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Youth Unemployment: What Can the Flow Data Tell Us?

Bachelor thesis

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Abstract

This thesis deals with the dynamics of the Czech labour market, with special emphasis on the youth. The calculations of gross labour market flows and flow transition rates deliver evidence on higher youth labour market dynamics compared to prime-age labour market.

The thesis then analyses the driving forces of unemployment rate fluctuations. It explores the concept of steady-state unemployment rate and then focuses on decomposition of fluctuations in the steady-state unemployment rate. In the Czech Republic, the results at the aggregate level suggest that changes in unemployment inflow contribute with considerably higher share to the fluctuations in steady-state unemployment rate than changes in unemployment outflow. In case of the youth steady-state unemployment rate, changes in unemployment inflow account for an even higher share of fluctuations in the steady-state unemployment rate.

Keywords

youth unemployment, panel data, gross labour market flows, flow labour market transition rates, steady-state unemployment rate

Abstrakt

Tato bakalářská práce se zabývá dynamikou českého pracovního trhu se zvláštním důrazem na mladé. Z výpočtů hrubých toků na trhu práce a pravděpodobností přechodů mezi stavy na trhu práce lze vysledovat, že dynamika trhu práce mladých (15-24 let) je vyšší než dynamika dospělé populace (25-54 let).

Práce rovněž zkoumá příčiny změn míry nezaměstnanosti, studuje koncept setrvalé míry nezaměstnanosti a rozklad jejích změn. Z výsledků vyplývá, že ke změnám v míře setrvalé nezaměstnanosti populace v produktivním věku přispívají v České republice podstatně více změny v přítocích do nezaměstnanosti než v odtocích z ní. U mladých je tento jev ještě zřetelnější.

Klíčová slova

nezaměstnanost mladých, panelová data, hrubé toky na trhu práce, pravděpodobnosti přechodů na trhu práce, setrvalá míra nezaměstnanosti

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Declaration of Authorship

1. The author hereby declares that she compiled this thesis independently, using only the listed resources and literature.

2. The author hereby declares that all the sources and literature used have been properly cited.

3. The author hereby declares that the thesis has not been used to obtain a different or the same degree.

Prague, May 12, 2016 Lenka Šlegerová

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I would like to thank my supervisor, doc. Ing. Vladislav Flek, CSc., for the valuable guidance and advice he has provided me throughout writing this thesis.

Institute of Economic Studies
Bachelor thesis proposal

The aim of this bachelor thesis is to analyse youth unemployment in theoretical, analytical and economic policy dimension.

Firstly, youth unemployment will be described on the theoretical level, including the explanation of the specifics of youth unemployment and why youth unemployment becomes frequent research subject. Next, the hypothesis, whether the higher level and dynamics of youth unemployment rate is based on economic arguments and the purpose of economic policy is only to dampen the social and economic impacts or whether it is possible to reach the complete convergence of youth unemployment with the unemployment rate of other age groups, especially the “prime age” group, will be verified.

Secondly, an overview and comparison of economic policies that are used while trying to solve the problem of youth unemployment will be compiled. This part will be based on research and recommendations of the European Commission, ILO, OECD and Ministry of Labour and Social Affairs of the Czech Republic, with emphasis on the types of data which are used in these researches - whether the data are stock or flow. The informative value of the more frequently used stock data will be verified and the potential of flow data for creating economic policies will be highlighted.

Thirdly, the particular possibilities of flow data will be explored using data from EU-SILC for the Czech Republic with intention to identify forms in which the analysis of flow data can contribute to youth unemployment policies and to identify the risks linked to youth unemployment that are so far evaluated only with difficulties using the official data. The analysis will be based on one hand on transitional probabilities using methods of Markov chains and on the other hand on the impacts of duration of previous statuses on transitional probability.

Contents

Introduction

Youth unemployment has been widely viewed as an important policy issue for several decades (Ellwood, 1982; Bell and Blanchflower, 2011; Perciun and Balan, 2013). Many governments prioritize this issue and attempt to develop appropriate policies and programmes (ILO, 2015a). In addition, youth employment has been part of the ILO agenda for a long time (ILO, 2015b). Analogously, the European Commission is increasingly focussing on youth unemployment, especially after its further disproportionate increases during the Great Recession (EC, 2011).

The main objective of this thesis is to discuss the specificity of youth labour markets by exploring a flow approach. I concentrate on the theory and methodology of a flow approach and attempt to explain its potential for deeper understanding of labour market dynamics. This also includes the adoption of advanced methods such as decomposition of the fluctuations in steady-state unemployment rate. To achieve this goal, I combine the methods introduced by Shimer (2005); Fujita and Ramey (2007); and Petrongolo and Pissarides (2008).

The emphasis on studying labour market dynamics by using a flow approach has a long tradition, starting from a paper of Blanchard and Diamond (1990). However, except for a limited number of studies, such as Elsby et al. (2011) or Flek et al. (2015), youth labour market flows have not represented the main research focus. This thesis thus attempts to broaden the number of studies in this line of research. The emphasis is laid especially on the Czech youth labour market by using the accessible data from Eurostat and Ministry of Labour and Social Affairs, to find supporting evidence for the hypothesis of higher youth labour market dynamics reflected in higher youth labour market flows compared to prime-age population. Then I intend to show how this dynamics is reflected in youth unemployment evolutions.

Presumed higher dynamics of youth labour markets is closely related to the concept of heterogeneous labour markets first introduced by Reich et al. (1973). This concept lays the ground for studying separately the youth and adult labour markets, as they appear to form two relatively autonomous segments.

Disaggregation of labour market by age thus enables to identify dissimilarities in the functioning of these two segments and the different drivers of youth and adult unemployment. This hypothesis will be supported by theory and then substantiated by data evidence.

For policy purposes, the present approach is capable to identify which forces, flows, and to which extent drive the increase in youth and adult unemployment rate - whether it is a decrease in job finding rate, an increase of in job loss rate, or same combination of these two factors. Apart from theoretical and empirical insights into the dynamics of youth labour markets, this thesis also addresses the issue of active labour market policies that are used for solving the problem of high youth unemployment.

The rest of this thesis is organised as follows: Section 1 concentrates on the specificity of youth labour market as reflected in commonly used labour market indicators, Section 2 describes Czech youth labour market policies and suggests what type of flow indicators are used to evaluate and adjust the programmes. Section 3 provides a summary of the theory of labour market flows while Section 4 applies available data to verify the validity of theoretical concepts introduced in Section 3. The last section concludes the thesis.

1 Youth labour market

This chapter evolves the hypothesis of heterogeneous labour market. It argues that it is well-founded to study segments of the labour market separately since they exhibit different characteristics. This thesis focuses especially on youth labour market and its differences from prime-age labour market. Even though youth unemployment is the most examined research topic in relation to youth labour market, specificity of youth labour market does not reside only in higher unemployment rates. Other aspects of the youth labour market are worth noting, such as labour force participation which is strongly influenced by education participation rates. There is an immense quantity of research on youth unemployment owing mainly to the higher rates of youth unemployment. This chapter presents some possible reasons for the higher rates and their consequences for individuals and society.

1.1 Specificity of the youth labour market

The hypothesis of heterogeneous labour market is supported by a theory that was emerging in the 1970s, theory of *Labour market segmentation* (Reich, Gordon and Edwards, 1973). According to this theory there are groups of workers divided by sex, race, educational attainment, industry branch and, for this thesis importantly, by age that seem to be operating in different labour markets with different working conditions, promotional opportunities, wages, and market institutions. The theory suggests segmentation into primary and secondary markets, where secondary jobs are characterized by higher turnover, lower wages, and lower stability. During the emergence of the Labour market segmentation theory in the 1970s these secondary jobs mainly comprised minority workers, women, and youth (Reich, Gordon and Edwards, 1973). This chapter further discusses the characteristics of the recent youth labour market and considers similarities with the characteristics described by Reich, et al. (1973).

Differences in unemployment rates, labour force participation rates, and other labour market indicators are still persistent especially between youth and prime-age population.[1] The International Labour Organization (ILO) regularly releases estimates of labour force participation rates according to the standardized age groups: 15-24, then ten-year cohorts and 65+. The Czech labour force participation rates for several age cohorts are displayed in Table 1.

Table 1 Labour force participation rate by age groups, Czech Republic, (%)

Year	15-24	25-54	55-64	15-64
2000	46.4	88.4	38.5	71.6
2001	44.0	88.4	39.4	71.2
2002	40.9	88.2	42.6	71.0
2003	38.7	87.7	44.3	70.6
2004	36.0	87.7	45.2	70.2
2005	33.9	88.2	46.9	70.5
2006	33.3	88.1	47.6	70.3
2007	31.7	87.7	48.4	69.9
2008	30.8	87.3	49.8	69.7
2009	31.6	87.6	49.7	70.0
2010	30.7	87.8	49.8	70.1
2011	29.7	88.0	50.5	70.5
2012	31.0	88.3	52.1	71.5
2013	31.4	89.1	54.3	72.8
2014	32.2	88.8	56.5	73.6
2015	32.2	88.9	56.9	74.1

Source: ILO (2015a), Key Indicators of the Labour Market 2015: Labour force participation rate

The youth labour force participation rates are systematically lower than rates of prime-age population. The youth rates even followed a decreasing trend over the last 15 years. On the other hand the participation rates of prime-age population remained more or less stable.

The decreasing youth labour force participation rate is closely related to increasing level of inactivity, *I*, since inactivity is the inverse of labour force participation.[2] Youth labour force participation is naturally strongly influenced by education participation rates, since participating in a full time education substitutes labour force activity. In the Czech Republic, the participation rate of

[1] The term “youth” covers individuals aged 15 -24 years. The term “prime-age” refers to persons aged 25-54 years.

[2] Everybody in working age population falls within one of three labour market states (statuses); i.e., employment, unemployment and economic inactivity; but nobody can fall within more than one status at the same time; the three labour market states are mutually exclusive and exhaustive (ILO, 2014c).

youth in formal education reached 67.8% in 2014, in comparison with the 25+ age group with only 2% participating in education in 2014.[3]

1.2 Youth unemployment

Youth unemployment has been perceived as a problem in many countries for several decades. Accordingly, youth unemployment has become a concern of policy makers and a focus of labour market researches. It has long been recognised that unemployment in general is a stressful life event associated with negative health consequences, mental stress, loss of self-esteem and an increased risk of depression. Ellwood (1982), and Bell and Blanchflower (2011) argue that unemployment spells are especially harmful to the individual and society when young people become unemployed. Unemployment while young raises the probability of being unemployed in later years and also carries a wage penalty. Youth unemployment and potential inactivity resulting from discouragement worsen the ability of youth to play an active role in society (Perciun and Balan, 2013). There is also evidence from UK suggests that both youth and adult unemployment rates are positively correlated with crime rates, however the relationship between youth unemployment and crime rate was found to be stronger (Bell and Blanchflower, 2010).

The recent development of youth unemployment rate in the Czech Republic is displayed in Table 2. These rates can be directly compared with youth unemployment rates in other European countries by means of Table 11 in Appendix. The Czech Republic stands reasonably well in this comparison; youth unemployment rates in most European countries are much higher. It can be seen, besides other points that the level of youth unemployment rate during the recent economic crisis varies from country to country.

[3] 15-24: 67.8%; 25-34: 6.9%; 35-44: 1.6%; 45-54: 0.4%; 55-64: 0.1%; 65+: 0.0%
However 89.2% of 35+ individuals participated only in distance learning, as opposed to only 1.6% of distance students in 15-24 age group and 36.4% of distance students in 25-34 age group.
This information was provided by one of the employees of the Czech Statistical Office. It is based on data from Office Labour Force Sample Survey; computed by averaging over data collected in four surveys during 2014.

Table 2 Youth unemployment rate, Czech Republic, (%)

Czech Republic	2007	2008	2009	2010	2011	2012	2013	2014	2015
Youth unemployment rate	10.7	9.8	16.8	18.4	18.0	19.6	19.1	15.8	13.0

Source: ILO (2015a), Key Indicators of the Labour Market 2015: Youth unemployment

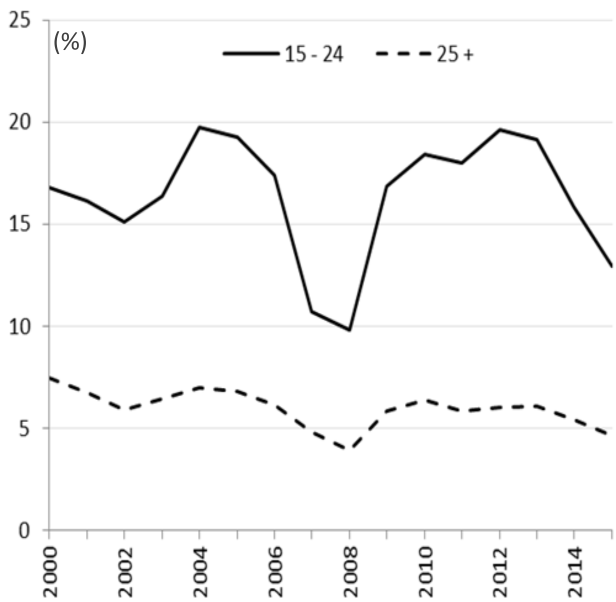
The youth unemployment rates in the Czech Republic rocketed in 2009 and followed an increasing trend until 2012; see Table 2. The group of the Czech young individuals aged 15-24 was, together with the 50+ group, most affected by the 2008 economic crisis (MoLSA, 2014a). Since then, the rates were gradually declining; however it is worth noting that the overall unemployment rate was decreasing in the recent time period as well (ILO, 2015a).

To ascertain relationship between youth and adult unemployment rates, the development of ratio of youth to adult unemployment rates is considered.[4]

Table 3 Ratio of youth unemployment rate to adult unemployment rate, Czech Republic

Figure 1 Youth unemployment rate, adult unemployment rate, Czech Republic, (%)

Year	Ratio of youth unemployment rate to adult unemployment rate
2000	2.25
2001	2.37
2002	2.56
2003	2.55
2004	2.83
2005	2.83
2006	2.83
2007	2.23
2008	2.49
2009	2.89
2010	2.89
2011	3.09
2012	3.26
2013	3.13
2014	2.93
2015	2.79



Source: Table: ILO (2015a), Key Indicators of the Labour Market 2015: Youth unemployment
Figure: Own creation from ILO (2015a), Key Indicators of the Labour Market 2015: Youth unemployment

4 Adults in this case represent the age group 25+.

The youth-to-adult unemployment rate ratio is a useful measure that can be used to infer whether young people have suffered during the recent economic crisis disproportionately, as it has been suggested; see, for instance, Choudhry, Marelli and Signorelli (2010); Bell and Blanchflower (2011); and ILO (2013a).

Figure 1 displays development of youth and adult unemployment rates separately. Remarkably higher variance in youth unemployment rate in comparison with relatively stable adult unemployment rate can be seen. This indicates differences in responsiveness to negative shocks in economy, namely responses to 2008 economic crisis. Since youth are overrepresented among job seekers a decline in job creation hits them more significantly.

At the same time, youth-to-adult unemployment rate ratios in Table 3 reflect the tendency of youth unemployment rates to be higher than adult rates irrespective of the state of the economy; the ratio has been higher than one or more precisely higher than two for the past 15 years. It peaked in 2012 (reaching 3.26) and it has been steadily decreasing since then (ILO, 2015a).

There are several theoretical explanations that have been thoroughly described before that support the data based fact of higher youth unemployment rates; see, for example, Bell and Blanchflower (2011); Caliendo, Künn and Schmidl (2011); ILO (2015a); Baranowska-Rataj and Magda (2013). On the demand side of youth labour market, young people naturally have on average less work skills at their disposal and accumulated less firm-specific capital. In consequence they may fall into experience trap.

Finding a job after leaving formal education with limited working experience might be associated with certain disadvantages in comparison to equally educated adults who had already have some labour market experience. Reasons for that are explored in a theory, published in the 1970s by M. Spence, which delves further into decisions of employers under uncertainty while hiring new employees. According to the theory of *Job market signalling* (Spence, 1973) employers are not sure about productivity of individuals during the hiring process and they must rely on observable characteristics and attributes of potential employees that are available and verifiable.

Yet, these observable characteristics and attributes are generally assumed to differ for youth and prime-age population. The characteristics are either changeable or fixed, to the latter race and sex can be assigned. M. Spence (1973) considers education as the typical changeable characteristics. Individuals can invest in their education at some cost in terms of time and money (at least in form of opportunity costs). He refers to these costs as to “signalling costs” (Spence, 1973). Job experience is another characteristic that can be deepened by investing. Nevertheless, the productivity of young workers has not yet been discovered and appraised by appropriate wage that would serve as a signal to other employers; neither their credibility, responsibility, nor loyalty to employers can be derived from past job experience.

The inappropriate structure of qualifications, lack of professional experience and lack of ability to acquire the necessary for achieving success in the labour market; the *skills mismatch*, see ILO (2014a); could be ascribed to institutional settings of education, as well as to insufficient emphasis laid on internships or other practical training during formal education, and poor partnership between schools and employers. Good cooperation of schools and employers could potentially lead to transfer of employers’ needs into teaching (MoLSA, 2014a).

To reach improvement and extension of young people’s experience on labour market, the Czech Republic could draw inspiration, for instance, from Austria and its Training Guarantee. The Training Guarantee ensures that all young people who completed compulsory schooling have access to an apprenticeship (Escudero and Mourelo, 2015). This programme is believed to support employing of young people, yet the unemployment rates may potentially increase at least in the short run. The level of youth unemployment rate is, apart from the state of the economy, greatly influenced by educational participation through size of youth labour market. Increase in educational participation rate diminishes youth labour force which could potentially increase the youth unemployment rate without any increase in the number of young people who are searching for a job (O‘Higgins, 2015). Youth labour market policies that are applied in the Czech Republic to address youth unemployment represent the main focus of Chapter 2.

Apart from the lack of gained experience that limits employability, youth have to also endure the unfavourable consequences of the last-in first-out policy that firms may be at least informally promoting. The overall future benefit of investment into young workers might be outweighed by its current costs. Moreover, statutory redundancy payments are usually determined according to seniority and increase with tenure. Fixed-term labour contracts signed with young employees, apart from precarious jobs, belong also to frequent practice (Flek, Hala and Mysikova, 2015).

Due to all these aspects of labour market, youth may suffer from the consequences of a labour market bias directed against them. They tend to be easier and less expensive to dismiss.

On the other hand, on the supply side of the market, youth are less experienced in finding a job, they have fewer contacts, and are often supported by their parents which might together with lower likelihood of financial commitments on their side diminish incentives to find an employment (Bell and Blanchflower, 2011). They might also voluntarily engage in multiple short spells of unemployment as they are gaining experience and looking around for the more satisfying job (ILO, 2015a).

All these arguments indicate dissimilarities in labour market dynamics of the youth and prime-age population. These specificities in labour market dynamics are thoroughly discussed in Chapter 3 and 4.

Before moving to the next chapter, it is worth noting that the youth unemployment rate does not include those young people who are neither in employment, education, nor training. The young *NEETs* represent lately frequently emphasized labour market group. High numbers of the young NEETs, known in the United States also as the "disconnected youth", indicate discouragement in the labour market, since these young people are inactive for reasons other than education.

The NEET rates, similarly as unemployment rates in most developed economies, are currently on their way down. The share of young NEETs peaked in 2010 in most of the developed economies; it reached 13.1% of the young in EU-28. In 2014, the global share of young NEETs declined to 12.4% of the young (ILO, 2015b); it was even lower in the Czech Republic, 8.11%. The NEET rate is a measure of unexploited potential of youth who could contribute to the national development through work. Because the NEET group is neither improving their future employability through investment in education nor gaining experience and skills through employment, this group is particularly at risk of labour market exclusion (ILO, 2015b).

2 Youth labour market policies in the Czech Republic

The active labour market policy in the Czech Republic is defined in the Act No 435/2004 Coll. on Employment, as a set of measures designed to ensure the maximum possible level of employment. Active labour market policy measures are managed by the Ministry of Labour and Social Affairs (MoLSA) and the Labour Office of the Czech Republic. This chapter will target on current labour market policies with special focus on youth labour market policies.

2.1 Labour market policies in the Czech Republic

Labour market policies in the Czech Republic build on the Europe 2020 Strategy representing the European Union's ten-year jobs and growth strategy that was launched in 2010 to create the conditions for smart, sustainable and inclusive growth (EC, 2015). Raising employment rate is one of the headline targets to be met by the EU by the end of 2020. This target is further developed in the National Reform Programme of the Czech Republic that, besides others, aims to reduce unemployment rate of youth by one third of 2010 level, i.e. 12.2%. For the purpose of monitoring and regularly evaluating the progress towards the intermediate objectives of the National Reform Programme, MoLSA publishes on a semi-annual frequency basis analyses of the labour market. (MoLSA, 2015a)

Problems of the Czech labour market and their causations, main target groups, and measures to increase employment and employability of job seekers are defined in the Employment Policy 2020 Strategy introduced by the MoLSA. The Strategy recognizes principal problems that are persisting in the Czech labour market, such as problematic access to employment of disadvantaged groups. Active labour market instruments are thus allocated primarily to job applicants who owing to their individual personal characteristics have difficulties to find an employment otherwise. Young people under 30 years of age people were assessed to be one of these disadvantaged groups. (MoLSA, 2014b)

Implementation of the Employment Policy 2020 Strategy required adoption of additional short-term documents, such as *Activation measures to address the adverse situation in the labour market*. One of the proposed measures focusing on youth and graduates are presented here; the programme

Job - internships in companies consisting of part-time working up to 80 hours per month for 3 months with financial support for trainee and mentor in the company, where 5000 jobseekers up to 25 years were planned to encourage. (MoLSA, 2014c)

Ministry of Labour and Social Affairs releases regularly data on active labour maket expenditures, see MoLSA (2016b); however these data do not include information on separate expenditures on youth. Expenditures on graduates positions were recorded until 2004 when new employment act became applicable. Active labour market policies funds are currently allocated from national resources and the European social fund.

2.2 Youth Guarantee Programme

Youth Guarantee is currently the most extensive programme that addresses youth unemployment in the Czech Republic. The Youth Guarantee in the European Union was formally adopted by the Council as a Recommendation to Member States on 22 April, 2013, in response to high levels of youth unemployment which reached 23.5% in Europe at the end of 2012 and threatened to delay economic recovery. The Youth Guarantee is a commitment by the EU Member States to guarantee that "all young people under the age 25 years receive a good quality offer of employment, continued education, an apprenticeship or a traineeship, within a period of four months of becoming unemployed or leaving formal education" (Council, 2013).

The European Council has declared to contribute to solving a difficult situation of young people in NUTS 2 regions where the unemployment rate of young exceeded 25% in 2012. It was agreed to create the Youth Employment Initiative with an endowment of 6,000 million euros to fund the Youth Guarantee's implementation. The funds were allocated to 14 countries that were found eligible, including the Czech Republic, even though it was granted the smallest amount, 13.6 million euros (0.45%).[5] (Escudero and Mourelo, 2015)

The Youth Guarantee comprises measures to increase young people's employability as well as measures aimed to increase the demand for the young. It

[5] The funding was allocated based on the size of the target population in each country's regions.

has been confirmed that including a full range of different measures into programmes brings the best outcomes; there are certain conditions that can be highlighted for successful functioning of interventionist programmes and youth guarantee programmes particularly; to reveal some of them: prompt implementation of intervention is needed (prolonged unemployment spells experienced while young rise the probability of being unemployed in later years and also carry a wage penalty, moreover the spells increase the risk of abandoning the job search and thus becoming discouraged); a useful combination of formal education and training for gaining work experience should be achieved, to acquire general skills as well as specific skills; institutional economists then especially emphasize the importance of developing an appropriate institutional framework for implementing the programme; and there is naturally a necessary condition of sufficient funding.

All the European countries' plans aspired to fulfil these conditions nevertheless they still exhibit differences; some measures were incorporated into plans by all the Member States; namely education and training for employment; measures to reduce school dropout and provide remedial education; employment intermediation such as job-search assistance and personalized follow-up of career plans. These are included in the Youth Guarantee Programme of the Czech Republic, however the other three measures are not part of the Czech Republic's programme; these are direct employment creation; hiring subsidies; and start-up incentives. (Escudero and Mourelo, 2015)

In the Czech Republic, only two NUTS 2 regions met the condition of youth unemployment rate over 25% in 2012, particularly Ustecky and Karlovarsky region; the youth unemployment rate there reached 28.2% in this period. The Czech Republic decided to voluntarily extend the Programme's target group to those under 30, even though majority of countries decided to follow the Council's recommendations and implemented programmes intended for the young under 25 (MoLSA, 2014a).

The running evaluation of the Programme in the Czech Republic is carried out using data provided mainly by the Labour Office. Beside the most expectable labour market indicator, the unemployment rate, the Youth Guarantee

Programme is also evaluated using indicators denoting the number of newly registered job seekers at the Labour Office aged 15 to 24 years; the number of job seekers aged 15 to 24 years who left the register within 4 months (within 6 months, within 12 months) from their registration; the number of job seekers aged 15 to 24 years positioned to work within 4 months from their registration at the Labour Office, etc.[6] This type of labour market indicators considering labour market movements of individuals is broadly explored in Chapter 3.

The methodology of evaluation of the Programme is being gradually adjusted. Given the diversity of the range and quality of data handed by the Member States, the European Commission is seeking a way of monitoring the Programme most effectively. Currently, Member States are required to provide detailed information on the collection of data through questionnaires, and further modification of monitoring requirements can be expected. The Programme is subjected to yearly update based on an assessment of efficiency, effectiveness and usefulness of each measure under the Programme (MoLSA, 2014a).

Employment Committee, the advisory organ of the European Commission and the Council of the European Union, notes in its annual assessment of Youth Guarantee programmes that the Guarantee in the Czech Republic focuses almost exclusively on registered NEETs and stresses the need of attending also to those individuals who are not registered at the Labour Office. The Committee also notifies that funding provided from the national resources is not sufficient to ensure long-term comprehensive approach and reproaches the lack of adequate evaluation of effectiveness of the applied measures. (EC, 2016)

The next chapter examines methodological concepts that might be useful for better targeting of labour market policies.

[6] This information was provided by one of the employees of the MoLSA.

3 Dynamics of the labour market

This chapter emphasizes the potential of a flow approach to labour market that provides information that are not available when relying only on stock indicators. The analysis of labour market flows and their sizes enables to establish the importance of the flows for the entire labour market dynamics. The chapter covers basic theory and methodology that is then used in the subsequent chapter to derive specificities in dynamics of youth labour market.

3.1 Importance of a flow approach to labour market

Labour market indicators, such as labour force participation and unemployment rates, which were illustrated in Chapter 1, belong to frequently used stock labour market indicators. These stock indicators provide important information on the state of the aggregate labour market over time. They are used by policymakers and others to obtain a basic overview of the overall condition of the labour market; especially the unemployment rate is widely quoted by media.

However relying only on stock indicators may not be advisable while making policy decisions. The stocks do not capture information about dynamics of the labour market, about its fluidity. Even though the absolute number of the unemployed is stagnant it is probably not the case that no workers are leaving or entering the labour market. Many individuals flow at every moment between the three labour market states. These flows of individuals into and out of the particular stocks cause changes in those stocks. The analysis of labour market flows and its sizes enables to establish the importance of the flows for the entire labour market dynamics.

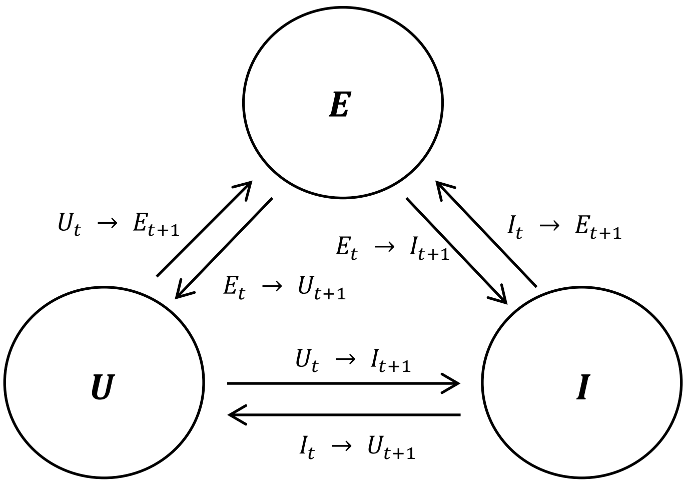
Based on the flows we can decide whether unemployment rises as a result of increased inflows into unemployment driven by elevated rates of job loss, or because the unemployed leave the unemployment pool at a slower rate due to declines in their ability to find jobs, or conceivably as a result of some combination of these two reasons (Elsby, Smith and Wadsworth, 2011). Ability to decide which of these causes is of higher importance is particularly crucial for efficient policy making. Policies encouraging outflows from unemployment may not be as relevant in an economy in which rises in unemployment rate were driven by changes in the outflows from employment. Moreover, age- or sex-disaggregated flows may help to target the policies more specifically at certain groups of the labour market.

3.2 Movements between labour market states

Movements of individuals between labour market states are usually referred to in the literature as *gross labour market flows*. There are six gross flows of individuals moving between the three states. People are moving from one labour market state to another across time periods t and $t+1$. The possible combinations then are: $(E_t \rightarrow U_{t+1})$, $(E_t \rightarrow I_{t+1})$ representing the employed workers who, respectively, leave to unemployment or leave the active labour force entirely. $(U_t \rightarrow E_{t+1})$, $(U_t \rightarrow I_{t+1})$ representing the unemployed who find an employment or the unemployed who leave the active labour force. $(I_t \rightarrow E_{t+1})$, $(I_t \rightarrow U_{t+1})$, representing the inactive who enter the active labour force to become employed or to become unemployed. The lastly mentioned gross flow comprises individuals who, for example, started searching for an employment after a period of discouragement and thus they now satisfy the condition of active search for work in definition of unemployment, or they terminated formal education however have not found an employment yet. The latter occurs mainly in the group of young individuals.

These movements are summarized in Figure 2 in a diagram introduced by Blanchard et al. (1990), where the six gross flows are displayed.

Figure 2 Gross labour market flows between Employment, Unemployment, and Inactivity



Source: Own creation according to Blanchard et al. (1990)

The circles in the diagram represent the three labour market states, the stocks; the arrows represent movements of people, the gross flows. The diagram facilitates easier orientation in the sizes of labour market flows; the comparisons of the inflows into and outflows from a particular stock can then be easily made.

Individuals who do not change their labour market states between two subsequent time periods form gross flow to the same labour market state, i.e. $(E_t \rightarrow E_{t+1})$, $(U_t \rightarrow U_{t+1})$ and $(I_t \rightarrow I_{t+1})$.

The gross labour market flows, are closely interconnected with the probabilities the individuals face of flowing from one particular labour market state to another; i.e. the six probabilities of losing a job to become unemployed (λ_t^{EU}) or to leave labour force (λ_t^{EI}); entering labour force to become employed (λ_t^{IE}) or to become unemployed (λ_t^{IU}); or leaving unemployment pool for a job (λ_t^{UE}) or to inactivity (λ_t^{UI}). These probabilities, called flow transition rates and introduced by Clark et al. (1979), represent the second main indicator of labour market dynamics. These flow transition rates together with the probabilities of staying in the same labour market state λ_t^{EE}, λ_t^{UU}, and λ_t^{II} can be summarized into a transition matrix displayed in Table 4. These lastly mentioned transition rates are presented on the main diagonal (from the top left corner), the remaining transition rates constitute the off-diagonal terms.

Table 4 Flow labour market transition rates between Employment, Unemployment, and Inactivity

		State in current period		
		E_{t+1}	U_{t+1}	I_{t+1}
State in previous period	E_t	λ_t^{EE}	λ_t^{EU}	λ_t^{EI}
	U_t	λ_t^{UE}	λ_t^{UU}	λ_t^{UI}
	I_t	λ_t^{IE}	λ_t^{IU}	λ_t^{II}

Source: Own creation according to Flek, et al. (2015)

Trivially, the sum of the flow transition rates in a row in the transition matrix is 1; it represents the probability that an individual will move from one particular state to one of the three labour market states. More interesting deductions can be made from the sum of flow transition rates from the main diagonal. If this sum equals 1, then the off-diagonal terms all equal 0 and the labour market is completely tight. No individuals change their labour market state, only direct changes of employment to another employment can be admitted. On the other hand, if the sum of diagonal terms equals 0, then the labour market is completely fluid and every individual changes his/her labour market state each time period.

The computation of flow transition rates is derived from gross flows of people moving between the labour market states. Considering the transition from employment to unemployment, the transition rate is computed by dividing the gross flow from employment to unemployment, by the sum of all workers who are moving from employment to one of the three labour market states

$$\lambda_t^{EU} = \frac{(E_t \rightarrow U_{t+1})}{(E_t \rightarrow E_{t+1}) + (E_t \rightarrow U_{t+1}) + (E_t \rightarrow I_{t+1})} \tag{1}$$

Since the denominator comprises people who moved from employment pool to one of the three labour market states, the sum can be substituted by the number of employed people in the initial time period. Hence, generally the flow transition rate between two labour market states is given as a ratio of the gross flow of individuals moving from the initial labour market state to the other and size of the initial labour market state, the stock at the start of the period. The transition probability of unemployed individuals in time period t to find a job in the subsequent time period $t + 1$ is then equal to

$$\lambda_t^{EU} = \frac{E_t \rightarrow U_{t+1}}{E_t} \tag{2}$$

These flow transition rates are supposed to follow first-order Markov process, where person's state next time period depends only on his current state.[7] (Elsby, Smith and Wadsworth, 2011; Flek, Hala and Mysikova, 2015)

While describing specificity of the youth labour market in Chapter 1, few attributes have been mentioned that suggest different dynamics in comparison to

[7] It is a Markov process consisting of three states and transition probabilities for moving between those three states. The assumptions of Markov processes are fixed set of states and possibility of getting from one state to another through a series of transitions which are met in case of labour market transitions; and fixed transition probabilities. If a system follows a Markov Process, then initial conditions, interventions, and history itself have no bearing on the long run distribution over states. On a given time period, any person will be in exactly one of the states and the person's state next time period will depend only on the current state. (Dynkin, 2006)

prime-age labour market. Based on these suggestions higher youth gross labour market flows between employment and unemployment compared to prime-age labour market can be expected.

The flows of individuals into and out of the labour market stocks that were just described are a defining feature of changes in the stocks, as it has been already suggested above. The following subchapter will back up this statement to make it more accurate and technical.

3.3 Decomposition of fluctuations in the steady-state unemployment rate

Decomposition of fluctuations in unemployment rate enables to decide to what extent the fluctuations in unemployment rate are driven by changes in unemployment inflow or outflow. As suggested above, this is crucial for deciding efficient policy making. Policies encouraging outflows from unemployment may not be as relevant in an economy in which growth in unemployment rate is driven by changes in the outflows from employment. Moreover, labour market policies may approach different age groups differently based on the decomposition, since the unemployment rate fluctutaions can be decomposed individually across age groups.

To distinguish to what extent the fluctuations in unemployment rate are driven by changes in unemployment inflow or outflow, a formal relationship between the above presented flow indicators and changes in unemployment rate is needed. On that account, literature attempts to find an approximation that would be strongly correlated with the actual unemployment rate and a formal decomposition of fluctuations would be achievable. A close relationship between actual and steady-state unemployment rate is broadly emphasized in certain countries, e.g. Shimer (2005) stresses high correlation between actual and steady-state unemployment rate in the US. Steady-state unemployment rate is derived using flow transition rates thus formal methods could have been developed to distinguish what proportion of steady-state unemployment rate fluctuations is caused by changes in unemployment inflow and what proportion by changes in unemployment outflow. I illustrate here the whole procedure of the formal decomposition of fluctuations in steady-state unemployment rate.

First, I propose a procedure of deriving the steady-state unemployment rate starting with a deeper theoretical insight into changes in unemployment stock. It has been already described that gross flows between the labour market states might be substantial, comprising individuals who are continually finding and losing jobs, and entering and exiting the labour force. The gross flows generate changes in the sizes of stocks that are called the net flows. The net flows might be minor relatively to the stocks' size, in contrast to the gross flows.

The connection between changes in unemployment, the net flows and the gross flows is formally captured by the *law of motion for unemployment* (Elsby, Smith and Wadsworth, 2011). This states that the changes in unemployment can be expressed as the difference between inflows into and outflows from the unemployment pool. The first two terms in equation (3) represent unemployment inflow, the second two represent unemployment outflow. Exceeding inflows result in positive unemployment change, and consequently in increase in the unemployment stock by exactly the difference of inflows and outflows. The law of motion for unemployment can be expressed either in terms of gross flows,

$$\Delta U_{t+1} = (E_t \rightarrow U_{t+1}) + (I_t \rightarrow U_{t+1}) - (U_t \rightarrow E_{t+1}) - (U_t \rightarrow I_{t+1}) \quad (3)$$

or in the terms of flow transition rates,

$$\Delta U_{t+1} = \lambda_t^{EU} E_t + \lambda_t^{IU} I_t - (\lambda_t^{UE} + \lambda_t^{UI}) U_t \quad (4)$$

Equations (3) and (4) are equivalent. Multiplying the flow transition rate λ_t^{EU} representing the probability of losing a job, by total number of people who were employed in time period t, I get number of employed people in time period t who moved to unemployment. This is exactly the gross flow from employment to unemployment. This can also be seen technically from rearranged equation (2). The other terms in equation (4) could be explained in a corresponding way. Even though the flow transition rates in general cannot be added, λ_t^{UE} and λ_t^{UI} both represent share of one stock so they can. Similar formulas for law of motion can be applied to each of the two remaining labour market states. The net flows are simply computed by differencing inflows into and outflows from the particular stock.

The law of motion in equations (3) and (4) covers movements both between unemployment and employment and between unemployment and inactivity. It considers all the three labour market states. To decompose unemployment rate fluctuations, I will first use the reduced form of the law that takes into account only two labour market states, employment and unemployment. This reduced form of the law of motion in equation (5) leaves out of consideration inactivity stock. Thus s_t is the unemployment inflow rate representing the probability of moving from employment in time period t to unemployment in the subsequent time period $t+1$, or otherwise the job-loss rate. And f_t is the unemployment outflow rate from unemployment to employment, or otherwise the job-finding rate.

$$\Delta U_{t+1} = s_t E_t - f_t U_t \tag{5}$$

Setting the left-hand side of equation (5) equal to zero, the unemployment inflow equals the unemployment outflow. This is a steady-state condition, where unemployment is in its steady-state U_t^{ss} and steady-state unemployment rate u_t^{ss} can be derived by rearranging equation (5) with zero left-hand side

$$u_t^{ss} = \frac{U_t^{ss}}{U_t^{ss} + E_t} = \frac{s_t}{s_t + f_t} \tag{6}$$

If unemployment inflow and outflow were always equal, the theoretical steady-state unemployment rate would be constant over time. However, since this assumption is not always true, the steady-state unemployment rate does move over time, in spite of its name that might induce a false impression of constancy in reality. Using values of job-loss and job-finding rates derived from actual labour market flows, it can be computed what the steady-state unemployment rate would be if unemployment inflow and outflow were equal. The steady-state unemployment rate thus needs to be computed successively for every time period.

Since the steady-state unemployment rate is derived using values of job-loss and job-finding rates, a formal decomposition of fluctuations in the rate is achievable. Now, I demonstrate the nature of relationship between steady-state unemployment and the actual unemployment. The relationship can be deduced from rearranged equation (5) and applying the steady-state condition

$$\Delta U_{t+1} = -(s_t + f_t)(U_t - U_t^{ss}) \tag{7}$$

Whenever the steady-state unemployment U_t^{ss} is higher than the actual unemployment U_t, the actual unemployment rises to move towards the steady-state unemployment, as ΔU_{t+1} is positive, since the sum of transition probabilities is always positive. Equivalently, whenever the steady-state unemployment U_t^{ss} is lower than the actual unemployment U_t, the actual unemployment decreases. The steady-state unemployment determines the future development of the actual unemployment; Elsby et al. (2011) observe that steady-state unemployment acts as a leading indicator for actual unemployment. Shimer (2005) specifies that the steady-state unemployment rate computed in the US for one time period is a very good approximation of the actual unemployment rate at the end of this time period.

Using the US data, Shimer (2005) reports that the correlation between steady-state unemployment rate in one time period and actual unemployment rate in the next time period reaches 0.99, which could imply the steady-state unemployment rate to be a good approximation of the actual unemployment rate. However Smith (2011) argues that UK unemployment rate substantially deviates from its steady-state, mainly because the unemployment inflow and outflow rates are much smaller than those in the US. Smith (2011) further analyses the relation between actual and steady-state unemployment rates emphasizing the role of unemployment acceleration; see Smith, 2011, Appendix C.1.1.

Methods of decomposing fluctuations of unemployment rate differ depending on several parameters. Literature presents methods providing decomposition of steady-state unemployment rate but also non-steady unemployment rate. For non-steady-state decomposition see, for example, Elsby et al. (2008) or Smith (2011).[8] Methods can be further divided to those that use log of unemployment rate, e.g. Elsby et al. (2008), or level of unemployment rate for decomposition, e.g. Petrongolo and Pissarides (2008). Some methods are

[8] Literature on the non-steady-state decomposition is not that numerous. The method proposes a decomposition of unemployment rate that is away from steady-state rate. It takes into account changes in steady-state unemployment rate and the rate of acceleration of the actual unemployment rate; it includes the impact of past transition rates. Differences in the steady-state and non-steady-state methods are especially observable when unemployment is changing most rapidly and actual and steady-state unemployment rates deviate substantially (Smith, 2011).

restricted only to two labour market states, employment and unemployment; others propose methods of decomposition including also the third state, inactivity. The method described in this thesis combines methods introduced by Shimer (2005); Fujita and Ramey (2007); and Petrongolo and Pissarides (2008). It decomposes fluctuations of level of steady-state unemployment rate and encompasses both two-state and three-state approaches consecutively.

First, the two-state-approach method uses the approximation of actual unemployment rate by the steady-state unemployment rate, u_t^{ss}. This method aims to distinguish the contributions of changes in job-loss and job-finding rates to changes in steady-state unemployment rate. It is necessary to proceed by determining the formula for changes in steady-state unemployment rate. This is expressed by the following equations (8), where $\Delta s_t = s_t - s_{t-1}$ and $\Delta f_t = f_t - f_{t-1}$are changes in job-loss and job-finding rates respectively.[9]

$$\Delta u_t^{ss} = \frac{s_t}{s_t + f_t} - \frac{s_{t-1}}{s_{t-1} + f_{t-1}} = (1 - u_t^{ss})\, u_{t-1}^{ss}\, \frac{\Delta s_t}{s_{t-1}} - u_t^{ss}\, (1 - u_{t-1}^{ss})\, \frac{\Delta f_t}{f_{t-1}} \qquad (8)$$

The right-hand side of equations (8) was derived from the left-hand side expression using standard mathematical methods. It displays decomposition of changes in steady-state unemployment rate into two components covering changes in job-loss and job-finding rate, respectively. This can be formally expressed by equation (9)

$$\Delta u_t^{ss} = \Delta u_t^{s} + \Delta u_t^{f} \qquad (9)$$

where

$$\Delta u_t^{s} = (1 - u_t^{ss})\, u_{t-1}^{ss}\, \frac{\Delta s_t}{s_{t-1}}, \qquad \Delta u_t^{f} = -\, u_t^{ss}\, (1 - u_{t-1}^{ss})\, \frac{\Delta f_t}{f_{t-1}}$$

In other words, the changes in steady-state unemployment rate are driven by percentage changes in job-loss and job-finding rates, $\frac{\Delta s_t}{s_{t-1}}$ and $\frac{\Delta f_t}{f_{t-1}}$ respectively, multiplied by the steady-state unemployment rates (from current or previous time period), and by complements of u_t^{ss} or u_{t-1}^{ss} to unity. This complements were observed by Elsby et al. (2008) to be approximately one, since u_t^{ss} and u_{t-1}^{ss} are close to zero. However, this is only a rough approximation.

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9 See the derivation of this relationship introduced by Petrongolo and Pissarides (2008) in Smith (2011), Appendix C.2.

To quantify the relative importance of changes in job-loss and job-finding rates for fluctuations in steady-state unemployment rate, a concept based on variances and covariances has been developed. Fujita and Ramey (2007) provide a detailed derivation of betas in equations (10) that decompose the total variation in Δu_t^{ss}. They derive them from $Var(\Delta u_t^{ss})$ using standard equations for variance and covariance.

$$\beta_s = \frac{Cov(\Delta u_t^{ss}, \Delta u_t^{s})}{Var(\Delta u_t^{ss})}, \qquad \beta_f = \frac{Cov(\Delta u_t^{ss}, \Delta u_t^{f})}{Var(\Delta u_t^{ss})} \tag{10}$$

The betas express how much of the overall variation in steady-state unemployment rate can be accounted for by inflow into unemployment, β_s and by outflow from unemployment, β_f (Fujita and Ramey, 2007). The betas sum up approximately to one, $\beta_s + \beta_f \approx 1$. Fujita and Ramey (2007) solve this imprecision caused by approximation by adding an error term, ε_t, in the equation (9) as another term and computing β_ε. The three betas then sum up exactly to unity.

Now, I extend the above described method by inactivity. Including inactivity and thus flows to and from inactivity enables to distinguish the relative importance of direct flows between employment and unemployment and then of flows between employment and unemployment that are broken by spell of inactivity. These transitions are underwent, for illustration, by individuals who report in one time period that they are employed, then they lose their jobs but do not start looking for another one right away, so they are inactive, and after that they finally start looking for a job before they report their labour market state again.

The method of three-state decomposition that is described below does not represent an exhaustive generalisation of the two-state decomposition. This method does not take into account transitions of individuals who move from inactivity in one time period to unemployment in the subsequent time period, and vice versa. It only enables a distinction between relative importance of changes in direct transition rates between employment and unemployment, and transition rates between employment and unemployment via inactivity, which

I denote as indirect transitions. This spell of inactivity is not reported in data on gross flows, because it occurred between two surveys.

The unemployment decomposition in three-state approach follows procedure analogous to that detailed in two-state decomposition. However, the calculation of steady-state unemployment rate is not based on equation (6), but on an adjusted form stated in equation (11). It is derived from two conditions for steady-state unemployment and employment, where the number of people moving into and out of unemployment is equalized, as well as the number of people moving into and out of employment, respectively.[10] These steady-state conditions are derived from setting equal to zero the equations for law of motion of unemployment and of employment. U_t and E_t are expressed from these equations and plugged into the unemployment rate equation, $u_t^{ss} = \frac{U_t^{ss}}{U_t^{ss}+E_t}$.

The lambdas from equation (11) represent the flow transition rates that are defined in the previous subchapter. In comparison with equation (6), the formula for steady-state unemployment rate in equation (11) includes expressions $\frac{\lambda_t^{EI}\lambda_t^{IU}}{\lambda_t^{IU}+\lambda_t^{IE}}$ and $\frac{\lambda_t^{UI}\lambda_t^{IE}}{\lambda_t^{IU}+\lambda_t^{IE}}$. The nominator of the first fraction includes probability of moving from employment to inactivity multiplied by probability of leaving inactivity to unemployment which represents the probability of movement from employment to unemployment via inactivity. The second nominator represents the probability of movement from unemployment to employment via inactivity. Both denominators represent the probability of leaving inactivity. The steady-state unemployment rate equation then includes direct transition rates between employment and unemployment and transition rates of the indirect movements

$$u_t^{ss} = \frac{\lambda_t^{EU} + \frac{\lambda_t^{EI}\lambda_t^{IU}}{\lambda_t^{IU} + \lambda_t^{IE}}}{\lambda_t^{EU} + \frac{\lambda_t^{EI}\lambda_t^{IU}}{\lambda_t^{IU} + \lambda_t^{IE}} + \lambda_t^{UE} + \frac{\lambda_t^{UI}\lambda_t^{IE}}{\lambda_t^{IU} + \lambda_t^{IE}}} \quad (11)$$

The overall inflow to unemployment from employment consists of the direct transition plus the transition via inactivity, the same is true for the outflow

10 $\lambda_t^{EU}E_t + \lambda_t^{IU}I_t = (\lambda_t^{UI} + \lambda_t^{UE})U_t$
$\lambda_t^{UE}U_t + \lambda_t^{IE}I_t = (\lambda_t^{EI} + \lambda_t^{EU})E_t$

from unemployment. Substituting equations (12) and (13) for corresponding terms in equation (8) enables decomposition of fluctuations in steady-state unemployment rate into four components covering contributions of direct inflow to unemployment from employment and the indirect inflow through inactivity and direct and indirect outflow from employment. Derivation of equations (12) and (13) can be deduced from substituting the corresponding expressions from the steady-state unemployment rate equations (6) and (11); $s_t = \lambda_t^{EU} + \frac{\lambda_t^{EI}\lambda_t^{IU}}{\lambda_t^{IU}+\lambda_t^{IE}}$ and $f_t = \lambda_t^{UE} + \frac{\lambda_t^{UI}\lambda_t^{IE}}{\lambda_t^{IU}+\lambda_t^{IE}}$ into $\frac{\Delta s_t}{s_{t-1}}$ and $\frac{\Delta f_t}{f_{t-1}}$, respectively; see Petrongolo and Pissarides (2008).

$$\frac{\Delta s_t}{s_{t-1}} = \frac{\Delta \lambda_t^{EU}}{\lambda_{t-1}^{EU} + \frac{\lambda_{t-1}^{EI}\lambda_{t-1}^{IU}}{\lambda_{t-1}^{IU} + \lambda_{t-1}^{IE}}} + \frac{\Delta \frac{\lambda_t^{EI}\lambda_t^{IU}}{\lambda_t^{IU} + \lambda_t^{IE}}}{\lambda_{t-1}^{EU} + \frac{\lambda_{t-1}^{EI}\lambda_{t-1}^{IU}}{\lambda_{t-1}^{IU} + \lambda_{t-1}^{IE}}} \tag{12}$$

$$\frac{\Delta f_t}{f_{t-1}} = \frac{\Delta \lambda_t^{UE}}{\lambda_{t-1}^{UE} + \frac{\lambda_{t-1}^{UI}\lambda_{t-1}^{IE}}{\lambda_{t-1}^{IU} + \lambda_{t-1}^{IE}}} + \frac{\Delta \frac{\lambda_t^{UI}\lambda_t^{IE}}{\lambda_t^{IU} + \lambda_t^{IE}}}{\lambda_{t-1}^{UE} + \frac{\lambda_{t-1}^{UI}\lambda_{t-1}^{IE}}{\lambda_{t-1}^{IU} + \lambda_{t-1}^{IE}}} \tag{13}$$

The changes in steady-state unemployment can then be formally decomposed in equation (14)

$$\Delta u_t^{ss} = \Delta u_t^{EU} + \Delta u_t^{UE} + \Delta u_t^{EIU} + \Delta u_t^{UIE} \tag{14}$$

where

$$\Delta u_t^{EU} = (1 - u_t^{ss})\, u_{t-1}^{ss} \frac{\Delta \lambda_t^{EU}}{\lambda_{t-1}^{EU} + \frac{\lambda_{t-1}^{EI}\lambda_{t-1}^{IU}}{\lambda_{t-1}^{IU} + \lambda_{t-1}^{IE}}}, \quad \Delta u_t^{UE} = -\, u_t^{ss}\,(1 - u_{t-1}^{ss}) \frac{\Delta \lambda_t^{UE}}{\lambda_{t-1}^{UE} + \frac{\lambda_{t-1}^{UI}\lambda_{t-1}^{IE}}{\lambda_{t-1}^{IU} + \lambda_{t-1}^{IE}}}$$

$$\Delta u_t^{EIU} = (1 - u_t^{ss})\, u_{t-1}^{ss} \frac{\Delta \frac{\lambda_t^{EI}\lambda_t^{IU}}{\lambda_t^{IU} + \lambda_t^{IE}}}{\lambda_{t-1}^{EU} + \frac{\lambda_{t-1}^{EI}\lambda_{t-1}^{IU}}{\lambda_{t-1}^{IU} + \lambda_{t-1}^{IE}}}, \quad \Delta u_t^{UIE} = -\, u_t^{ss}\,(1 - u_{t-1}^{ss}) \frac{\Delta \frac{\lambda_t^{UI}\lambda_t^{IE}}{\lambda_t^{IU} + \lambda_t^{IE}}}{\lambda_{t-1}^{UE} + \frac{\lambda_{t-1}^{UI}\lambda_{t-1}^{IE}}{\lambda_{t-1}^{IU} + \lambda_{t-1}^{IE}}}$$

The relative importance of inflows into and outflows from steady-state unemployment for the fluctuations in steady-state unemployment rate is again given by the following betas that have been derived from $Var(\Delta u_t^{ss})$ using standard equations for variance and covariance as before. The betas express how much of the overall variation in steady-state unemployment rate can be accounted for by changes in direct inflow into unemployment, β_{EU}, and by changes in direct outflow from unemployment, β_{UE}, and how much can be accounted for by the changes in indirect flows via inactivity is quantified by β_{EIU}, β_{EIU}. The betas sum up approximately to unity, $\beta_{EU} + \beta_{UE} + \beta_{EIU} + \beta_{UIE} \approx 1$

$$\beta_{EU} = \frac{Cov(\Delta u_t^{ss}, \Delta u_t^{EU})}{Var(\Delta u_t^{ss})}, \qquad \beta_{UE} = \frac{Cov(\Delta u_t^{ss}, \Delta u_t^{UE})}{Var(\Delta u_t^{ss})},$$
$$\beta_{EIU} = \frac{Cov(\Delta u_t^{ss}, \Delta u_t^{EIU})}{Var(\Delta u_t^{ss})}, \qquad \beta_{UIE} = \frac{Cov(\Delta u_t^{ss}, \Delta u_t^{UIE})}{Var(\Delta u_t^{ss})} \tag{15}$$

The total contribution of changes in unemployment inflow to fluctuations in steady-state unemployment rate is given by the sum $\beta_{EU} + \beta_{EIU}$; the total contribution of changes in unemployment outflow is calculated accordingly. (Petrongolo and Pissarides, 2008)

It is troublesome to make a prediction about the relative importance of changes in unemployment inflow and outflow for fluctuations in unemployment rate since results in previous literature are not always consistent. Smith (2011) notes that the relative importance of changes in unemployment inflow and outflow differ substantially over time depending on economic situation, besides other things. However, there is no simple relationship between the contributions and state of the economic cycle. Petrongolo and Pissarides (2008) divide their observation time sample according to rises and falls of unemployment rate and decompose the steady-state rate separately for each time period. According to their results, unemployment inflow gains importance during period of “rising u”. On the other hand, they report the importance of unemployment inflow to be substantially lower during period of “big u rise” than for the whole time period sample. As for the differences between youth and prime-age population, again previous literature is not consistent in findings. At least an intuitive prediction that indirect transitions via inactivity are more important for youth than for prime-age population is confirmed, e.g. by Elsby, et al. (2011), and Ochsen (2015).

4 Empirical results

To expound on the theoretical concepts introduced above, this thesis includes data analysis based on available data from Eurostat and Ministry of Labour and Social Affairs. First, requisite data and their limitations for estimating labour market flows are described in general. Then the data from Eurostat and the MoLSA are introduced. Second, youth labour market flows are presented using relevant literature and data. This subchapter discusses specificity of youth labour market dynamics more formally; youth gross flows and flow transition rates are compared to those of prime-age population. Third, the two-state and three-state decompositions of steady-state unemployment rate fluctuations are computed for the Czech labour market and compared with results from other countries.

4.1 Data issues

To be able to compute the gross flows of workers between labour market states, one needs appropriate data. The most suitable data in this case are panel data, also known as longitudinal data. The term *panel data* refers to the "pooling of observations on a cross-section of households, countries, firms, etc. over several time periods" (Baltagi, 2008). The invariability in time of the one randomly chosen sample is the important feature of the panel data that is used while computing the gross labour market flows. The computation is then relatively straightforward (Elsby, Smith and Wadsworth, 2011). To do this, one needs micro-panel data, where the units are represented by individuals. Yet, these data contain confidential information, and as a result are not generally available. This is a serious drawback to realizing the true potential of a flow approach to unemployment and its utilization in policy making. Apart from troublesome accessibility, there are other rather general limitations of micro-panel data.

To survey the same sample of individuals may include problems of non-response bias and response error bias (Gomes, 2009). After leaving observation units with missing values from an unbalanced panel to make it balanced the dataset might suffer from non-randomness. This depends on the cause of the unavailability of values; this cause should not be correlated with the idiosyncratic errors for the observed unit (Wooldridge, 2013). The causes of nonresponse may generally be the lack of cooperation of the respondent, or the interviewer's error (Baltagi, 2008). The response error bias is induced by incorrect information provided by respondents. Respondents may not recall their labour market status correctly after longer time period. This is the shortcoming of the information on recalled status. People tend to underreport periods of unemployment. On one hand the short spells are forgotten, on the other hand, it is rather a general tendency to underreport and withhold the information about a period of unemployment (Elsby, Smith and Wadsworth, 2011). The ability of respondents to remember correctly the sequence of their labour market statuses with the exact time of entering and leaving the status increases with the frequency of interviewing.

Nevertheless, these limitations are more than outweighed by benefits and advantages of micro-panel data, at least when studying labour market transitions. Panel data are most suitable for studying the dynamics of adjustment; such as adjustments to unemployment spells. Cross-sectional data hide a multitude of changes. These data can be used to estimate what proportion of the population is at a given point in time part of a particular labour market state, e.g. employment. Repeated cross-sectional data, time series, can display how this proportion changes over time, i.e. development of employment stock. Only by using panel data it can be estimated what proportion of those who are employed in one time period remain employed in the subsequent one. Panel data are also well suited for studying the duration of staying in a labour market state like unemployment. They can shed light on the speed of adjustments to economic policy changes (Baltagi, 2008). A particular benefit of using micro-data is that one can analyse and compare the unemployment experiences of particular subgroups of the labour market; age-, sex- or education attainment-disaggregation is possible.

Dynamic aspects of the labour market have been thoroughly analysed in particular in terms of the US labour market, which allows a relatively easy access to the monthly sample micro-data of Current Population Survey conducted by the US Bureau of Labour Statistics (Elsby, Smith and Wadsworth, 2011). In contrast, micro-panel data are not generally available for the Czech labour market. Nevertheless, Eurostat publishes regularly labour market transition data that are constructed from the Labour Force Survey (LFS). The dataset *Labour market transitions - quarterly data* (Eurostat, 2016) comprise quarterly flow indicators, both gross flows and flow transition rates. According to the metadata, Eurostat before computing the flows checks the quality and consistency of raw data transmitted by National Statistical Institutes. Based on these raw data Eurostat calculates the quarterly flow indicators that are subsequently released in the dataset *Labour market transitions - quarterly data*. (Eurostat, 2015)

The Labour Force Survey in the Czech Republic that is managed by the Czech Statistical Office (CSO) follows recommendations of Eurostat, ILO and other international organizations to the maximum possible extent. It is conducted by means of an electronic questionnaire that has been fully harmonised with Eurostat's survey methodology since 2002. In 2015q3, the Survey covered over 24 thousand households living in randomly sampled dwellings (0.6% of all permanently occupied dwellings), with more than 46 thousand respondents aged 15+ representing all fourteen regions of the Czech Republic. Each sampled household is asked questions assigned to one of the 13 reference weeks in the particular quarter. This sample size allows the making of estimates of labour market indicators for the country and also for regions required by Eurostat. Weight adjustments have been made to all the sample data according to the age structure of the population based on population projections. The data constitute a *rotating panel*, there is a regular turnover in the sample of households. Each household stays in the sample for five consecutive quarters, hence the turnover comprises each quarter 20% of the sample (CSO, 2015).[11]

The quarterly LFS data from Eurostat are not sufficient as such for the purpose of this thesis since they are not available disaggregated by age. Thus this thesis makes use also of another type of data. Petrongolo and Pissarides (2008) denote them as administrative or claimant data, because they record number of individuals who join and leave the Labour Office register and so claim unemployment benefits. The MoLSA has been recording monthly the numbers of newly registered and discharged individuals aged 15-24 since April 2014 for evaluation of the Youth Guarantee Programme. Even though the MoLSA records

[11] As opposed to a *pure panel* that consists of the same sample for the whole observation period. Some additional remarks on methodology of LFS were provided by one of the employees of the Czech Statistical Office.

regularly these data, they have not been made publicly available before. However, I was granted permission to access the data (MoLSA, 2016a).

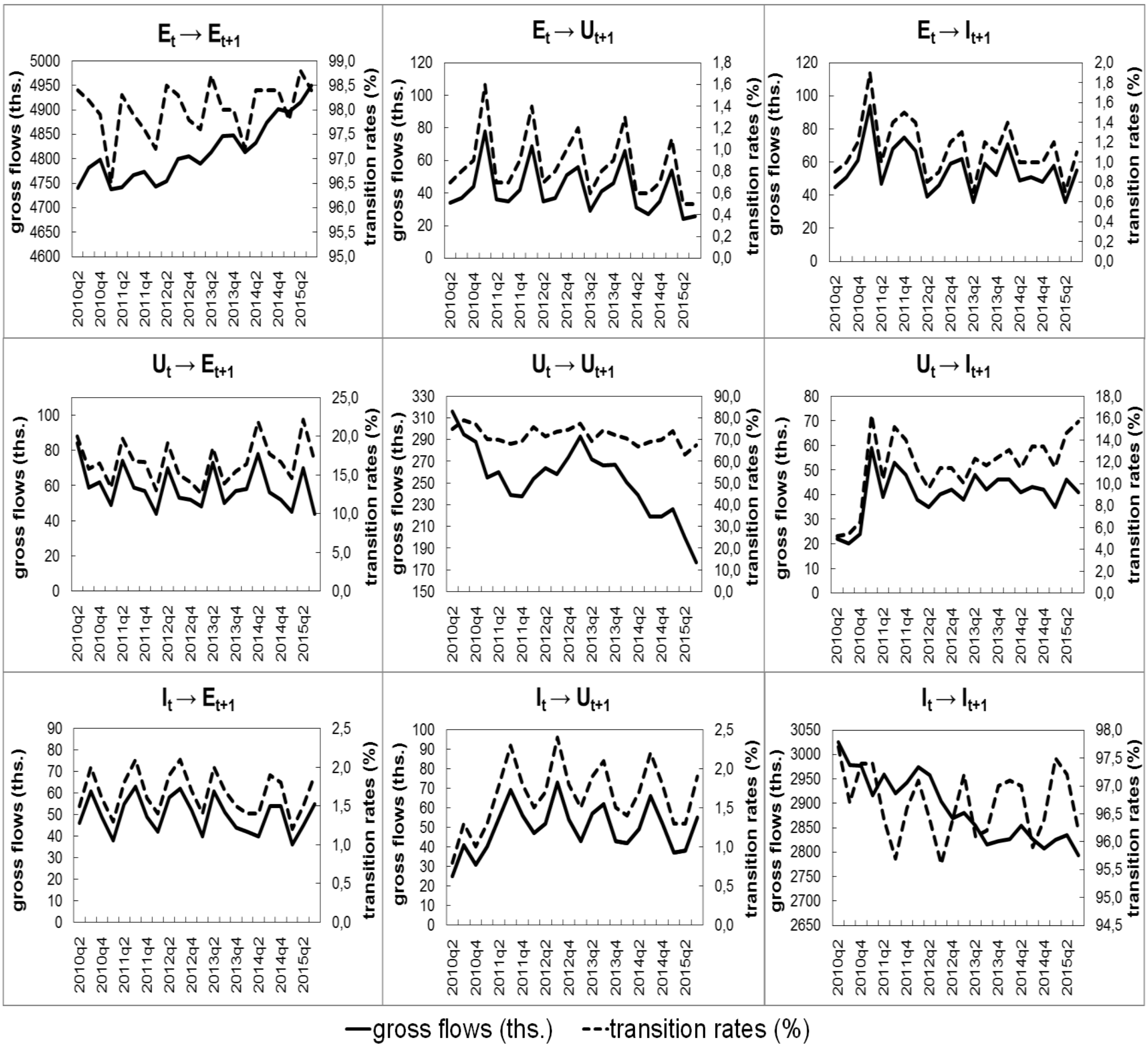
4.2 Dynamics of the youth labour market

In this subchapter, I make use of the introduced data to explore labour market dynamics. First, I provide a brief illustration of the labour market flows of total working-age population in the Czech Republic using the LFS data. Figure 3 displays development of all the nine gross flows and flow transition rates in the Czech Republic between 2010q2 and 2015q3.

The time series of gross flows and flow transition rates exhibit high variance over time. By computing for each gross-flow time series its standard deviation and dividing it by average, I ascertained that greatest relative volatility according to this indicator is exhibited by the gross flow from employment to unemployment (33.5%). Especially the off-diagonal time series, for both gross flows and transition rates, demonstrate strong cyclicity over quarters that follows essentially one's expectations.

This cyclicality could be attributed to regular movements of people in the labour market. For instance, the time series of $(I_t \rightarrow E_{t+1})$ gross flows peaks regularly in the third quarter which could be closely related to ends of academic years followed by entries of graduated students into employment. This is equally true for the $(I_t \rightarrow U_{t+1})$ gross flows, however students are moving to unemployment after graduating. Peaks in the first quarter of the gross flows from employment $(E_t \rightarrow I_{t+1})$, $(E_t \rightarrow U_{t+1})$ could be associated with retiring workers and with lay-offs at the end of the calendar year. And $(U_t \rightarrow E_{t+1})$ gross flows are traditionally highest in the second quarter which might be connected to seasonal jobs, such as agriculture or construction industry, that employ considerably less workers in winter months. The $(U_t \rightarrow I_{t+1})$ gross flows are relatively stable over time. Cyclicity in flow transition rates is influenced also by changes in sizes of the particular stocks in the initial time period, so the interpretation is not that intuitive. But still, the flow transition rates mostly follow the same pattern as the gross flows do.

Figure 3 Gross labour market flows and flow transition rates between Employment, Unemployment, and Inactivity, Czech Republic, 2010q2 - 2015q3, (ths., %)



Source: Own creation from Eurostat (2016a), LFS data, 2010q2 - 2015q3

Steadily increasing gross flows of people who are staying employed $(E_t \rightarrow E_{t+1})$ and decreasing (at least since 2013) gross flows of people who stay unemployed $(U_t \rightarrow U_{t+1})$ or inactive $(I_t \rightarrow I_{t+1})$ reflect economic recovery in the last years. Looking at a longer time period, Gomes (2009) argues that sizes of gross flows and flow transition rates are strongly influenced by economic cycles. In time of economic growth, there are fewer movements between the three labour market states. During economic downturns the movements between the labour market states become more numerous. It hits the unemployment stock particularly, since the stock expands as more workers lose their job and more of the inactive start searching for one. Simply put, the gross flows between different labour market states are considered to be countercyclical (Gomes, 2009). The off-diagonal gross flows in Figure 3 have all mildly downward linear trends, except for flows between unemployment and inactivity. This is in accordance with unemployment rate development that is displayed in Figure 1.

Gomes (2009) further comments on importance of the economic cycle for flow transition rates. The probabilities of entering unemployment from either employment or inactivity are according to Gomes (2009) strongly countercyclical, whereas the probability of entering employment pool is strongly cyclical. Focusing on direct changes of employment, the probability of these job-to-job transitions is strongly cyclical, even though the number of workers who are in search of change of employment is countercyclical.

Flow transition rates alone do not provide a full picture about labour market fluidity. Individual transition rates cannot be compared with each other as they do not represent share of the same labour market state. To compare the transitions and to verify to what extent is the Czech labour market fluid, I computed for every quarter what percentage of total working-age population changes labour market status using LFS gross-flows data. Table 5 displays what percentages of Czech working-age population participate in individual transitions between labour market states computed by dividing the relevant gross flow by the total working-age population, or in other words, by the sum of all the nine gross labour market flows. As opposed to flow transition rates, these percentages can be added to a total percentage of working-age population that changes labour market states. An alternative computation of the total percentage is to add the six off-diagonal gross flows and then divide this sum by total working-age population. The latter method was used in this thesis.

Participation in labour market transitions ranges from 3.07 to 4.33% of working-age population every quarter in the Czech Republic. This indicates rather rigid labour market in comparison to the UK where the total percentage reaches 6.8% quarterly (Gomes, 2009). Gross flows data do not detect individuals who switch directly from one employment to a different one. These individuals are included in $(E_t \rightarrow E_{t+1})$ gross flows and are not accounted for when estimating labour market dynamics, even though they should be. Gomes (2009) estimates that every quarter 2.1% of working-age population participate in these job-to-job transitions in the UK.

Czech participation in individual labour market transitions can be compared with the UK average quarterly percentages of working-age population. The individual flows in the UK comprise circa 1% of working-age population each. Highest share of working-age population moves from employment to inactivity every quarter and from unemployment to employment. These are the most important movements in the Czech Republic as well, taking magnitude into account. On the other hand the movement from inactivity to employment does not reach such relative importance in the Czech Republic as it does in the UK, see Table 5.

Table 5 Percentage of working-age population changing labour market states, CZ, UK, (%)

Country	Total	$E_t \rightarrow U_{t+1}$	$E_t \rightarrow I_{t+1}$	$U_t \rightarrow E_{t+1}$	$U_t \rightarrow I_{t+1}$	$I_t \rightarrow E_{t+1}$	$I_t \rightarrow U_{t+1}$
CZ	(3.07 - 4.33)	(0.29 - 0.94)	(0.44 - 1.14)	(0.53 - 1.01)	(0.24 - 0.71)	(0.44 - 0.76)	(0.30 - 0.88)
UK	6.8	1.0	1.4	1.3	0.8	1.3	1.0

Source: CZ: Own computations from Eurostat (2016a), LFS data, 2010q2 - 2015q3
UK: Gomes (2009), Table A, 1997 - 2007
Notes: CZ: Percentages were computed separately for each quarter. Each column includes range of minimum and maximum values over quarters, (min - max).

Gomes (2009) presents US monthly percentages as well,[12] however he emphasizes the role of time aggregation bias and does not recommend simple comparison of quarterly and tripled monthly data. Because of this warning this thesis does not present US monthly data.

Now, I focus especially on youth labour market dynamics. While describing heterogeneity in the labour market emphasizing differences in labour force participation and unemployment rates between various age groups, few attributes of the youth labour market have been mentioned that suggest different dynamics in comparison to prime-age labour market. One of these attributes is, for instance, the last-in first-out policy that youth have to endure.

Flek et al. (2015) discuss these differences for the Czech Republic and use data to quantify them. They demonstrate that young individuals participate in

[12] In the US, the total percentage reaches 5 to 7% monthly.

labour market transitions relatively more frequently in comparison to the prime-age reference group. The share of the prime-age individuals who change their labour market state each month on average was estimated to be 1.19% whereas the share of youth who move to different labour market state was estimated to reach on average 1.56% each month between 2009 and 2010.

Flek et al. (2015) further analyse flow transition rates and show that the one from employment to unemployment is systematically higher for youth in both studied time periods (2007-2008 and 2009-2010). This finding could support the idea of disadvantaged youth; however, this is only a part of the whole picture. The flow transition rate from unemployment to employment is also higher for youth. All the flow transition rates both for prime-age individuals and youth are displayed in Table 6.

Table 6 Flow transition rates, monthly averages, Czech Republic, (%)

	Prime-age			**Youth**		
	E_{t+1}	U_{t+1}	I_{t+1}	E_{t+1}	U_{t+1}	I_{t+1}
E_t	99.35	0.44	0.21	98.28	1.32	0.40
U_t	5.59	93.84	0.57	5.83	93.16	1.01
I_t	1.47	0.59	97.94	0.39	0.52	99.09

Source: Flek, Hala and Mysikova (2015), Table 3.1.A, 3.2.A, 2009-2010

The first two diagonal rates λ_t^{EE} and λ_t^{UU} suggest that the share of youth who remain in the same labour market state is lower than for prime-age individuals. This is in accordance with the finding of higher youth labour market dynamics.

To present more recent data on Czech youth labour market dynamics, I make use of the youth claimant data from the MoLSA. The youth claimant data record monthly time series of newly registered and discharged individuals aged 15-24 since April 2014. The MoLSA reports discharged individuals who leave the register within four month after joining it. I computed the total number of the young unemployed who leave the register each month given the number of newly registered individuals and the differences in registered individuals at beginnings of two consecutive months. The time series of unemployed individuals is reported by the MoLSA referring to the last day in each month. For each month that is displayed in Table 7, I use the reported count of the unemployed from the previous month and get number of unemployed at the beginning of each month. These are the data that are needed later in the decomposition of the steady-state unemployment rate fluctuations, see equation (19).

Table 7 Youth registered at Labour Office, newly registered and discharged individuals, Czech Republic, (absolute numbers)

Month / Year	Newly registered	Discharged (within 4 months)	Discharged (total)	Unemployed at Labour Office register
04/2014	11 270	6 318	13 373	31 434
05/2014	9 160	5 729	11 921	29 331
06/2014	10 317	6 584	14 130	26 570
07/2014	12 756	8 415	11 765	22 757
08/2014	12 015	7 041	10 378	23 748
09/2014	33 414	19 600	25 760	25 385
10/2014	13 199	7 448	14 561	33 039
11/2014	10 523	5 680	13 479	31 677
12/2014	10 458	6 370	11 675	28 721
01/2015	13 518	8 097	14 837	27 504
02/2015	11 119	6 410	11 163	26 185
03/2015	11 594	6 754	12 558	26 141
04/2015	10 579	6 072	12 305	25 177
05/2015	8 836	5 631	11 928	23 451
06/2015	9 873	6 456	12 090	20 359
07/2015	11 676	7 916	10 043	18 142
08/2015	11 967	7 706	10 109	19 775
09/2015	27 996	17 149	23 036	21 633
10/2015	11 524	6 677	12 879	26 593
11/2015	10 604	5 893		25 238

Source: Newly registered and Discharged (within 4 months): MoLSA (2016a), youth claimant data
Unemployed at Labour Office register: MoLSA (2016c), file no.5

Notes: The last column displays number of unemployed at Labour Office register at beginning of each month. Values in column Discharged (total) were computed given the number of newly registered individuals and the differences in registered individuals at beginnings of two consecutive months.

Incompleteness of these data resides in the lack of distinction between people who join the Labour Office register either from employment or inactivity. There is a similar issue with the number of people who leave the register. It cannot be told from the provided data, how many of the young unemployed left the register for an employment and how many for inactivity.

It is worth noticing that unemployment inflow almost triples in September when the academic year ends and a share of students who have not found an employment yet joins the register. On the other hand, unemployment outflow is also sizeably higher in September than in any other month. There is no particular reason to believe that employers are hiring substantially more employees during this time than during other months, so it can be concluded that high unemployment outflow is induced mainly by youth joining education at the beginning of an academic year.

The turnover of youth registered at the Labour Office is very high. Taking the total number of discharged individuals during time period t and dividing it by number of all the unemployed individuals at the beginning of time period t, a rate showing the proportion of young unemployed who are leaving the register can be computed. The rate fluctuates around 0.5, with outliers 1.01 and 1.06 in September 2014 and 2015, respectively. The flow transition rates, which were theoretically introduced in Chapter 3, are computed using data on individuals who report their labour market statuses at certain points in time, disregarding movements between labour market states that took place between the two consecutive points in time. Then, the total number of people who leave one labour market state cannot exceed the original number of people in this state. Whereas in the case of claimant data, the number of discharged individuals can be higher than the total number of registered individuals at the beginning of the time period, see September data in Table 7. During the one particular month many individuals register at the Labour Office and some of them leave it during the same month too. The feature of this type of data allowing for multiple transitions within one month will be used in the next subchapter.

4.3 Decomposition of fluctuations in the youth steady-state unemployment rate

This subchapter builds on the previously studied data. It uses the formal methods that have been described in the previous chapter to distinguish what proportion of unemployment rate fluctuations is caused by changes in unemployment inflow and what proportion by changes in unemployment outflow. It explores contributions to unemployment rate fluctuations of the Czech total working-age population and then specifically contributions to youth unemployment rate fluctuations. Results of these decompositions for the Czech Republic are compared with available literature on other countries.

First, I decompose fluctuations in two-state steady-state unemployment rate of the whole population in the Czech Republic using the LFS data. Then I also provide an alternative method of this decomposition using corrected data. Second, I proceed by decomposing fluctuations in youth two-state steady-state unemployment rate using claimant data provided by MoLSA. Third, I take into account also inactivity and present decomposition of three-state steady-state unemployment rate of the whole population in the Czech Republic using again the LFS data.

To decompose fluctuations in the two-state steady-state unemployment rate of the whole Czech working-age population using LFS flow transition rates, I proceeded according to the procedure described in the previous chapter. I plugged the time series of flow transition rates from employment to unemployment and time series from unemployment to employment into equations (8) - (10) for job-loss rate s_t and for job-finding rate f_t, respectively.

Table 8 Decomposition of two-state total steady-state unemployment rate, CZ, UK, US

Country	Unemployment outflow	Unemployment inflow
CZ	0.28	0.77
UK	0.30	0.71
US	0.62	0.38

Source: CZ: Own computations from Eurostat (2016a), LFS data, 2010q2 - 2015q3
UK: Elsby, Smith and Wadsworth (2011), Table 2, 1975 - 2010
US: Own computations from Petrongolo and Pissarides (2008), Table 2, 1967-2006

The results in Table 8 suggest that changes in both unemployment inflow and outflow matter for the steady-state unemployment rate fluctuations in the Czech Republic. However changes in unemployment inflow contribute with considerably higher share. 77% of steady-state unemployment rate fluctuations are caused by changes in unemployment inflow. Elsby et al. (2011) ascertained practically the same results for the UK labour market. In the US, on the other hand, changes in unemployment outflow contribute to fluctuations by higher share than changes in unemployment inflow, according to Petrongolo and Pissarides's (2008) estimates.

Petrongolo and Pissarides (2008) come to different results from Elsby et al. (2011) calculating rather balanced shares of the flows in the UK (0.515:0.485, only marginal dominance of unemployment outflow). Nonuniformity in results in general may be driven by differences in used methodologies, observation time period, and number of observations. Number of available quarters for decomposition of fluctuations in the Czech steady-state unemployment rate is rather limited. One observation out of the 22 is even lost during the computations owing to differencing. Elsby et al. (2011) emphasize the role of selection of observation period. Changes in unemployment inflow accounted according to them for even higher share of fluctuations in period of economic recession, between 2008 and 2010 in the UK. The highest share is reported in period of economic recession in 1990 - 1993, when changes in unemployment inflow accounted for 85% of steady-state unemployment rate fluctuations in the UK.

Literature proposes also a different procedure of deriving the relative importance of changes in unemployment inflow and outflow using adjusted data. The data on average transition rates available only at discrete time intervals fail to capture multiple transitions of individuals that take place within the interval. The data thus underreport the actual number of transitions and the relative importance of changes in unemployment inflow and outflow cannot be accurately derived. The transition data available at discrete intervals thus need to be corrected to diminish time aggregation bias (Shimer, 2005).

Shimer (2005) proposes a method of correcting for this. His method develops a relationship between gross labour market flows, or more precisely, the already discussed flow transition rates λ_t^{UE}, λ_t^{EU} and the underlying instantaneous job-finding rate and job-loss rates, f_t and s_t, respectively. Both the flow transition rates can be derived using equations (16).

$$\lambda_t^{EU} = \frac{E_t \rightarrow U_{t+1}}{E_t}, \qquad \lambda_t^{UE} = \frac{U_t \rightarrow E_{t+1}}{U_t} \tag{16}$$

Shimer (2005) assumes that finding an employment during one time period follows Poisson process and all unemployed individuals thus find jobs at job-finding rate $f_t = -log(1 - F_t)$, where F_t is the job finding probability. Alongside, every employed worker loses his/her job at job-loss rate $s_t = -log(1 - S_t)$, where S_t is job-loss probability, or more specifically, it is a probability that a worker who was employed at the beginning of the time period loses his job during this period. Assuming this, Shimer (2005) then derives equations (17) that define relationships between the flow transition rates and the underlying instantaneous job-finding and job-loss rates.

$$\lambda_t^{EU} = \frac{s_t\,(1 - e^{-(s_t + f_t)})}{s_t + f_t}, \qquad \lambda_t^{UE} = \frac{f_t\,(1 - e^{-(s_t + f_t)})}{s_t + f_t} \tag{17}$$

This system of equations can be solved for f_t and s_t, since these are the only two unknowns after computing λ_t^{UE} and λ_t^{EU} from equations (16). These instantaneous rates can then be plugged into equations (8) - (10).

To decompose the fluctuations in Czech steady-state unemployment rate using instantaneous transition rates, I took available LFS flow transition rates for period 2010q2 - 2015q3 and plugged them into equations (16) and (17). The time series of derived two-state steady-state unemployment rates is displayed in Table 12 in Appendix.

The results using instantaneous transition rates do not differ substantially from the previously displayed results in Table 8. The share of fluctuations in total two-state steady-state unemployment rate that can be accounted to changes in unemployment inflow decreased to 74% (from 77%). The importance of changes in unemployment outflow on the other hand increased to 31% (from 28%). The non-adjusted data thus overestimate the importance of changes in unemployment inflow.

I further proceed by computing the relative importance of changes in unemployment inflow and outflow for youth steady-state unemployment rate fluctuations. Since the quarterly LFS data are not disaggregated by age, I use claimant data provided by the MoLSA to decompose youth steady-state unemployment rate fluctuations.

The monthly claimant data do capture multiple transitions of individuals that take place within the month, in contrast to the quarterly LFS data. To derive the instantaneous transition rates, Petrongolo and Pissarides (2008) propose a method presented in equations (18) - (20). Equation (18) expresses the total outflow from unemployment, F_t. The first term is very straightforward to interpret; outflow of individuals who were unemployed at the beginning of the time period and found employment during this period (computed as probability that an unemployed individual finds employment during period t multiplied by number of the unemployed U_t at the beginning of the time period t). The second term expresses number of workers who lost their job after the beginning of period t, however found another one before the end of the time period t. The individuals that flow into unemployment, S_t, have the same probability of finding a job.[13] τ ∈[0,1) is time elapsed since beginning of the time period t.

$$F_t = \left(1 - e^{-f_t}\right)U_t + \int_0^1 \left(1 - e^{-f_t(1-\tau)}\right)S_{t+\tau}\, d\tau \tag{18}$$

Equation (19) is derived by evaluating the definite integral and assuming that unemployment inflow S_t is distributed uniformly over the time period

$$F_t = \left(1 - e^{-f_t}\right)U_t + \left(1 - \frac{1 - e^{-f_t}}{f_t}\right)S_t \tag{19}$$

Equation (20) for unemployment inflow is derived symmetrically.

$$S_t = (1 - e^{-s_t})E_t + \left(1 - \frac{1 - e^{-s_t}}{s_t}\right)F_t \tag{20}$$

Instantaneous job-finding and job-loss rates, f_t and s_t, respectively can be derived from equations (19) and (20) given that youth unemployment inflow and outflow data and employment and unemployment stock data are available from the MoLSA. The method of deriving the betas from the youth claimant data is then identical to what has been described above.

The computed betas displayed in Table 9 sum approximately to unity, however the interpretation is not particularly straightforward as in the case of Table 8. The resultant betas suggest that changes in unemployment inflow account more than entirely for steady-state unemployment rate fluctuations. The time series of changes in unemployment outflow is covarying negatively with the changes in steady-state unemployment rate and the computed contribution is therefore negative. This labour market situation has already been described before, for example by Smith (2011) who finds negative contribution of unemployment outflow in the early 1990s in the UK.

[13] The assumption of the same probability for all individuals is violated by the concept of durational dependence that emphasizes different unemployment exit rates for short-term and long-term unemployed (Whelan, 1997).

Table 9 Decomposition of two-state youth steady-state unemployment rate, CZ, UK, DE, PL, ES

Country	Unemployment outflow (M / W)	Unemployment inflow (M / W)
CZ	-0.492	1.548
UK	0.36	0.66
Germany	0.55	0.45
Poland	0.50 / 0.43	0.52 / 0.60
Spain	0.58 / 0.77	0.45 / 0.25

Source: CZ: Own computations from MoLSA (2016a), youth claimant data, 4/2014 - 11/2015; CSO (2016); MoLSA (2016c)
UK: Elsby, Smith and Wadsworth (2011), Table 4, 1975 - 2010
DE: Ochsen (2015), Table 3, 2007-2013
PL: Baranowska-Rataj and Magda (2013), Table 2, 1990 - 2011
ES: Baranowska-Rataj and Magda (2013), Table 1, 1990 - 2011

Notes: Betas are in case of Poland and Spain provided separately for men and women (M/W).

Elsby et al. (2011) find the relative importance of contributions of changes in unemployment inflow and outflow for fluctuations in youth steady-state unemployment rate similarly distributed as the contributions to the total steady-state unemployment rate fluctuations in the UK. Unemployment outflow only slightly grew on importance. In Germany the relative importance for youth shifts towards unemployment outflows as opposed to the overall contributions of unemployment inflow and outflow that are balanced (50.2% and 49.8% in favour of unemployment inflow). Baranowska-Rataj and Magda (2013) include in their study of Polish and Spanish youth labour markets decomposition disaggregated by sex. Distinction between men and women is particularly sizable in Spain, where there is a dominance of changes in unemployment outflow. The study further confirms that prime-age population in Spain is more protected from the risk of lay-offs than young men since the contribution of changes in unemployment inflow to fluctuations is only 0.25, same for women in Spain.

Decomposition of steady-state unemployment rate fluctuations using only information about two labour market states might enrich existing knowledge about labour market flows; however only after including inactivity in the computations a full picture of labour market can be obtained. This is especially emphasized by Ochsen (2015) who argues that inactivity explains on average more than 40% of unemployment rate fluctuations in Germany. The author further specifies the role of inactivity for various age groups and states that on average 75% of youth unemployment rate fluctuations are explained by flows from and into inactivity.[14]

Expansion of two-state-approach formulas to three-state-approach formulas has been illustrated in the previous chapter. Whereas the two-state decomposition could have been supplemented with using instantaneous transition rates, in the three-state approach the instantaneous transition rates cannot be computed. The method thus does not correct for time aggregation bias. Shimer (2005) in his study alerts that he cannot prove a modification of equation (17) that defines relationships between flow transition rates and the underlying instantaneous job-finding and job-loss rates in the three-state approach. But he also remarks that using discrete flow transition rate does not appear to be a problem with US data.

Since youth labour market transition rates in and from inactivity are not available in the Czech Republic, I demonstrate the three-state decomposition only for the total working-age population. The time series of computed three-state steady-state unemployment rates is displayed in Table 12 in Appendix.

The results of the decomposition in Table 10 are in accordance with those from two-state decomposition.

Table 10 Decomposition of three-state total steady-state unemployment rate, CZ, UK, DE

Country	$\beta^{outflow}$	β^{inflow}	β^{UE}	β^{UI}	β^{EU}	β^{IU}
CZ	0.22	0.78	0.25	-0.03	0.52	0.26
UK	0.36	0.66	0.33	0.03	0.57	0.08
Germany	0.54	0.46	0.14	0.40	0.11	0.35

Source: CZ: Own computations from Eurostat (2016a), LFS data, 2010q2 - 2015q3
UK: Elsby, Smith and Wadsworth (2011), Table 2, 1975 - 2010
DE: Ochsen (2015), Table 3, 2007-2013

Changes in unemployment inflow gained importance, their contribution to steady-state unemployment rate fluctuations increased by 4 pp. in comparison with two-state decomposition using instantaneous rates. On the other hand, contribution of changes in unemployment outflow dropped from 31% to only 22%. These results do not indicate such strong contribution of flows via inactivity

[14] It is worth noting that the methodology of including inactivity into decomposition presented in Ochsen (2015) differs from the methodology used in this thesis.

as Ochsen (2015) suggested; however the changes in the flow from employment to unemployment via inactivity still contribute substantially to the fluctuations. Table 10 also displays the betas for the UK and Germany. The sizeable dissimilarity in individual contributions between the UK and Germany is mainly due to employed methodology.

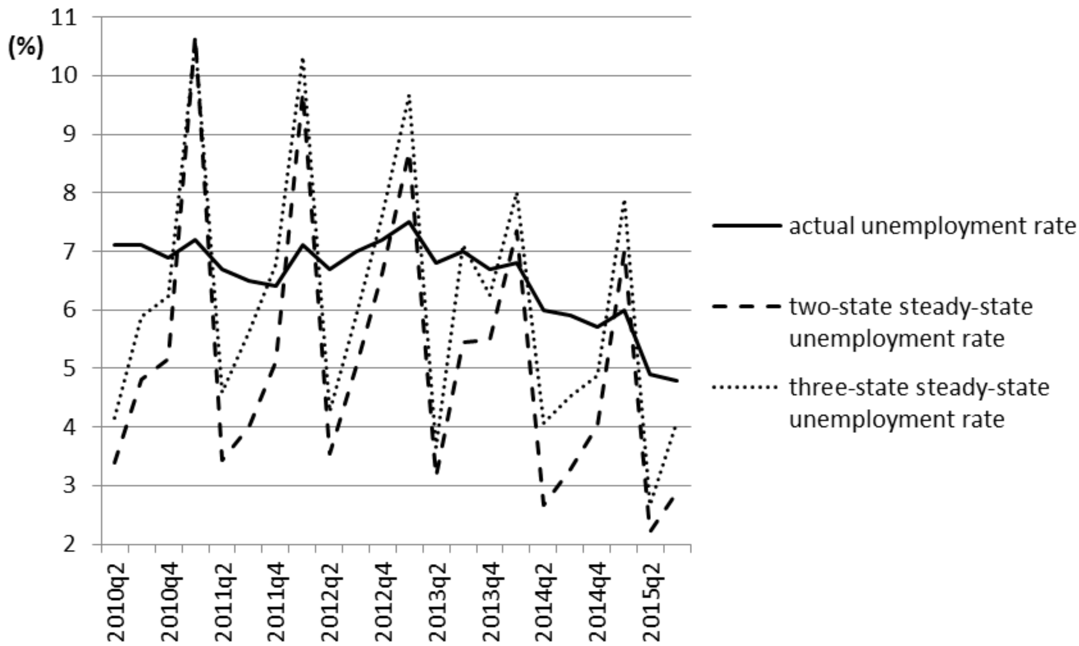
The results of all the decompositions for the Czech Republic suggest that changes in both unemployment inflows and outflows matter for steady-state unemployment rate fluctuations. However changes in unemployment inflow contribute with considerably higher share to the fluctuations particularly in the case of youth unemployment. These findings can be utilized for adjustments of active labour market policies. Since it has been suggested that changes in unemployment inflow account for a considerable share of youth unemployment rate fluctuations existent jobs held by young workers should be more protected. Policies protecting employment would be according to the results more efficient in diminishing the adverse youth unemployment rate fluctuations rather than the policies encouraging job finding.

The analysis of driving forces of unemployment fluctuations can be further deepened when comparing periods of economic growth and recession. Gomes (2009) suggests that unemployment inflow explains most of the fluctuations in unemployment rate during sharp recessions in the UK whereas changes in unemployment outflow are crucial during mild economic downturns.

I conclude the discussion of the results presented in this thesis by asking a question about accuracy and appropriateness of approximation of unemployment rate by steady-state unemployment rate in the Czech labour market conditions. Smith (2011) argues that estimates of contribution are only valid if unemployment rate is closely approximated by its steady-state. To achieve this, the labour market should be sufficiently fluid; however the Czech labour market appears to be less fluid than the UK labour market.

Building on this finding, I explore the relationship between total actual unemployment rate and the steady-state unemployment rates. The actual and calculated steady-state unemployment rates are displayed in Table 12 in Appendix and expressed graphically in Figure 4.

Figure 4 Total actual and steady-state unemployment rates, Czech Republic, (%)



Source: Own computations and creation from Eurostat (2016a), and Eurostat (2016b), LFS data, 2010q2 - 2015q3

Both steady-state unemployment rates display greatly higher volatility than the actual unemployment curve, even though all the rates are computed from seasonally unadjusted data. Standard deviation of the three-state steady-state unemployment rate is 2.14%, standard deviation of actual unemployment rate is on the other hand only 0.71%. The correlation between the three-state steady-state unemployment rate in one time period and the actual unemployment rate in the next time period reaches according to my computations only 0.21, which is quite poor in contrast to Shimer's (2005) report on 0.99 correlation in the US. The rates follow at least a similar trend; correlation between a linear trend of the steady-state unemployment rate and the actual unemployment rate exceeds 0.7.

According to the figures presented above and Smith's (2011) results, the estimates of relative importance of changes in unemployment inflow and outflow for fluctuations in unemployment rate using the steady-state approximation might differ from their true values. Nonetheless, the decomposition of fluctuations in steady-state unemployment rate is still valuable for policy making, because it signals which flow appears to be the more crucial one for fluctuations in unemployment rate.

Conclusion

This thesis contributes to the existing literature focusing on the Czech youth labour market by decomposing the steady-state unemployment rate fluctuations of total working-age population and of the youth. It also provides the fundamental methodology of labour market flows and the corresponding computations for the Czech Republic.

I found evidence on higher youth labour market dynamics reflected in higher flow transition rates compared to prime-age labour market. Young people thus participate in labour market transitions on average more frequently than prime-age population.

Still, the Czech labour market as a whole is less fluid than in the UK or the US. Only 3-4% of total Czech working-age population participate every quarter in labour market transitions, whereas this indicator reaches almost 7% in the UK.

Further, I concentrated on the driving forces of unemployment rate fluctuations. Knowledge about the relative importance of changes in unemployment inflows and outflows to these fluctuations can be used for better targeting of labour market policies. I considered two-state and three-state decompositions of the steady-state unemployment rate and explained the methodology of these computations. The results of the decompositions for the Czech Republic suggest that changes in both unemployment inflows and outflows matter for steady-state unemployment rate fluctuations. However, changes in unemployment inflow contribute with considerably higher share to the fluctuations. Considering the two-state decomposition of total steady-state unemployment rate fluctuations using instantaneous transition rates, 74% of the fluctuations are caused by changes in unemployment inflow. This contribution rises to 78% after including the third labour market state.

The decomposition of youth steady-state unemployment rate fluctuations detected that changes in unemployment inflow account even for higher share of steady-state unemployment rate fluctuations than for the total working-age population. Owing to the lack of available data on youth flows, I was able to compute only two-state decomposition of youth steady-state unemployment rate fluctuations. I compared the results with those published for other countries (the UK, Germany, the US, Poland, and Spain).

The present analysis of driving forces of unemployment rate fluctuations can be further deepened by comparing the periods of economic growth and recession. This thesis contributes to the existing limited literature focusing on Czech youth labour market dynamics by decomposing the steady-state unemployment rate fluctuations of total working-age population and of the youth. It also provides the fundamental methodology of labour market flows and the corresponding computations for the Czech Republic.

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Appendix

Table 11 Youth unemployment rate, European countries, (%)

Country	2007	2008	2009	2010	2011	2012	2013	2014	2015
Albania	22.0	26.2	25.0	25.5	24.4	27.5	28.9	32.8	32.7
Austria	9.5	8.4	10.7	9.4	8.9	9.5	9.5	10.2	10.2
Belarus	12.4	11.5	12.6	12.5	12.1	11.7	11.9	12.3	12.9
Belgium	19.0	18.0	21.9	22.5	18.6	19.7	23.6	23.2	21.8
Bosnia and Herzegovina	58.9	48.2	49.6	58.6	58.8	64.7	60.2	68.8	66.9
Bulgaria	15.2	12.7	16.0	22.9	25.2	28.2	28.3	23.8	22.2
Croatia	25.1	23.7	25.3	32.5	37.0	42.2	50.4	45.8	43.8
Czech Republic	10.7	9.8	16.8	18.4	18.0	19.6	19.1	15.8	13.0
Denmark	7.5	7.9	11.8	14.1	14.3	14.1	13.0	12.6	10.8
Estonia	10.2	12.1	27.3	33.0	22.4	20.9	18.6	15.2	11.3
Finland	16.4	16.3	21.3	21.3	19.9	18.9	19.8	20.6	23.3
France	18.5	17.9	22.5	22.2	21.6	23.3	23.8	24.2	24.7
Germany	11.9	10.5	11.2	9.9	8.5	8.1	7.7	7.8	7.1
Greece	22.9	22.3	25.9	32.1	44.1	54.1	57.7	52.0	49.2
Hungary	18.1	19.5	26.3	26.4	25.9	28.1	26.7	20.4	18.2
Iceland	6.8	7.8	15.6	16.2	14.2	13.4	10.5	9.6	8.7
Ireland	9.2	13.5	24.3	27.9	29.1	30.5	26.7	23.9	20.9
Italy	20.4	21.2	25.1	28.2	29.4	35.7	40.1	43.0	42.1
Latvia	10.8	13.7	33.5	36.3	31.0	28.5	23.3	19.5	14.8
Lithuania	8.2	13.3	29.7	35.7	32.6	26.7	22.0	19.1	17.6
Luxembourg	15.2	17.7	17.0	14.5	16.8	18.5	15.2	22.2	18.6
Macedonia	57.7	56.6	55.3	53.9	55.5	54.0	52.0	53.1	49.4
Malta	13.8	12.0	14.9	13.4	13.6	14.2	13.1	11.8	12.3
Moldova	14.4	11.3	15.3	17.7	15.0	13.1	12.2	9.9	15.6
Montenegro	38.4	30.7	35.7	46.0	37.2	41.4	40.7	37.3	37.5
Netherlands	5.9	5.5	6.6	8.8	7.6	9.5	11.1	10.5	8.8
Norway	7.4	7.3	9.1	9.1	8.6	8.3	9.0	7.9	10.1
Poland	21.5	17.0	20.5	23.5	25.5	26.4	27.2	23.8	19.9
Portugal	16.8	16.7	20.2	22.8	30.3	37.8	38.2	34.8	30.1
Romania	20.3	18.9	21.3	22.3	24.2	22.9	24.3	24.5	23.1
Serbia	43.1	34.4	41.9	45.7	50.5	50.6	48.9	46.2	45.2
Slovakia	20.3	19.1	27.3	33.6	33.5	34.1	33.7	29.8	25.2
Slovenia	10.1	10.6	13.7	14.5	15.8	20.6	21.8	20.4	16.7
Spain	18.0	24.6	38.0	41.6	46.4	53.0	55.6	53.1	49.4
Sweden	19.4	19.9	25.1	24.8	22.8	23.7	23.7	22.8	20.8
Switzerland	7.2	6.9	8.5	7.7	7.6	8.5	8.6	8.4	7.0
Ukraine	14.4	14.4	18.0	17.5	19.1	17.4	17.7	23.5	23.1
United Kingdom	14.2	14.7	18.7	19.6	20.9	21.0	20.3	16.8	15.1

Source: ILO (2015a), Key Indicators of the Labour Market 2015: Youth unemployment

Table 12 Total unemployment rate, Czech Republic, (%)

Time period	Actual	Two-state steady-state	Three-state steady-state
2010q2	7.1	3.4	4.2
2010q3	7.1	4.8	5.9
2010q4	6.9	5.2	6.2
2011q1	7.2	10.7	10.6
2011q2	6.7	3.4	4.6
2011q3	6.5	4.0	5.6
2011q4	6.4	5.1	6.8
2012q1	7.1	9.7	10.3
2012q2	6.7	3.5	4.3
2012q3	7.0	5.1	5.9
2012q4	7.2	6.6	7.6
2013q1	7.5	8.7	9.7
2013q2	6.8	3.1	3.7
2013q3	7.0	5.4	7.1
2013q4	6.7	5.5	6.3
2014q1	6.8	7.3	8.0
2014q2	6.0	2.7	4.1
2014q3	5.9	3.3	4.5
2014q4	5.7	4.0	4.9
2015q1	6.0	7.0	7.9
2015q2	4.9	2.2	2.7
2015q3	4.8	2.9	4.1

Source: Own computations from Eurostat (2016a), and Eurostat (2016b), LFS data, 2010q2 - 2015q3

Notes: Two-state steady-state unemployment rate was calculated using instantaneous transition rates.