313	0.2142	-0.3448	0.2475	0.7644	-0.2705
TRU	0.6722	-0.0313	1.0000	0.2837	0.4111	0.1527	-0.1484	-0.1538
DISC	0.5989	0.2142	0.2837	1.0000	0.3192	0.4505	0.1417	-0.0807
VE	0.3610	-0.3448	0.4111	0.3192	1.0000	0.4562	-0.4735	-0.1171
YNEET	0.4948	0.2475	0.1527	0.4505	0.4562	1.0000	0.0326	-0.5894
EDUBAS	0.2899	0.7644	-0.1484	0.1417	-0.4735	0.0326	1.0000	-0.0469
LFPRF	-0.2133	-0.2705	-0.1538	-0.0807	-0.1171	-0.5894	-0.0469	1.0000

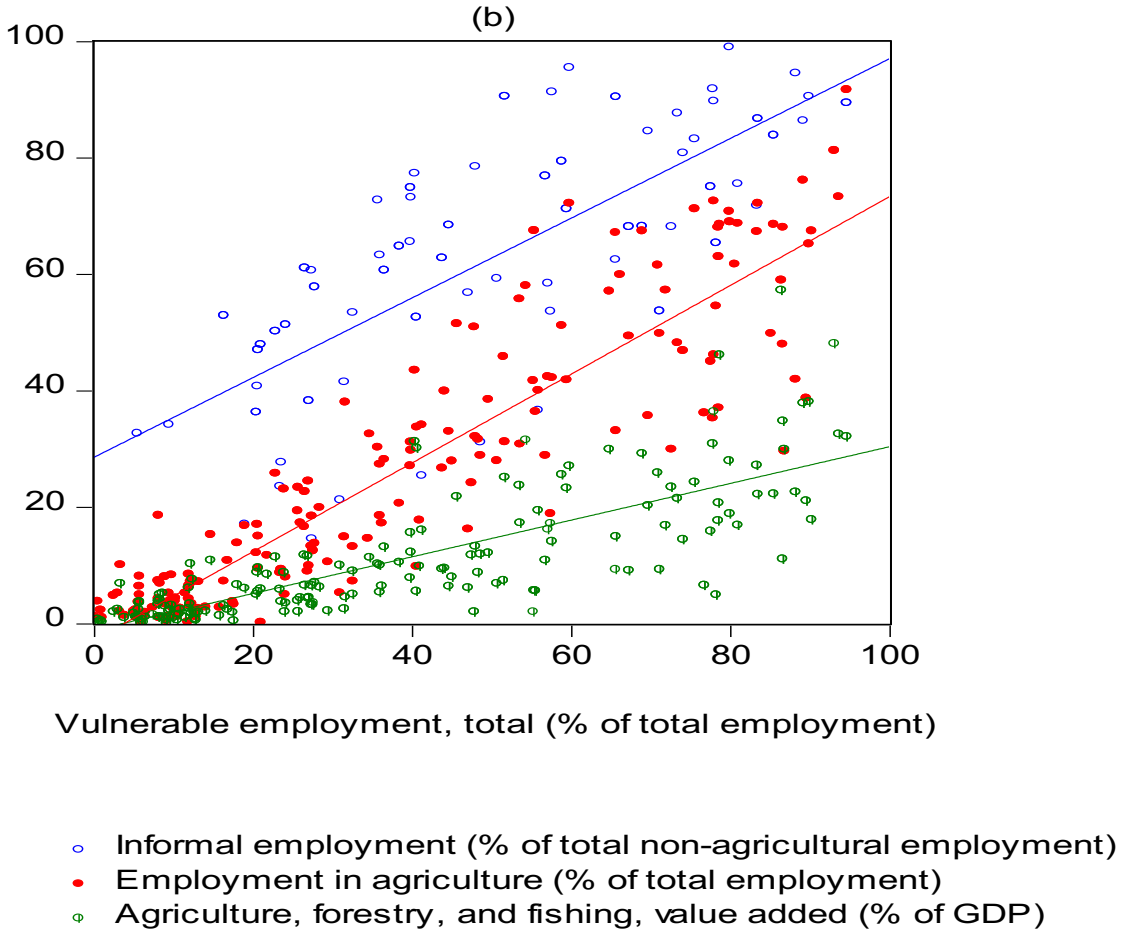
Source: Author's elaboration on ILO modelled estimates, ILO 2018

From a careful study of the literature, LU4 determined by the traditional unemployment rate (LU1), time-related unemployment (TRU), job-seeker-discouragement as a share of the extended labour force (DISC), vulnerable employment as a share of total employment (VE), share of youth not in education, employment or training (NEET), unemployment with basic education as a share of total labour force with basic education (EDUBAS), and the female labour force participation rate as a share of the female population aged 16 to 64 (LFPRF, Figure 4.5).

Figure 4. 5 Relationship between the LU4 and its determinants



- Unemployment (% of total labor force)
- Time-related underemployment rate (%)
- Discouragement as a share of the extended labour force
- Vulnerable employment (% of total employment)
- Share of youth not in education, employment or training, NEET
- Unemployment with basic edu (% of total labor force with basic edu)
- Labor force particip. rate, female (% of female population aged 16 to 64)



Source: Author's elaboration on ILO modelled estimates, ILO 2018

As we mentioned in the introductory chapter, the measurement of unemployment is not spared from the classical problems that confront the measurement of typical social concepts based on a survey sampled over a given period. For analysis of a social concept such as unemployment, policies and programs across the individual countries over time will influence the analysis. The challenge is that the variable we seek to study, LU4, is not available at sufficient span and for many of the developing countries where labour is most often underutilized. The same is true for time-related underemployment, discouraged workers, etc. This constrains verifying to what degree a broader measure as the U6 of the United States' or the Hauser's LU4 adopted by the ILO (equivalent to the US U6 rate) can be produced for the countries. Also, it would be interesting

tracking down the dynamics in our observations with respect to LU4. However, we not able to do so neither are we able to adopt, for example, a panel fixed-effects model, due to data unavailability. While the data is contiguous for LU1 and VE for the countries, it is not so for TRU, DISC, and the LU4. We take averages of the variables therefore to obtain cross-sectional observations. Where available, we take 5-year averages of the data variables, e.g. LU1 and VE for each country. However, since they are not available in a contiguous form for LU4, TRU, DISC, YNEET, EDUBAS, and LFPRF, we take between one- and five-year averages of the variables depending on their availability. We arrive at data for 82 cross-sections among the countries with data available. In applied work, predictor variables of a model could be correlated among themselves, a familiar problem known as multicollinearity. When we perform a test of multicollinearity using the variance inflation factor approach selecting the popular benchmark of 5 in our test, we reject multicollinearity among our explanatory variables (Appendix 4.1).

Table 4. 3 Model estimation

Dependent Variable: LU4
Method: Least Squares

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-9.560169	3.81766	-2.504196	0.0145
LU1	0.539008	0.146155	3.687906	0.0004
TRU	1.136906	0.107136	10.6118	0.0000
DISC	0.653923	0.199821	3.272538	0.0016
VE	0.065385	0.029688	2.202447	0.0307
YNEET	0.270058	0.081489	3.314054	0.0014
EDUBAS	0.255689	0.103993	2.458712	0.0163
LFPRF	0.10677	0.044899	2.378013	0.0200
R-squared	0.839586	Mean dependent var		19.89748
Adjusted R-squared	0.824412	S.D. dependent var		10.4027
S.E. of regression	4.359064	Akaike info criterion		5.874859
Sum squared resid	1406.106	Schwarz criterion		6.109661
Log likelihood	-232.8692	Hannan-Quinn criter.		5.969129
F-statistic	55.32962	Durbin-Watson stat		2.165947
Prob(F-statistic)	0.0000			

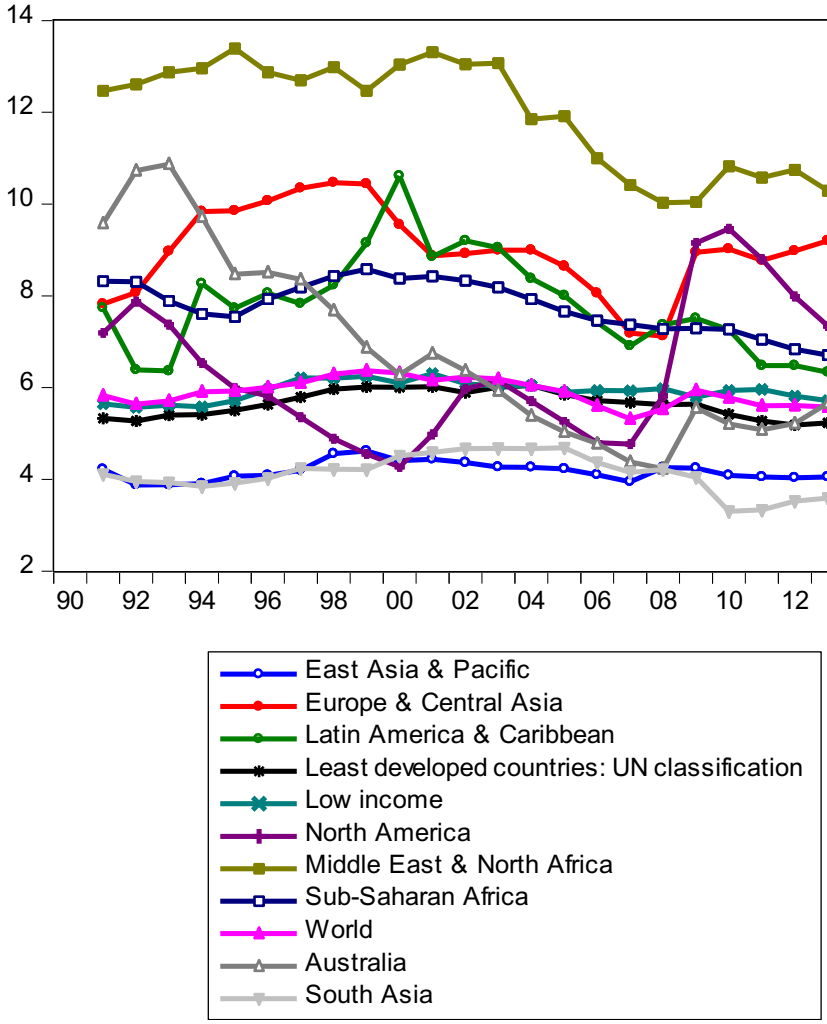
Source: Author's calculations based on ILO modelled estimates 2018

With 82 observations, our OLS estimates indicate a significant positive relation between U6 and our explanatory variables, namely, U3, time related underemployment (TRU), worker discouragement (DISC), vulnerable employment (VE), the share of youth not in employment, education, and training (YNEET), basic education (EDUBAS), and the women labour force participation rate of active age, i.e. from 16 to 64 (LFPRF). Specifically, a percentage increase in LU1, TRU, DISC, VE, YNEET, EDUBAS, and LFPRF cause 0.54%, 1.14%, 0.65%, 0.07%, 0.27%, O.26%, and 0.11% increases respectively of the unemployment in its extension. Though not the best model in terms of sophistication due to data challenges, our results present a compact summary of the trends in the relevant indicators provided in the ILO statistics that enables us to explain the determinants of LU4.

A note on the labour underutilization in the least developed countries

The ILO statistics include statistics by countries' income groupings and regional aggregates. Using the ILO statistics by aggregates confirms the limitation of using the LU1 rate only to assessing the labour slack which we mention many times in the study. Using graphical support, we find that the unemployment rate for a number of the countries in Europe exceed the world's average, the low-income countries' average including the least developed economies' average (by the UN classification) and Sub-Sahara Africa's average (Figure 4.6).

Figure 4. 6 Traditional unemployment rates, groups



Source: Author's elaboration based on International Labour Organization, ILOSTAT database, 2018.

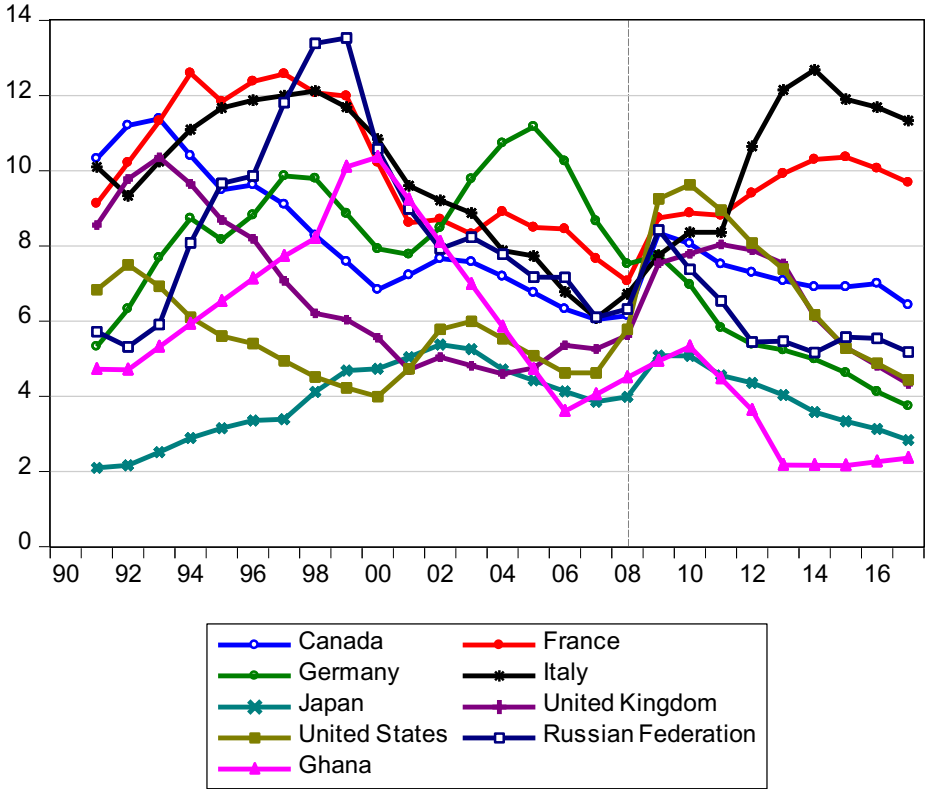
This attests to the fact that the problem of worker discouragement is less among developed countries compared to the developing. In least development regions, a chunk of labour is engaged in agriculture. Questions are raised on whether persons in peasant forms of production are "really" in employment or not. With the ILO's criterion of at least one-hour work, many countries account for persons engaged in these areas where marginal employment persists as working but, a considerable number only offer a hand in family in such engagements and not contributing labour services to commercial production. To many of them, they would be happy to embrace

opportunities that enables them to channel their labour services to non-family enterprises if such opportunities were available. In this sense, the vulnerable forms of employment most often in the informal sector tend to confound the unemployment statistics. Like the cases of Spain and Italy, this is worse in low-income and developing countries[58]. In other words, the number of persons in precarious marginal jobs and the worker discouragement are way less for developed countries than developing countries. Once again, this is partly blamed on lack of access to job searching infrastructure in those regions. Little wonder after a decade of the recent global economic crisis in 2008, the unemployment rate of low-income economies, e.g. of Ghana for instance, has been lower than some of the most advanced industrialized countries of the world, particularly the G7 economies including Russia, a former member. But for persons conversant with the Ghanaian economy, it is obvious that the joblessness situation of the country is way more severe[59]. many

[58] To refresh our memory, we mentioned in the introductory chapter that many people (over 87% of youths) in Italy and Spain engage in marginal jobs and family businesses, and this makes it tricky counting those persons as in employment where in fact they see themselves as unemployed.

[59] See https://www.ghanaweb.com/GhanaHomePage/NewsArchive/Over-15-000-queue-for-500-Immigration-Service-jobs-614551 for idea about the dire unemployment situation in Ghana, like several developing countries.

Figure 4. 7 Traditional unemployment rates, countries



Source: Author's elaboration based on ILOSTAT database, ILO 2018

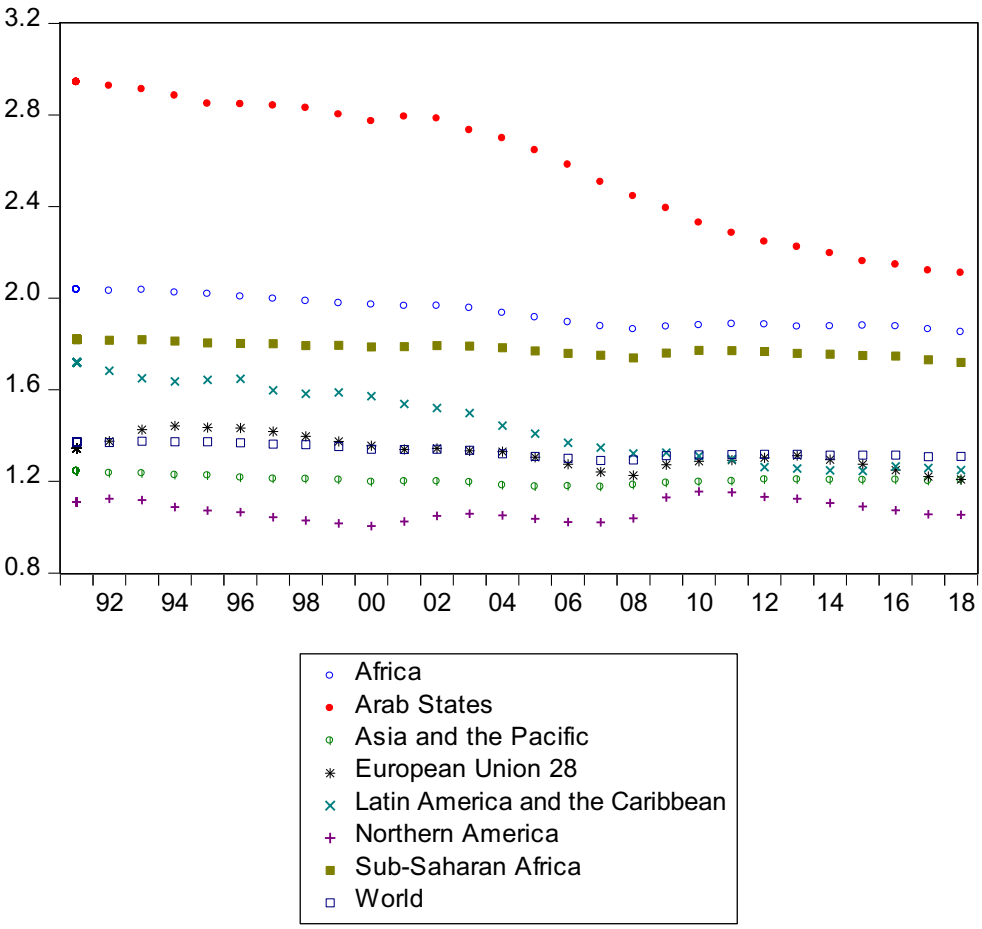
Complementary statistics of the ILO

One could complement the statistics with additional statistics like the ILO's labour dependency ratio[60] "harmonized to account for differences in national data and scope of coverage, collection and tabulation methodology as well as for other country-specific factors" (according to the ILO definition of the statistic). In communities of Africa, Arab States and the Americas where a chunk of the population are children or youths, the dependency burden of the employed is high and the plight of the working poor way more severe compared to the developed country counterparts of

[60] Labour dependency ratio is the ratio of dependents to total employment. The ILO defines it as the ratio of dependents (persons aged 0 to 14 + persons aged 15 and above that are either outside the labour force or unemployed) to total employment. See the ILO estimates and projections methodological note https://ilostat.ilo.org/resources/methods/ilo-modelled-estimates/

Europe, North America and Australia. On a global level, the labour dependency ratio (LDR) at 1.3 is not much informative. Exceeding 2.0 for many African countries particularly in the North of the continent as well as many countries in the Middle East (e.g. 4.12 for Lower-middle income Arab States), the LDR is useful for providing idea on the number of livelihoods (or proportions of persons) dependent on the labour incomes of working persons in the world's geographical areas. The LDR is particularly high in Africa, the Arab States and Latin America and the Caribbean but low in Northern America, Asia and the Pacific and Europe, linked to the findings above of a positive relationship between vulnerable forms of employment and unemployment in its broadness.

Figure 4. 8 The labour dependency ratio for the world and its regions



The ILO's age dependency ratio[61] (of persons < 15 or > 64 years) including its young age dependency ratio (i.e. of persons <15 years) and old age dependency ratio (persons > 64 years) provided in percentage of working-age population (i.e. of ages 15 to 64) are intended also to add richness to the analysis when assessing the degree of strain on the labour income by its dependents. As poverty is more of a household phenomenon than at the individual worker's level, supplementary indicators such as this is useful for evaluating the severity of the economic conditions within a given geographical area. A similar metric could be, for example, the *poverty line*, which could be estimates of people leaving below a certain dollar mark as practiced by the UN and in ILO statistics or, for instance, persons below 60% of the median income across a certain geographical region. The statistics[62] on the working poverty rate under sustainable development goals of the United Nations accepted by the ILO achieves this result. If the overall goal is on improving the economic welfare, the quality of employment and traits such as the degree of labour utilization, the degree of skill utilization per worker, one's level of job fulfillment which comes from participating in a satisfying job role all contribute in satisfying one's need for achievement which usually fall under the tenets of social goals. These goals form part of the broader set of goals

[61] Per ILO definitions, the age dependency ratio is the ratio of dependents to the working-age population. Age dependency ratio, young, is the ratio of younger dependents - people younger than 15 - to the working-age population, i.e. of ages 15-64 while age dependency ratio, old, is the ratio of older dependents - people older than 64 - to the working-age population. Data are given as the proportion of dependents per 100 working-age population.

[62] See, for example, https://ilostat.ilo.org/data/#summarytables or https://www.census.gov/data/tables/time-series/demo/income-poverty/historical-poverty-thresholds.html relating to the United States.

specified in the ILO standards relating to work dubbed "the rules of the game[63]" in its centenary edition of 2019 intertwined in goals set in the United Nation's "sustainable development goals (SDGs)" which are targets looked forward to be achieved by the year 2030 after goals of its predecessor dubbed millennium development goals that were targeted for 2015. These goals constitute an important overlap between economic and social goals as the achievement one set of goals reinforces the attainment of the other. The statistics on additional indicators such as these provide essential complement to the labour underutilization, particularly for the developing countries where much of the data is lacking.

Conclusion to the chapter

Unemployment reduction is one of the most promising ways of improving the global standard of living besides increasing the economic growth. Data challenges, however, continue to confront the ILO statistics as a complete harmonization is yet to be achieved. With the available data, we find that the hidden unemployment in the world has a direct association with open unemployment; and, a considerable number is hidden in the global unemployment, implying that the total labour utilization is way below its potential particularly for developing economies where the worker discouragement is high. It is time data on job-seeker discouragement relating to the world's populous countries, namely China and India, is made available even if this requires redesign of the labour force survey of the world's countries. The ILO should play its usual role in this in ensuring the availability of completely harmonious global statistics on worker discouragement. Absent proper legislation, labour law enforcement, (adequate) social protection, unemployment benefits and proper labour programs results in many marginal forms of employment and massive labour

[63] See Rules of the game: An introduction to the standards-related work of the International Labour Organization International Labour Office, Geneva, 2019.

underutilization in the labour abundant areas of the world in Africa and Asia where a considerable number of the world's labour resources reside. Reducing global poverty demands tapping more effectively into the full labour potential which remain largely underutilized in underdeveloped countries and regions of the world and also for the developed countries. This will do more to reducing forms of vulnerable employment in the world.

CHAPTER V

Underemployment among European countries

The Statistical Office for European communities (Eurostat) draws on ILO guidelines for labour statistics among European countries. To aid international comparability, Eurostat computes unemployment rates from harmonized labour force surveys. The labour slack in its extension is estimated at 18% in 2017 about double the traditional unemployment rate that year (at 9.5%), linked to subdued wage growth in the euro area from the recent economic crisis, according to recent estimates of the European Central Bank (ECB). The report adds that while about 3% of the working age population work less hours than they would like to, 3½% represent marginally attached labour, despite post-crisis (employment) recovery in more countries and sectors (ECB, 2017).

According to 2016 Eurostat estimates, about 225 million persons are in employment while a little over 20 million are unemployed among the 28 countries in the European Union altogether (EU28). Over 11 million more other persons represent a pool of potential available labour supply divided between persons who are available but not presently seeking employment (8.8 million) and persons seeking but not presently available for employment (2.3 million). Of about 425 million persons of working age, about 245 million are in the labour force while 180 million are inactive. Inactive persons do not belong to the unemployed neither do they belong to persons in employment. Among persons in employment, there are 9.5 million persons who work part-time not because that is their preferred working hours but due reasons that are involuntary. In ILO concepts, they constitute the "underemployed part-time" workers or workers who are "employed part-time for economic reasons" in the United States Bureau of Labour Statistics concepts.

Table 5. 1 The unemployment statistics for EU28 (for 2016)

	European Union (28 countries) (thousand)
Employment	224173.2
Unemployed	20939
Labour Force	245112.2
Persons available to work but not seeking	8784
Persons seeking work but not immediately available	2271
Underemployed part-time workers	9490
Active persons 15 years and above	245092.1
Potential additional labour force	11055
Extended labour force	256167.2

Source: Author's elaboration based on Eurostat data, 2017

The labour force participation rate in 2016 was 58% while the remaining 42 constitutes labour inactivity. By gender, the participation for men is higher at 70% for men than 59% for women. This implied that the rest of the males and females working age population accounting for the remaining 30% and 41% respectively were inactive that year. In 2015, 24% of the population in the EU-27 were deemed at risk of poverty or social exclusion and 24% of same in 2018[64] according to Eurostat estimates.

In a fashion similar to our study in the previous section, if we call the traditional unemployment rate LU1 (equivalent to the U3 rate of the United States labour statistics) and unemployment in its extension, i.e. Hauser's LU4 (equivalent to the US BLS' U6) to be consistent with the names of indicators used in the Hauser's underutilization framework, the gap between the LU1 and the LU4 composes of underemployed part-time employees, persons available but not seeking (discouraged) as well as other persons seeking but not immediately available (a.k.a. other marginally attached to

[64] See https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Interaction_of_household_income,_consumption_and_wealth_-_statistics_on_main_results#Income.2C_consumption_and_wealth_indicators

the labour force in the terms of Eurostat statistics[65]). These are three supplementary indicators to the unemployment rate announced in 2010, and having traits of the unemployed, are not classified as unemployed (De La Fuente, 2011). Eurostat provides its statistics on "underemployment and potential additional labour force statistics[66]" for the countries at levels, with the goal of identifying additional potential labour force attached to the economically active population at the core of the labour statistics. However, the statistics that would enable a curious person to estimate the extent of underutilized labour for the countries in a fashion, for example, of the United States' for the countries are available from the time coinciding with the last global recession in 2008.[67]

The 18th ICLS in 2008 of the ILO[68] defines unemployment with respect to the employed and a short hour duration of at least one-hour. In one eye-opening ILO report based on some cross-sections from 2003 to 2006, if the one-hour criterion in its definition of the duration for one to engage in work to be classified as in employment is adjusted to ten for analytical purpose, it finds higher changes in the unemployment rate among the European countries (from 1.2 percentage points to 1.5 percentage points) than among the non-European countries (from 0.1 percentage points to 0.8 percentage points). Among five European countries in the study (i.e. the Netherlands, Norway, Romania, Switzerland and the United Kingdom), four of them (namely the Netherlands, Norway, Switzerland and the UK) record the greatest percentage changes in unemployment rate,

---

[65] Persons underemployed part-time outnumber discouraged jobseekers while unavailable jobseekers constitute the smallest group in the statistics of unemployment in its extension.

[66] See http://ec.europa.eu/eurostat/statistics-explained/index.php/Underemployment_and_potential_additional_labour_force_statistics

[67] See Appendix 5.1 for dispersion of the measures of labour underutilization for European countries.

[68] See ILO, 2009 at http://www.ilo.org/wcmsp5/groups/public/---dgreports/---stat/documents/meetingdocument/wcms_100652.pdf. Also see Appendix 5.2.

using the new ten-hour benchmark rather than the traditional one-hour rule (ILO 2008). This tells us about some inadequate employment situation on the continent.

Based on the above, we compute broad unemployment estimates in rates for each country, including aggregate estimates for the 28 countries in the European Union (including the United Kingdom) as well as the 19 countries of the eurozone (Table 5. 2) to track down the total labour slack in Europe. We find considerable gaps between the traditional unemployment rate and unemployment in extension among the countries, exceeding the traditional unemployment rate itself in many occurrences.

Table 5. 2 The gap between U6 and U3 for European countries

		Year 2008			Year 2009			Year 2016		
Code	Country	U3	U6	U6-U3	U3	U6	U6-U3	U3	U6	U6-U3
EU28	European Union (28 countries)	7.00	13.80	6.81	8.90	16.00	7.10	8.54	16.19	7.65
EA19	Euro area (19 countries)	7.54	14.88	7.34	9.59	17.01	7.42	10.01	18.39	8.37
AUT	Austria	4.13	11.24	7.12	5.30	12.78	7.47	6.01	14.00	7.99
BEL	Belgium	6.97	9.74	2.78	7.92	10.82	2.91	7.84	13.41	5.57
BGR	Bulgaria	5.67	11.92	6.25	6.87	13.86	6.99	7.57	14.22	6.65
HRV	Croatia	8.57	15.22	6.65	9.29	16.51	7.22	13.35	23.59	10.24
CYP	Cyprus	3.77	7.41	3.64	5.43	9.66	4.23	12.95	24.31	11.36
CZE	Czech Republic	4.40	5.82	1.42	6.66	8.34	1.68	3.96	5.53	1.56
DNK	Denmark	3.42	7.78	4.36	6.01	11.47	5.47	6.18	14.93	8.75
EST	Estonia	5.48	-	-	13.54	-	-	6.80	12.76	5.97
FIN	Finland	6.36	13.33	6.97	8.25	15.88	7.63	8.83	19.13	10.30
FRA	France	7.56	14.42	6.85	9.27	16.38	7.11	10.06	18.18	8.13
DEU	Germany	7.26	16.03	8.77	7.45	15.36	7.91	4.12	9.64	5.52
GRC	Greece	7.76	10.92	3.16	9.62	13.31	3.69	23.54	31.21	7.67
HUN	Hungary	7.81	11.80	3.99	10.03	15.46	5.43	5.12	8.83	3.71
IRL	Ireland	6.99	-	-	12.92	19.49	6.57	8.80	15.12	6.31
ITA	Italy	6.72	17.53	10.80	7.75	18.35	10.60	11.69	24.36	12.67
LVA	Latvia	7.70	14.29	6.59	17.52	27.70	10.17	9.61	16.65	7.03
LTU	Lithuania	5.81	10.77	4.96	13.81	18.78	4.98	7.85	10.76	2.91
LUX	Luxembourg	4.71	6.06	1.36	5.24	12.75	7.51	6.46	14.45	7.99
MLT	Malta	5.93	8.79	2.86	7.00	9.80	2.80	4.48	6.44	1.96
NLD	Netherlands	3.57	7.95	4.38	4.24	8.86	4.62	6.00	16.09	10.09
NOR	Norway	2.56	8.21	5.65	3.18	8.90	5.73	4.76	10.61	5.85
POL	Poland	6.87	12.27	5.40	7.89	13.33	5.44	6.16	10.70	4.55

PRT	Portugal	8.51	11.49	2.98	10.36	13.32	2.96	11.03	19.43	8.40
SVK	Slovakia	9.45	12.02	2.57	11.95	14.65	2.70	9.68	13.78	4.11
SVN	Slovenia	4.41	7.36	2.94	5.86	9.84	3.99	8.04	12.87	4.83
ESP	Spain	11.25	18.38	7.13	17.86	25.91	8.06	19.63	29.23	9.59
SWE	Sweden	6.23	13.99	7.76	8.31	16.93	8.61	6.94	13.86	6.93
GBR	United Kingdom	5.62	12.45	6.84	7.54	15.46	7.92	4.81	12.30	7.49

Source: Author's elaboration based on Eurostat data, 2017

Unemployment is downward moving for many developed nations since 2013 evident also for counties in Europe. Prior, there was increasing trends for the countries at least from 2007. Presenting a big twist after World War II, macroeconomic discussions on events following the recent global economic crisis (of the late 2000s) which took roots from the United States flood the economic literature due to its indelible impact on the world economy. While the impact permeates every continent including Europe, European country-specific crisis, e.g. European sovereign debt crisis (from 2009), the Greek government-debt crisis (from 2009), Spanish financial crisis (2008 to 2016), and the Portuguese financial crisis (2010 to 2014) may have had their indirect effect on the unemployment rate and its extension on the continent.

While there is significant heterogeneity in the unemployment rate among the countries in Europe, we see the pre-crisis unemployment levels among the countries largely restored a decade after 2008. Though a few countries (e.g. Germany, Czech Republic, Malta, Norway and the United Kingdom) had unemployment rates below 5% in 2016, we see that the unemployment rate in its broadness (equivalent to U6) for the euro area (EA19) were high above 18%, and above 16% for the countries of the European Union (EU28) looking at data for 2016. Compared to other regions, it could be said that much remain to be done for many of European countries to catch up or match with US and Japan whose U3 rates remained below 5% in 2016. Prior to 2008, all the countries had single digit unemployment rate except Spain. We see that a few (namely Czech, Denmark, Cyprus, Luxembourg, the Netherlands, Austria, and Slovenia) also had unemployment rate below

5% (Table 5.2). By estimates for 2018, we see that none of the countries had maintained a decreasing unemployment rate even through the crises and been below 5% unemployment rate, except Germany (Appendices 5.3 and 5.4). In other words, the rest of the countries had increase at least at one point through the crisis.

Based on Eurostat data available till 2016, we study the dynamics of the unemployment rate and unemployment, including its extended measure, for European countries. Keeping individual country effects (e.g. GDP growth, inflation, interest rate, etc.) exogenous, we want to understand how tight the countries' labour markets are.

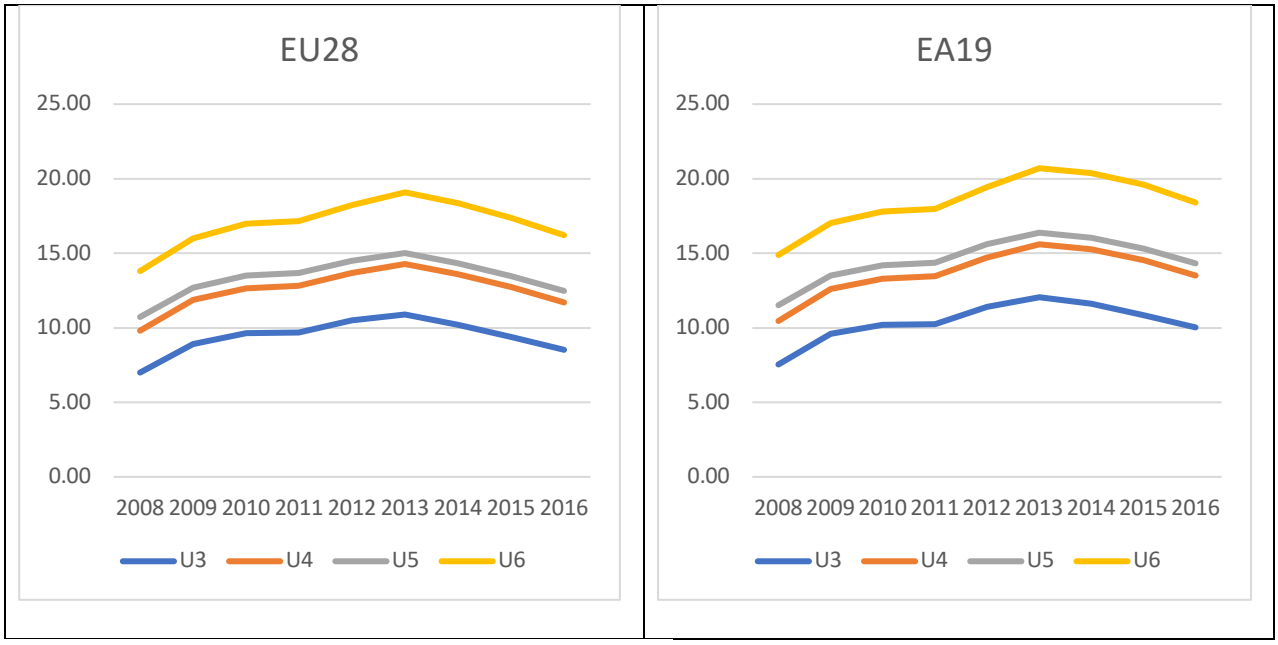
Table 5. 3 Eurostat measures of the labour market distinct groups and its relationship with the ILO

<table>
<tr><th>Eurostat indicator</th><th>ILO equivalent</th><th colspan="2">Perceived as</th></tr>
<tr><td>Employed</td><td>Employed</td><td colspan="2" rowspan="2">In the labour force</td></tr>
<tr><td>Unemployed</td><td>Unemployed</td></tr>
<tr><td>Underemployed part-time workers</td><td>Time-related underemployed</td><td>In the labour force and supplementary indicator to unemployment</td><td rowspan="3">"Halos" around the labour force</td></tr>
<tr><td>Persons seeking work but not immediately available</td><td rowspan="2">Potential labour force</td><td rowspan="2">Supplementary indicators to unemployment, not in the labour force</td></tr>
<tr><td>Persons available to work but not seeking (mainly discouraged)</td></tr>
<tr><td>---</td><td>Other economically inactive persons – persons who want employment, not seeking and not available) – also Potential labour force</td><td>---</td></tr>
</table>

Source: Author's elaboration

A visual analysis of the U3 rate indicates that unemployment increased from 2008 to 2013 but decreased from 2013 to 2016 for the countries. We observe that countries with higher U3 in 2013 had higher decrease in unemployment in 2016, with countries having U3 rate above 15% in 2013 recording even the most remarkable decrease by 2016 (Appendix 5.3).

Figure 5. 1 Trends in unemployment (EU28 and EA19)

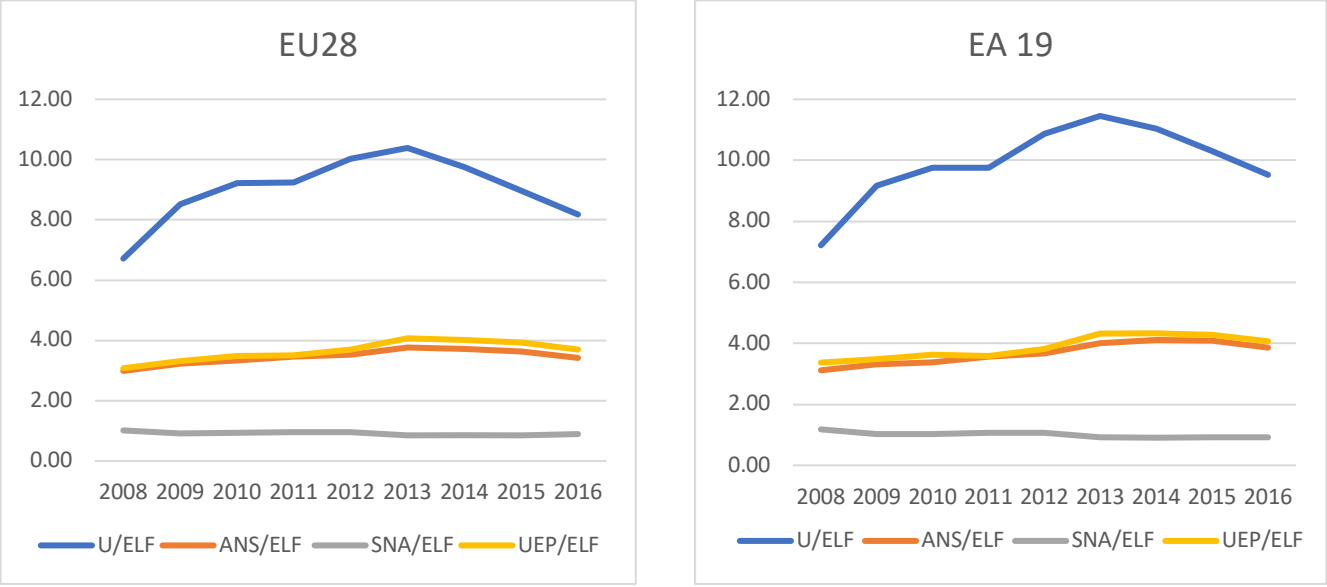


Source: Author's elaboration based on Eurostat data

The measures closely move together in like manner; increasing from around the period of the crisis in 2008 to 2013 and decreasing moderately afterwards for EU28 and EA19. The estimates, including the gap between the broadest and the narrowest (i.e. the difference between U6 and U3), however, are slightly higher for EA19 than EU28 through the period. But since the variables do not have the same denominator, we plot the time series for U3 together with ANS, SNA and UEP (the variables that make up the difference between U6 and U3) for EU28 and EU19 as a share of ELF to see how they move together. ANS and UEP as shares of ELF closely move together and they are high above SNA as a share of ELF. U as a share of ELF has grown the most over the period but has been on the downside since economic recovery in 2013. Like the U's, the variables

(as percentage of ELF) roughly move together over the pre- and post-recovery period and are slightly higher for the euro area 19 countries taken together (EA19) than for the composition of Europe before Brexit (EU28) taken together. However, the cross-country estimates of the measures are diverse and the size of the difference between the broader measures and U3 vary unsystematically from country to country.

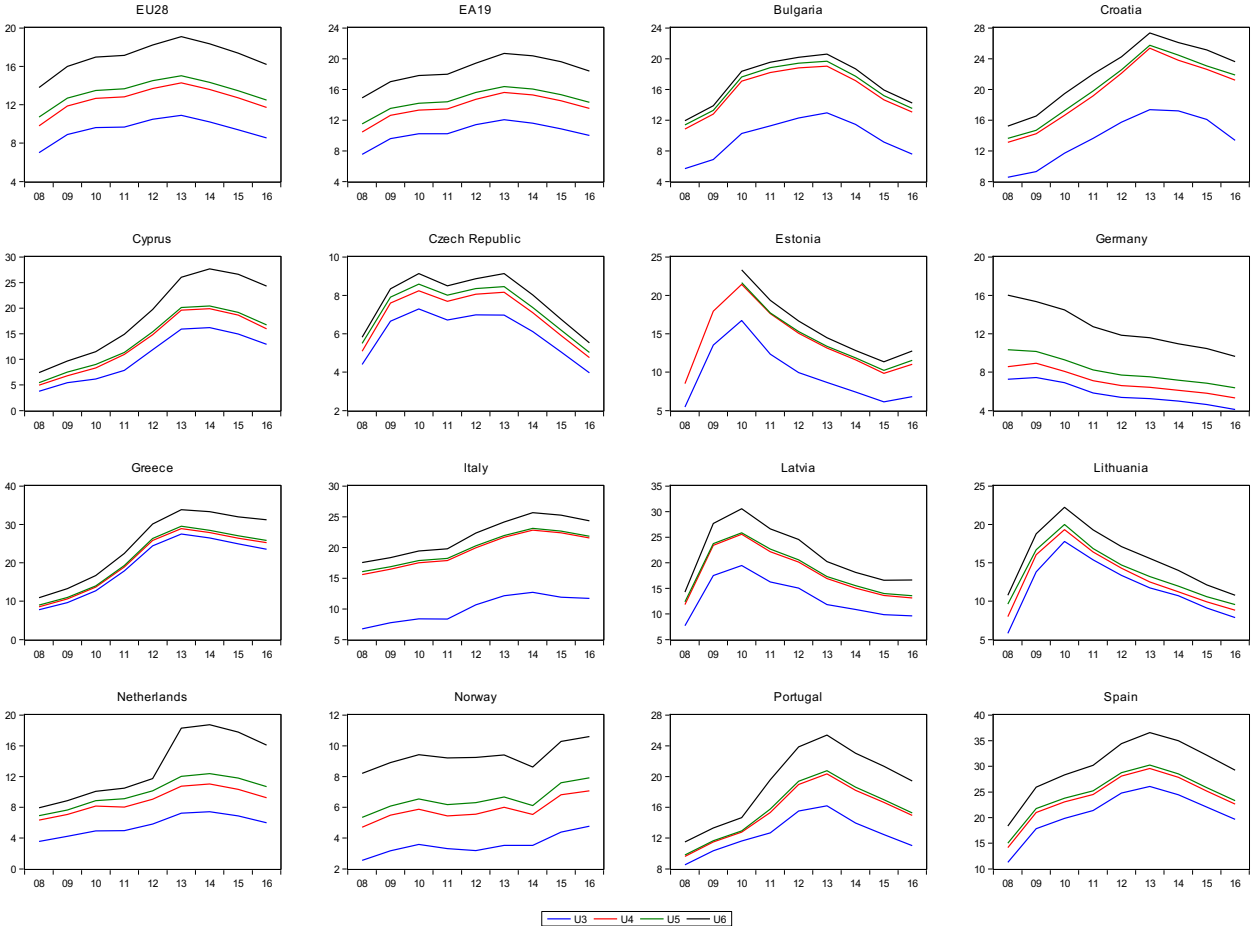
Figure 5. 2 Time series of U, ANS, SNA and UEP (% of ELF)



Source: Authors calculations based on Eurostat data

Exploring the time series of the variables enables us to have a visual understanding of their movement over time. Since the determinants of U3 and U6 overlap, the factors that affect the traditionally measured unemployment rate will affect unemployment in its broadness as increases in U3 correspond with increases in U6. This is seen in the data – the gap between U6 and U3 has increased for all the countries from 2008 through the crisis through 2016, apart from Germany which decreased and the Czech Republic and Norway which remained largely flat.

Figure 5. 3 Movements in the rates among some European countries

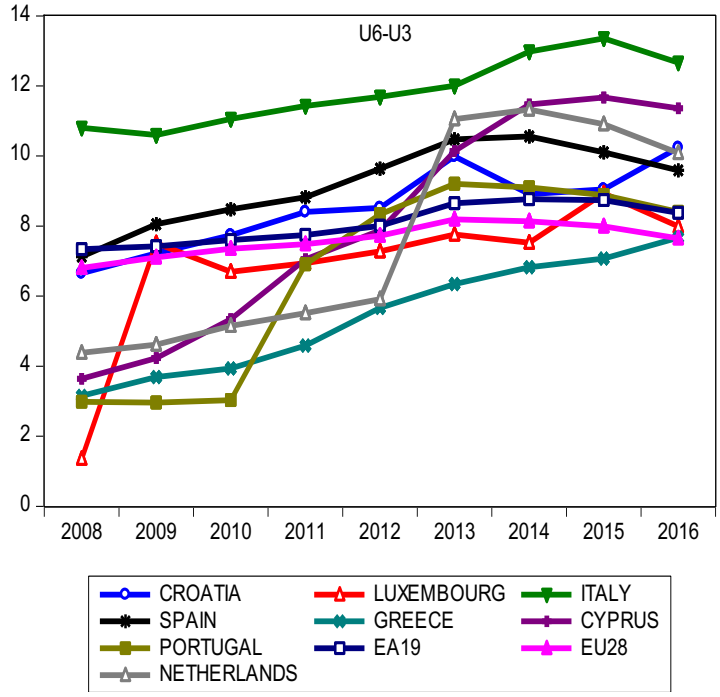


Sources: Author's elaboration using Eurostat data, 2017 (See Appendix 5.4 for equal axis scale).

While the standard U3 rate, the potential available labour force, the female activity rate, and the employment in services may influence the gap between the U3 rate and the U6 rate, we do not overrule the effect of the business cycle, country legislation, the structural shifts in the composition of economic production, as well as idiosyncratic factors. For example, it should not be surprising that Greece has a higher U3, U6 and U6-U3 gap than Germany looking at the different economic situations of both countries. They, in fact, have differing and opposite movement in all three variables. The gap between U6 and U3 while moving downwards or flat for Czech Republic, Germany and Malta (Table 5.2 and figure 5.3), is on the surge for Greece, Spain and Italy. The

gap between U3 and broader measures including U6 through the period is higher for Italy than any other country in Europe. The national circumstances of the individual countries must indeed have a role to play.

Figure 5. 4 Increasing U6-U3 gap among some of the countries



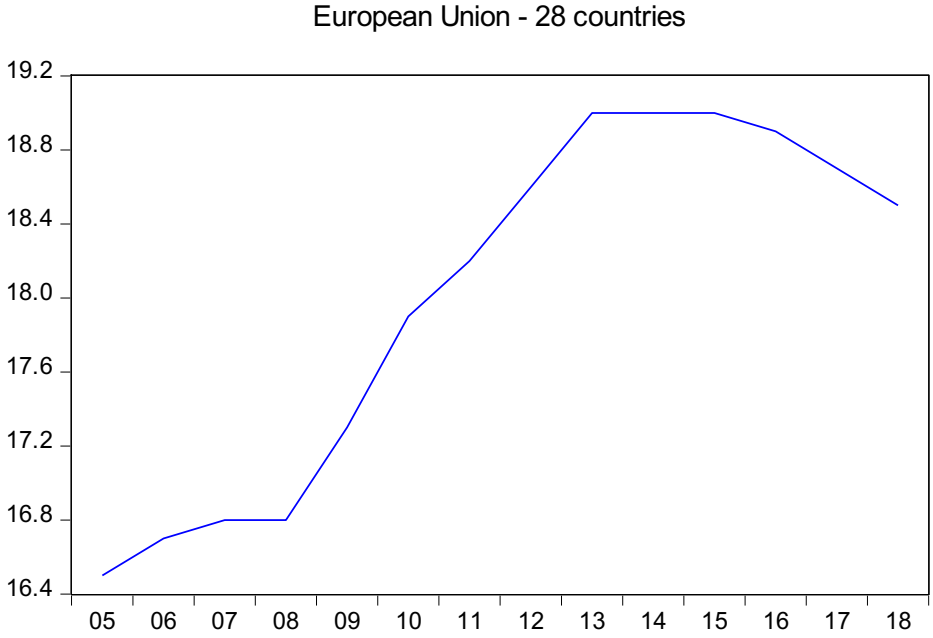
Sources: Author's elaboration using Eurostat data.

Part-time employment

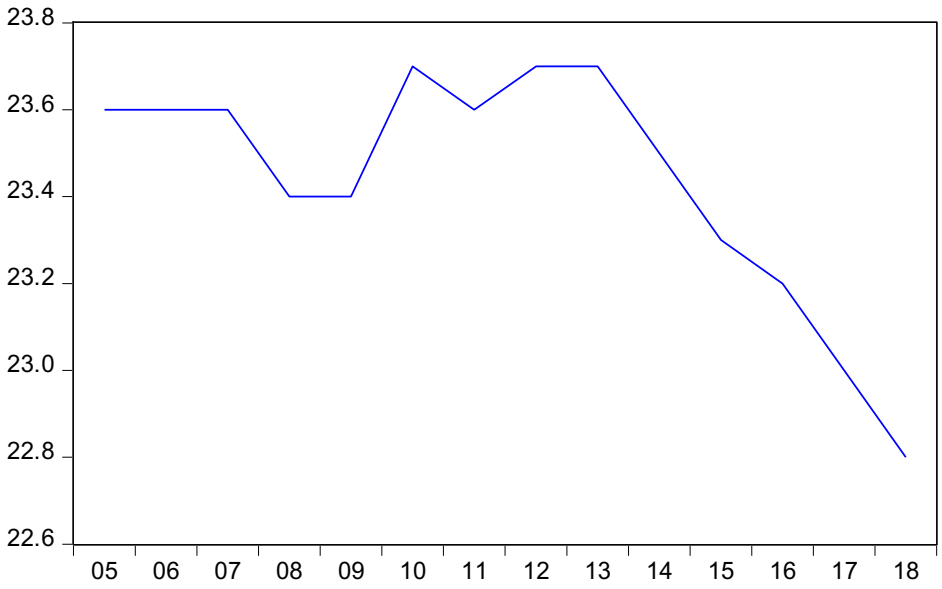
The number of persons employed part-time has also followed heterogenous patterns. As part time employment and worker discouragement explains much of the trends in the unemployment measures above, we see increases also over the period of crisis in the part-time working phenomenon but decreasing only after recovery from 2013. For EU28 and EA19, there is a close match between underemployed part-timers and persons available but not seeking work (discouraged workers). However, besides unemployed persons, the spread of the relationship

among the remainder of the components is varied across the countries (Appendices 5.5 – 5.6). While the share of underemployed part-time workers in total employment decrease during the recovery in 2013, it coincides with a falling gender disparity between the underemployed part time workers (Figure 5.5).

Figure 5. 5 Persons employed part time for economic reasons



Gender gap of persons employed part time for economic reasons



Source: Author's elaboration, Eurostat data (2019)

Further analysis using OECD countries

We have said that low income countries have the highest share of persons outside the labour force. This is partly associated with many persons in those economies belonging to either the youthful or children population, and that many others are hidden in the unemployment statistics. We turn our attention to developed countries of the OECD due to data availability among these countries which are more developed.

According to recent estimates, the unemployment rate among OECD countries was 5.2% (33 million persons) in July 2019, 7.5% for Euro Area countries belonging to the OECD, 5.7% for Canada, and 3.7% for US. It was also 11.2% for the total OECD youths, 15.6% for the youths in the euro area, as well as 8.5% and 3.4% for US youths and Japan youths[69] respectively. Female youths have relatively less than the males: 10.9% and 11.5% respectively overall for the OECD. While the total employment rate, however, around the same time in the third quarter of 2019 was 68.9%, harmonized unemployment rates computed using latest data show between 2% for Czech Republic (by 2019 estimate) and 19.3% for Greece (2018 estimate). Among the countries in the upper end of the distribution are Italy at 10% and at 11%, 14.1% and 19.3% respectively for Turkey, Spain and Greece using latest (2018 or 2019) estimates for the member-countries. The long-term unemployment rate[70] is especially high above 50% for Slovak Republic, *Bulgaria*, Italy, *South Africa*, Greece, and *North Macedonia* at 58.1%, 58.4%, 59%, 62.1%, 70.3%, and 74.6% respectively using 2018 estimates[71]. Further, the youth unemployment rate is also above 30% for Italy, Spain, and Greece (OECD members) and *South Africa* (non-member partner) at 32.2%,

[69] Japan youths have the lowest youths unemployment rate among OECD countries.

[70] The long-term unemployed are persons unemployed for more than one year, deemed to be correlated with "mental and material stress for those affected" according to the OECD's definition.

[71] See https://data.oecd.org. Accessed on February 2020. Note: The OECD include some non-member partner-countries in their estimates (italicized).

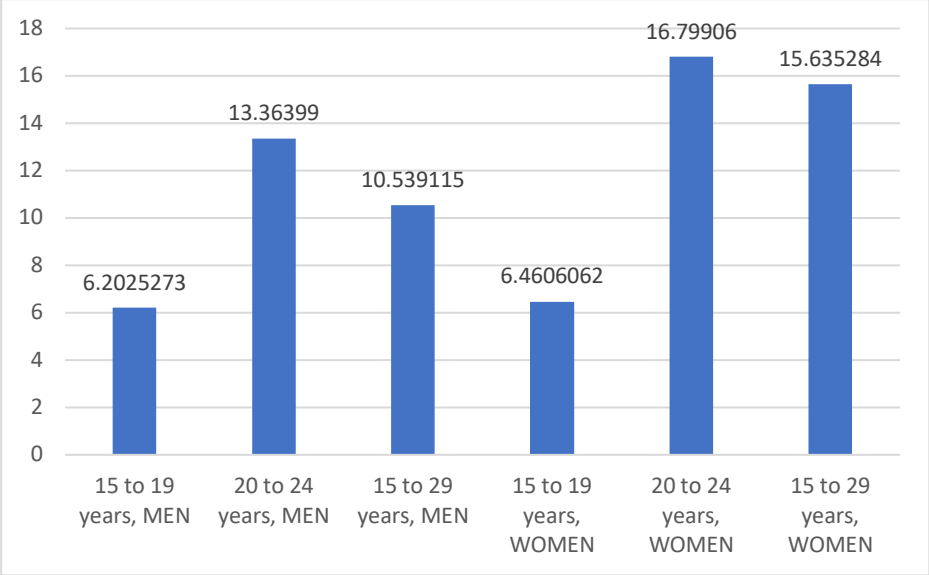
34.4%, 39.9%, and 53.4% respectively though the differences between gender across countries are not so great. As we would expect, the higher there is of persons' level of education, the lower their unemployment rate, we see an inverse relationship between unemployment and educational qualification among the countries[72].

The share of youth not in education, employment or training affects more females than males on average in the OECD and affects those in the upper sects (of ages 20 to 24) than those in lower sects (ages 15 to 19, Figure 5.5). The labour force participation for OECD members (see introductory chapter of thesis for more) is roughly heterogenous. While the labour force has been falling for the US since the turn of the 21st century, it has increased marginally for OECD countries, e.g. for Japan and in European communities as a whole although relatively low for some of the countries (e.g. Hungary, Italy, Romania, etc. in Europe), and Mexico, Turkey, etc. compared to others (e.g. UK, Germany, Switzerland, Iceland, Denmark, Norway, etc)[73].

[72] See Appendix 5.7 or unemployment rates by education level (indicator). doi: 10.1787/6183d527-en (Accessed on 14 February 2020)

[73] See https://data.oecd.org/emp/labour-force-participation-rate.htm

Figure 5. 6 Youth not in education, employment or training (NEET) OECD average, estimate for 2018

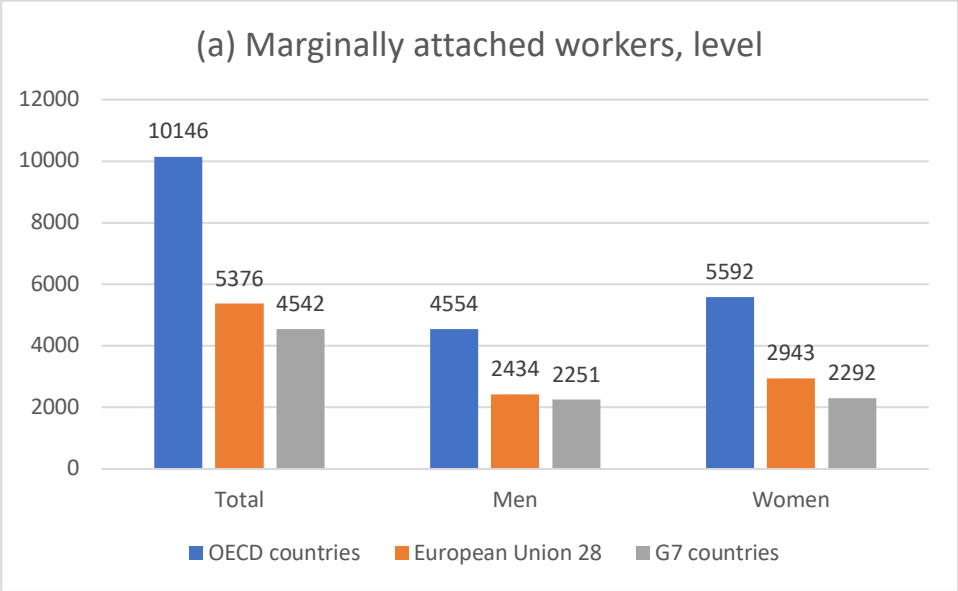


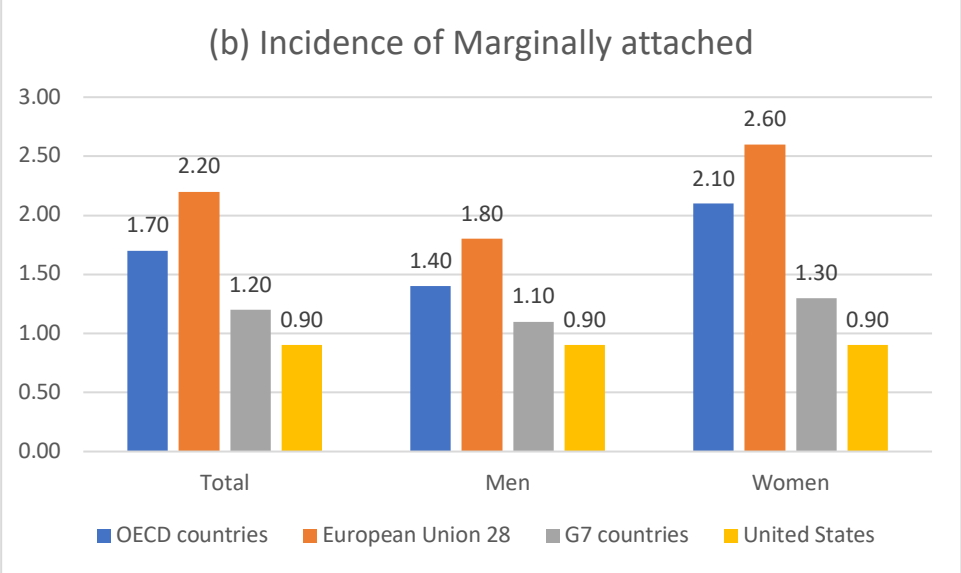
Source: Author's elaboration on OECD data

Marginally attached labour in the OECD

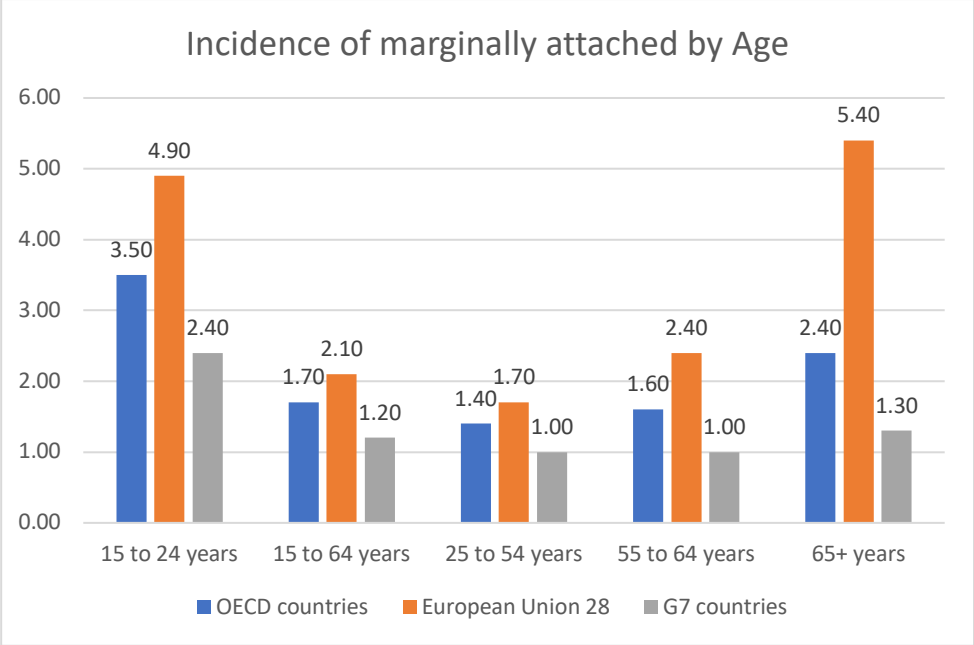
The OECD statistics indicate that over 10 million (10.15 million) persons are marginally attached to the labour force, where more than half (5.38 million) are EU28 members. This is somewhat higher for females than males for EU28 and the OECD average, a difference of 0.40 percentage points each respectively by the incidence of the marginal attached indicator. The gender disparity for G7 countries, however, is almost non-existent (0.1 percentage points difference). For the United States, persons marginally attached is fairly distributed between males and females with the incidence of marginally attached spread equally at 0.9 for each gender. This, however, varies with OECD members not belonging to the EU; for instance, besides being uniformly high among females than males in these latter countries, the incidence is higher in Turkey and Australia than the remainder of the countries, exceeding Italy's which falls in the middle among the countries for both gender (Appendix 5. 8). Quite intuitively, the marginally workers are higher for youth and the aged than for prime-age persons who are often the most active participants in the labour force.

Figure 5.7 Marginally attached workers





Source: Author's elaboration on OECD data



Source: Author's elaboration based on OECD data

Conclusion to the chapter

The continent Europe is deemed less prolific at creating jobs compared to the United States. To verify this claim, we analyzed unemployment is its extension relative to the traditional unemployment rate among European countries using data from Eurostat. Our estimates show that broader unemployment rates though varied across the countries are particularly high above 24% for Greece, Spain, Italy, Cyprus, and Croatia. The difference between with the traditional unemployment rate and unemployment in its extension has increased, also, since the time of the crisis till 2017 at least, among the countries as a whole. We find patterns in the movements in U3, U6 and the difference in-between to be heterogenous, influenced by idiosyncratic factors, policies and programs affecting the individual countries. We find that business cycle fluctuations, and deeper economic fundamentals influencing the individual state of the countries in the period of analysis do play key roles in influencing the relationship between the traditional unemployment

rate and extended unemployment rate. Though a majority of the OECD countries are European but due to access to the rich data of OECD, we extended the analyses to OECD countries comparing the statistics with Eurostat's analyzed earlier.

General conclusion and policy recommendation

While the ILO and the US BLS provides good complementary indicators to the unemployment rate, understanding the total (global) labour underutilization requires the broadest labour underutilization indicator (LU4) statistics being available also for the developing countries. The traditional unemployment is clearly inadequate in assessing the whole of the labour slack and there is the need, therefore, for data on worker discouragement, time-related underemployment, and work in the shadow economy for developing economies. Policy efforts and labour programs should be targeted towards youth who constitute the bedrock for capacity building but have been the ones facing a relatively high rate of unemployment. Policies that incentivize the female participation in the labour force should also be encouraged.

Three scholars jointly received the Nobel Prize in Economics in 2019 for recognition of their "experimental approach to alleviating global poverty[74]" piloted in parts of India and western Kenya. Reducing the world's underemployment and underutilization of labour resources could reduce the global poverty rate not only in developing countries but also the developed ones. There is the need for government policies and programs targeted at reducing the hidden unemployment for all countries but especially among the developing communities of Africa, Asia and the Americas. Last, there is the need for bridging the wide gap in the infrastructure for job searching

[74] See https://www.nobelprize.org/prizes/economic-sciences/2019/press-release/

in the world's developing economies. This would increase the job search propensities among discouraged workers in the potential labour force as well as their employment possibilities.

APPENDICES

Appendix 1. 1 Synopsis of coverage and concepts of unemployment in labour force surveys

The International Labour Office (ILO), US, Canada, and Eurostat

Item	ILO standard (1982 onward)	United States (1994 onward)	Canada (1997 onward)	Eurostat (1992 onward)
Frequency of survey	At least biannually	Monthly	Monthly	Annual, in spring[1]
Scope of survey:				
Households or persons	Unspecified	Households	Households	Households or persons
Institutional population	Included	Excluded	Excluded	Excluded
Collective households (hotels, motels, and so forth)	Included	Included	Included	Excluded
Special exclusions	None	None	Yukon and Northwest Territories; Indian reserves	Persons doing compulsory military service are excluded from the population of private households and regarded as members of collective households, even if, during the reference week, they are present in the private household to which they belong.
Labour force denominator:				
Age limits	Unspecified	16 years and older	15 years and older	15 years and older
Civilian or total	Total	Civilian	Civilian	Includes career military
Treatment of unpaid family workers working fewer than 15 hours per week	Employed	Not in labour force; potentially unemployed	Employed	Employed
Unemployment Job search:				
Reference period for job search	Specified recent period	4 weeks	4 weeks	4 weeks
Search only by reading newspaper ads	Excluded	Excluded	Included	Included
Waiting to start new job	No search required	Search required	No search required; job must start in 4 weeks	No search required
Temporarily laid off	Search optional	No search required	No search required	Search required
Availability criterion:	Yes	Yes	Yes	Yes
When	Unspecified	During reference week	During reference week	Within 2 weeks of interview
Availability question asked	Yes	Yes	Yes	Yes
Exceptions	Unspecified	Temporary illness and waiting to start new job	Temporary illness, personal or family responsibilities, vacation, awaiting new job	None
Treatment of those temporarily laid off	Employed if formal job attachment; unemployed if no attachment and available for work; job search requirement is optional in such cases.	Unemployed if expecting to be recalled to job in 6 months or employer gives recall date. Must be available for work, but no job search required.	Unemployed if expecting to be recalled within 1 year and available for work; no search required.	Unemployed if actively looking for work in the last 4 weeks and if available to start work in 2 weeks; otherwise classified as inactive. (See text for “zero hours” case.)
Treatment of full-time students seeking full-time work and available for work	Unemployed	Unemployed	Not in labour force	Unemployed
Treatment of unpaid family workers working fewer than 15 hours per week and available for work and seeking work	Employed	Unemployed	Employed	Employed

[1] A new EU regulation calls for labour force surveys on a continuous basis, with quarterly results.

[2] If residing in private households.

SOURCE: Sorrentino 2000; Prepared by the Bureau of Labour Statistics from the following documents: *ILO Resolution Concerning Economically Active Population, Employment, Unemployment, and Underemployment* (on the Internet at http:// www.ilo.org/public/120stat/res/ecacpop.htm); "Explanatory Notes on House- hold Data," *Employment and Earnings* (Bureau of Labour Statistics, published monthly); *"*Notes on the Survey," *The Labour Force* (Statistics Canada, published monthly); and *The European Union Labour Force Survey: Methods and Definitions* (Eurostat, 1996), as cited in Sorrentino 2000

Appendix 1. 2 Schematic presentation of operational definitions of Hauser's labour underutilization framework

Component	Indicator	Cut-off
Unemployment	Hours of work and job-search	Hours of work equal to zero
Involuntary part-time work	Part-time, full-time status	Part-time for involuntary reasons
Inadequate Earnings	Work-related income	Level at which full-time workers experience economic hardship
Skill mismatch	Years of completed schooling	First standard deviation above the mean for completed years of schooling in the detailed

Source: ILO 2008, 18th International Conference of Labour Statisticians, ILO Room Document 13. The **Hauser's** Labour underutilization framework was adopted by the 11th ICLS in 1966.

Appendix 3. 1 Current Alternative measures of labour underutilization (Percent), US

Measure	Defined as	Computed as
U-1	Persons unemployed 15 weeks or longer, as a percent of the civilian labour force	[Persons unemployed 15 weeks or longer / civilian labour force] * 100
U-2	Job losers and persons who completed temporary jobs, as a percent of the civilian labour force	[Job losers and persons who completed temporary jobs / civilian labour force] * 100
U-3	Total unemployed, as a percent of the civilian labour force (official unemployment rate)	[Total unemployed / civilian labour force] * 100
U-4	Total unemployed plus discouraged workers, as a percent of the civilian labour force plus discouraged workers	[Total unemployed + discouraged workers / civilian labour force + discouraged workers] * 100
U-5	Total unemployed, plus discouraged workers, plus all other persons marginally attached to the labour force, as a percent of the civilian labour force plus all persons	[Total unemployed + discouraged workers + all other persons marginally attached to the labour force] * 100

	marginally attached to the labour force	
U-6	Total unemployed, plus all persons marginally attached to the labour force, plus total employed part time for economic reasons, as a percent of the civilian labour force plus all persons marginally attached to the labour force	[Total unemployed + all persons marginally attached to the labour force + total employed part time for economic reasons / civilian labour force + all persons marginally attached to the labour force] * 100
Note: "Persons marginally attached to the labour force are those who currently are neither working nor looking for work but indicate that they want and are available for a job and have looked for work sometime in the past 12 months. Discouraged workers, a subset of the marginally attached, have given a job-market related reason for not currently looking for work. Persons employed part time for economic reasons are those who want and are available for full-time work but have had to settle for a part-time schedule" (www.bls.gov). See Appendix… for measures for Canada.		

Source: Exhibit 2, Bregger and Haugen, 1995 p.23; Table A-15 Economics News Release, U.S. Bureau of Labour Statistics https://www.bls.gov/news.release/empsit.toc.htm

Appendix 3. 2 Old Measures (U1 - U7) of labour underutilization (Percent), United States

U-1	Persons unemployed 15 weeks or longer as a percent of the civilian labour force
U-2	Job losers as a percent of the civilian labour force
U-3	Unemployed persons 25 years and over as a percent of the civilian labour force for persons 25 years and over
U-4	Unemployed full-time jobseekers as a percent of the full-time civilian labour force
U-5	Total unemployed as a percent of the civilian labour force (official unemployment rate)
U-6	Total full-time jobseekers plus 1/2 part-time jobseekers plus 1/2 total on part-time for economic reasons as a percent of the civilian labourforce less 1/2 of the part-time labour force
U-7	Total full-time jobseekers plus 1/2 part-time jobseekers plus 1/2 total on part-time for economic reasons plus discouraged workers as a percent of the civilian labour force plus discouraged workers less 1/2 of the part-time labour force

Source: Skiskin (1976), US Bureau of Labour Statistics
Note: The old U5a and U5b measures are differentiated by an old practice of including the resident armed forces population in the overall unemployment rate. Where U5a included the members of the armed forces, U5b did not

Appendix 3. 3 Supplementary unemployment rates, Canada

Rate	Defined as	Computed as

R1	Unemployed 1 year or more	R1 = [Unemployed 52 weeks or more / (employed + unemployed)] * 100
R2	Unemployed 3 months or more	R2 = [Unemployed 12 weeks or more / (employed + unemployed)] * 100
R3	Comparable to the United States rate	R3 = [Unemployed - (I5 year olds + short-term future starts starting in 1994 + searchers unavailable for work due to personal or family responsibilities) + full-time students looking for full-time work / (employed I5 year olds) + (unemployed - (15 year olds + short-term future starts starting in 1994 + searchers unavailable for work due to personal or family responsibilities) + full-time students looking for full-time work)] * 100
R4	Official rate	R4 = [Unemployed / (employed + unemployed)] * 100
R5	Plus discouraged searchers	R5 = [Unemployed + discouraged searchers employed + unemployed + discouraged searchers] * 100
R6	Plus waiting group (recall, replies, long-term future starts)	R6 = [(Unemployed + waiting for recall + waiting for replies + long-term future starts) / (employed + unemployed + waiting for recall + waiting for replies + long-term future starts)] * 100
R7	Plus involuntary part-timers (in full-time equivalents)	R7 = [Unemployed looking for full-time work + (unemployed looking for part-time work * (average hours of part-time workers at main job / average hours of full-time workers at main job)) + (involuntary part-timers with total hours less than 30 * (average hours of involuntary part-timers at main job average hours of full-time workers at main job)) / employed full-time + (employed part-time * (average hours of part-time workers at main job / average hours of full-time workers at main job)) + unemployed looking for full-time work + (unemployed looking for part-time work (average hours of part-time workers at main job / average hours of full-time workers at main job))] * 100
R8	Plus discouraged searchers, waiting group, portion of involuntary part-timers	R8 = [Unemployed + discouraged searchers + waiting for recall + waiting for replies + long-term future starts + (involuntary part-timers with total hours less than 30 * (average hours of involuntary part-timers at main job / average hours of full-time workers at main job)) / employed + unemployed discouraged searchers + waiting for recall + waiting for replies + long-term future starts] * 100

Source: Statistics Canada, *Table 282-0085. Also see* Labour Force Update Summer 1999 Vol.3, No. 3 Labour Statistics Division of Statistics Canada

Appendix 3. 4 Descriptive stats our variables

Stat	U6	U3	CONSCONF	INDPRO	PR	PRW	PTUR	TCU	RECES	UD	URW	URY
Mean	10.50	5.82	100.19	94.44	65.38	58.72	5.42	78.52	0.09	22.31	5.65	12.38
Median	9.66	5.44	100.51	95.68	66.10	59.10	5.40	78.15	0.00	18.80	5.40	11.70
Maximum	17.19	9.98	102.72	107.79	67.30	60.30	6.70	84.99	1.00	40.70	9.00	19.50
Minimum	6.80	3.75	96.71	68.76	62.30	56.40	4.20	66.71	0.00	12.10	3.60	8.40
Std. Dev.	2.84	1.62	1.44	9.66	1.61	1.12	0.56	3.79	0.28	8.41	1.37	2.69
Skewness	1.02	1.14	-0.52	-0.99	-0.61	-0.67	0.10	-0.51	2.91	0.84	0.98	0.98
Kurtosis	2.88	3.28	2.72	3.19	1.78	2.01	2.25	3.22	9.44	2.37	2.91	3.00
Jarque-Bera	51.28	65.18	14.40	48.40	36.60	34.41	7.37	13.40	925.33	39.44	47.58	47.23

Probability	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00
Sum	3096.84	1717.71	29556.62	27858.59	19286.50	17323.60	1600.30	23162.44	26.00	6581.40	1666.60	3651.60
Sum Sq. Dev.	2365.53	773.95	608.92	27444.91	764.09	367.92	93.55	4220.77	23.71	20774.68	548.54	2122.62
Observations	295.00	295.00	295.00	295.00	295.00	295.00	295.00	295.00	295.00	295.00	295.00	295.00

Source: Author's calculations on BLS and FRED data, 2018

Appendix 3. 5 Correlation matrix

	U6	U3	BISCONF	CONSCONF	INDPRO	PR	PR16TO19	PR20TO24	PRW	PTUR	TCU	RECNBER	UD	URW	URY
U6	1.00	0.98	0.02	-0.77	0.02	-0.43	-0.59	-0.59	-0.34	0.75	-0.58	0.06	0.79	0.98	0.97
U3	0.98	1.00	0.01	-0.77	-0.06	-0.29	-0.50	-0.48	-0.20	0.79	-0.58	0.07	0.70	0.99	0.99
BISCONF	0.02	0.01	1.00	0.28	0.10	-0.22	-0.15	-0.18	-0.25	-0.04	0.17	-0.58	0.23	0.04	-0.01
CONSCONF	-0.77	-0.77	0.28	1.00	-0.22	0.31	0.59	0.52	0.19	-0.56	0.59	-0.43	-0.56	-0.73	-0.76
INDPRO	0.02	-0.06	0.10	-0.22	1.00	-0.63	-0.74	-0.65	-0.48	-0.43	-0.40	0.03	0.41	-0.08	-0.05
PR	-0.43	-0.29	-0.22	0.31	-0.63	1.00	0.90	0.94	0.96	0.05	0.45	0.15	-0.82	-0.29	-0.27
PR16TO19	-0.59	-0.50	-0.15	0.59	-0.74	0.90	1.00	0.96	0.78	-0.07	0.65	-0.02	-0.84	-0.47	-0.47
PR20TO24	-0.59	-0.48	-0.18	0.52	-0.65	0.94	0.96	1.00	0.87	-0.11	0.56	0.08	-0.87	-0.46	-0.46
PRW	-0.34	-0.20	-0.25	0.19	-0.48	0.96	0.78	0.87	1.00	0.04	0.28	0.23	-0.76	-0.22	-0.18
PTUR	0.75	0.79	-0.04	-0.56	-0.43	0.05	-0.07	-0.11	0.04	1.00	-0.12	0.02	0.42	0.82	0.81
TCU	-0.58	-0.58	0.17	0.59	-0.40	0.45	0.65	0.56	0.28	-0.12	1.00	-0.30	-0.45	-0.50	-0.51
RECNBER	0.06	0.07	-0.58	-0.43	0.03	0.15	-0.02	0.08	0.23	0.02	-0.30	1.00	-0.19	0.01	0.08
UD	0.79	0.70	0.23	-0.56	0.41	-0.82	-0.84	-0.87	-0.76	0.42	-0.45	-0.19	1.00	0.73	0.70
URW	0.98	0.99	0.04	-0.73	-0.08	-0.29	-0.47	-0.46	-0.22	0.82	-0.50	0.01	0.73	1.00	0.98
URY	0.97	0.99	-0.01	-0.76	-0.05	-0.27	-0.47	-0.46	-0.18	0.81	-0.51	0.08	0.70	0.98	1.00

Source: Author's calculations on BLS and FRED data, 2018

Correlation matrix 2

	D(U6)	D(U3)	D(BISCONF)	D(CONSCONF)	D(INDPRO)	D(PR)	D(PR16TO19)	D(PR20TO24)	D(PRW)	D(PTUR)	D(TCU)	RECNBER	D(UD)	D(URW)	D(U
D(U6)	1.00	0.77	-0.07	-0.19	-0.37	0.12	0.06	0.04	0.13	0.18	-0.34	0.53	0.03	0.55	
D(U3)	0.77	1.00	0.00	-0.14	-0.36	0.23	0.07	0.08	0.24	0.30	-0.34	0.48	0.06	0.75	
D(BISCONF)	-0.07	0.00	1.00	0.30	0.16	-0.01	-0.03	0.02	-0.01	-0.03	0.19	-0.01	0.09	0.04	
D(CONSCONF)	-0.19	-0.14	0.30	1.00	0.06	-0.01	-0.02	-0.02	-0.08	-0.03	0.05	-0.10	0.05	-0.12	
D(INDPRO)	-0.37	-0.36	0.16	0.06	1.00	0.01	0.04	-0.01	-0.04	-0.04	0.96	-0.48	-0.04	-0.22	
D(PR)	0.12	0.23	-0.01	-0.01	0.01	1.00	0.44	0.41	0.72	-0.03	-0.02	-0.04	0.08	0.18	
D(PR16TO19)	0.06	0.07	-0.03	-0.02	0.04	0.44	1.00	0.30	0.25	0.06	0.04	-0.05	-0.06	0.05	
D(PR20TO24)	0.04	0.08	0.02	-0.02	-0.01	0.41	0.30	1.00	0.31	0.04	-0.02	-0.04	0.00	0.11	
D(PRW)	0.13	0.24	-0.01	-0.08	-0.04	0.72	0.25	0.31	1.00	-0.05	-0.07	-0.01	0.08	0.27	
D(PTUR)	0.18	0.30	-0.03	-0.03	-0.04	-0.03	0.06	0.04	-0.05	1.00	-0.04	0.04	0.02	0.31	
D(TCU)	-0.34	-0.34	0.19	0.05	0.96	-0.02	0.04	-0.02	-0.07	-0.04	1.00	-0.44	-0.01	-0.21	
RECNBER	0.53	0.48	-0.01	-0.10	-0.48	-0.04	-0.05	-0.04	-0.01	0.04	-0.44	1.00	0.14	0.30	

D(UD)	0.03	0.06	0.09	0.05	-0.04	0.08	-0.06	0.00	0.08	0.02	-0.01	0.14	1.00	0.02	
D(URW)	0.55	0.75	0.04	-0.12	-0.22	0.18	0.05	0.11	0.27	0.31	-0.21	0.30	0.02	1.00	
D(URY)	0.43	0.62	0.02	-0.09	-0.20	0.13	0.18	0.10	0.10	0.29	-0.19	0.24	0.00	0.42	

Source: Author's calculations on BLS and FRED data, 2018

Appendix 3. 6 Johansen cointegration between U6 and U3

Vector Error Correction Estimates
Date: 02/12/20 Time: 13:51
Sample (adjusted): 1995M02 2020M01
Included observations: 300 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1
U3(-1)	1.000000
U6(-1)	-0.393432 (0.02973) [-13.2337]
C	-0.016527 (0.00317) [-5.21908]

Error Correction:	D(U3)	D(U6)
CointEq1	-0.127305 (0.02023) [-6.29360]	-0.161203 (0.03327) [-4.84582]
D(U3(-1))	-0.672889 (0.10247) [-6.56677]	-0.140683 (0.16852) [-0.83481]
D(U3(-2))	-0.726291 (0.12100) [-6.00244]	-0.616177 (0.19900) [-3.09644]
D(U3(-3))	-0.694739 (0.13002) [-5.34316]	-0.744336 (0.21384) [-3.48084]
D(U3(-4))	-0.616545 (0.13630) [-4.52330]	-0.697726 (0.22417) [-3.11254]
D(U3(-5))	-0.361485 (0.13575) [-2.66291]	-0.321319 (0.22325) [-1.43927]
D(U3(-6))	-0.412613 (0.13191) [-3.12803]	-0.361486 (0.21694) [-1.66632]

D(U3(-7))	-0.480388	-0.421455
	(0.13266)	(0.21817)
	[-3.62129]	[-1.93179]
D(U3(-8))	-0.286484	-0.301405
	(0.13142)	(0.21613)
	[-2.17997]	[-1.39457]
D(U3(-9))	-0.335778	-0.554917
	(0.12540)	(0.20623)
	[-2.67767]	[-2.69074]
D(U3(-10))	-0.159763	-0.426381
	(0.12108)	(0.19913)
	[-1.31951]	[-2.14127]
D(U3(-11))	-0.141124	-0.286283
	(0.11448)	(0.18828)
	[-1.23274]	[-1.52056]
D(U3(-12))	0.329435	0.307801
	(0.09840)	(0.16184)
	[3.34778]	[1.90193]
D(U6(-1))	0.394221	0.066389
	(0.06259)	(0.10293)
	[6.29861]	[0.64497]
D(U6(-2))	0.461366	0.403969
	(0.07361)	(0.12106)
	[6.26745]	[3.33682]
D(U6(-3))	0.390300	0.433729
	(0.07934)	(0.13048)
	[4.91935]	[3.32404]
D(U6(-4))	0.423292	0.442437
	(0.08201)	(0.13487)
	[5.16165]	[3.28049]
D(U6(-5))	0.308621	0.310285
	(0.08255)	(0.13576)
	[3.73876]	[2.28561]
D(U6(-6))	0.282654	0.271940
	(0.08211)	(0.13504)
	[3.44230]	[2.01374]
D(U6(-7))	0.381365	0.333155
	(0.08302)	(0.13654)
	[4.59357]	[2.44003]
D(U6(-8))	0.255231	0.176351
	(0.08437)	(0.13876)
	[3.02512]	[1.27094]
D(U6(-9))	0.228720	0.338166
	(0.08285)	(0.13626)

	[2.76064]	[2.48185]
D(U6(-10))	0.106206	0.291512
	(0.08020)	(0.13190)
	[1.32419]	[2.21002]
D(U6(-11))	0.091238	0.267718
	(0.07699)	(0.12662)
	[1.18503]	[2.11433]
D(U6(-12))	0.236342	0.561248
	(0.06924)	(0.11387)
	[3.41338]	[4.92877]
R-squared	0.800792	0.764426
Adj. R-squared	0.783407	0.743867
Sum sq. resids	0.000758	0.002051
S.E. equation	0.001661	0.002731
F-statistic	46.06110	37.18180
Log likelihood	1507.548	1358.299
Akaike AIC	-9.883656	-8.888658
Schwarz SC	-9.575007	-8.580009
Mean dependent	-7.40E-05	-0.000114
S.D. dependent	0.003568	0.005396
Determinant resid covariance (dof adj.)		6.42E-12
Determinant resid covariance		5.40E-12
Log likelihood		3040.403
Akaike information criterion		-19.91602
Schwarz criterion		-19.26168
Number of coefficients		53

Source: Author's calculations on BLS and FRED data
Note: Trace test and max-eigenvalue stats suggest 1 cointegrating equation

Appendix 3. 7 Redundant Variables Test

From general to restricted equation

Null hypothesis: D(U6(-2)) D(U6(-3)) D(U3(-1)) D(U3(-2)) D(U3(-3)) D(BISCONF(-2)) D(BISCONF(-3)) D(CONSCONF(-1)) D(INDPRO(-1)) D(INDPRO(-2)) D(INDPRO(-3)) D(PR(-1)) D(PR(-2)) (PR20TO24(-1)) D(PR20TO24(-2)) D(PR20TO24(-3)) D(PRW(-1)) D(PRW(-3)) D(PTUR(-1)) D(PTUR(-2)) D(PTUR(-3)) D(TCU(-1)) D(TCU(-2)) D(TCU(-3)) D(UD(-1)) D(UD(-2)) D(UD(-3)) D(URW(-1)) D(URW(-2)) D(URY(-1)) D(URY(-2)) D(URY(-3)) U6(-1) U3(-1) PR(-1) PTUR(-1) UD(-1) URY(-1) are jointly insignificant
Equation: REDUNDANT
Specification: D(U6) C D(U6(-1)) D(U6(-2)) D(U6(-3)) D(U3(-1)) D(U3(-2)) D(U3(-3)) D(BISCONF(-1)) D(BISCONF(-2)) D(BISCONF(-3)) D(CONSCONF(-1)) D(CONSCONF(-2)) D(CONSCONF(-3)) D(INDPRO(-1)) D(INDPRO(-2)) D(INDPRO(-3)) D(PR(-1)) D(PR(-2)) D(PR(-3)) D(PR16TO19(-1)) D(PR16TO19(-2)) D(PR16TO19(-3)) D(PR20TO24(-1)) D(PR20TO24(-2)) D(PR20TO24(-3)) D(PRW(-1)) D(PRW(-2)) D(PRW(-3)) D(PTUR(-1)) D(PTUR(-2)) D(PTUR(-3)) D(TCU(-1)) D(TCU(-2)) D(TCU(-3)) RECNBER D(UD(-1)) D(UD(-2))

D(UD(-3)) D(URW(-1)) D(URW(-2)) D(URW(-3)) D(URY(-1)) D(URY(-2)) D(URY(-3)) U6(-1) U3(-1) BISCONF(-1) CONSCONF(-1) INDPRO(-1) PR(-1) PR16TO19(-1) PR20TO24(-1) PRW(-1) PTUR(-1) TCU(-1) UD(-1) URW(-1) URY(-1)

	Value	df	Probability
F-statistic	1.093577	(38, 233)	**0.3358**
Likelihood ratio	47.75792	38	**0.1333**

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	1.242015	38	0.032685
Restricted SSR	8.205869	271	0.030280
Unrestricted SSR	6.963854	233	0.029888

LR test summary:

	Value
Restricted LogL	106.3018
Unrestricted LogL	130.1808

Appendix 3. 8 Wald test

Equation: PRW=0

Test Statistic	Value	df	Probability
t-statistic	-1.031315	282	0.3033
F-statistic	1.063611	(1, 282)	0.3033
Chi-square	1.063611	1	0.3024

Source: Author's calculations

Appendix 3. 9 Determining the number of lags

a. Determining the number of lags to include in model involving four variables

U6 on C U3 CONSCONF PRW

Variable	Lag length (individual variables endogenous and c exogenous)		Lag length (individual variables endogenous; c and all but the variable in question exogenous)	
	AIC	SC	AIC	SC
U6	6	6	6	1
U3	6	6	8	1
CONSCONF	5	4	4	4
PRW	8	2	3	2

Source: Author's calculations

b. Determining the number of lags to include in model involving three variables

U6 C U3 CONSCONF

Variable	Lag length (individual variables as endogenous with only constant as exogenous)		Lag length (individual variables as endogenous with constant and all others but the variable in question as exogenous)	
	AIC	SC	AIC	SC
U6	**6**	**6**	**3**	1
U3	7	7	8	7
CONSCONF	4	4	4	4

Source: Author's calculations

Appendix 3. 10 ARDL Error Correction Regression

Dependent Variable: D(U6)
Selected Model: ARDL(3, 3, 0)

ECM Regression
Case 3: Unrestricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.658462	0.878733	5.301341	*0.0000*
D(U6(-1))	-0.336616	0.056745	-5.932096	*0.0000*
D(U6(-2))	-0.147311	0.056339	-2.614728	*0.0094*
D(U3)	1.106480	0.057173	19.35310	*0.0000*
D(U3(-1))	0.568021	0.085492	6.644176	*0.0000*
D(U3(-2))	0.267502	0.084735	3.156935	*0.0018*
CointEq(-1)*	**-0.057569**	0.010858	-5.302155	**0.0000**

R-squared	0.690876	Mean dependent var	-0.013932
Adjusted R-squared	0.684391	S.D. dependent var	0.233148
S.E. of regression	0.130981	Akaike info criterion	-1.203935
Sum squared resid	4.906591	Schwarz criterion	-1.116012
Log likelihood	183.3764	Hannan-Quinn criter.	-1.168720
F-statistic	106.5324	Durbin-Watson stat	2.011578
Prob(F-statistic)	0.000000		

* p-value incompatible with t-Bounds distribution.

F-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	**9.305419**	**10%**	3.17	**4.14**

k	2	**5%**	3.79	**4.85**
		2.5%	4.41	**5.52**
		1%	5.15	**6.36**

t-Bounds Test			Null Hypothesis: No levels relationship	
Test Statistic	Value	Signif.	I(0)	I(1)
t-statistic	**-5.302155**	**10%**	-2.57	**-3.21**
		5%	-2.86	**-3.53**
		2.5%	-3.13	**-3.8**
		1%	-3.43	**-4.1**

Source: Author's calculations

Appendix 3. 11 Battery of tests Model 6

1. Model 3. 6 (LS(H) D(U6) U6(-1) U3(-1) PRW(-1) C D(U6(-1)) D(U3) D(U3(-1)) D(CONSCONF(-1)) RECNBER

a. Chow Breakpoint Test

Chow Breakpoint Test: 2008M01
Null Hypothesis: No breaks at specified breakpoints
Varying regressors: All equation variables
Equation Sample: 1994M03 2018M08

F-statistic	2.774381	Prob. F(9,276)	0.0040
Log likelihood ratio	25.46270	Prob. Chi-Square(9)	0.0025
Wald Statistic	20.34312	Prob. Chi-Square(9)	0.0159

b. Test prediction

Chow Forecast Test
Equation: EQ3_6
Specification: D(U6) U6(-1) U3(-1) PRW(-1) C D(U6(-1)) D(U3) D(U3(-1)) D(CONSCONF(-1)) RECNBER
Test predictions for observations from 2008M01 to 2018M08

	Value	df	Probability
F-statistic	2.133122	(128, 157)	0.0000
Likelihood ratio	296.2437	128	0.0000

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	3.080470	128	0.024066
Restricted SSR	4.851765	285	0.017024
Unrestricted SSR	1.771295	157	0.011282

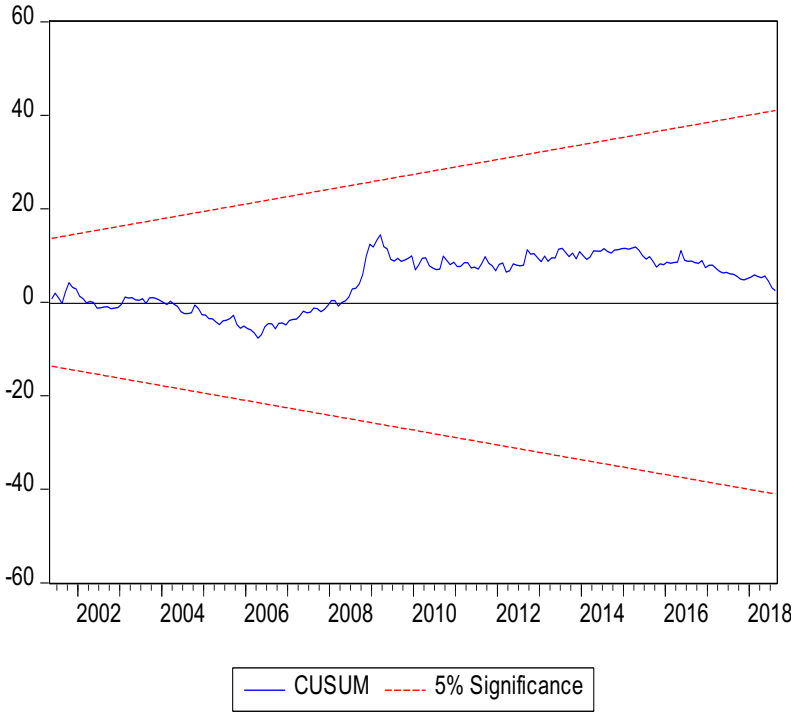
LR test summary:

Value

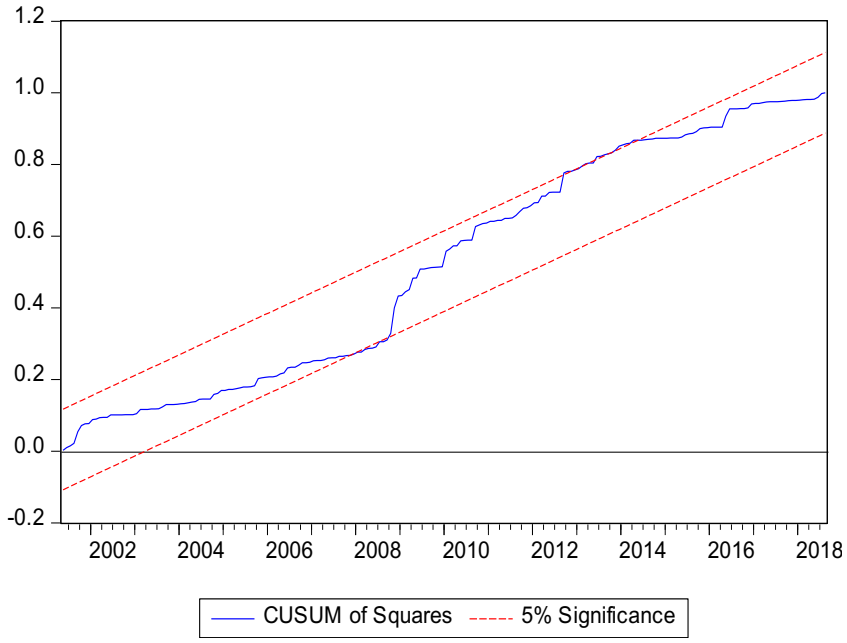
Restricted LogL	186.1549
Unrestricted LogL	334.2768

Unrestricted log likelihood adjusts test equation results to account for observations in forecast sample

c. CUSUM test



d. CUSUM of squares test



e. Ramsey RESET Test

Equation: EQ3_6

Specification: D(U6) U6(-1) U3(-1) PRW(-1) C D(U6(-1)) D(U3) D(U3(-1)) D(CONSCONF(-1)) RECNBER
Omitted Variables: Squares of fitted values

	Value	df	Probability
t-statistic	1.869896	284	0.0625
F-statistic	3.496513	(1, 284)	0.0625
Likelihood ratio	3.597529	1	0.0579

f. Correlogram

Q-statistic probabilities adjusted for 8 dynamic regressors

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob*
.|. |	.|. |	1	-0.041	-0.041	0.4891	0.484
*|. |	*|. |	2	-0.109	-0.111	4.0207	0.134
.|. |	.|. |	3	0.021	0.012	4.1558	0.245
.|. |	.|. |	4	0.027	0.016	4.3700	0.358
.|. |	.|. |	5	0.016	0.022	4.4500	0.487
.|. |	.|. |	6	-0.010	-0.004	4.4822	0.612
*|. |	*|. |	7	-0.071	-0.069	5.9987	0.540
.|. |	.|. |	8	-0.054	-0.064	6.8952	0.548
.|. |	.|. |	9	0.008	-0.013	6.9146	0.646
.|. |	.|. |	10	0.062	0.053	8.1020	0.619
.|. |	.|. |	11	0.016	0.028	8.1830	0.697
.|. |	.|. |	12	0.014	0.034	8.2397	0.766
.|* |	.|* |	13	0.074	0.081	9.9506	0.698
*|. |	*|. |	14	-0.087	-0.087	12.279	0.584
.|. |	.|. |	15	-0.051	-0.058	13.091	0.595
.|. |	.|. |	16	0.015	-0.017	13.162	0.661
.|. |	.|. |	17	0.014	0.012	13.224	0.721
.|. |	.|. |	18	-0.023	-0.005	13.388	0.768
.|. |	.|. |	19	0.010	0.028	13.420	0.816
.|. |	.|. |	20	-0.028	-0.021	13.673	0.847
.|* |	.|* |	21	0.103	0.099	17.068	0.707
.|* |	.|. |	22	0.076	0.062	18.925	0.650
.|. |	.|. |	23	0.013	0.027	18.983	0.702
.|. |	.|. |	24	-0.037	-0.019	19.420	0.729
.|. |	.|. |	25	-0.023	-0.024	19.584	0.768
.|. |	.|. |	26	-0.024	-0.044	19.777	0.802
.|. |	.|. |	27	-0.015	-0.012	19.846	0.837
.|. |	.|. |	28	-0.049	-0.042	20.628	0.841
.|. |	.|* |	29	0.068	0.083	22.135	0.815
.|. |	.|. |	30	0.016	0.030	22.216	0.846
.|. |	.|. |	31	0.037	0.055	22.664	0.861
*|. |	*|. |	32	-0.107	-0.134	26.488	0.742
.|. |	.|. |	33	0.041	0.020	27.040	0.758
.|* |	.|. |	34	0.094	0.042	30.018	0.663
.|. |	.|. |	35	0.025	0.051	30.227	0.698
*|. |	*|. |	36	-0.178	-0.142	40.951	0.262

*Probabilities may not be valid for this equation specification.

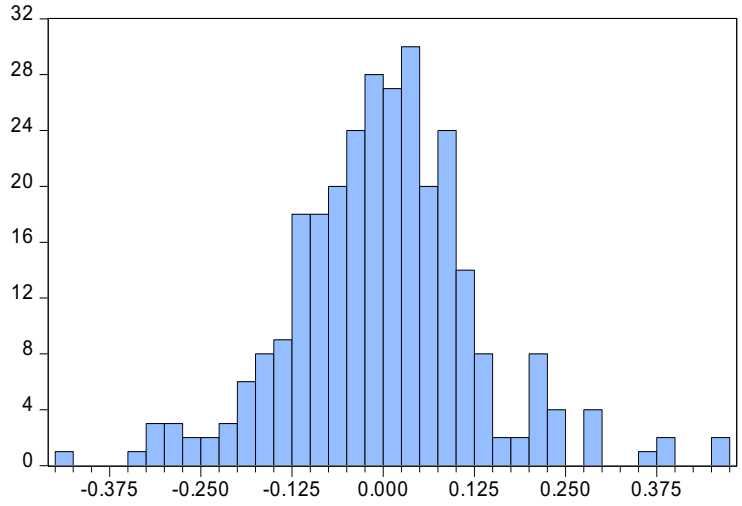
g. Breusch-Godfrey Serial Correlation LM Test:

F-statistic	2.793629	Prob. F(2,283)	0.0629
Obs*R-squared	5.692052	Prob. Chi-Square(2)	0.0581

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	5.988240	Prob. F(8,285)	0.0000
Obs*R-squared	42.30727	Prob. Chi-Square(8)	0.0000
Scaled explained SS	69.46249	Prob. Chi-Square(8)	0.0000

h. Test of normality



Series: Residuals
Sample 1994M03 2018M08
Observations 294

Mean	-3.47e-16
Median	0.000633
Maximum	0.462961
Minimum	-0.429316
Std. Dev.	0.128681
Skewness	0.245370
Kurtosis	4.494381
Jarque-Bera	30.30652
Probability	0.000000

Appendix 3. 12 Battery of tests Model 3.7

a. Ramsey RESET Test

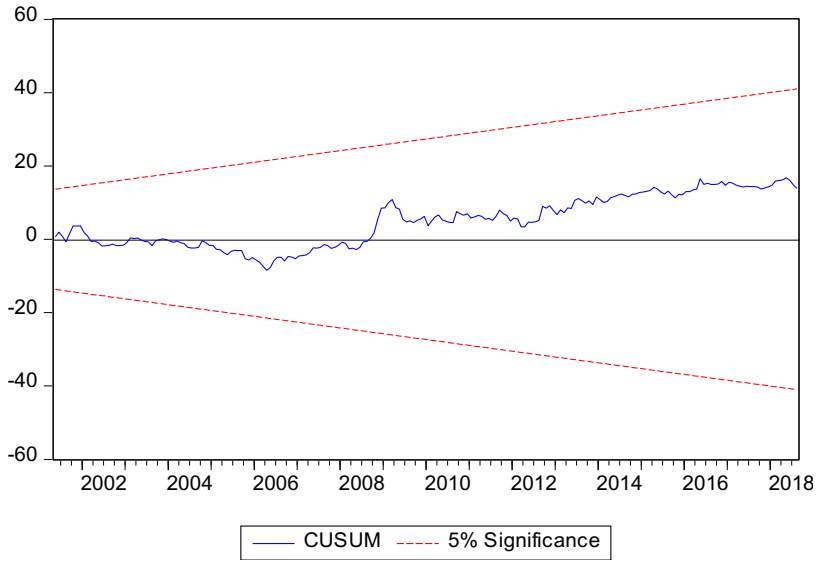
Equation: EQ_37
Specification: U6 U6(-1) U6(-2) U6(-3) U6(-4) U3 U3(-1) U3(-2) U3(-3) CONSCONF CONSCONF(-1) CONSCONF(-2) CONSCONF(-3) RECNBER C
Omitted Variables: Squares of fitted values

	Value	df	Probability
t-statistic	0.770059	277	0.4419
F-statistic	0.592990	(1, 277)	0.4419

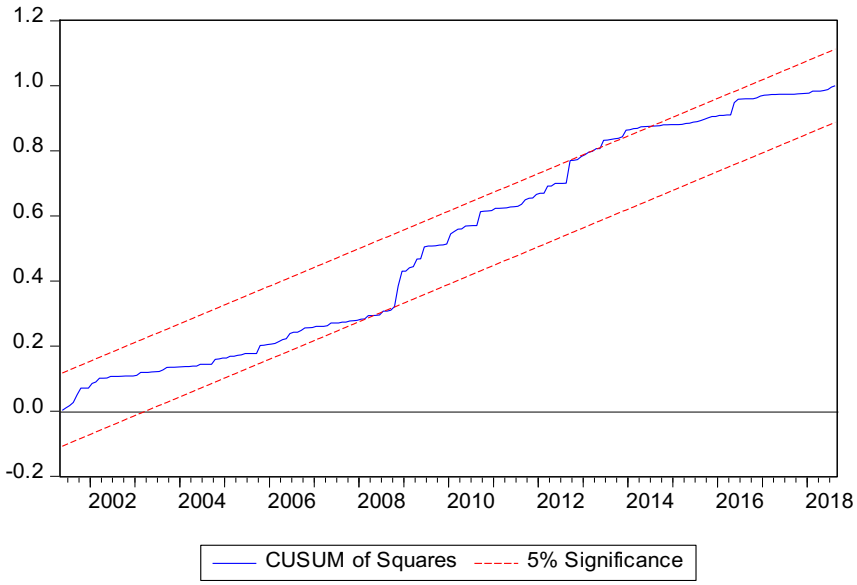
F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	0.009768	1	0.009768
Restricted SSR	4.572671	278	0.016448
Unrestricted SSR	4.562903	277	0.016473

b. CUSUM test



c. CUSUM of squares



d. Correlogram

Q-statistic probabilities adjusted for 4 dynamic regressors

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob*
.|. |	.|. |	1	-0.012	-0.012	0.0407	0.840
.|. |	.|. |	2	-0.029	-0.029	0.2935	0.864
.|. |	.|. |	3	-0.047	-0.048	0.9555	0.812
*|. |	*|. |	4	-0.067	-0.070	2.3033	0.680
.|. |	.|. |	5	-0.045	-0.050	2.9005	0.715
.|. |	.|. |	6	-0.046	-0.055	3.5322	0.740
*|. |	*|. |	7	-0.108	-0.122	7.0567	0.423
*|. |	*|. |	8	-0.089	-0.112	9.4705	0.304

.|.	|	.|.	|	9	-0.025	-0.056	9.6617	0.379
.|.	|	.|.	|	10	0.072	0.038	11.231	0.340
.|.	|	.|.	|	11	0.030	-0.005	11.498	0.403
.|.	|	.|.	|	12	0.000	-0.030	11.498	0.487
.|.	|	.|.	|	13	0.056	0.035	12.459	0.490
*|.	|	*|.	|	14	-0.074	-0.093	14.129	0.440
.|.	|	*|.	|	15	-0.062	-0.090	15.331	0.428
.|.	|	.|.	|	16	-0.013	-0.039	15.386	0.497
.|.	|	.|.	|	17	-0.024	-0.035	15.569	0.555
.|.	|	*|.	|	18	-0.054	-0.071	16.484	0.559
.|.	|	.|.	|	19	0.045	0.021	17.133	0.581
.|.	|	.|.	|	20	-0.002	-0.026	17.134	0.644
.|*	|	.|*	|	21	0.120	0.091	21.695	0.417
.|.	|	.|.	|	22	0.065	0.036	23.046	0.399
.|.	|	.|.	|	23	0.012	-0.010	23.089	0.456
.|.	|	.|.	|	24	-0.023	-0.020	23.257	0.505
.|.	|	.|.	|	25	-0.058	-0.049	24.340	0.500
.|.	|	*|.	|	26	-0.064	-0.066	25.662	0.482
.|.	|	.|.	|	27	-0.017	-0.007	25.752	0.532
.|.	|	.|.	|	28	-0.034	-0.015	26.122	0.566
.|*	|	.|*	|	29	0.074	0.081	27.901	0.523
.|.	|	.|.	|	30	0.015	0.020	27.973	0.572
.|.	|	.|.	|	31	0.067	0.058	29.439	0.546
*|.	|	*|.	|	32	-0.077	-0.118	31.388	0.497
.|.	|	.|.	|	33	0.053	0.036	32.321	0.501
.|*	|	.|.	|	34	0.075	0.060	34.183	0.459
.|.	|	.|.	|	35	0.003	0.025	34.185	0.507
*|.	|	*|.	|	36	-0.177	-0.148	44.675	0.152

*Probabilities may not be valid for this equation specification.

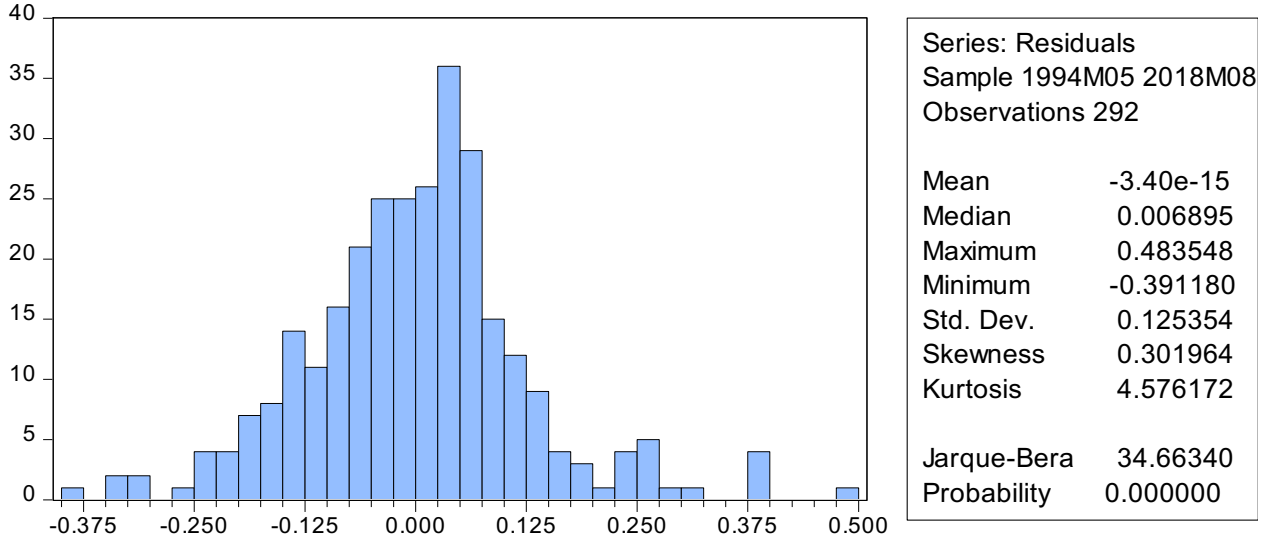
e. Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.732469	Prob. F(2,276)	0.4817
Obs*R-squared	1.541679	Prob. Chi-Square(2)	0.4626

f. Heteroskedasticity Test: Breusch-Pagan-Godfrey

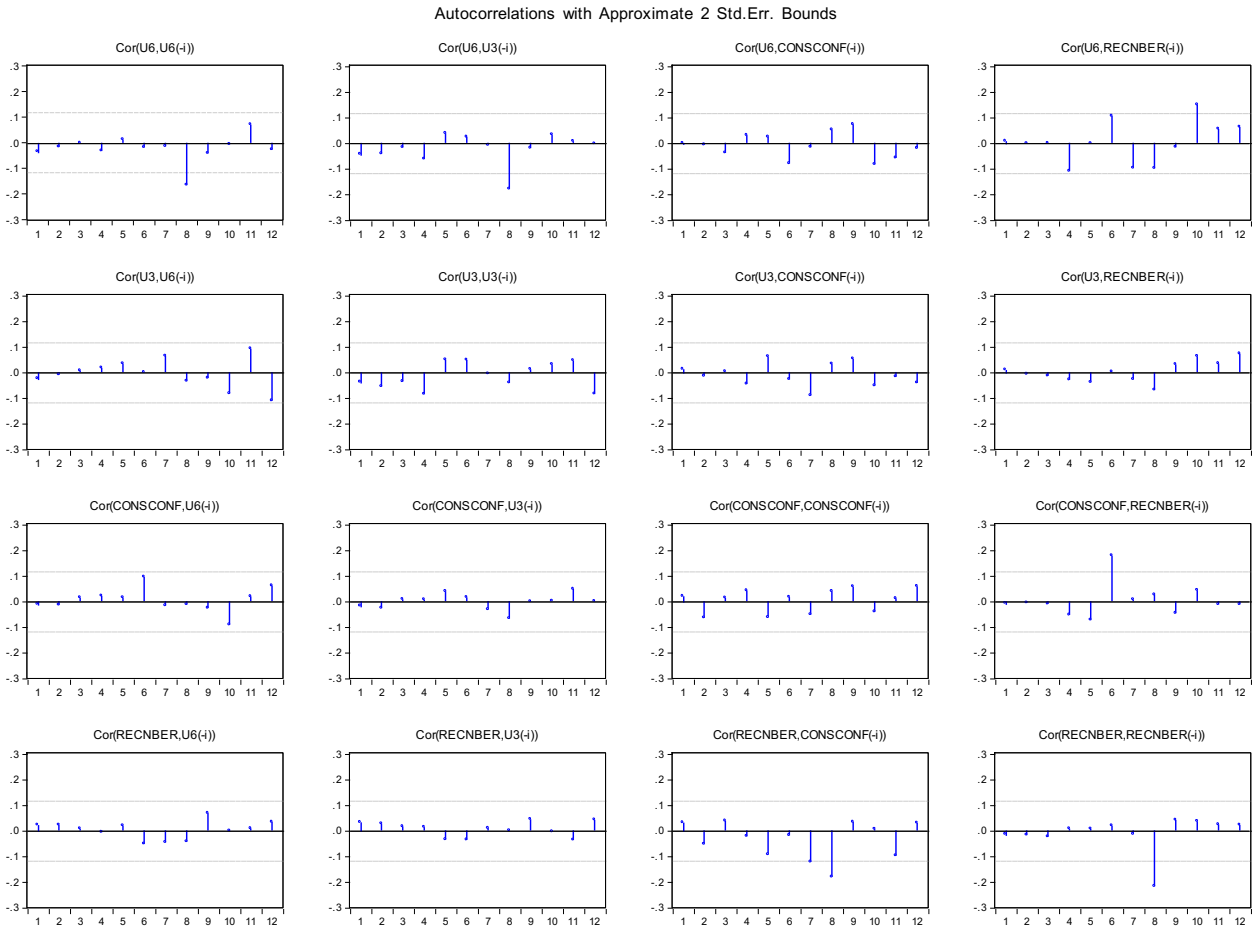
F-statistic	3.149871	Prob. F(13,278)	0.0002
Obs*R-squared	37.48856	Prob. Chi-Square(13)	0.0003
Scaled explained SS	60.75905	Prob. Chi-Square(13)	0.0000

g. Test of normality



Appendix 3. 13 Battery of tests VECM

a. Correlogram



b. VEC Residual Portmanteau Tests for Autocorrelations

Null Hypothesis: No residual autocorrelations up to lag h
Date: 02/28/20 Time: 17:03
Sample: 1948M01 2020M12
Included observations: 292

Lags	Q-Stat	Prob.*	Adj Q-Stat	Prob.*	df
1	2.001886	---	2.008766	---	---
2	6.991460	---	7.032750	---	---
3	10.38361	---	10.46011	---	---
4	27.42389	0.4953	27.73707	0.4784	28

*Test is valid only for lags larger than the VAR lag order.
df is degrees of freedom for (approximate) chi-square distribution after adjustment for VEC estimation (Bruggemann, et al. 2005)

c. VEC Residual Serial Correlation LM Tests

Date: 02/28/20 Time: 17:04
Sample: 1948M01 2020M12
Included observations: 292

Null hypothesis: No serial correlation at lag h

Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	28.70021	16	0.0260	1.809637	(16, 828.6)	0.0260
2	28.57018	16	0.0270	1.801297	(16, 828.6)	0.0270
3	16.23111	16	0.4370	1.015780	(16, 828.6)	0.4370
4	24.84192	16	0.0727	1.562728	(16, 828.6)	0.0727

Null hypothesis: No serial correlation at lags 1 to h

Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	28.70021	16	0.0260	1.809637	(16, 828.6)	0.0260
2	42.48801	32	0.1018	1.336005	(32, 986.2)	0.1018
3	61.23289	48	0.0951	1.284945	(48, 1015.1)	0.0953
4	77.43896	64	0.1207	1.218669	(64, 1016.2)	0.1211

*Edgeworth expansion corrected likelihood ratio statistic.

d. VEC Residual Normality Tests

Orthogonalization: Cholesky (Lutkepohl)
Null Hypothesis: Residuals are multivariate normal
Date: 02/28/20 Time: 17:05
Sample: 1948M01 2020M12
Included observations: 292

Component	Skewness	Chi-sq	df	Prob.*
1	-0.001992	0.000193	1	0.9889
2	-0.191493	1.784582	1	0.1816
3	-0.252610	3.105499	1	0.0780
4	1.085471	57.34132	1	0.0000
Joint		62.23159	4	0.0000

e. VEC Residual Heteroskedasticity Tests (Includes Cross Terms)

Date: 02/28/20 Time: 17:05
Sample: 1948M01 2020M12
Included observations: 292

Joint test:

Chi-sq	df	Prob.
1177.873	770	0.0000

Source: Author's calculations based on US BLS and Fred data, 2018

Appendix 3. 14 Results of Johansen cointegration test

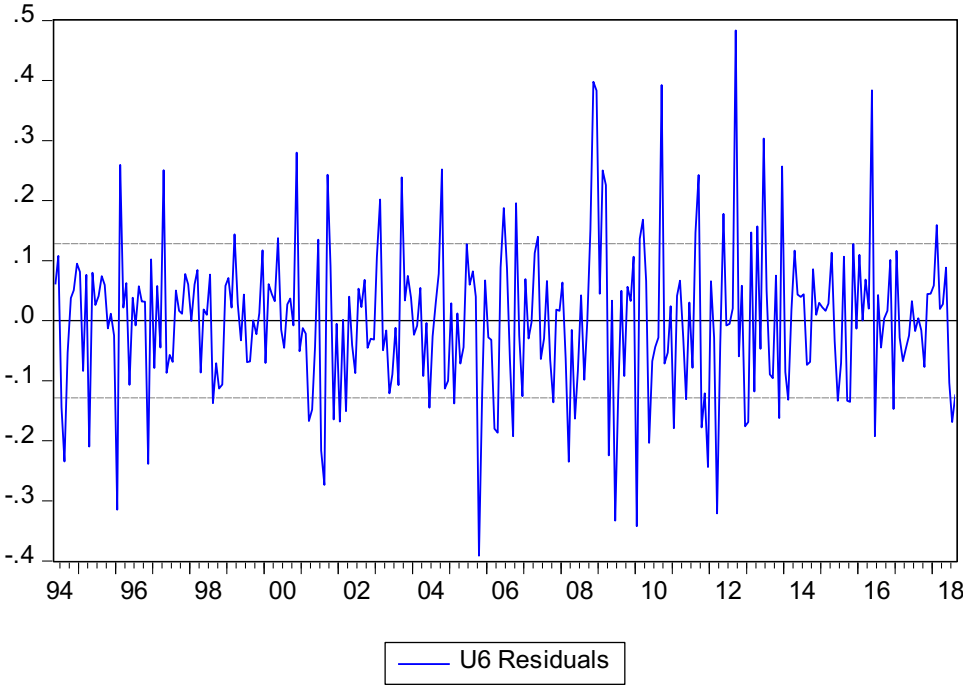
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.254462	85.45186	27.58434	0.0000
At most 1	0.063416	19.06520	21.13162	0.0950
At most 2	0.032951	9.750264	14.26460	0.2288
At most 3 *	0.013667	4.004435	3.841466	0.0454

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Source: Author's calculations based on US BLS and Fred data, 2018

Appendix 3. 15 Plot of residuals of ARDL model



Source: Author's elaboration based on BLS and FRED data, 2018

Appendix 3. 16 Granger causality

Pairwise Granger Causality Tests
Sample: 1948M01 2020M12

Null Hypothesis:	Obs	F-Statistic	Prob.
U3 does not Granger Cause U6	294	7.87236	0.0005
U6 does not Granger Cause U3		7.78711	0.0005
CONSCONF does not Granger Cause U6	294	29.3076	3.E-12
U6 does not Granger Cause CONSCONF		1.52809	0.2187
CONSCONF does not Granger Cause U3	702	53.1454	3.E-22
U3 does not Granger Cause CONSCONF		0.31127	0.7326

Source: Author's elaboration based on BLS and FRED data, 2018.

Appendix 3. 17 Recession in the US: dates and duration

BUSINESS CYCLE REFERENCE DATES		DURATION IN MONTHS		
Peak	**Trough**	**Contraction**	**Expansion**	**Cycle**

Quarterly dates		*Peak*	*Previous trough*	*Trough from*	*Peak from*
are in parentheses		*to*	*to*	*Previous*	*Previous*
		Trough	*this peak*	*Trough*	*Peak*
	December 1854 (IV)	--	--	--	--
June 1857(II)	December 1858 (IV)	18	30	48	--
October 1860(III)	June 1861 (III)	8	22	30	40
April 1865(I)	December 1867 (I)	32	46	78	54
June 1869(II)	December 1870 (IV)	18	18	36	50
October 1873(III)	March 1879 (I)	65	34	99	52
March 1882(I)	May 1885 (II)	38	36	74	101
March 1887(II)	April 1888 (I)	13	22	35	60
July 1890(III)	May 1891 (II)	10	27	37	40
January 1893(I)	June 1894 (II)	17	20	37	30
December 1895(IV)	June 1897 (II)	18	18	36	35
June 1899(III)	December 1900 (IV)	18	24	42	42
September 1902(IV)	August 1904 (III)	23	21	44	39
May 1907(II)	June 1908 (II)	13	33	46	56
January 1910(I)	January 1912 (IV)	24	19	43	32
January 1913(I)	December 1914 (IV)	23	12	35	36
August 1918(III)	March 1919 (I)	7	44	51	67
January 1920(I)	July 1921 (III)	18	10	28	17
May 1923(II)	July 1924 (III)	14	22	36	40
October 1926(III)	November 1927 (IV)	13	27	40	41
August 1929(III)	March 1933 (I)	43	21	64	34
May 1937(II)	June 1938 (II)	13	50	63	93
February 1945(I)	October 1945 (IV)	8	80	88	93
November 1948(IV)	October 1949 (IV)	11	37	48	45
July 1953(II)	May 1954 (II)	10	45	55	56
August 1957(III)	April 1958 (II)	8	39	47	49
April 1960(II)	February 1961 (I)	10	24	34	32
December 1969(IV)	November 1970 (IV)	11	106	117	116
November 1973(IV)	March 1975 (I)	16	36	52	47
January 1980(I)	July 1980 (III)	6	58	64	74
July 1981(III)	November 1982 (IV)	16	12	28	18
July 1990(III)	March 1991(I)	8	92	100	108
March 2001(I)	November 2001 (IV)	8	120	128	128
December 2007 (IV)	June 2009 (II)	18	73	91	81
Average, all cycles:					
1854-2009 (33 cycles)		17.5	38.7	56.2	56.4*
1854-1919 (16 cycles)		21.6	26.6	48.2	48.9**
1919-1945 (6 cycles)		18.2	35	53.2	53

1945-2009 (11 cycles)	11.1	58.4	69.5	68.5
* 32 cycles				
** 15 cycles				

Source: NBER (2010) https://www.nber.org/cycles/cyclesmain.html
Note: The determination that the last expansion began in June 2009 is the most recent decision of the Business Cycle Dating Committee of the National Bureau of Economic Research.

Appendix 3. 18 Breakpoint unit root test (Sample 1994 – 2018)

Variable	Breakpoint (month)	Breakpoint lag	Order of integration
U6	2006m12	5	I(1)
U3	2006m10	6	I(1)
BISCONF	2008m09	3	I(0)
CONSCONF	2000m07	3	I(1)
INDPRO	2009m03	4	I(1)
PR	2009m06	1	I(1)
PR16TO19	2001m01	2	I(1)
PR20TO24	2008m12	1	I(1)
PRW	2009m07	1	I(1)
PTUR	2014m09	3	I(1)
TCU	2000m05	4	I(1)
RECNBER	2009m06	0	I(1)
UD	2008m07	0	I(1)
URW	2007m02	7	I(2)
URY	2014m09	1	I(1)

Source: Author's calculations, data from BLS and FRED. Data are monthly, seasonally adjusted except RECNBER which is monthly but seasonally unadjusted, i.e. a dummy variable of 1 or 0 for recession or not. Note: Only intercept was included in trend specification and in break specification of breakpoint unit root tests. The indicated break dates are based on innovational outlier that minimizes the Dickey-Fuller t-statistic. Lag length is based on Schwarz information criterion.

Appendix 3. 19 VECM estimates

Vector Error Correction Estimates
Included observations: 292 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1
U6(-1)	1.000000
U3(-1)	-1.424656

	(0.23320)			
	[-6.10918]			
CONSCONF(-1)	0.292280			
	(0.29187)			
	[1.00139]			
RECNBER(-1)	-10.67732			
	(1.26201)			
	[-8.46060]			
C	-30.53436			

Error Correction:	D(U6)	D(U3)	D(CONSCONF)	D(RECNBER)
CointEq1	-0.046405	-0.027067	0.000924	0.012483
	(0.00575)	(0.00380)	(0.00315)	(0.00351)
	[-8.06501]	[-7.12178]	[0.29366]	[3.55137]
D(U6(-1))	-0.210712	0.156706	0.022236	0.082263
	(0.08403)	(0.05551)	(0.04597)	(0.05133)
	[-2.50755]	[2.82326]	[0.48368]	[1.60255]
D(U6(-2))	0.044809	0.221439	-0.005769	0.003900
	(0.08977)	(0.05929)	(0.04911)	(0.05484)
	[0.49917]	[3.73460]	[-0.11748]	[0.07113]
D(U6(-3))	0.071883	0.152212	-0.018478	-0.019114
	(0.08414)	(0.05558)	(0.04603)	(0.05140)
	[0.85432]	[2.73874]	[-0.40141]	[-0.37187]
D(U3(-1))	0.180266	-0.382545	-0.007792	-0.006036
	(0.12615)	(0.08333)	(0.06902)	(0.07706)
	[1.42895]	[-4.59084]	[-0.11290]	[-0.07832]
D(U3(-2))	-0.018660	-0.294115	0.027156	-0.053907
	(0.13409)	(0.08857)	(0.07336)	(0.08191)
	[-0.13915]	[-3.32058]	[0.37017]	[-0.65808]
D(U3(-3))	-0.148434	-0.213204	0.021846	0.101711
	(0.12677)	(0.08374)	(0.06936)	(0.07744)
	[-1.17087]	[-2.54610]	[0.31499]	[1.31338]
D(CONSCONF(-1))	-0.280402	-0.126527	1.343722	-0.068883
	(0.10766)	(0.07111)	(0.05890)	(0.06577)
	[-2.60458]	[-1.77929]	[22.8143]	[-1.04740]
D(CONSCONF(-2))	0.047273	0.006172	-0.930911	0.044741
	(0.15265)	(0.10083)	(0.08352)	(0.09325)
	[0.30967]	[0.06121]	[-11.1466]	[0.47978]
D(CONSCONF(-3))	0.060635	0.050250	0.227116	-0.112061
	(0.10930)	(0.07219)	(0.05980)	(0.06677)
	[0.55477]	[0.69604]	[3.79823]	[-1.67838]
D(RECNBER(-1))	-0.275259	-0.241270	-0.086725	0.051129
	(0.10316)	(0.06814)	(0.05644)	(0.06302)
	[-2.66820]	[-3.54068]	[-1.53662]	[0.81131]

D(RECNBER(-2))	-0.185259	-0.150208	-0.048241	0.047904
	(0.09998)	(0.06604)	(0.05470)	(0.06107)
	[-1.85304]	[-2.27460]	[-0.88199]	[0.78438]
D(RECNBER(-3))	-0.353727	-0.276632	-0.063893	0.039929
	(0.09898)	(0.06538)	(0.05415)	(0.06047)
	[-3.57360]	[-4.23102]	[-1.17986]	[0.66035]
C	-0.014255	-0.009677	0.000581	0.001724
	(0.01100)	(0.00726)	(0.00602)	(0.00672)
	[-1.29626]	[-1.33226]	[0.09661]	[0.25668]
R-squared	0.391085	0.377323	0.752696	0.101286
Adj. R-squared	0.362611	0.348205	0.741131	0.059260
Sum sq. resids	9.633254	4.203022	2.883286	3.594854
S.E. equation	0.186150	0.122958	0.101841	0.113715
F-statistic	13.73462	12.95840	65.08623	2.410080
Log likelihood	83.75372	204.8486	259.8721	227.6685
Akaike AIC	-0.477765	-1.307183	-1.684056	-1.463483
Schwarz SC	-0.301483	-1.130900	-1.507773	-1.287200
Mean dependent	-0.013151	-0.008646	0.001283	0.000000
S.D. dependent	0.233164	0.152301	0.200162	0.117242

Determinant resid covariance (dof adj.)	3.34E-08
Determinant resid covariance	2.74E-08
Log likelihood	884.9158
Akaike information criterion	-5.650109
Schwarz criterion	-4.894611
Number of coefficients	60

Source: Author's elaboration based on BLS and FRED data, 2018.

Appendix 3. 20 Additional test on structural break (ARDL 4, 3, 3)

Dependent Variable: U6
Method: ARDL
Date: 02/28/20 Time: 13:37
Sample (adjusted): 1994M05 2018M08
Included observations: 292 after adjustments
Dependent lags: 4 (Fixed)
Dynamic regressors (3 lags, fixed): U3 CONSCONF DUM3*U6 DUM3*U3 DUM3*CONSCONF DUM2*U6 DUM2*U3 DUM2*CONSCONF
Fixed regressors: RECNBER C
White-Hinkley (HC1) heteroskedasticity consistent standard errors and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
U6(-1)	0.311796	0.152867	2.039659	0.0424
U6(-2)	0.369415	0.121152	3.049186	0.0025
U6(-3)	0.079397	0.095797	0.828803	0.4080
U6(-4)	-0.003737	0.013173	-0.283691	0.7769
U3	0.941695	0.090205	10.43954	0.0000
U3(-1)	-0.212752	0.187654	-1.133748	0.2580
U3(-2)	-0.256594	0.141115	-1.818333	0.0702
U3(-3)	-0.040792	0.134839	-0.302525	0.7625
CONSCONF	0.009797	0.022471	0.435991	0.6632

CONSCONF(-1)	0.014737	0.045009	0.327411	0.7436
CONSCONF(-2)	-0.012989	0.043300	-0.299982	0.7644
CONSCONF(-3)	-0.016703	0.021261	-0.785618	0.4328
DUM3*U6	0.998087	0.005475	182.2843	0.0000
DUM3(-1)*U6(-1)	-0.306073	0.153616	-1.992453	0.0474
DUM3(-2)*U6(-2)	-0.368596	0.120607	-3.056163	0.0025
DUM3(-3)*U6(-3)	-0.079429	0.094209	-0.843116	0.4000
DUM3*U3	-0.948947	0.088933	-10.67041	0.0000
DUM3(-1)*U3(-1)	0.212695	0.188129	1.130576	0.2593
DUM3(-2)*U3(-2)	0.258118	0.141035	1.830175	0.0684
DUM3(-3)*U3(-3)	0.042386	0.133931	0.316476	0.7519
DUM3*CONSCONF	-0.031579	0.003479	-9.076979	0.0000
DUM3(-1)*CONSCONF(-1)	0.012843	0.005818	2.207631	0.0282
DUM3(-2)*CONSCONF(-2)	0.015348	0.004993	3.073819	0.0023
DUM3(-3)*CONSCONF(-3)	0.003784	0.005075	0.745516	0.4566
DUM2*U6	0.997927	0.007238	137.8746	0.0000
DUM2(-1)*U6(-1)	-0.307239	0.153191	-2.005595	0.0460
DUM2(-2)*U6(-2)	-0.366152	0.120877	-3.029116	0.0027
DUM2(-3)*U6(-3)	-0.085448	0.095389	-0.895789	0.3712
DUM2*U3	-0.940437	0.089005	-10.56613	0.0000
DUM2(-1)*U3(-1)	0.212094	0.187631	1.130373	0.2594
DUM2(-2)*U3(-2)	0.253648	0.140157	1.809743	0.0715
DUM2(-3)*U3(-3)	0.047875	0.135861	0.352380	0.7248
DUM2*CONSCONF	-0.032003	0.003419	-9.360360	0.0000
DUM2(-1)*CONSCONF(-1)	0.013078	0.005817	2.248192	0.0254
DUM2(-2)*CONSCONF(-2)	0.015347	0.005037	3.046610	0.0026
DUM2(-3)*CONSCONF(-3)	0.003960	0.005147	0.769419	0.4424
RECNBER	-0.007473	0.008264	-0.904321	0.3667
C	0.491428	0.385083	1.276161	0.2031

R-squared	0.999746	Mean dependent var	10.47396
Adjusted R-squared	0.999710	S.D. dependent var	2.854497
S.E. of regression	0.048648	Akaike info criterion	-3.087550
Sum squared resid	0.601128	Schwarz criterion	-2.609068
Log likelihood	488.7823	Hannan-Quinn criter.	-2.895889
F-statistic	27071.17	Durbin-Watson stat	2.012778
Prob(F-statistic)	0.000000		

*Note: p-values and any subsequent tests do not account for model selection.

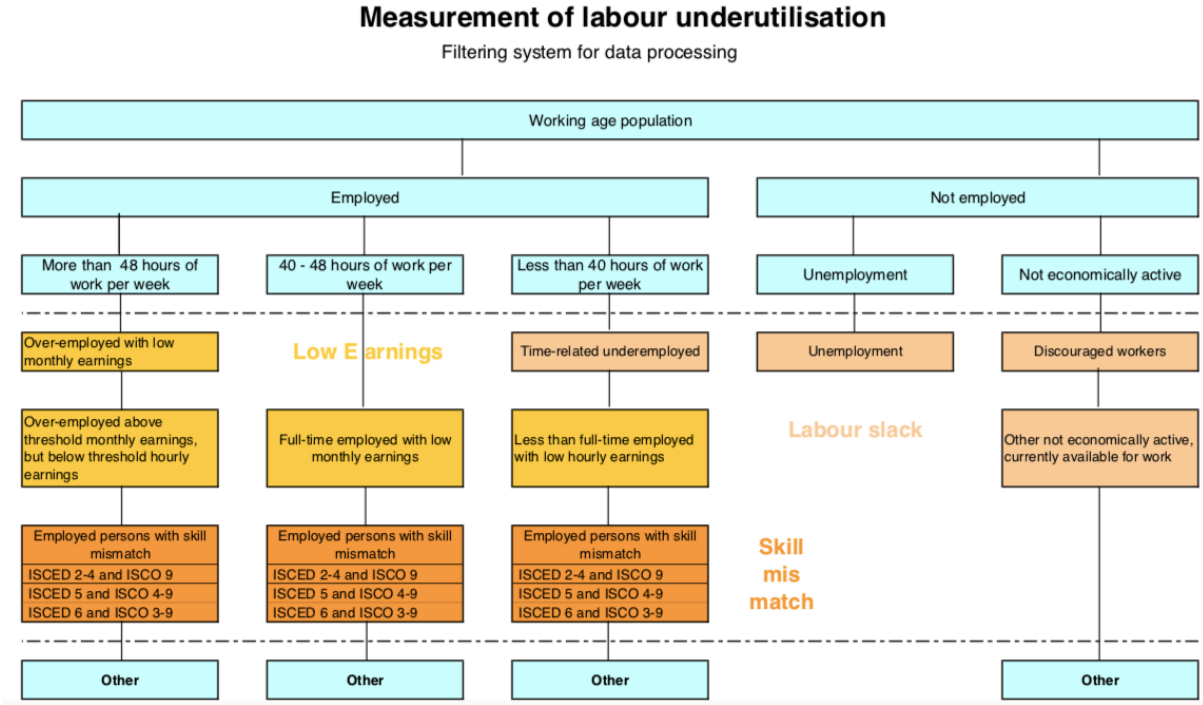
Source: Author's elaboration based on BLS and FRED data, 2018.

Appendix 4. 1 Test of multicollinearity

Regression of	R^2	VIF	Multicollinearity (VIF > 5)?
X1 on X2, X3, X4, X5, X6 and X7	0.684829	3.172881	No
X2 on X1, X3, X4, X5, X6 and X7	0.195058	1.242326	No
X3 on X1, X2, X4 X5, X6 and X7	0.307716	1.444494	No
X4 on X1, X2, X3 X5, X6 and X7	0.549429	2.219406	No
X5 on X1, X2, X3 X4, X6 and X7	0.358853	1.559705	No
X6 on X1, X2, X3 X4, X5 and X7	0.681839	3.143063	No
X7 on X1, X2, X3 X4, X5 and X6	0.385398	1.627069	No

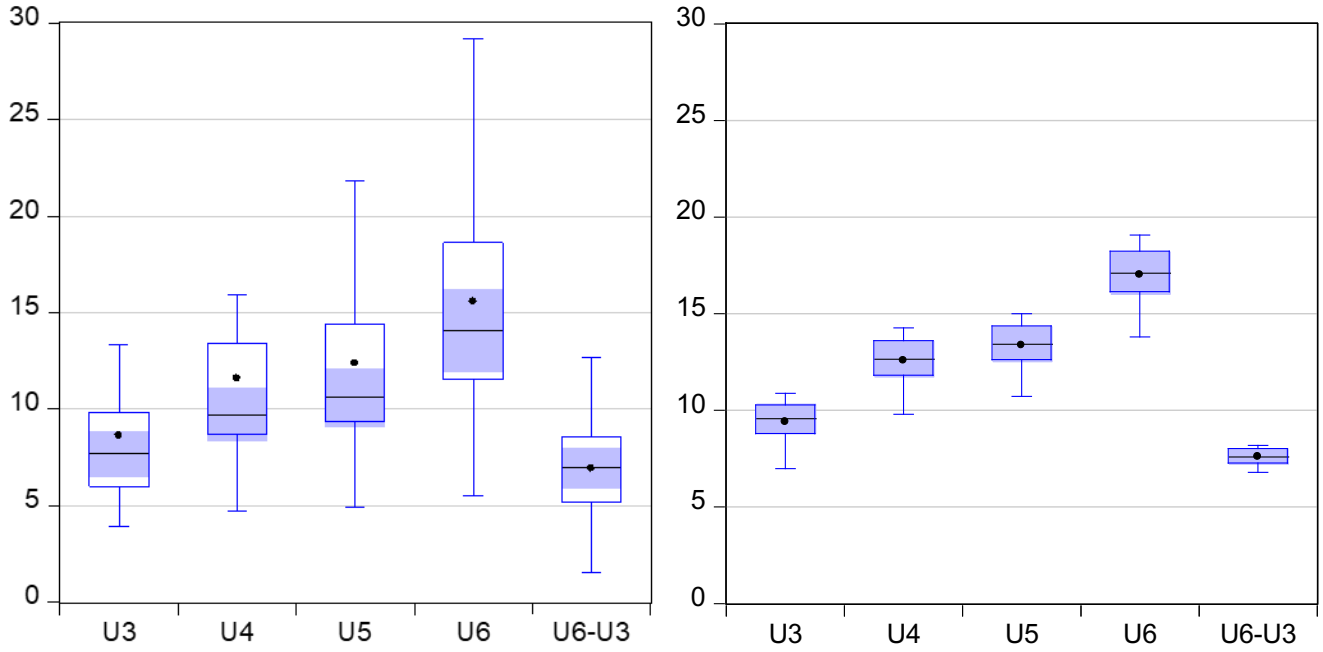
Source: Author's calculations using ILO data, 2018

Appendix 4. 2 Filtering system for data processing: labour underutilization



Source: ILO 2008, Room Document 13, Working group on Labour underutilization, 18th International Conference of Labour Statisticians Geneva.

Appendix 5. 1 Dispersion of measures of labour underutilization for European countries



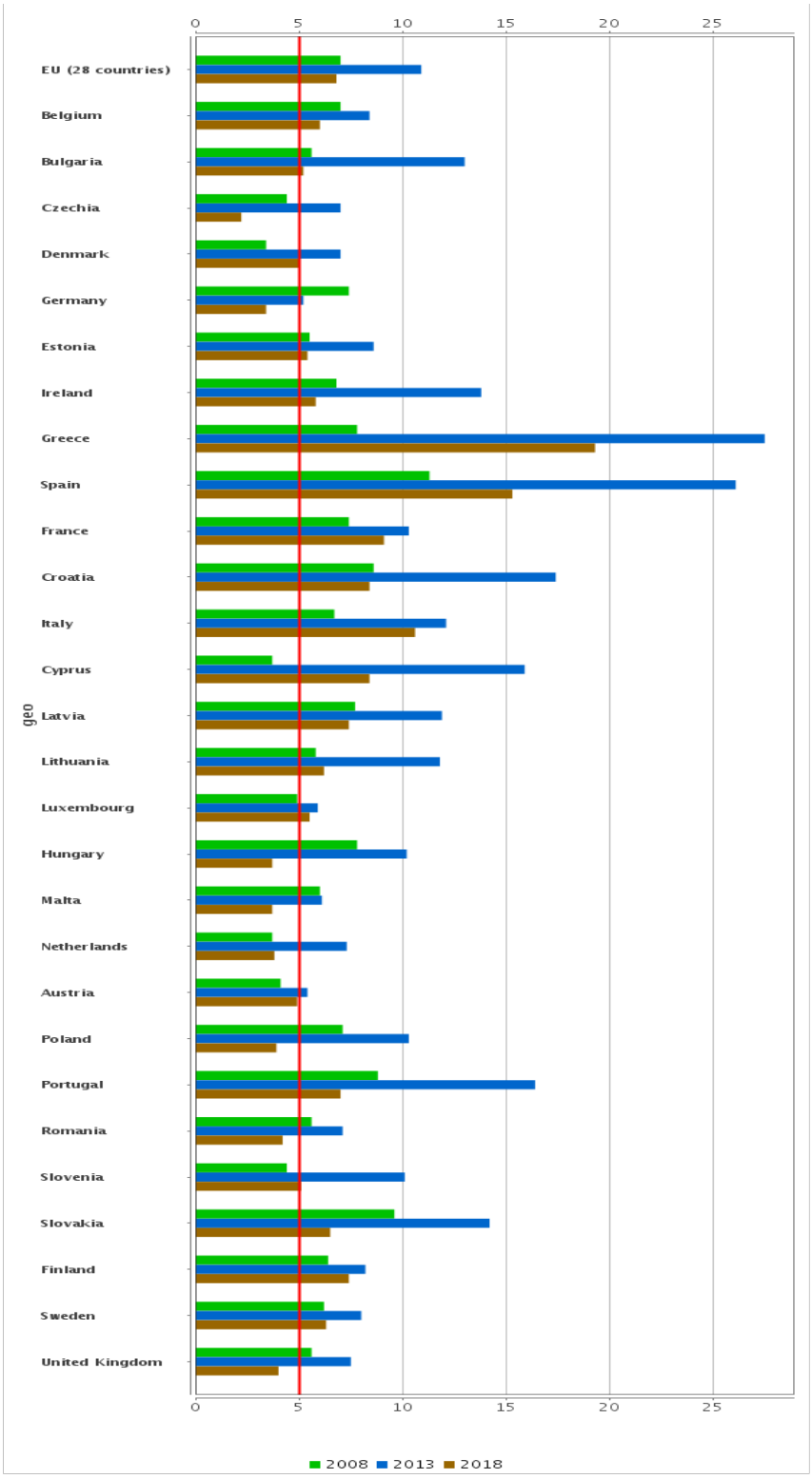
Source: Author's calculations using Eurostat data, 2017. Left, time (2016); right, cross-sections (countries).

Appendix 5. 2 Hypothetical change in measured unemployment rate after reclassification of persons working short hours from a 1-hour minimum to 10-hour during reference week into "unemployed" or "not economically active"

Country (Date)	Unemployment rate		Change
	Standard definition	After reclassification of persons working short hours	
Canada (2005)	6.3%	6.5%	0.2%
Argentina (2004)	8.9%	9.7%	0.8%
Brazil (2003)	9.3%	9.8%	0.5%
Colombia (2005 Q2)	12.1%	12.5%	0.4%
Costa Rica (2003)	6.5%	7.1%	0.5%
Honduras (2003)	4.2%	4.3%	0.1 %
Mexico (2004 Q2)	3.5%	3.7%	0.2%
Peru (2003 Q3)	10.8%	11.1%	0.3%
Ethiopia (2005 March)	9.6%	9.9%	0.3%
Thailand (2006)	1.5%	1.7%	0.2%
Netherlands (2006)	**4.5%**	**6.0%**	**1.5%**
Norway (2006)	**3.4%**	**4.7%**	**1.3%**
Romania (2006)	**7.3%**	**7.4%**	**0.1%**
Switzerland (2006)	**4.1%**	**5.5%**	**1.4%**
United Kingdom (2006)	**5.3%**	**6.5%**	**1.2%**
Note: The required data for this table were not available for Tanzania (2001). Zambia (1999), Pakistan (2006), Philippines (2006).			

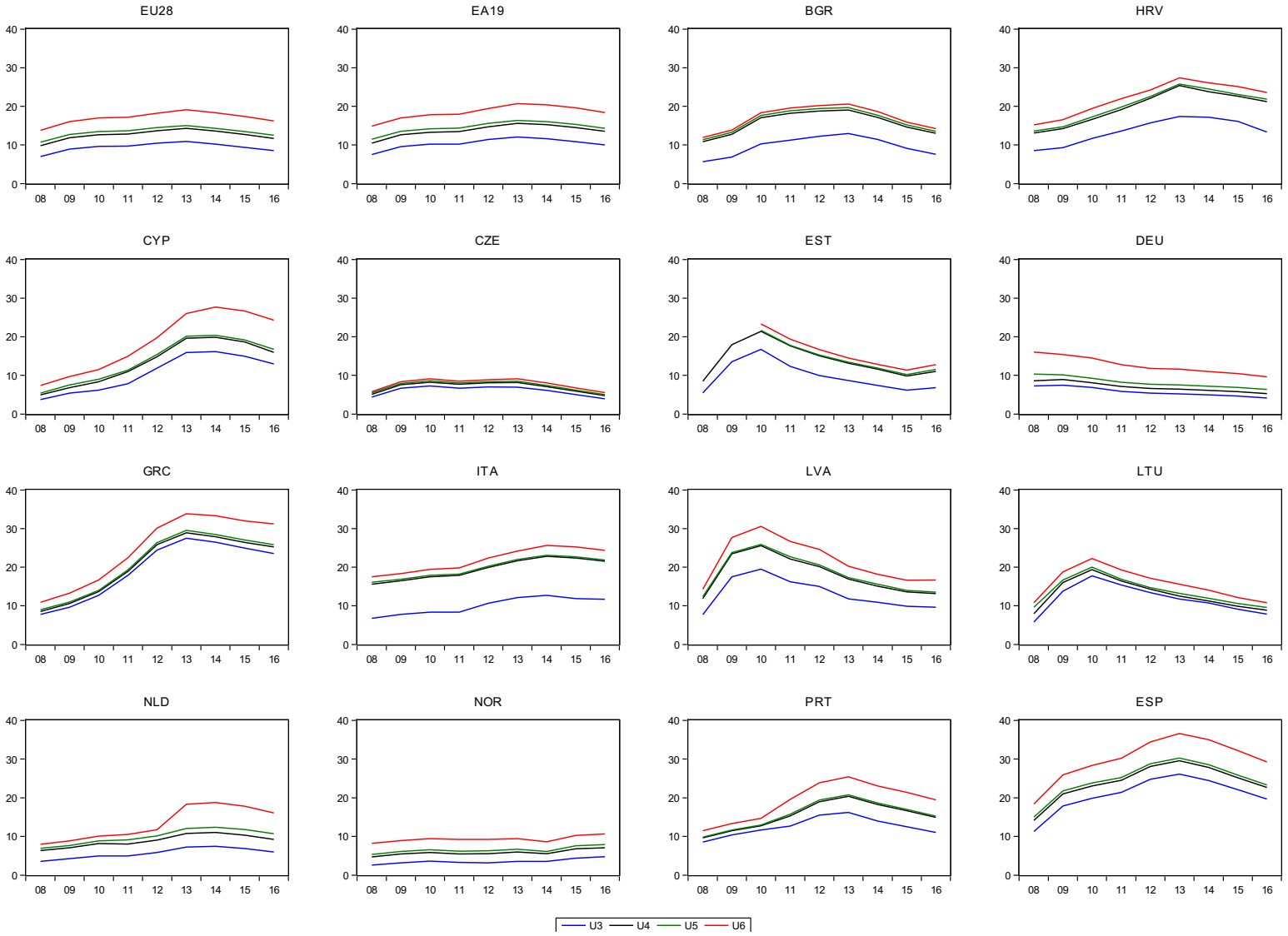
Source: ILO 2008, 18th International Conference of Labour Statisticians, Room Document 13

Appendix 5. 3 Traditional unemployment rate among European countries (%)



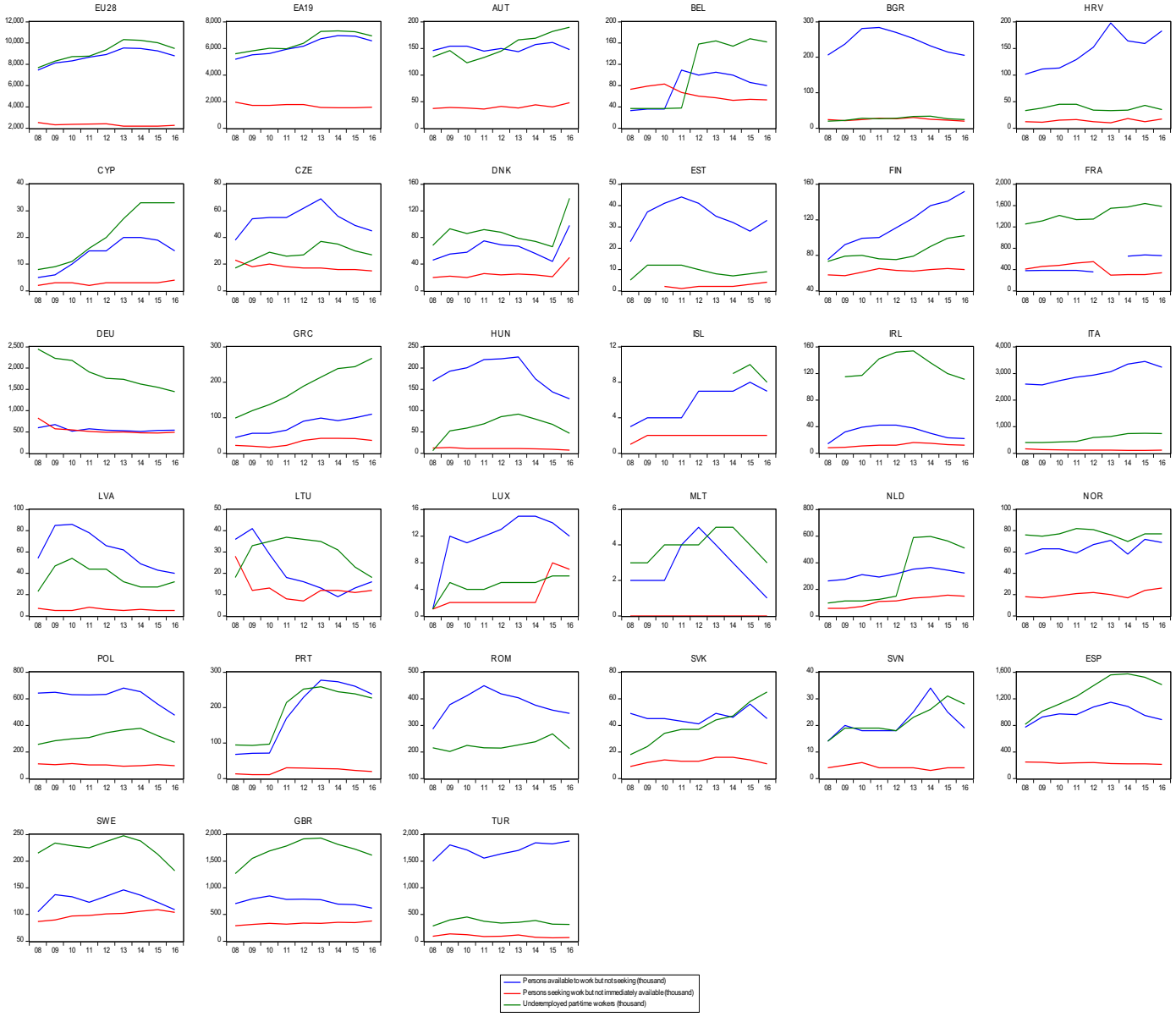
Source: Eurostat 2019, accessed at https://ec.europa.eu/eurostat/tgm/graph.do?tab=graph&plugin=1&language=en&pcode=tps00203&toolbox=type

Appendix 5. 4 U3 through U6 for European countries



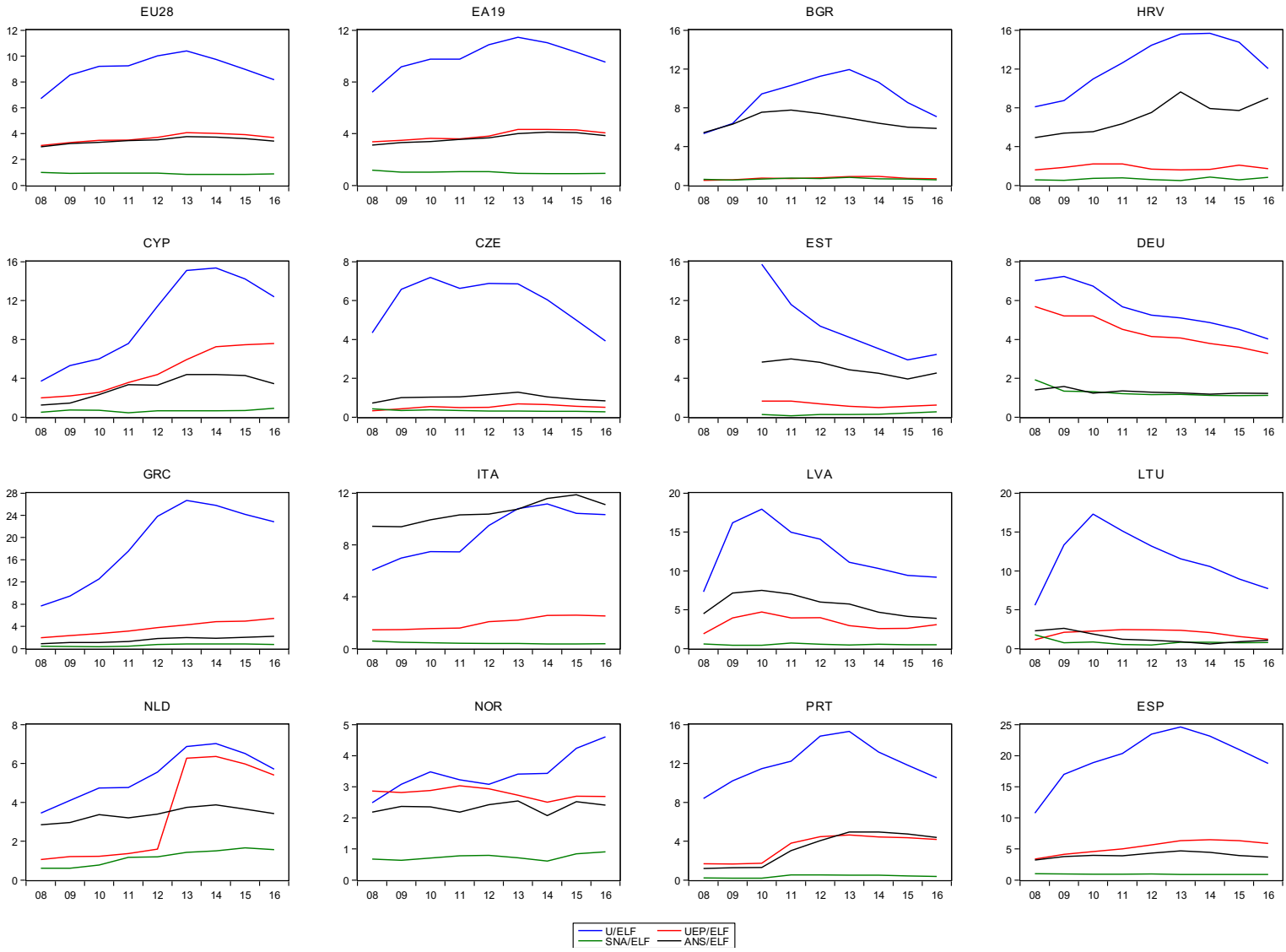
Source: Author's elaboration, Eurostat (2017)

Appendix 5. 5 Unemployment, underemployment, worker discouragement, and unavailable jobseekers for European countries



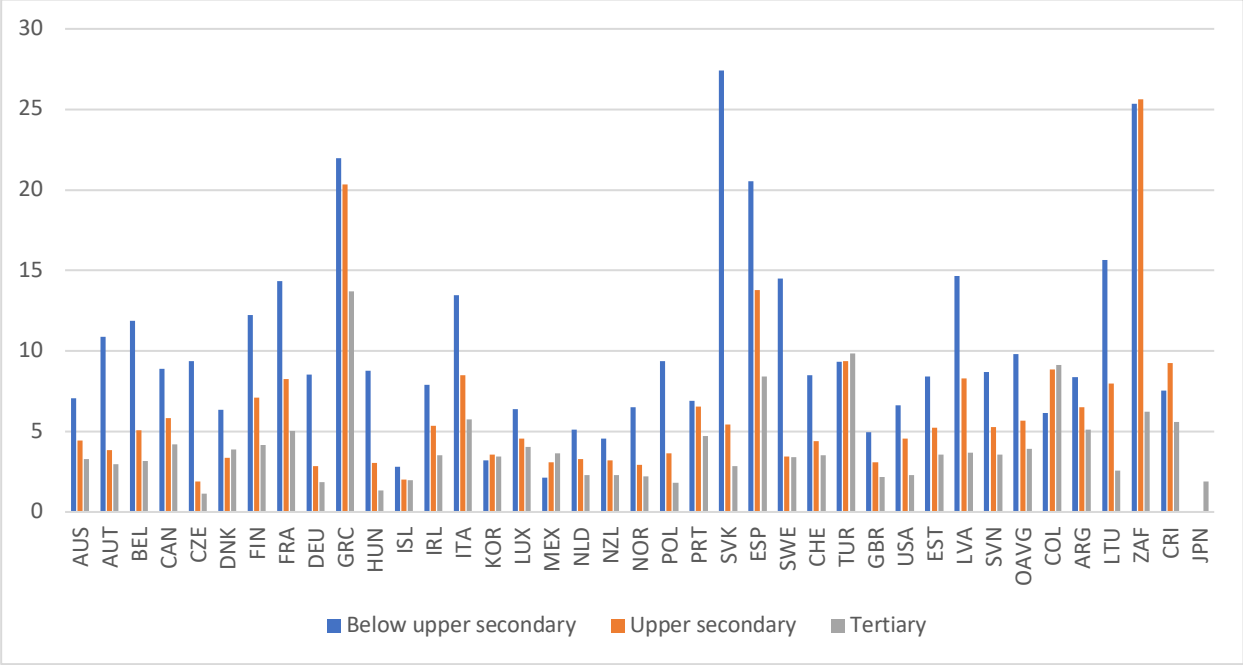
Source: Author's elaboration, Eurostat (2017)

Appendix 5. 6 Unemployment, underemployment, worker discouragement, and unavailable jobseekers as a share of the extended labour force for European countries



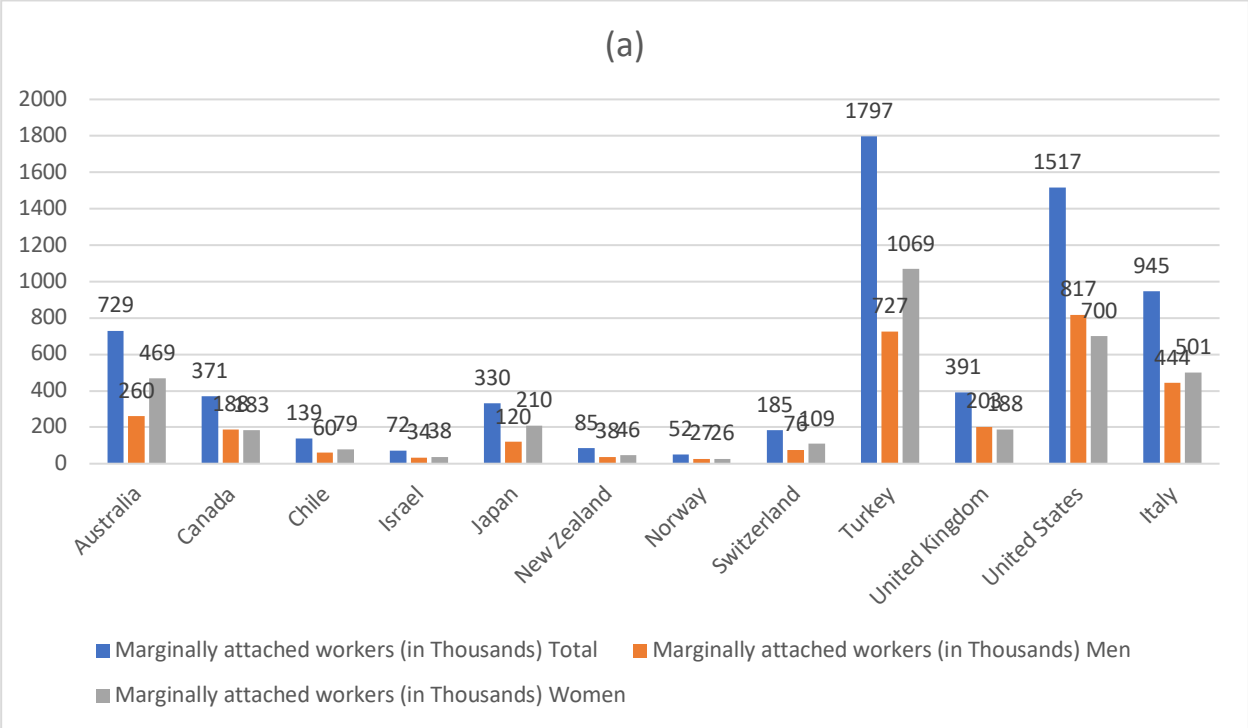
Source: Author's elaboration, Eurostat (2017)

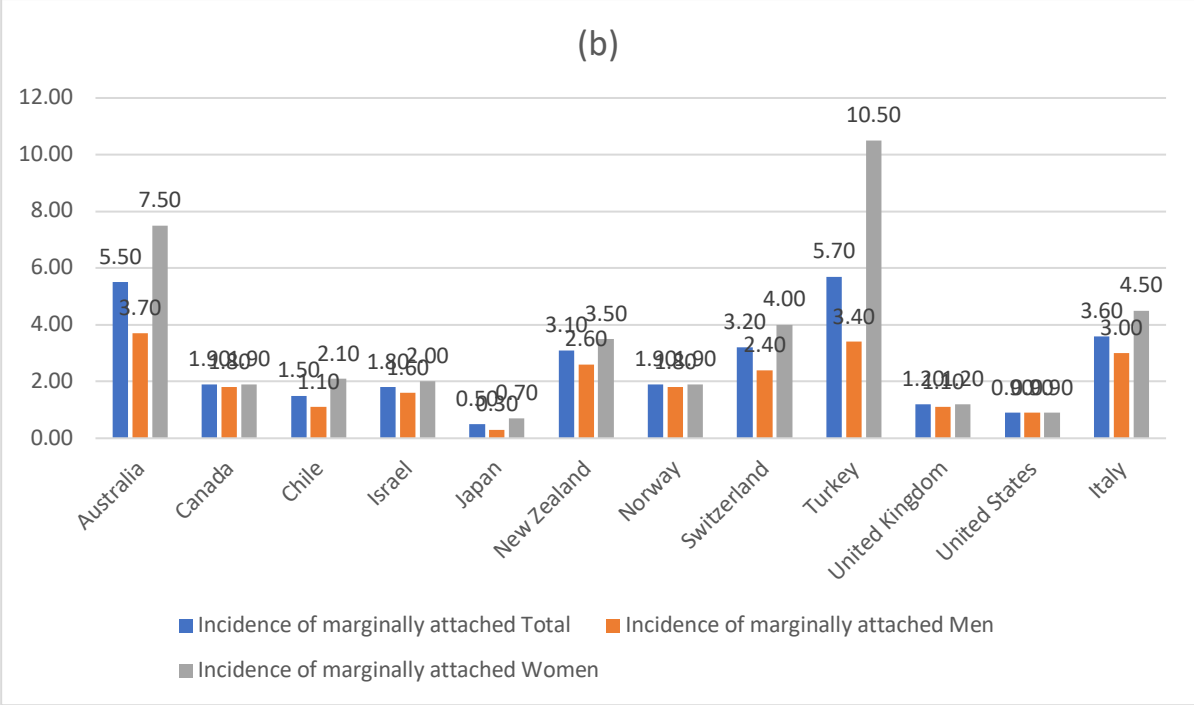
Appendix 5. 7 Unemployment rates by education level, 2018 estimates

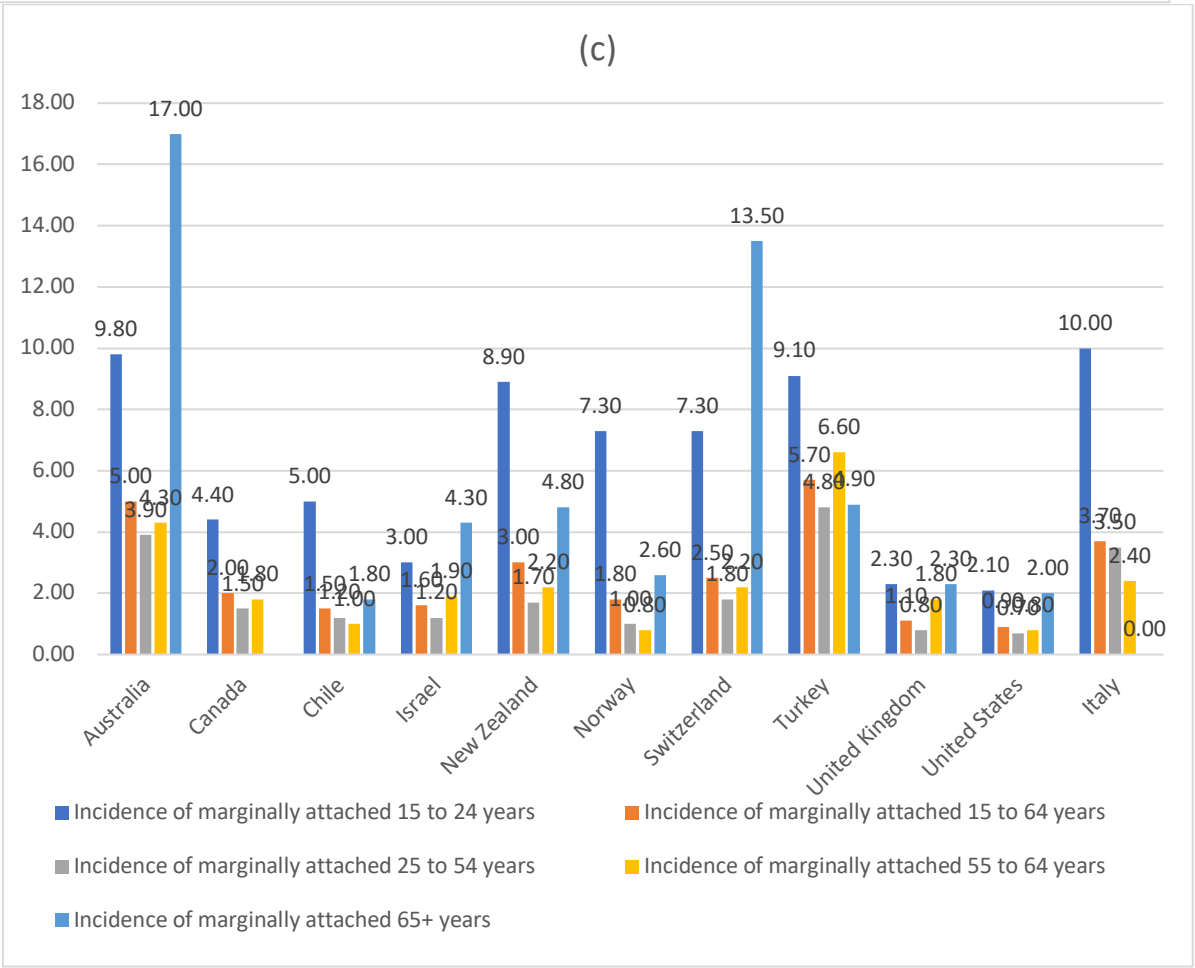


Source: Author's elaboration on OECD data

Appendix 5. 8 Marginally attached workers, by gender and age. OECD countries not in EU and Italy




(b)
12.00
10.00
8.00
6.00
4.00
2.00
0.00
Australia
Canada
Chile
Israel
Japan
New Zealand
Norway
Switzerland
Turkey
United Kingdom
United States
Italy
Incidence of marginally attached Total
Incidence of marginally attached Men
Incidence of marginally attached Women


(c)
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
Australia
Canada
Chile
Israel
New Zealand
Norway
Switzerland
Turkey
United Kingdom
United States
Italy
Incidence of marginally attached 15 to 24 years
Incidence of marginally attached 15 to 64 years
Incidence of marginally attached 25 to 54 years
Incidence of marginally attached 55 to 64 years
Incidence of marginally attached 65+ years

References

Abdel-Latif, H., Ouattara, B. and Murphy, P., 2017. Catching the mirage: The shadow impact of financial crises. *The Quarterly Review of Economics and Finance*, *65*, pp.61-70.

African Development Bank (2012) Labour Force Data Analysis: Guidelines with African Specificities.

Agbola, F.W., 2008. Integrating hidden unemployment in the measurement of unemployment in selected OECD countries.

Bell, D.N. and Blanchflower, D.G., 2013. Underemployment in the UK Revisited. *National Institute Economic Review*, *224*(1), pp.F8-F22.

Bienefeld, M. and Godfrey, M., 1975. Measuring unemployment and the informal sector: some conceptual and statistical problems. *IDS Bulletin*, *7*(3), pp.4-10.

Brandolini, A., Cipollone, P. and Viviano, E., 2006. Does the ILO definition capture all unemployment? *Journal of the European Economic Association*, *4*(1), pp.153-179.

Bregger, J.E. and Haugen, S.E., 1995. BLS introduces new range of alternative unemployment measures. *Monthly Lab. Rev.*, *118*, p.19.

Card, D., 2011. Origins of the unemployment rate: the lasting legacy of measurement without theory. *American Economic Review*, *101*(3), pp.552-57.

Chang, R., 1997. Is low unemployment inflationary? *Economic Review (Atlanta, Ga.)*, *82*(1), pp.4-14.

Choudhry, M.T., Marelli, E. and Signorelli, M., 2012. Youth unemployment rate and impact of financial crises. *International journal of manpower*, *33*(1), pp.76-95.

De La Fuentes, A., 2011. New measures of labour market attachment-3 new Eurostat indicators to supplement the unemployment rate file, Eurostat, Statistics in Focus, 57/2011, 2011.

Dunn, M., Haugen, S.E. and Kang, J.L., 2018. The Current Population Survey—tracking unemployment in the United States for over 75 years. *Monthly Labor Review*, pp.1-23.

ECB Economic Bulletin, Issue 3 / 2017 – Boxes. Assessing labour market slack, ECB.

Ehrenberg, R. G., Rosenberg, P., & Li, J., 1988. Part-time employment in the United States [Electronic version]. In R. A. Hart (Ed.), *Employment, unemployment and labour utilization* (pp. 256-281). Boston, MA: Unwin Hyman, Inc.

Elmeskov, J. And Pichelmann, K., Interpreting Unemployment: The Role of Labour-Force Participation. October 1994. Sonderdruck aus: Economic Studies, No. 21/Winter 1993.

Engle, R.F. and Granger, C.W., 1987. Co-integration and error correction: representation, estimation, and testing. *Econometrica: journal of the Econometric Society*, pp.251-276.

Eurostat, 2003. The European Union Labour Force Survey. Methods and Definitions–2001.

Euwals, R. and Hogerbrugge, M., 2006. Explaining the Growth of Part-time Employment: Factors of Supply and Demand. *Labour*, *20*(3), pp.533-557.

Feng, S. and Hu, Y., 2013. Misclassification errors and the underestimation of the US unemployment rate. *American Economic Review*, *103*(2), pp.1054-70.

Fleck, S. and Sorrentino, C., 1994. Employment and unemployment in Mexico's labor force. *Monthly Lab. Rev.*, *117*, p.3.

Frey, C. B., & Osborne, M. A. (2017). The future of employment: how susceptible are jobs to computerization? Technological Forecasting and Social Change, 114, 254-280.

Fujita, S., 2014. On the causes of declines in the labor force participation rate. *Research Rap Special Report, Federal Reserve Bank of Philadelphia*, *6*.

Granger, C.W., 1969. Investigating causal relations by econometric models and cross-spectral methods. *Econometrica: Journal of the Econometric Society*, pp.424-438.

Gray, M., Heath, A. and Hunter, B., 2005. The labour force dynamics of the marginally attached. *Australian Economic Papers*, *44*(1), pp.1-14.

Haugen, S.E., 2009. *Measures of labour underutilization from the current population survey* (No. 424).

Hornstein, A., Kudlyak, M., Lange, F. and Sablik, T., 2014. Does the Unemployment Rate Really Overstate Labour Market Recovery? *Richmond Fed Economic Brief*, (June), pp.1-5.

Hornstein, Andreas, Marianna Kudlyak, and Fabian Lange, 2015. "Measuring Resource Utilization in the Labour Market." FRB Richmond *Economic Quarterly* 2015: Q1.

https://www.richmondfed.org/publications/research/economic_quarterly/2014/q1/hornstein

Howell, D. R. (2004). Beyond Unemployment: Measuring Labour Market Performance Across Countries. Draft accessed at https://www.researchgate.net/publication/228540719_Beyond_Unemployment_Measuring_Labour_Market_Performance_Across_Countries

ILO, 1998. Resolution concerning the measurement of underemployment and inadequate employment situations, adopted by the Sixteenth International Conference of Labour Statisticians (October 1998)

ILO, 2008. 18th International Conference of Labour Statisticians, 24 Nov. – 5 Dec. 2008, Room Document 13. Working group on Labour underutilization. Beyond Unemployment: Measurement of Other Forms of Labour Underutilization. International Labour Office, Geneva. http://www.ilo.org/wcmsp5/groups/public/---dgreports/---stat/documents/meetingdocument/wcms_100652.pdf

ILO, 2009. Report of the Conference, No. ICLS/18/2008/IV/FINAL. 18th International Conference of Labour Statisticians, 24 Nov. – 5 Dec. 2008, International Labour Office, Geneva. http://www.ilo.org/wcmsp5/groups/public/---dgreports/---stat/documents/meetingdocument/wcms_101467.pdf

ILO, 2013a. Decent Work Indicators: Guidelines for producers and users of statistical and legal framework indicators.

ILO, 2013. Measuring informality: a statistical manual on the informal sector and informal employment/ International Labour Office. - Geneva: ILO, 2013. https://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/---publ/documents/publication/wcms_222979.pdf

ILO, 2013. Report of the Conference: 19th International Conference of Labour Statisticians, Geneva, 2–11 October 2013/ International Labour Office, Department of Statistics. Geneva, ILO, 2013. http://www.ilo.org/wcmsp5/groups/public/---dgreports/---stat/documents/publication/wcms_234124.pdf

ILO, 2017. *Global Employment Trends for Youth 2017: Paths to a better working future*. International Labour Office.

ILO, 2018a. World Employment and Social Outlook: Trends 2018. International Labour Office – Geneva

ILO, 2018b. ILOSTAT Spotlight on work statistics nº 4 – August 2018. Avoiding unemployment is not enough. An analysis of other forms of labour underutilization.

ILO, 2018c. Women and men in the informal economy: a statistical picture (third edition) / International Labour Office – Geneva.

ILO, 2018d. ILOSTAT Spotlight on work statistics nº 2 – May 2018. Where are the jobs? Employment patterns across sectors and occupation

ILO, 2018e. ILOSTAT Spotlight on work statistics nº 3 – June 2018. Paid employment vs vulnerable employment A brief study of employment patterns by status in employment.

ILO, 2018f. ILOSTAT Spotlight on work statistics nº 1 – May 2018. What about seniors? A quick analysis of the situation of older persons in the labour market. ILO, 2019a. ILOSTAT Spotlight on work statistics nº 5 – March 2019. Labour market access – a persistent challenge for youth around the world. ILO, 2019b. ILOSTAT Spotlight on work statistics nº 8 – August 2019. Persons outside the labour force: How inactive are they really? Delving into the potential labour force with ILO harmonized estimates.

ILO, 2019c. Quick guide to interpreting the unemployment rate, The International Labour Office, Geneva.

ILO, 2019d ILOSTAT Spotlight on work statistics nº 6 – April 2019. The working poor or how a job is no guarantee of decent living conditions. A study based on ILO's global estimates of employment by economic class.

ILO, 2019e. Rules of the game: An introduction to the standards-related work of the International Labour Organization International Labour Office, Geneva, 2019

Johansen, S., 1988. Statistical analysis of cointegration vectors. *Journal of economic dynamics and control*, *12*(2-3), pp.231-254.

Johansen, S., 1991. Estimation and hypothesis testing of cointegration vectors in Gaussian vector autoregressive models. *Econometrica: Journal of the Econometric Society*, pp.1551-1580.

Jonathan D. Jones (1989) A comparison of lag–length selection techniques in tests of Granger causality between money growth and inflation: evidence for the US, 1959–86, Applied Economics, 21:6, 809-822, DOI: 10.1080/758520275

Jones, S.R. and Riddell, W.C., 1999. The measurement of unemployment: An empirical approach. *Econometrica*, *67*(1), pp.147-162.

Jones, S.R. and Riddell, W.C., 2000, August. The Dynamics of US Labour Force Attachment. In *manuscript, Econometric Society World Congress Series*.

Jones, S. R., & Riddell, W. C. 2002, Unemployment and non-employment: Heterogeneities in labour market states. *Department of Economics WP*, (2002-05)

Kao, C., 1999. Spurious regression and residual-based tests for cointegration in panel data. *Journal of econometrics*, *90*(1), pp.1-44.

Keynes, J.M. (1933). Economic possibilities for our grandchildren (1930). Essays in persuasion, pp. 358–73.

Levrero, E.S., 2013a. Marx on absolute and relative wages and the modern theory of distribution. *Review of Political Economy*, *25*(1), pp.91-116.

Levrero, E.S., 2013b. Marx's theory of wages and the revival of the surplus approach. In *Sraffa and the Reconstruction of Economic Theory: Volume One* (pp. 153-175). Palgrave Macmillan, London.

Webster, C., & Ivanov, S. (2019). Robotics, artificial intelligence, and the evolving nature of work. In George, B., & Paul, J. (Eds.). Business Transformation in Data Driven Societies, Palgrave-MacMillan (forthcoming)

Kudlyak, M. and Lange, F., 2014. Measuring heterogeneity in job finding rates among the nonemployed using labour force status histories.

OECD 2017. Employment quantity and labour market slack, 2015, in *OECD Employment Outlook 2017*, OECD Publishing, Paris. http://dx.doi.org/10.1787/empl_outlook-2017-graph2-en

OECD 2017. *OECD Employment Outlook 2017*, OECD Publishing, Paris, https://doi.org/10.1787/empl_outlook-2017-en.

Martin, G., 2000. Employment and unemployment in Mexico in the 1990s. *Monthly Lab. Rev.*, *123*, p.3.

Martin, J. P., & Grubb, D. (2001). *What works and for whom: a review of OECD countries' experiences with active labour market policies* (No. 2001: 14). Working Paper, IFAU-Institute for Labour Market Policy Evaluation.

Nickell, S., 1997. Unemployment and labour market rigidities: Europe versus North America. *Journal of Economic perspectives*, *11*(3), pp.55-74.

OECD 2017. Employment quantity and labour market slack, 2015, in *OECD Employment Outlook 2017*, OECD Publishing, Paris. http://dx.doi.org/10.1787/empl_outlook-2017-graph2-en

Pedroni, P., 1999. Critical values for cointegration tests in heterogeneous panels with multiple regressors. *Oxford Bulletin of Economics and statistics*, *61*(S1), pp.653-670.

Pedroni, P., 2004. Panel cointegration: asymptotic and finite sample properties of pooled time series tests with an application to the PPP hypothesis. *Econometric theory*, *20*(3), pp.597-625.

Perron, P., 1989. The great crash, the oil price shock, and the unit root hypothesis. *Econometrica: Journal of the Econometric Society*, pp.1361-1401.

Rettore, E., Torelli, N. and Trivellato, U., 1990. Unemployment and Search for Work: Exploratory Analyses of Labour Market Attachment using CPS-Type Data. *Labour*, *4*(3), pp.161-190.

Russell, H. and O'Connell, P.J., 2001. Getting a job in Europe: The transition from unemployment to work among young people in nine European countries. *Work, Employment and Society*, *15*(1), pp.001-024.

Sengenberger, W., 2011. Beyond the measurement of unemployment and underemployment. *ILO Working Paper, Geneva, International Labour Organization*.

Shaikh, A., 2016. *Capitalism: Competition, conflict, crises*. Oxford University Press.

Shimer, R., 2008. The probability of finding a job. American Economic Review, 98(2), pp.268-73.

Shimer, R., 2012. Reassessing the ins and outs of unemployment. *Review of Economic Dynamics*, *15*(2), pp.127-148.

Shiskin, J., 1976. Employment and unemployment: the doughnut or the hole?. *Monthly Labor Review*, *99*(2), pp.3-10.

Sims, C.A., 1974. Seasonality in regression. *Journal of the American Statistical Association*, *69*(347), pp.618-626.

Smith, J.C., 2011. The ins and outs of UK unemployment. *The Economic Journal*, *121*(552), pp.402-444.

Sorrentino, C., 1993. International comparisons of unemployment indicators. *Monthly Lab. Rev.*, *116*, p.3.

Sorrentino, C., 1995. International unemployment indicators, 1983-93. *Monthly Lab. Rev.*, *118*, p.31.

Sorrentino, C., 2000. International unemployment rates: how comparable are they? *Monthly Labour Review June 2000*, Bureau of Labour Statistics.

Statistics Canada. *Labour Force Update* Supplementary Measures of Unemployment. Labour Statistics Division. Summer 1999 Vol.3, No. 3

Taylor, J. and Bradley, S., 1997. Unemployment in Europe: A comparative analysis of regional disparities in Germany, Italy and the UK. *Kyklos*, *50*(2), pp.221-245.

Tronti, L. and Gatto, R., 2012. Measuring the long wave. Unemployment, discouragement and semi-employment in Italy, during and after the crisis. In *Social Exclusion* (pp. 171-198). Physica, Heidelberg.

Vogelsang, T.J. and Perron, P., 1998. Additional tests for a unit root allowing for a break in the trend function at an unknown time. *International Economic Review*, pp.1073-1100.

Vegh, C.A., Vuletin, G., Riera-Crichton, D., Pablo Puig, J., Camarena, J.A., Galeano, L., Morano, L. and Venturi, L., 2019. Effects of the Business Cycle on Social Indicators in Latin America and the Caribbean: When Dreams Meet Reality. LAC Semiannual Report (April), World Bank, Washington, DC. Doi: 10.1596/978-1-4648-1413-6. License: Creative Commons Attribution CC BY 3.0 IGO

Wallis, K.F., 1974. Seasonal adjustment and relations between variables. *Journal of the American Statistical Association*, *69*(345), pp.18-31.

United Nations, Department of Economic and Social Affairs, Population Division, 2017. World Population Prospects: The 2017 Revision, Key Findings and Advance Tables. Working Paper No. ESA/P/WP/248.

Internet sources

1. https://www.bls.gov
2. https://data.worldbank.org
3. https://fred.stlouisfed.org
4. https://www.ilo.org