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Labour Market Flows over the Business Cycle: The Role of the Participation Margin

Kamil Galuščák, Jan Šolc, and Pawel Strzelecki*

Abstract

We investigate the cyclical properties of labour market flows in the Czech Republic and Poland. We find that the role of flows from and into inactivity in explaining the cyclical properties of unemployment and employment rates is smaller than that of flows between employment and unemployment, but is not negligible. The participation rate is weakly countercyclical in both countries, driven by the countercyclical net flow from inactivity to unemployment. This could be explained by fewer employment opportunities in recessions, so that more inactive individuals go to unemployment than directly to employment. Our results are very similar for the two countries, the only noticeable difference being that flows between employment and inactivity have a bigger impact on the participation and employment rates in Poland than those in the Czech Republic.

Abstrakt

V tomto článku zkoumáme cyklické vlastnosti toků na trhu práce v České republice a Polsku. Výsledky ukazují, že vliv toků z neaktivity a do neaktivity na cyklické vlastnosti míry nezaměstnanosti a zaměstnanosti je menší než vliv toků mezi zaměstnaností a nezaměstnaností, ale není zanedbatelný. Míra participace je v obou zemích slabě proticyklická, což je dáno proticyklickým čistým tokem z neaktivity do nezaměstnanosti. To lze vysvětlit menším počtem nabídek práce v recesi, který vede k tomu, že více neaktivních osob přechází do nezaměstnanosti než přímo do zaměstnanosti. Naše výsledky jsou velmi podobné pro obě země. Jediným znatelným rozdílem je, že toky mezi zaměstnaností a neaktivitou mají větší vliv na míry participace a zaměstnanosti v Polsku než v České republice.

JEL codes: E17, E24, E32, J21, J64.
Keywords: Employment, labour market flows, participation, unemployment, vector autoregression.

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Nontechnical Summary

Understanding developments on the labour market is crucial for policy institutions such as central banks in assessing the position of the economy in the business cycle. While such analysis traditionally relies on stock variables such as employment, unemployment and participation, these stocks are driven by the underlying flows. In this paper, we investigate the cyclical properties of labour market flows, focusing on the impact of flows from and into inactivity. We take the example of two countries, Poland and the Czech Republic, to demonstrate any similarities and differences as well as the robustness of our results.

We describe a framework – taken from Dixon et al. (2015) – that links flows and stocks in a three-state labour market model characterised by employment, unemployment and inactivity. Using quarterly Labour Force Survey datasets, we construct series of labour market stocks and flows. We investigate the cyclical properties of the flows using simple correlation analysis and a vector autoregression model. We depart from Dixon et al. (2015) by focusing on how the flows respond to an output gap shock, assuming that they respond to a shock to the cyclical component of economic activity with a delay. No less important is our assumption, based on the evidence from previous literature (Elsby et al., 2015; Krusell et al., 2017; Shimer, 2013), that the cyclical properties of labour market flows are not affected by time aggregation bias or classification errors.

We find that a positive output gap shock increases the net flow from unemployment to employment and reduces the net flow from inactivity to unemployment. While the former response is consistent with the overall response of employment and unemployment, the lower net flow from inactivity to unemployment due to an output gap shock highlights the importance of the participation margin.

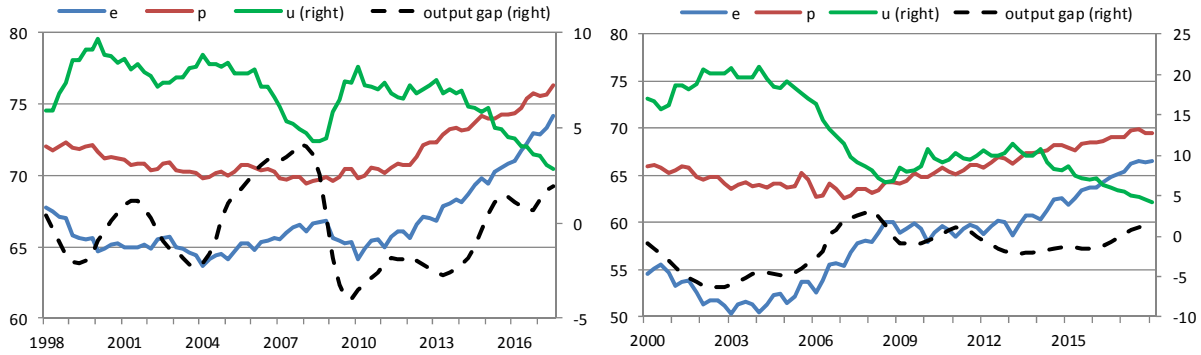
The results show that the role of flows from and into inactivity in explaining the cyclical properties of unemployment and employment rates is small in both countries, but is not negligible. The flows at the participation margin enhance the countercyclical nature of the unemployment rate and the cyclical pattern of the employment rate. The weakly countercyclical participation rate is driven by the countercyclical net flow from inactivity to unemployment. This may be due to less abundant employment opportunities in recessions, so that more inactive individuals go to unemployment than directly to employment. The results are very similar for the Czech Republic and Poland. The only noticeable difference is in the impact of flows between employment and inactivity, which is higher in Poland.

1. Introduction

Understanding developments on the labour market is crucial for policy institutions such as central banks in assessing the cyclical stance of the economy and the resulting inflationary pressures. While such analysis traditionally relies on stock variables such as employment and unemployment (for example the Beveridge curve as the relationship between unemployment and vacancies), labour market flows between employment and unemployment are key to understanding the drivers of the observed stock variables.

Changes in employment mirror changes in unemployment over the business cycle, but participation on the labour market – the sum of the employed and the unemployed – also exhibits significant movements. This is documented in Figure 1, which shows the rates of employment, unemployment and participation in the Czech Republic and Poland. Both the employment and unemployment rates respond to the business cycle, which is captured by output gap estimates, while the participation rate has been increasing in the Czech Republic since 2013 and in Poland since 2010. Questions arise from these observations as to whether participation responds to the business cycle or other factors such as demographic shifts, and how it impacts on employment and unemployment.

Figure 1: Employment, Unemployment and Participation Rates (CZ left, PL right, in %)



Note: Rates of employment (e) and participation (p, both in % of population) and unemployment rate (u, in % of labour force). Output gap in % of potential GDP. The Czech output gap is obtained from a small structural model as described in CNB Inflation Reports. For Poland, we use yearly data from OECD (2018), which we transform into quarterly frequency using cubic spline interpolation.

Source: Eurostat, OECD, authors' calculations.

The importance of the participation margin and the analysis of labour market flows can be illustrated using the example of the Czech economy, which has recently recorded a period of robust employment growth (see the left panel in Figure 1). Elderly people (aged 60 or more) have contributed significantly to the observed employment growth. A question has been raised about the extent to which the increasing employment is affecting wage growth. There are two competing hypotheses. Firstly, the effect on wage growth could be negative, since older individuals are often retired and thus have a lower reservation wage than incumbent workers. Secondly, the increasing employment of the elderly could be explained by a decrease in their labour market flows to inactivity. As long as wages at the end of the working career are typically high, this results in

higher wages than in the first scenario. One cannot test these hypotheses on stock variables alone. However, when we employ analysis of labour market flows, we see that the increasing employment of elderly people has been due rather to lower outflows from labour market activity, resulting in higher wage pressures.

Labour market flows can be used as a detailed source of information about labour market performance and the characteristics of workers (Blanchard et al., 1990). Another important application concerns flows of workers between different sectors (Davis, Haltiwanger and Schuh, 1998; Sorm and Terrell, 2000). Labour market flows have also frequently been used in the description of labour market changes in Central European economies (Gora, 2000; Gottvald, 2005; Duspivová and Kramulová, 2016; Flek and Mysíková, 2015). The empirical analysis of labour market flows also includes the consequences of the institutional structure and shocks in different countries (Bukowski et al., 2010). A detailed description of labour market flows has allowed researchers to answer many questions regarding country-specific features of the labour market (Gomes, 2009) and to reveal the roots of the labour market adjustment in the U.S. economy during the Great Recession in 2009 (Davis and Haltiwanger, 2014). The importance of transitions between labour market states is also underlined by Eurostat, which has started publishing aggregate transition probabilities between employment, unemployment and inactivity for the majority of EU28 countries (Eurostat, 2016).

The labour market flow approach is also closely related to the popularity of the search and matching model in describing the labour market (Diamond, 1982; Mortensen, 1982; Pissarides, 1985). The discussion about the main driving forces of cyclical fluctuations on the labour market – the creation of new jobs and the firing of employees – was directly connected with the direction of development of the search and matching model (Shimer, 2007; Darby, Haltiwanger and Plant, 1986; Elsby, Michaels and Solon, 2009; Fujita and Ramey, 2007). This discussion resulted in different methods for estimating labour market transition probabilities. The general conclusion emanating from the previous literature is that unemployment inflows and outflows are both correlated with the business cycle. However, the size of the influence depends on the specificities of the labour market. It has been observed that in Anglo-Saxon countries, outflows are usually more important in the explanation of unemployment changes, while in continental Europe, inflows and outflows seem to be equally important (Elsby, Hobijn and Sahin, 2008). The macroeconomic avenue of labour market flows research is paved with a number of studies for specific countries (Petrongolo and Pissarides, 2008; Strawinski, 2009; Daouli et al., 2015; Gradzewicz and Strzelecki, 2011; de la Rica and Rebollo-Sanz, 2015). Labour market flows are regularly analysed at the National Bank of Poland (NBP, 2016). Its methodology is based on the three-state labour market model of Shimer (2012) and accounts for measurement issues such as panel attrition. Brůha and Polanský (2015) analyse the cyclical properties of labour market macroeconomic data in advanced countries. They find that some features, such as Okun's law, are stable over time and across countries. While Brůha and Polanský (2015) use aggregate stock variables, in this paper we investigate the cyclical properties of labour market flows using micro-data.[1]

[1] Lim et al. (2018) look at the relationship between changes in the unemployment rate and output growth using labour market flows.

The recent literature focuses on measuring the instantaneous probability of transitioning between labour market states. However, the available datasets measure the number of persons in the individual labour market states in discrete time, leading to time aggregation bias if one captures the probability as the ratio of the number of persons changing states between two periods to the number of persons in the initial state. A prominent example is Shimer (2012), who measures the probability that an employed worker becomes unemployed and the probability that an unemployed worker finds a job, adjusting for the time aggregation bias. Elsby et al. (2015) use a similar approach to document the importance of the participation margin in explaining labour market fluctuations. They correct the data for too frequent transitions of individuals marginally attached to the labour market (deNUNification). Krusell et al. (2017) build a model of the aggregate labour market with standard labour supply and frictions to study business cycle properties of gross worker flows between employment, unemployment and inactivity.

Dixon et al. (2015) describe a framework linking labour market flows and stocks. They use net flows between employment, unemployment and inactivity to investigate mutual interactions using a structural vector autoregression model. Evans (2017) uses a more complex structural vector autoregression model with eight endogenous variables including gross and net flows to investigate impulse responses to an output shock.

In this paper, we describe a simple framework – taken from Dixon et al. (2015) – that links flows and stocks in a three-state labour market model characterised by employment, unemployment and inactivity. Using quarterly Labour Force Survey datasets, we construct series of labour market flows and stocks. We investigate the cyclical properties of the flows using simple correlation analysis and a vector autoregression model. We depart from Dixon et al. (2015) by focusing on how the flows respond to an output gap shock,[2] assuming that they respond to a shock to economic activity with a delay. We also assume that the cyclical properties of labour market flows are not affected by time aggregation bias or classification errors. This assumption is supported by the previous evidence (Elsby et al., 2015; Krusell et al., 2017; Shimer, 2013).

We take the example of two countries, Poland and the Czech Republic, to demonstrate any similarities and differences as well as the robustness of our results. These two neighbours are at a similar level in terms of GDP per capita in purchasing power standards. They share a similar history of economic transition from a command-driven to market economy since the early 1990s. In terms of population, Poland is almost four times bigger than the Czech Republic. Due to the relatively short time series in our datasets, covering 20 years of quarterly data in the Czech sample and 18 years in the Polish sample, we prefer the more parsimonious approach of Dixon et al. (2015), which we extend by using the output gap as an additional variable. Our vector autoregression model thus contains four endogenous variables.

The results show that labour market flows, including flows into and out of inactivity, are important in explaining the cyclical properties of unemployment, employment and participation. We find that a positive output gap shock increases the net flow from unemployment to employment and reduces the net flow from inactivity to unemployment. While the former response is consistent with the overall response of employment and unemployment, the lower net

[2] We use the available output gap estimates as a measure of the cyclical component of GDP.

flow from inactivity to unemployment due to an output gap shock highlights the importance of the participation margin. We also find that a positive output gap shock results in a negative response of the unemployment rate and a positive response of the employment rate, while the response of the participation rate is weakly negative. The responses of unemployment and employment are driven mainly by the net flow from unemployment to employment. The role of inactivity flows in explaining the cyclical properties of unemployment and employment rates is smaller, but not negligible. Our results are very similar for the Czech Republic and Poland. The only noticeable difference is in the impact of flows between employment and inactivity, which is higher in Poland.

The paper is organised as follows. In Section 2 we present an analysis of labour market flows, linking unemployment, participation and employment with the corresponding flows. In Section 3 we describe the data and present some statistical evidence. In Section 4 we investigate the cyclical properties of labour market flows using a vector autoregression model. The last section concludes.

2. Flows between Labour Market States

In this section we describe how flows between employment, unemployment and inactivity are related to employment, unemployment and inactivity. We borrow the notation from Dixon et al. (2015).

The working age population consists of the number of employed (E), unemployed (U) and inactive individuals (N). The labour force is L=E+U and the population is P=L+N. We define gross flows UE describing flows from unemployment to employment, EU describing the opposite flows from employment to unemployment, and similarly EN, NE, UN and NU. We introduce three net flows $\overline{UE}$=UE-EU, $\overline{EN}$=EN-NE and $\overline{NU}$=NU-UN.

Changes in the number of employed, unemployed and inactive persons and in the labour force are described using the following identities:

$$\Delta \boldsymbol{E} = \boldsymbol{E_t} - \boldsymbol{E_{t-1}} = (\boldsymbol{UE} - \boldsymbol{EU}) - (\boldsymbol{EN} - \boldsymbol{NE}) = \overline{\boldsymbol{UE}} - \overline{\boldsymbol{EN}} \quad (1)$$

$$\Delta \boldsymbol{U} = \boldsymbol{U_t} - \boldsymbol{U_{t-1}} = (\boldsymbol{NU} - \boldsymbol{UN}) - (\boldsymbol{UE} - \boldsymbol{EU}) = \overline{\boldsymbol{NU}} - \overline{\boldsymbol{UE}} \quad (2)$$

$$\Delta \boldsymbol{N} = \boldsymbol{N_t} - \boldsymbol{N_{t-1}} = (\boldsymbol{EN} - \boldsymbol{NE}) - (\boldsymbol{NU} - \boldsymbol{UN}) = \overline{\boldsymbol{EN}} - \overline{\boldsymbol{NU}} \quad (3)$$

$$\Delta \boldsymbol{L} = \Delta \boldsymbol{E} + \Delta \boldsymbol{U} = \left(\overline{\boldsymbol{UE}} - \overline{\boldsymbol{EN}}\right) + \left(\overline{\boldsymbol{NU}} - \overline{\boldsymbol{UE}}\right) = \overline{\boldsymbol{NU}} - \overline{\boldsymbol{EN}} \quad (4)$$

So far, we have been using the number of persons in individual labour market states and the corresponding flows. Consistently with the other literature, we define the unemployment rate u=U/L, the participation rate p=L/P and the employment rate e=E/P. We divide all flow variables by the total labour force L, obtaining net flow rates $\overline{ue}$, $\overline{nu}$ and $\overline{en}$ and gross flows *ue, eu, en, ne, nu* and *un*. Lower-case names thus denote rates.

The change in the unemployment rate is

$$\Delta u = \frac{U_t}{L_t} - \frac{U_{t-1}}{L_{t-1}} = \frac{U_t}{L_t} - \frac{U_{t-1}}{L_{t-1}} + \frac{U_{t-1}}{L_t} - \frac{U_{t-1}}{L_t} = \frac{\Delta U_t}{L_t} - \frac{\Delta L_t}{L_t} u_{t-1} \quad (5)$$

Using (2) and (4), equation (5) becomes

$$\Delta u = \overline{nu} - \overline{ue} - (\overline{nu} - \overline{en})\, u_{t-1} \quad (6)$$

The unemployment rate is then

$$u_t = \overline{nu} - \overline{ue} + (1 - \overline{nu} + \overline{en}) u_{t-1} \quad (7)$$

The unemployment rate contains all three net flows between employment, unemployment and inactivity and the lagged unemployment rate. The partial derivatives of the unemployment rate are

$$\frac{\partial u}{\partial \overline{nu}} = 1 - u_{t-1};\ \frac{\partial u}{\partial \overline{ue}} = -1;\ \frac{\partial u}{\partial \overline{en}} = u_{t-1} \quad (8)$$

A unit change in the net flow from unemployment to employment thus reduces the unemployment rate by the same amount. The response of the unemployment rate to changes in net flows between inactivity and unemployment and between employment and inactivity depends on the level of the lagged unemployment rate. As long as u<<1, the response to a change in $\overline{nu}$ is greater than the response to $\overline{ue}$.

As for the participation rate, we assume that the population does not change between t-1 and t, so that $P = P_t = P_{t-1}$.[3] The change in the participation rate between t-1 and t is

$$\Delta p = \frac{\Delta L_t}{P} = \frac{\Delta L_t}{L_t}\frac{L_t}{P} = (\overline{nu} - \overline{en})\, p_t \quad (9)$$

The participation rate can be written as

$$p_t = \frac{p_{t-1}}{1-(\overline{nu}-\overline{en})} \quad (10)$$

The participation rate in (10) depends on the flows between inactivity and unemployment and between inactivity and employment and on the participation rate in the previous period. The denominator in (10) is 1-ΔL/L, so that the participation rate is related to changes in the labour force. The partial derivatives of the participation rate are

$$\frac{\partial p}{\partial \overline{nu}} = \frac{p_{t-1}}{(1-(\overline{nu}-\overline{en}))^2};\ \frac{\partial p}{\partial \overline{en}} = \frac{-p_{t-1}}{(1-(\overline{nu}-\overline{en}))^2} \quad (11)$$

[3] This is a plausible assumption given the data structure, where we match individuals in two adjacent quarterly datasets. We describe the data issues in the next section.

We see that in absolute terms, the response of the participation rate is the same for a change in $\overline{nu}$ as it is for a change in $\overline{en}$.

Finally, the employment rate is

$$\boldsymbol{e_t = p_t(1 - u_t)} \tag{12}$$

It is the product of the participation rate and unity minus the unemployment rate. To complete the analysis, the partial derivatives of the employment rate in (12) are

$$\frac{\partial e}{\partial \overline{nu}} = \frac{p_{t-1}*(1-u_t)}{(1-(\overline{nu}-\overline{en}))^2} - p_t(1-u_{t-1});\ \frac{\partial e}{\partial \overline{ue}} = p_t;\ \frac{\partial e}{\partial \overline{en}} = \frac{-p_{t-1}*(1-u_t)}{(1-(\overline{nu}-\overline{en}))^2} - p_t u_{t-1} \tag{13}$$

Equations (7), (10) and (12) link the contemporaneous stocks on the labour market (the unemployment, participation and employment rates) with their lagged values and the corresponding labour market flows.

3. Data and Evidence on Gross and Net Flows

We use individual data from the Labour Force Survey (LFS) provided by the Czech Statistical Office and Polish Statistical Office. In Czech Republic, the LFS is a household-based survey of more than 24,000 apartments covering more than 46,000 residents aged 15 or more. The frequency of the survey is once a quarter. Each household is surveyed for five consecutive quarters, so the data construct a rotating panel. The data provide the information necessary to uniquely identify each respondent, along with demographic information (e.g. age, gender, marital status, education and nationality) and, most importantly for our analysis, information about economic status. The available data run from the first quarter of 1998 to the third quarter of 2017. In Poland, the LFS covers about 45,000 residents in each quarter until 2010 and approximately 100,000 since 2010. The survey scheme is 2(2)2, so each household is surveyed in two quarters, then there is a break of two quarters, and after that the household is surveyed in two consecutive quarters once again. The LFS sample is divided into four independently selected subsamples with different scheme delays. The comparable Polish LFS datasets are available from the first quarter of 2000 to the third quarter of 2017.

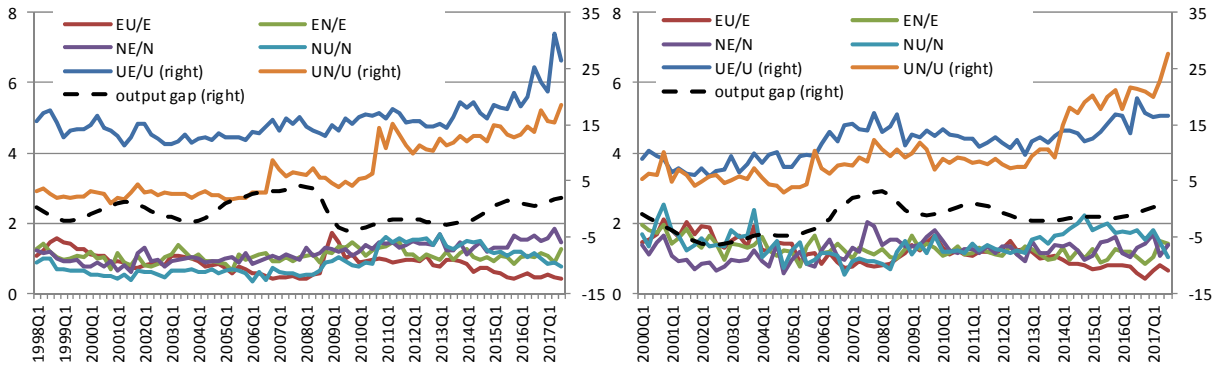
We match datasets between any two adjacent quarters to construct flow data, allowing us to compute the number of persons transitioning between labour market states. Given the rotating sample scheme used in the LFS, the resulting datasets contain only a part of the total data (about 80% in Czech Republic and less than 50% in Poland). The representativeness of the LFS statistics relies on the importance of the weights of individuals. Panel attrition is also a significant problem, but in this paper it is reduced by the relatively short time between observations (one quarter). In order to keep the data representative and the flows consistent with the publicly available data on stocks of the employed, the unemployed and the inactive, we implemented the following procedure. We used the arithmetic average of the weights for each individual when calculating flows. Then we recalibrated the data with the aim to "gross up" to population totals using the

iterative proportional fitting method (Fienberg, 1970). In this way, our flow data are representative and correspond to the aggregate data.

Figure 2 presents evidence on flows based on the LFS data. The flows are normalized, so that, for example, EU/E is the number of persons transitioning from employment to unemployment during a quarter as a proportion of the number of employed at the beginning of the quarter, and UE/U is the flow from unemployment to employment divided by the number of the unemployed. These labour market transitions are defined as the quarterly flows between two labour market states as a percentage of the size of the state where the flow originates. The transitions from unemployment to employment and from unemployment to inactivity are high in both countries, standing between 10% and 30%. Other labour market transitions are between 0.4% and 3%. They are much lower than the transitions from unemployment given the size of the pools of employed and inactive persons, but are not negligible.

Figure 2 also shows the output gap in relation to labour market transitions. The Czech output gap is calculated using the small structural model described in the CNB's Inflation Reports. For Poland, we use yearly output gap estimates from OECD (2018), which we transform into quarterly frequency using cubic spline interpolation.

Figure 2: Labour Market Transitions (CZ left, PL right, in %)



Note: Quarterly seasonally adjusted data from Labour Force Survey. Output gap in % of potential GDP.

The labour market transitions depicted in Figure 2 express the probabilities of transitioning between labour market states. However, due to the discrete time approximation given by the quarterly data, these transition rates are not instantaneous flow hazard rates owing to the omission of any transitions within quarters. In this paper, we focus on the cyclical properties of flows. Shimer (2013) finds that the cyclical properties of flows are not affected by this time aggregation bias. Elsby et al. (2015) and Krusell et al. (2017) show that the cyclical properties of labour market flows are unaffected when the flows are corrected for misclassification errors (Abowd and Zellner, 1985) and for too frequent transitions between inactivity and unemployment (Elsby et al., 2015). Based on this evidence, we do not correct the flow rates for time aggregation bias or classification errors. Furthermore, consistently with our framework defined in Section 2, we divide all labour market flows by the labour force, which allows us to derive identities between flows and stocks.

Table 1 shows summary statistics of the seasonally adjusted quarterly gross and net flow rates defined in Section 2.[4] In the Czech Republic, the gross flows between employment and unemployment and between employment and inactivity are 0.8%–1% of the labour force. The gross flows between unemployment and inactivity are smaller, ranging between 0.4% and 0.6%. The gross flows between unemployment and inactivity and from employment to unemployment have higher standard deviations than the remaining gross flows, indicating higher volatility. The mean net flows are between 0.19% and 0.23% of the labour force. The highest volatility is observed for the net flow from unemployment to employment and the lowest from inactivity to unemployment. In Poland, all gross flows are higher than in the Czech Republic. Unlike the Czech Republic, the gross flows between unemployment and inactivity are at a similar level as other gross flows. On the other hand, the net flows from and to inactivity are lower in Poland than in the Czech Republic, while the net flow from unemployment to employment is higher. The flows in Poland exhibit higher volatility than the Czech flows.

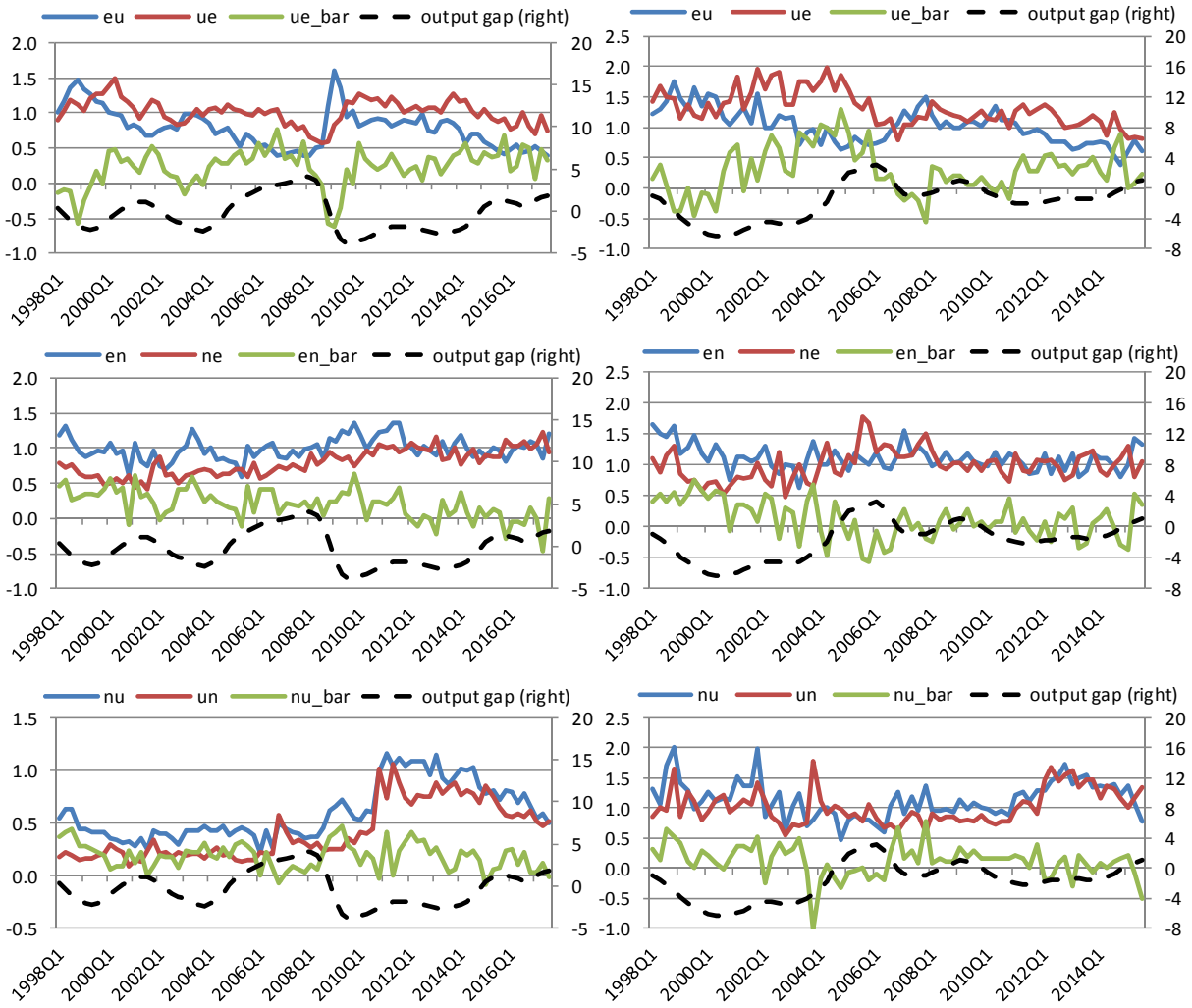
Table 1: Gross and Net Flow Statistics (% of labour force)

	Gross flows						Net flows		
	en	ne	eu	ue	nu	un	$\overline{en}$	$\overline{nu}$	$\overline{ue}$
Czech Republic									
Mean	1.00	0.79	0.79	1.02	0.60	0.42	0.20	0.19	0.23
Std. dev.	0.16	0.19	0.27	0.18	0.26	0.26	0.21	0.13	0.26
Poland									
Mean	1.11	0.99	1.01	1.31	1.14	1.02	0.12	0.12	0.29
Std. dev.	0.20	0.25	0.29	0.29	0.30	0.29	0.31	0.27	0.39

Figure 3 illustrates the gross and net flows in per cent of the labour force for the Czech Republic and Poland and their relation to the output gap. In the Czech Republic, the gross flow from employment to unemployment peaks in each recession period, particularly when recessions begin. The flow rate from unemployment to employment is low when a recession starts, then quickly recovers, and declines steadily thereafter until the next recession. On the other hand, a cyclical response is not apparent in the remaining Czech flows or in any of the flows for Poland.

[4] The X-12 seasonal adjustment method is used throughout the paper.

Figure 3: Gross and Net Flow Rates (CZ left, PL right, in % of labour force)



Note: Quarterly seasonally adjusted flow rates in % of labour force. Output gap in % of potential GDP. CZ sample 1q1998–3q2017, PL sample 1q2000–3q2017.

Table 2 offers a closer look at the cyclical properties of flows based on correlations with the output gap. The upper panel A shows the correlations of flows in per cent of the initial state, so these correlations can be compared with the correlations for the U.S. in Krusell et al. (2017). Negative correlations are observed for *eu* and *nu* in the Czech Republic, Poland and the U.S. The results for *eu* are intuitive, as employed persons are less likely to lose their jobs in good times, while the countercyclical pattern of *nu* could be explained by fewer employment opportunities in recessions, so that inactive persons are more likely to become unemployed than employed, hence *nu* is countercyclical.[5] For the same reason, the *ne* flow is cyclical, as documented in Table 2 for Poland and the U.S., but not for the Czech Republic. The positive correlations for *ue* are also intuitive, as more job seekers find jobs during expansions, although the correlation is small for the Czech Republic.

[5] The countercyclical *nu* is also consistent with the added worker hypothesis, which assumes that secondary earners start seeking jobs in those households where household heads lose their jobs in a recession.

The correlation of *un* with the output gap is positive in Poland and the U.S., but close to zero in the Czech Republic. Krusell et al. (2017) suggest that the gross flow from U to N is affected by the changing composition of unemployed workers in recessions. While in good times the pool of the unemployed contains many persons who are less attached to work and prone to transitions between U and N, in recessions new entrants into unemployment are dominated by exogenously separated workers, who are more attached to work and thus more likely to remain unemployed until they re-enter employment in the future. The transitions from U to N are thus lower in recessions, leading to a cyclical pattern.[6]

The flows from E to N are weakly cyclical in the U.S., as reported in Krusell et al. (2017). These flows are dominated by one-time transitions, as it is costly to return to E. More workers thus remain employed in recessions, leading to cyclicality in the gross flow from E to N. In the Czech Republic and Poland, the gross flow *en* exhibits a negative correlation with the output gap, perhaps due to demographic shifts and changes in eligibility rules for retirement benefits, such as increases in the statutory retirement age during the period in both countries.

Panel B in Table 2 shows the correlations of the output gap with flows defined in per cent of the labour force. The results are different than in panel A for *ue* and *un* only, as for these two flows the impact of the bigger denominator prevails. The correlations of the net flow $\overline{ue}$ with the output gap are positive in both countries, while the correlations of $\overline{en}$ and $\overline{nu}$ are negative.

Table 2: Correlations of Gross and Net Flow Rates with the Output Gap

	Gross flows						Net flows		
	en	ne	eu	ue	nu	un	$\overline{en}$	$\overline{nu}$	$\overline{ue}$
Panel A: Flows in % of the initial state									
CZ	-0.40	-0.12	-0.69	0.10	-0.46	-0.01	-0.13	-0.02	0.16
PL	-0.26	0.63	-0.62	0.78	-0.30	0.43	-0.60	-0.46	0.79
U.S.*	0.43	0.52	-0.63	0.76	-0.23	0.61			
U.S.**	0.29	0.57	-0.66	0.81	-0.56	0.55			
Panel B: Flows in % of the labour force									
CZ	-0.34	-0.13	-0.68	-0.55	-0.46	-0.27	-0.15	-0.41	0.32
PL	-0.01	0.63	-0.52	-0.38	-0.34	-0.15	-0.50	-0.23	0.10

Note: Results for the U.S. from Table 8 in Krusell et al. (2017), correlations with U.S. cyclical GDP.
* AZ-adjusted data (Abowd and Zellner, 1985)
** DeNUNified data (Elsby et al., 2015)

4. VAR Analysis of Labour Market Flows

We have seen that employment, unemployment and participation are related to flows between those three labour market states and that the flows are correlated with the business cycle. In this section we investigate the cyclical properties of labour market flows in a vector autoregression framework. We define a VAR model as

[6] The same explanation based on composition effects is provided in Elsby et al. (2015).

$$X_t = A_1 X_{t-1} + A_2 X_{t-2} + \cdots + A_k X_{t-k} + \varepsilon_t \quad (14)$$

$$\boldsymbol{u_t = \overline{nu} - \overline{ue} + (1 - \overline{nu} + \overline{en}) u_{t-1}}$$

$$p_t = \frac{p_{t-1}}{1 - (\overline{nu} - \overline{en})}$$

$$e_t = p_t(1 - u_t)$$

where X_t, is a 4x1 vector of endogenous variables containing demeaned seasonally adjusted net flow rates $\boldsymbol{\overline{ue}}$, $\boldsymbol{\overline{en}}$ and $\boldsymbol{\overline{nu}}$ and the output gap.[7] The terms A_1, A_2, …, A_k, are *kxk* matrices of lag coefficients. The term ε_t is a 4x1 white noise innovation process. The model is completed with the identities derived in Section 2 which link net flows to unemployment, participation and employment (equations 7, 10 and 12).

The number of lags (k) is set to 3, based on the sequential modified likelihood test as described in Lütkepohl (1991) and Sims (1980). For Poland, the optimal number of lags is 2. The Breusch-Godfrey test shows that the residuals are not autocorrelated in both models for the Czech Republic and Poland.

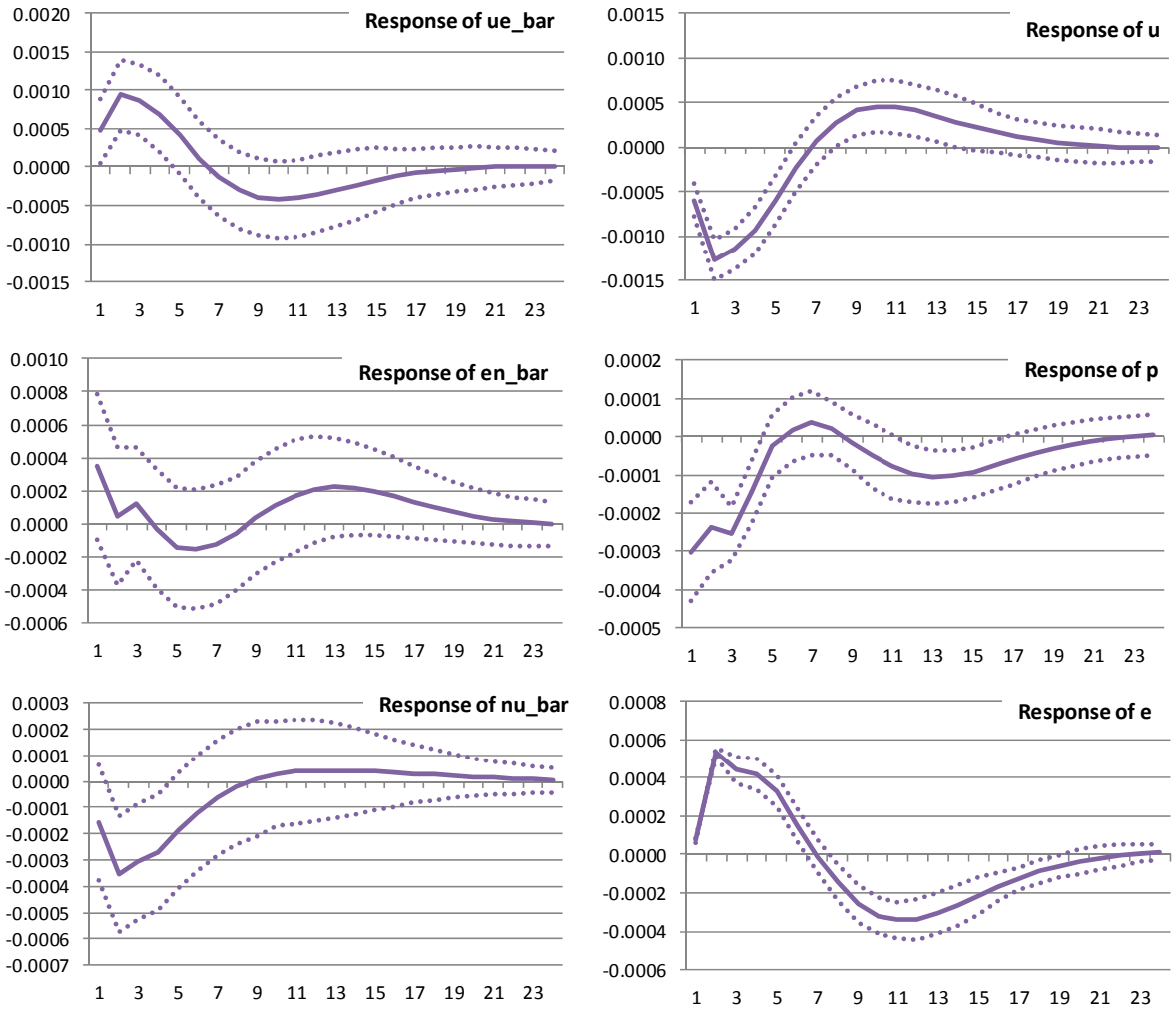
Figure 4 shows the impulse responses of Czech net flows and the unemployment, participation and employment rates to a one standard deviation shock to the Czech output gap. The response of the net flow from unemployment to employment is positive, peaking in two quarters following the shock. This positive response is in line with intuition, as a positive output shock leads to more transitions from U to E relative to transitions from E to U. It also corresponds well to the correlations shown in Table 2, where the countercyclical pattern of the gross flow *eu* is stronger than the impact of *ue*, leading to a cyclical response of $\overline{ue}$.

The response of the net flow from employment to inactivity $\overline{en}$ is insignificant. This net flow is represented mainly by transitions into retirement among the elderly population, by entries into the labour market by school graduates and also by parental leave among women. These flows are hence more likely to be affected by demographics than by the business cycle conditions. Finally, the response of the net flow from inactivity to unemployment $\overline{nu}$ is weakly negative, with the maximum reaction occurring after two quarters. In this case, fewer inactive persons start seeking jobs than the unemployed become inactive following a positive output gap shock. Looking at Table 2, this response is perhaps driven by the countercyclical pattern of the gross flow *nu*, as the correlation with the business cycle is stronger for *nu* than for *un*. The countercyclicality of *nu* may be due to scant job opportunities during recessions, leading to more transitions from N to U than from N to E.

[7] The ADF test rejects the null hypothesis of nonstationarity. In particular, the ADF statistics for the Czech sample are $\overline{ue}$ (-4.28), $\overline{en}$ (-3.83) and $\overline{nu}$ (-4.76). The 1% critical value is -3.52. For the Polish sample, the ADF statistics are $\overline{ue}$ (-3.98), $\overline{en}$ (-5.56) and $\overline{nu}$ (-5.71), while the 1% critical value is -3.53. The KPSS test does not reject the null hypothesis of stationarity in the Polish data, as the statistics are $\overline{ue}$ (0.10), $\overline{en}$ (0.60) and $\overline{nu}$ (0.10) and the 10% (1%) critical values are 0.35 (0.74). In the Czech data, the KPSS statistics are $\overline{ue}$ (0.25), $\overline{en}$ (0.99) and $\overline{nu}$ (0.16). The critical values are 0.35 at 10% and 0.74 at 1%, so the null of stationarity is rejected for $\overline{en}$ and not rejected for $\overline{ue}$ and $\overline{nu}$.

As the remaining panels in Figure 4 show, the response of the unemployment rate is negative (countercyclical), peaking after two quarters, and the response of the employment rate is strongly positive (cyclical). Both these responses are as expected. The response of the participation rate is mildly negative, so it is countercyclical. Equations (10) and (11) and the correlation results in Table 2 suggest that this may be driven by the countercyclical nature of *nu*. The maximum response of the participation rate is smaller than those of the employment and unemployment rates.

Figure 4: Impulse Responses to Output Gap Shock – Czech Republic

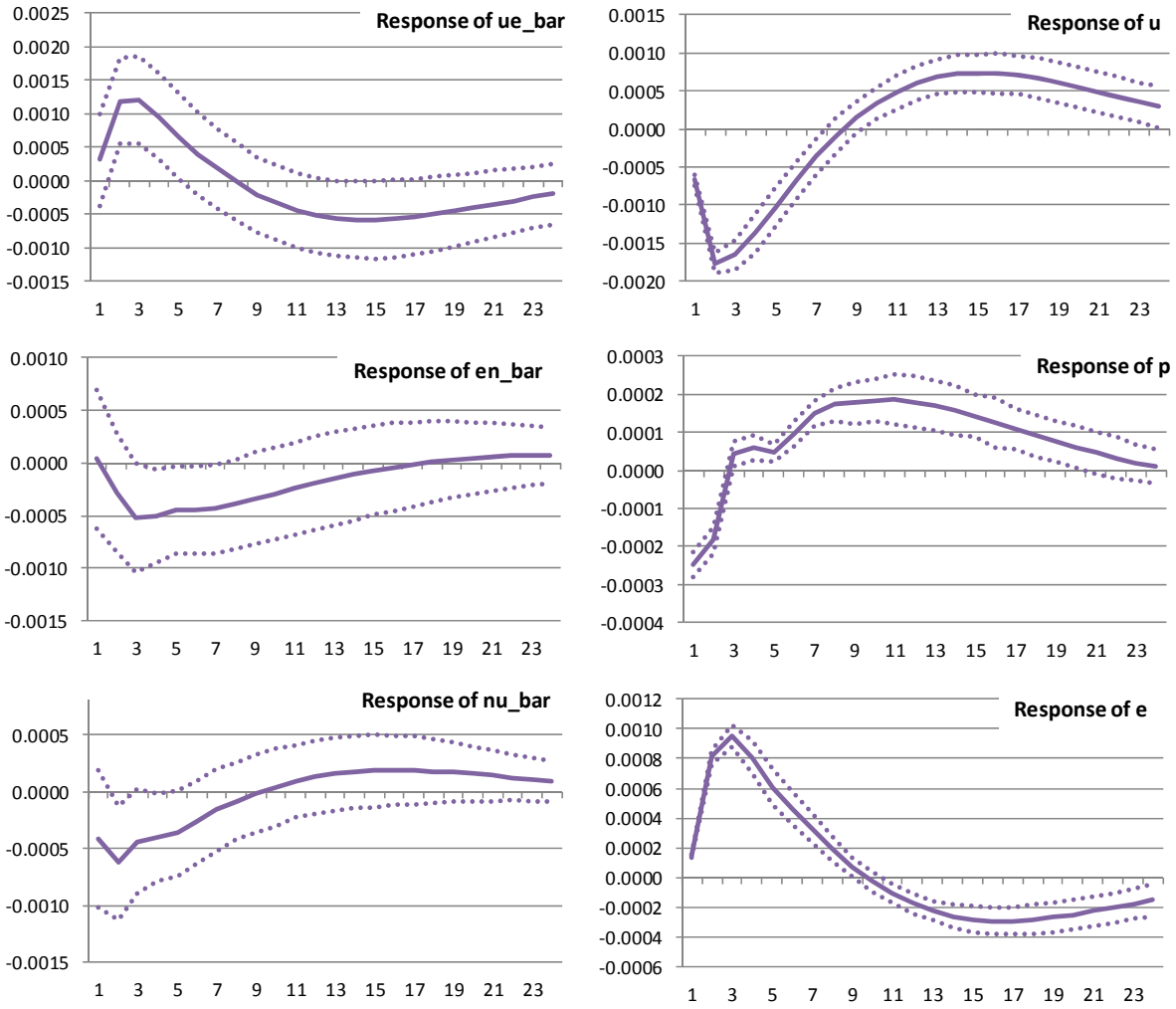


Note: Reponses to generalized one standard deviation innovations to output gap. Confidence intervals +/- 2*s.e. Generalized impulses as described by Pesaran and Shin (1998).

In Figure 5 we show the impulse responses for Poland. The cyclical patterns are very similar to those for the Czech Republic, with the exception of the response of the net flow $\overline{nu}$, which is insignificant. As in the Czech Republic, the participation rate in Poland is weakly countercyclical in the periods immediately after the output gap shock.[8]

[8] We associate cyclicality (countercyclicality) with positive (negative) impulse responses to the output gap shock in the first several periods after the shock. In Poland, the response of the participation rate reaches a maximum

Figure 5: Impulse Responses to Output Gap Shock – Poland



Note: Reponses to generalized one standard deviation innovations to output gap. Confidence intervals +/- 2*s.e. Generalized impulses as described by Pesaran and Shin (1998).

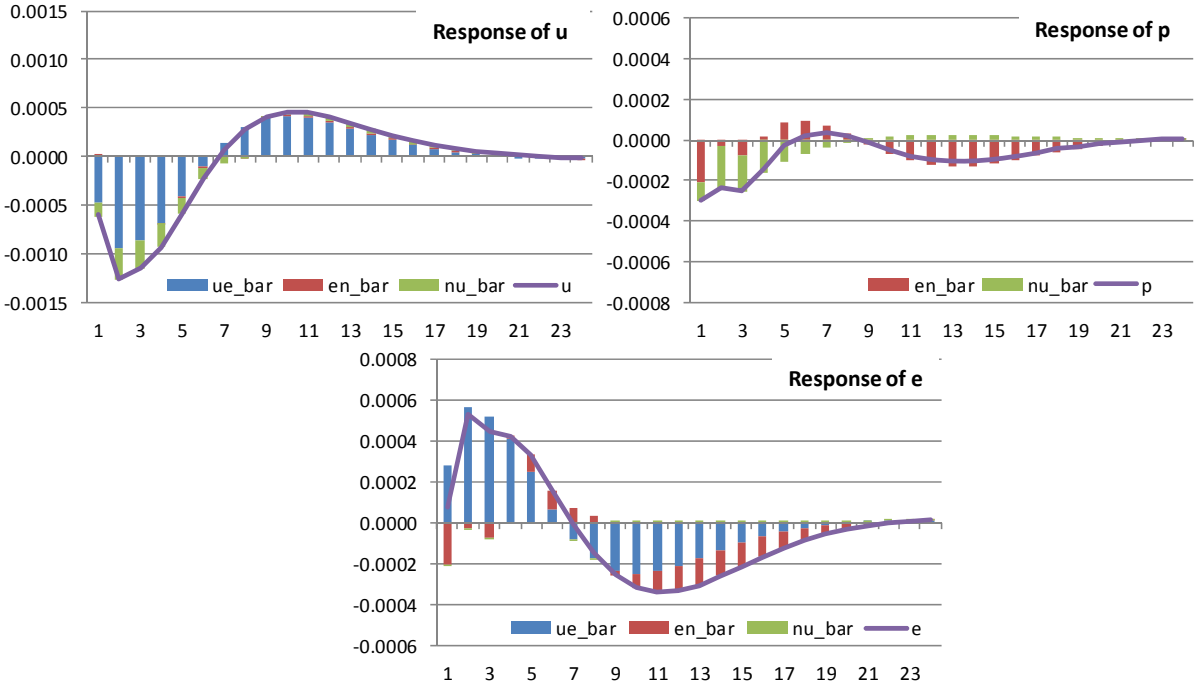
We decompose the impulse responses of the unemployment, participation and employment rates into the contributions of flow rates. We do so by combining the impulse responses of net flows and the partial derivatives in (8), (11) and (13) evaluated at the sample means. The results in Figure 6 indicate that in the Czech Republic, the response of the unemployment rate is driven mainly by the net flow from unemployment to employment ($\overline{ue}$). The contribution of the net flow from inactivity to unemployment ($\overline{nu}$) is smaller, enhancing the negative response following a positive output gap shock. The contribution of $\overline{en}$ to the response of the unemployment rate is negligible.

The second panel in Figure 6 describes the response of the participation rate. It is driven by the contribution of $\overline{nu}$ in the first several quarters after the output gap shock, while the contribution of $\overline{en}$ is smaller. The last part of Figure 6 depicts the response of the employment rate. The main contribution is from the net flow from unemployment to employment ($\overline{ue}$). The contribution of

after 9 to 11 quarters. It is of similar size to the response immediately after the shock. As we will see in Figure 7, the second peak in the response is due to the net flow from employment to inactivity.

$\overline{en}$ is small and without a clear pattern. This is perhaps due to its small and insignificant response, as we saw in Figure 4. The contribution of $\overline{nu}$ to the impulse response of the employment rate is negligible.

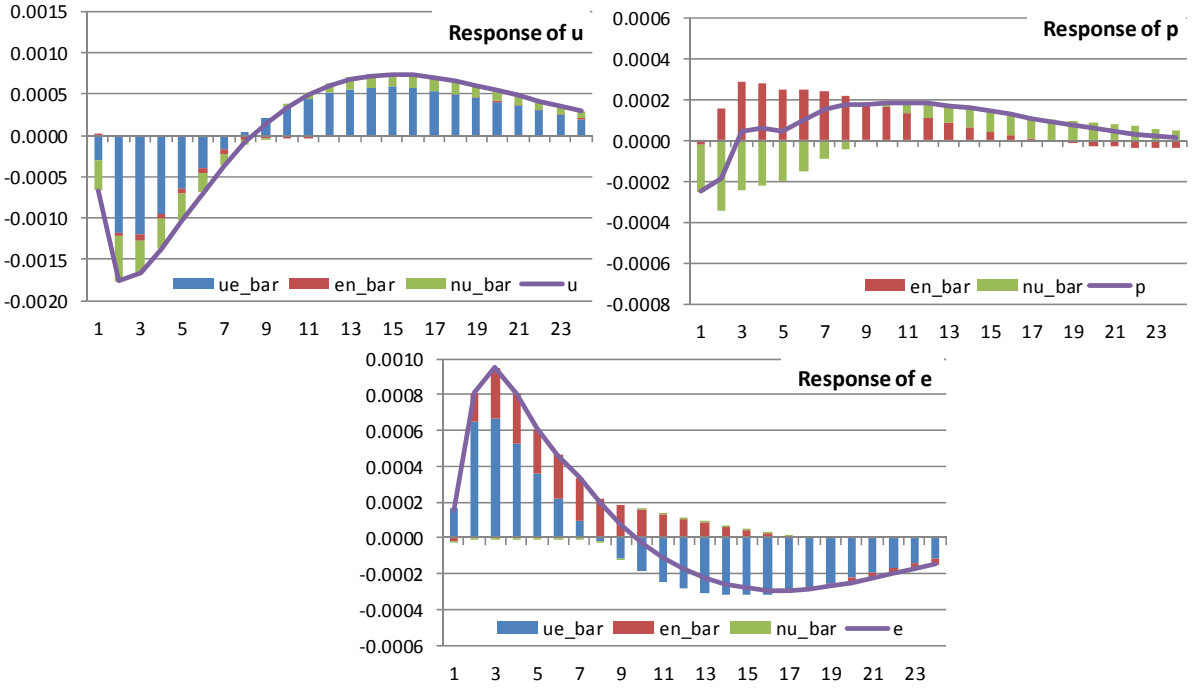
Figure 6: Decomposition of Impulse Responses to Output Gap Shock – Czech Republic



The impulse responses for Poland shown in Figure 7 are very similar to the Czech responses in Figure 6. A notable exception is a more pronounced positive contribution of the net flow from employment to inactivity, which attenuates the countercyclical pattern of the participation rate and enhances the cyclical response of the employment rate.

To summarize our results, the role of flows at the participation margin in explaining the cyclical properties of the unemployment and employment rates is small in both countries under review, but is not negligible. The flows from and into inactivity enhance the countercyclical nature of the unemployment rate and the cyclical pattern of the employment rate. The weakly countercyclical participation rate in the Czech Republic and Poland is driven by the countercyclical net flow from inactivity to unemployment. This may be due to less abundant employment opportunities in recessions, so that more inactive individuals go to unemployment than directly to employment. As Elsby et al. (2015) explain, the flows at the participation margin are subject to large measurement errors. Although the cyclical properties of flows are not affected by mismeasurement (Elsby et al., 2015; Krusell et al., 2017; Shimer, 2013), our results in explaining the role of the participation margin should be interpreted with caution.

Figure 7: Decomposition of Impulse Responses to Output Gap Shock – Poland



We conduct two robustness checks. In Figures 4 and 5, we show generalized impulse responses, where the ordering of the variables is irrelevant. As an alternative, we compute impulse responses with Cholesky orthogonalization, assuming an economically meaningful correlation structure such that shocks to the output gap affect the flows with a delay, neglecting any contemporaneous correlations. As we see in Figures A1 and A2 in Appendix A, the impulse responses are, with the exception of the first quarter, very close to our baseline impulse responses, which are depicted as dashed lines. The decompositions of the responses under the alternative assumption shown in Figures A3 and A4 are also very close to our baseline decomposition results in Figures 6 and 7.

Second, the working age population is defined as aged 15 or more. As an alternative, we restrict the sample to men aged 25 to 54 to see whether the results are affected by demographic factors such as retirement, school graduates or mothers on parental leave. The results are provided in Appendix B. Figures B1 and B2 show that the impulse responses are similar to our results in Figures 4 and 5. The response of the participation rate is to some extent different immediately after the output gap shock, but the overall countercyclical pattern of the participation rate is almost unchanged.

The results from the decomposition of the responses to the contributions of net flows in Figures B3 and B4 are also similar to our results in Figures 6 and 7, except for the contribution of the net flow from employment to inactivity, which is lower in explaining the participation and unemployment rates in the Czech Republic. While for the Czech Republic the impact of flows between employment and inactivity is low even in our baseline results, the still higher contribution of these flows in explaining the participation and employment rates among Polish prime age men indicates that the impact of demographics on the cyclical properties of these labour market flows in Poland is rather limited.

5. Conclusion

We investigate the cyclical properties of labour market flows in the Czech Republic and Poland. We take the example of these countries to investigate similarities and differences and to examine the robustness of our results. The results show that the role of flows at the participation margin in explaining the cyclical properties of unemployment and participation rates is smaller than that of flows between employment and unemployment, but is not negligible. They contribute to the countercyclical pattern of the unemployment rate and the cyclical nature of the employment rate. The participation rate is weakly countercyclical in both countries, driven by the contribution of flows from inactivity to unemployment. This observation could be explained by fewer employment opportunities in recessions, so that more inactive individuals become unemployed than employed, leading to a countercyclical pattern of the gross flow from inactivity to unemployment. The results are very similar for the Czech Republic and Poland. The only noticeable difference is in the impact of flows between employment and inactivity, which is higher in Poland.

We rely on the assumption that the cyclical properties of labour market flows are not affected by time aggregation bias or classification errors. This assumption is supported by the previous evidence (Elsby et al., 2015; Krusell et al., 2017; Shimer, 2013). Elsby et al. (2015) show that the impact of mismeasurement is higher in transitions between unemployment and inactivity by individuals marginally attached to the labour market. Given these caveats, we believe our results on the cyclical properties of labour market flows could be used in labour market analysis, which traditionally relies on labour market stocks. In addition, the results could be employed in building a complex labour market block in the CNB's core macroeconomic model.

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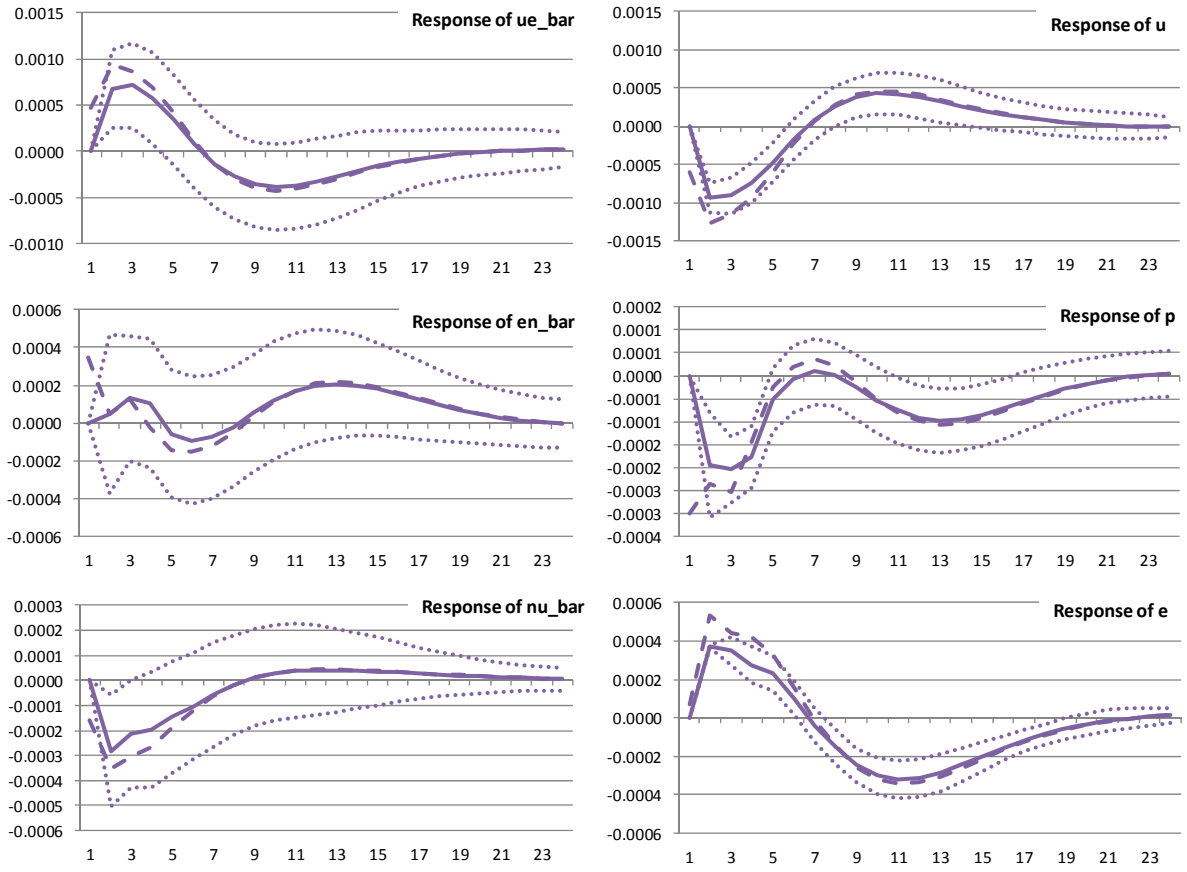
Appendix A

In Figures 4 and 5 we show generalized impulse responses, where the ordering of the variables does not matter. Alternatively, we use Cholesky orthogonalization in the computation of the impulse responses, assuming an economically meaningful correlation structure between the net flow rates and the output gap. For this purpose, we assume that shocks to the output gap affect the flows with a lag and that contemporaneous correlations are zero. In our VAR model defined in (14), the variables are ordered as $\overline{ue}$, $\overline{en}$, $\overline{nu}$ and the output gap.

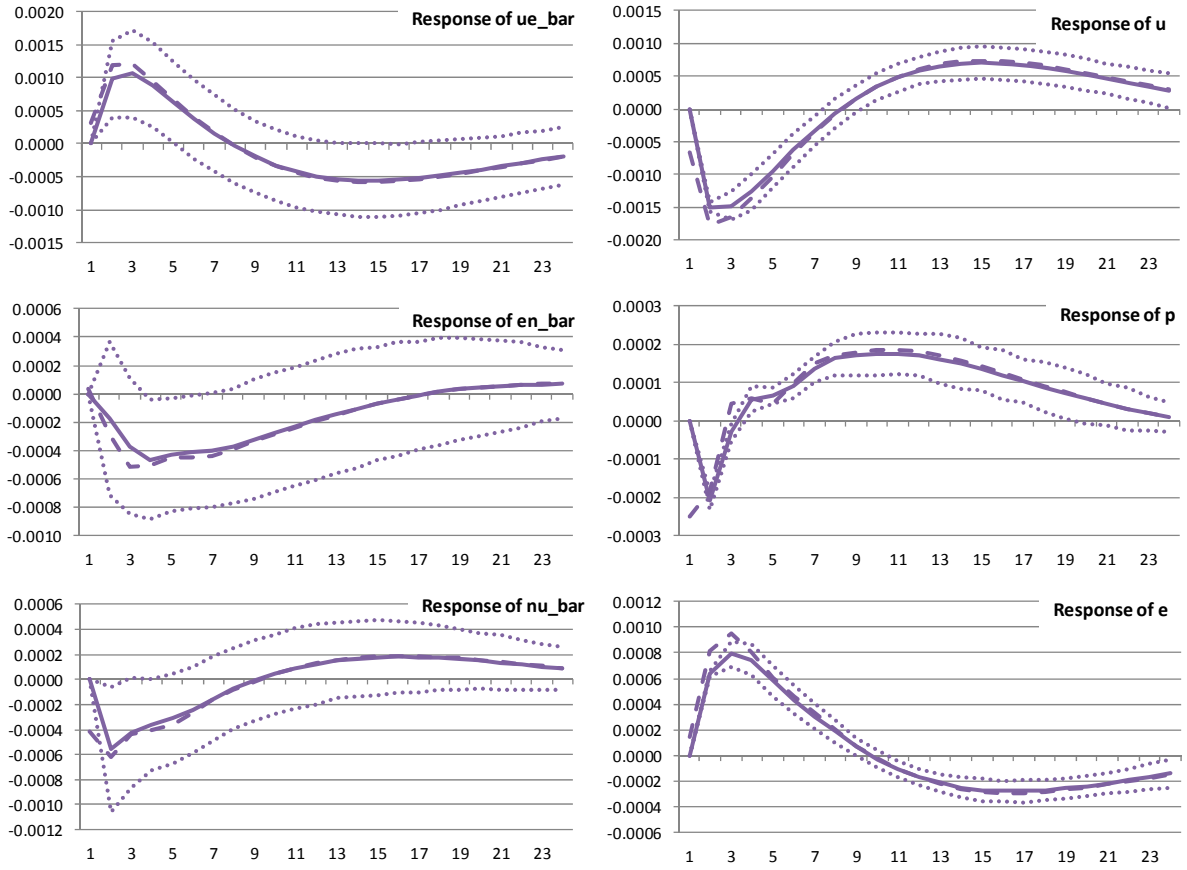
Figures A1 and A2 show the impulse responses with this alternative assumption. Our baseline responses from Figures 4 and 5 are depicted as dashed lines. The responses are, with the exception of the first period, close to our baseline impulse responses. In Figures A3 and A4, we show the decomposition of the responses of the unemployment, participation and employment rates under the alternative assumption. Again, the results are very close to our baseline results in Figures 6 and 7.

Figure A1: Impulse Responses to Output Gap Shock – Czech Republic, Cholesky Ordering



Note: Reponses to one standard deviation innovations to output gap. Confidence intervals +/- 2*s.e. Impulses are orthogonalized using inverse of Cholesky factor of residual covariance matrix. Dashed responses are from Figure 4.

Figure A2: Impulse Responses to Output Gap Shock – Poland, Cholesky Ordering



Note: Reponses to one standard deviation innovations to output gap. Confidence intervals +/- 2*s.e. Impulses are orthogonalized using inverse of Cholesky factor of residual covariance matrix. Dashed responses are from Figure 5.

Figure A3: Decomposition of Impulse Responses (Cholesky Ordering) – Czech Republic

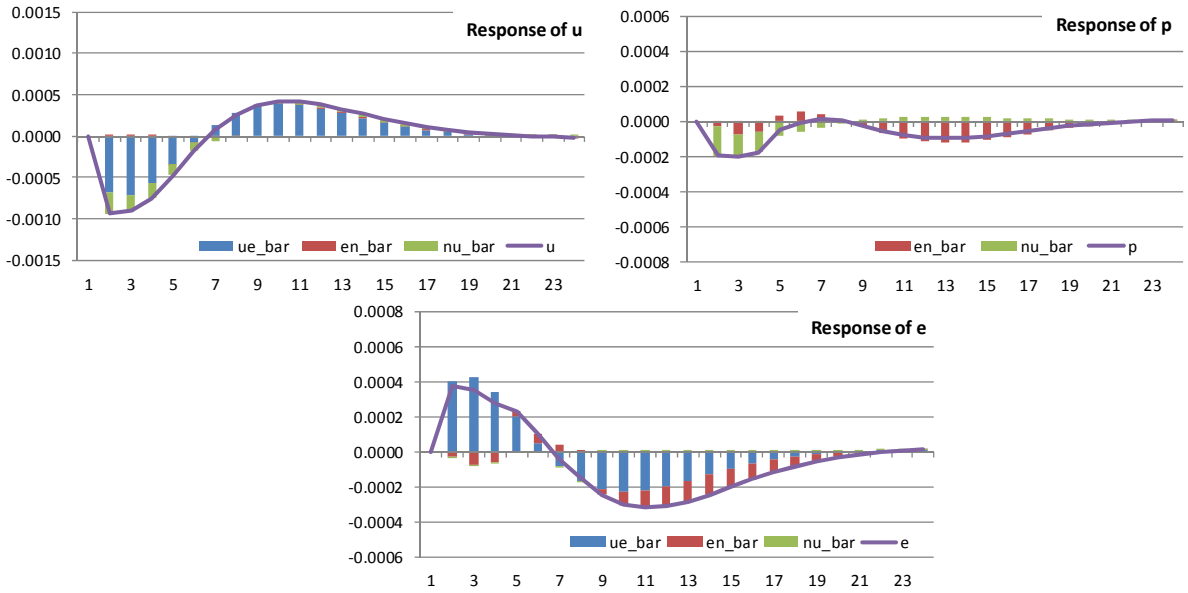
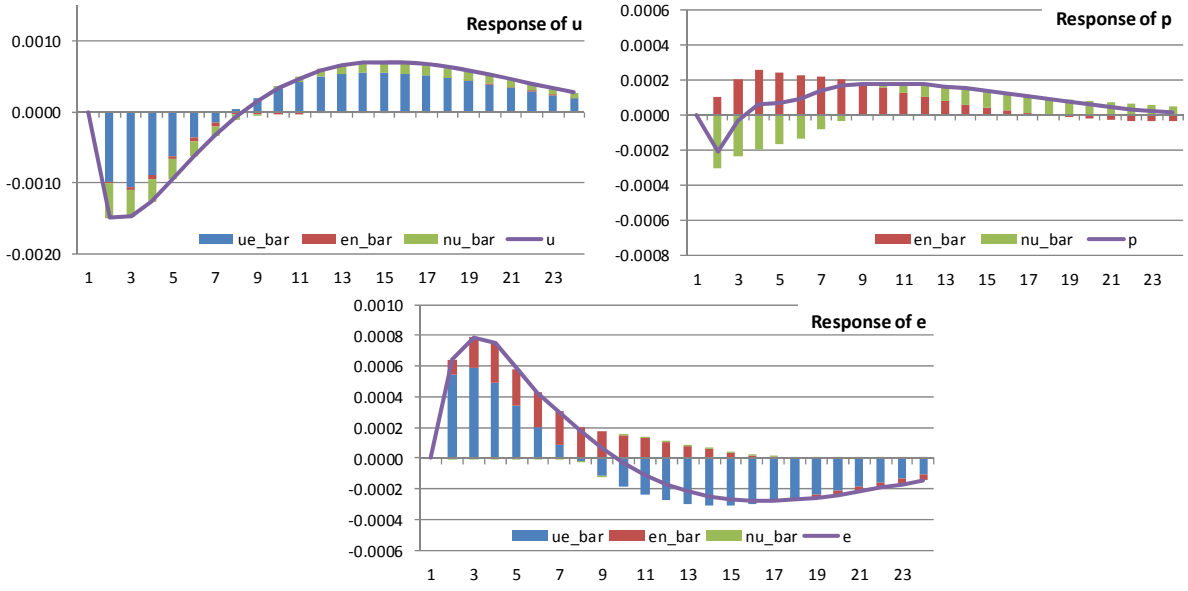


Figure A4: Decomposition of Impulse Responses (Cholesky Ordering) – Poland



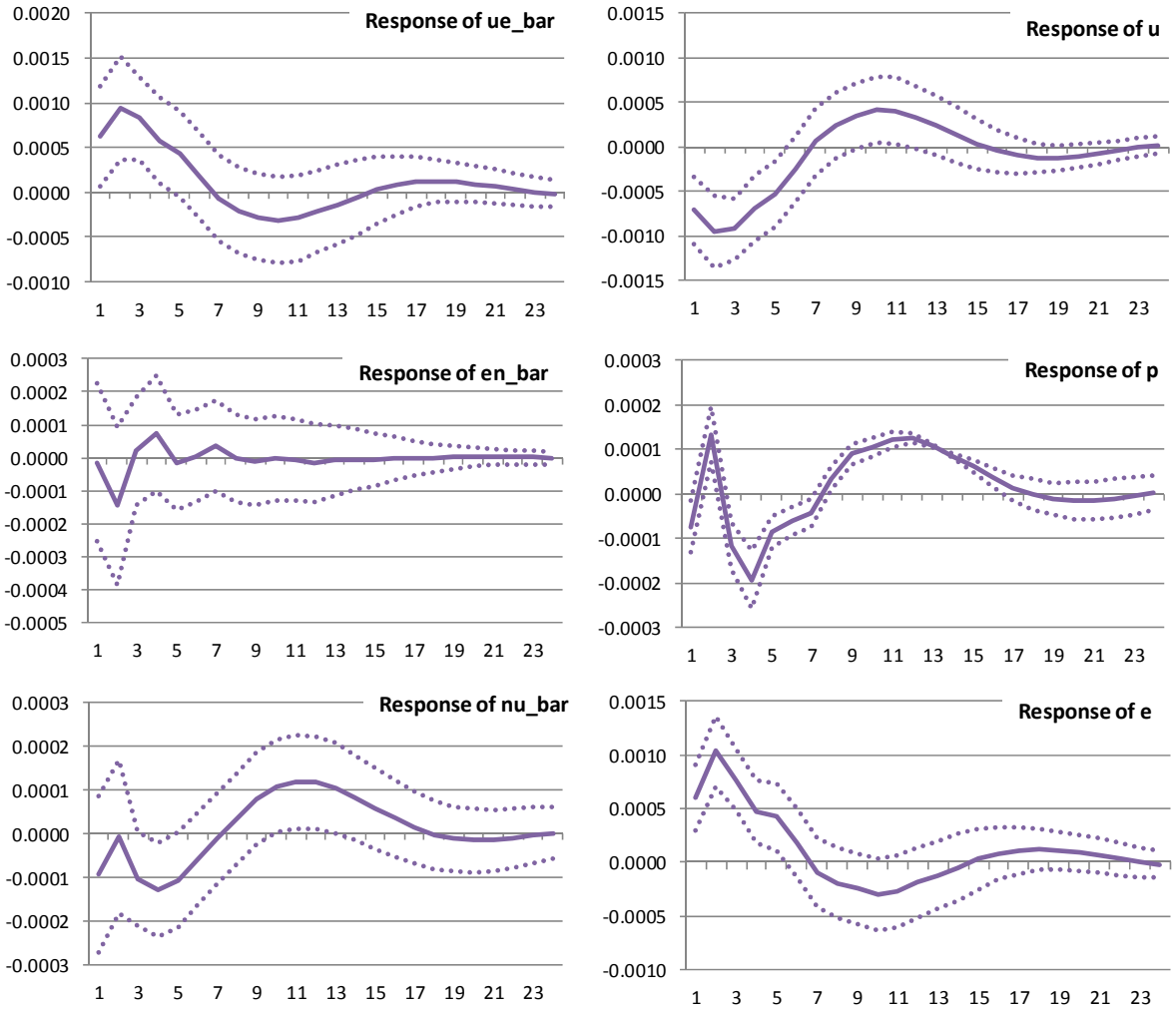
Appendix B

In this appendix, we provide impulse responses for samples restricted to men aged 25 to 54. The purpose of this robustness check is to filter out possible demographic effects due to retirement, graduates or mothers on parental leave.

The results in Figures B1 and B2 show that the impulse responses are similar to our results in Figures 4 and 5. The response of the participation rate differs to some extent immediately after the output gap shock, but the overall countercyclical pattern of the participation rate is almost unchanged.

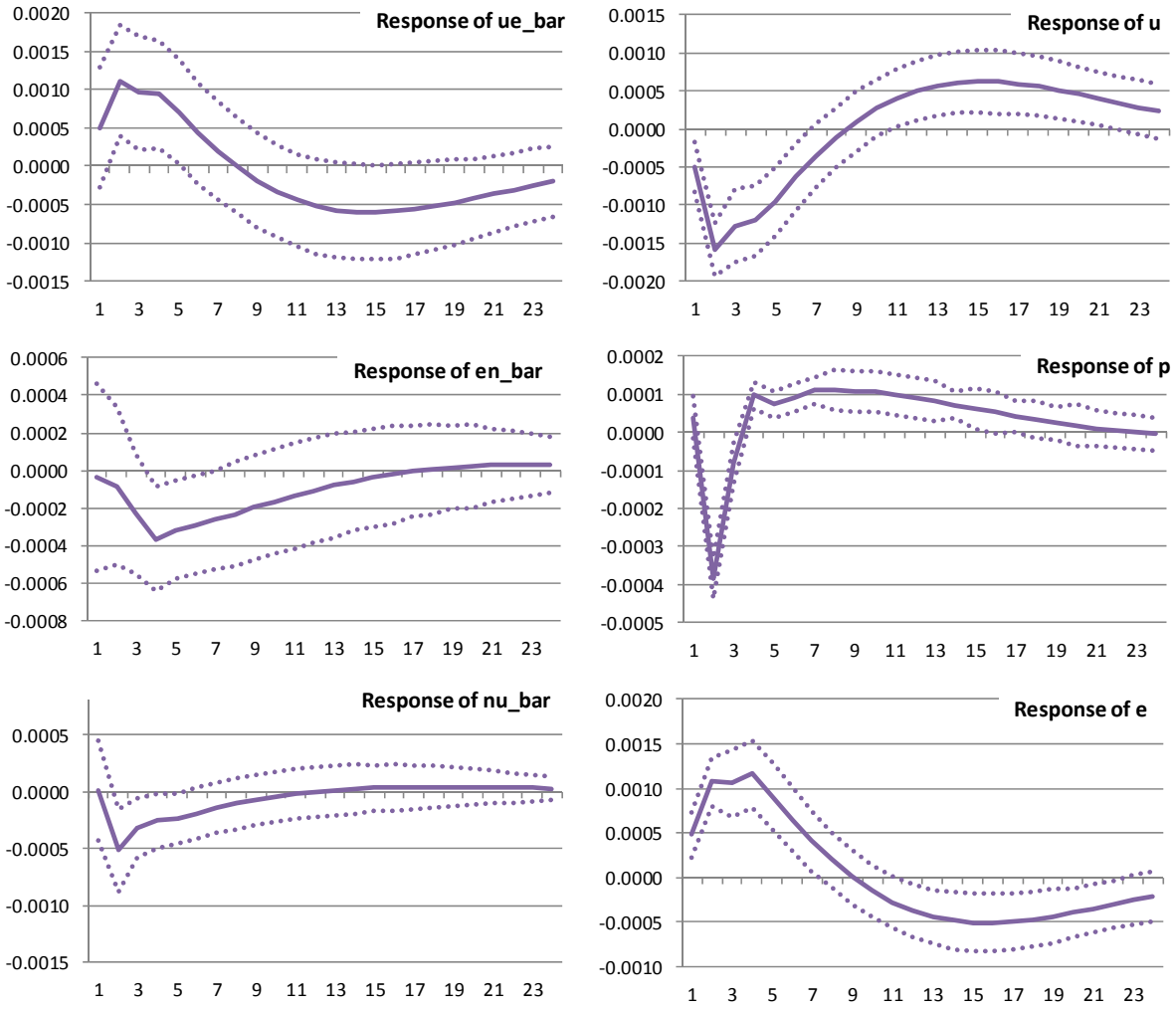
The results from the decomposition of the responses to the contributions of net flows in Figures B3 and B4 are similar to our results in Figures 6 and 7, although the contribution of the net flow from employment to inactivity may be lower in explaining the participation and unemployment rates in the Czech Republic. While for the Czech Republic the impact of flows between employment and inactivity is low even in our baseline results, the still higher contribution of these flows in explaining the participation and employment rates in Poland indicates that the impact of demographics on the cyclical properties of the Polish labour market flows is limited.

Figure B1: Impulse Responses, Men Aged 25 to 54 – Czech Republic



Note: Reponses to generalized one standard deviation innovations to output gap. Confidence intervals +/- 2*s.e. Generalized impulses as described by Pesaran and Shin (1998).

Figure B2: Impulse Responses, Men Aged 25 to 54 – Poland



Note: Reponses to generalized one standard deviation innovations to output gap. Confidence intervals +/- 2*s.e. Generalized impulses as described by Pesaran and Shin (1998).

Figure B3: Decomposition of Impulse Responses, Men Aged 25 to 54 – Czech Republic

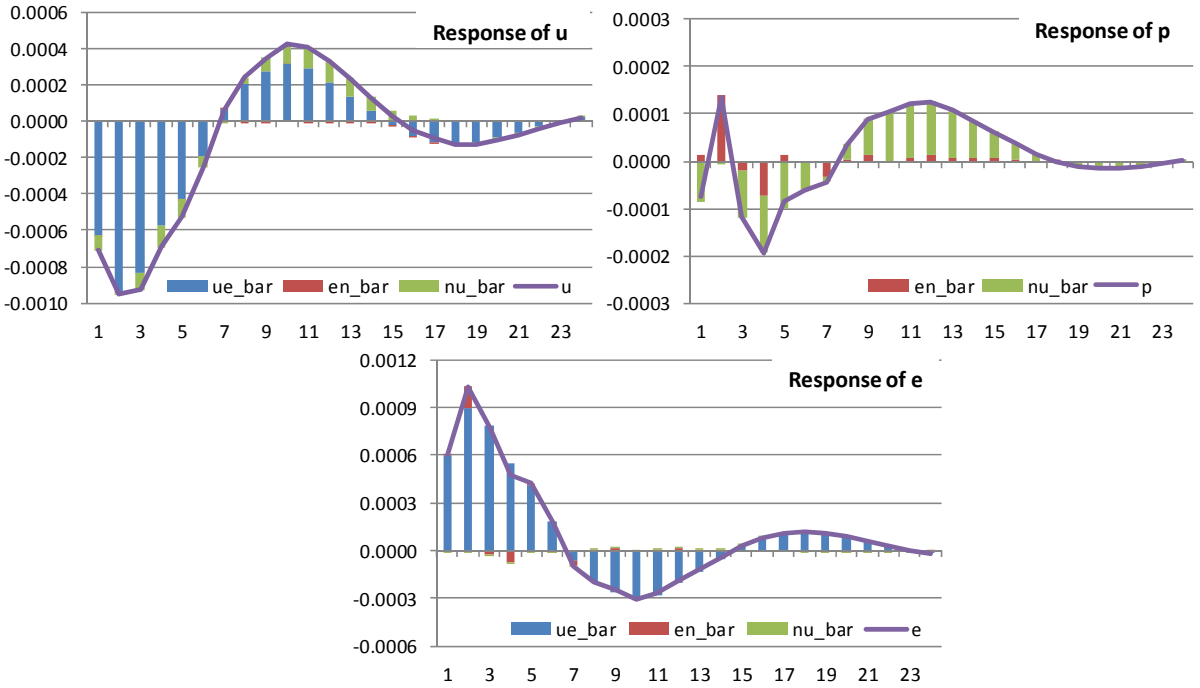
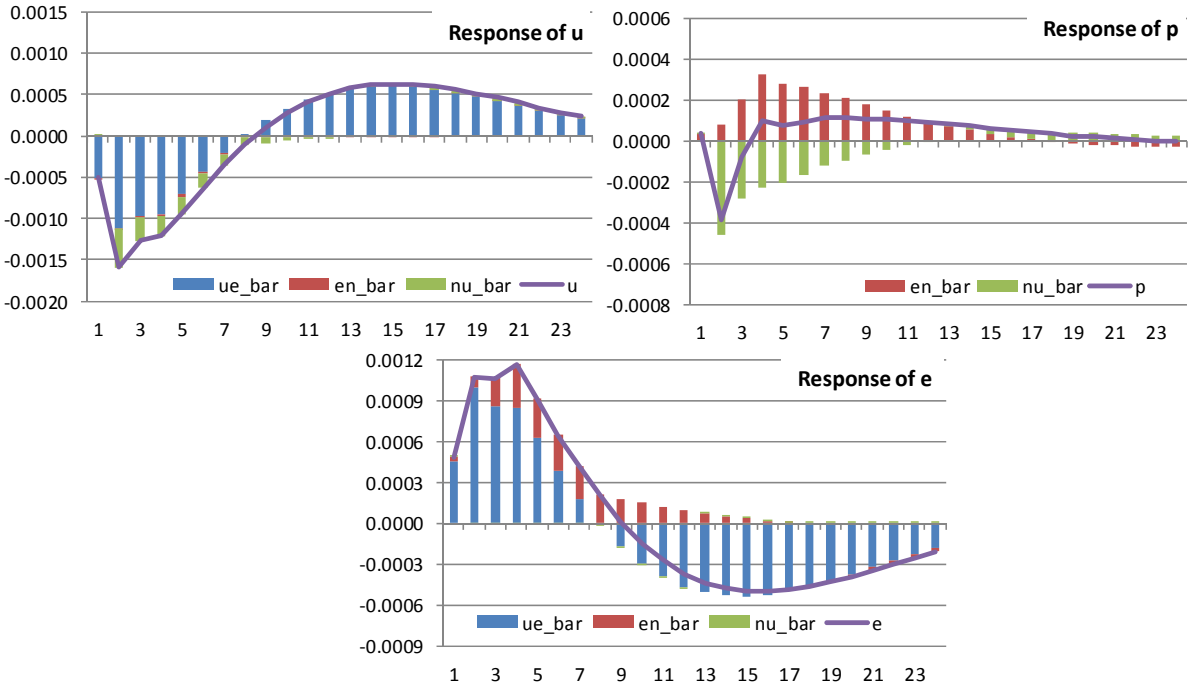


Figure B4: Decomposition of Impulse Responses, Men Aged 25 to 54 – Poland



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