Dynamics of Part-Time Employment to an Aggregate Shock: a Sign-Restriction Approach

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Highlights

- A recessionary aggregate shock is identified within a sign-restriction VAR framework including US labor market variables.
- The shock identified through the Beveridge curve relationship implies an increase in the part-time share.
- Transition probability from full-time to part-time work increases after the shock and has a major influence for the dynamics of the part-time share.

Abstract

This paper provides new stylized facts about the responses of the part-time employment share, the transition probability from full-time to part-time and the one from part-time to full-time jobs to a negative aggregate shock. The recessionary aggregate shock is identified within a sign-restriction VAR framework by imposing a short-run negative co-movement between unemployment and vacancies. The negative aggregate shock pushes the part-time employment share up. The latter increase is mainly due to a rise in the probability at which full-time work is transformed into part-time work without an intervening spell of unemployment. Given that such transitions mainly take place at the same firm/worker pair, these findings indicate that US firms use - in addition to the creation/destruction process - within-employment reallocation to adjust their labor input in recessionary episodes.

Keywords: part-time share, transition probabilities, VAR models
JEL classifications: E24, E32, J6

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1 Introduction

In seminal contributions of Blanchard and Diamond (1990), Fujita (2011) Canova, Lopez-Salido, and Michelacci (2013) (among others), the literature has recognized the importance of the extensive margin[1] in explaining cyclical dynamics of the labor market. However, the spotlight is shifting toward the intensive margin[2] thanks to the recent contribution of Borowczyk-Martins and Lalé (2019). Using US data (among others), they find that the fall in the intensive margin observed during recessionary episodes can be well approximated by fluctuations in the part-time employment share, namely the fraction of worker having a part-time job among employed. Then, from a simple unconditional-variance decomposition, they show that within-transitions, namely those involving jointly part-time and full-time work, account for more than two-third of the variations in the part-time share in the US.

The paper of Borowczyk-Martins and Lalé (2019) relies mostly on descriptive measures of part-time employment dynamics. Though useful as a first departure point, such descriptive exercises could reflect a mixture of different factors. The purpose of my paper is to establish a number of robust stylized facts about the responses of part-time related macro-variables conditional on a recessionary aggregate shock. In doing so, I estimate Vector-Autoregressive (VAR) models including selected US labor market time series: the unemployment rate, vacancies, the part-time employment share and transition probabilities implying part-time and full-time jobs. The structural shock is then identified by exploring the negative relationship existing between unemployment and vacancies. In particular, it is imposed that the negative aggregate shock implies a raise in unemployment together with a fall in vacancies (see also Fujita (2011) or Hairault and Zhutova (2018)). The sign restriction approach has a number of practical advantages for my purpose. First, the identified shock is general enough to be consistent with a wide range of theoretical models. Second, by focusing on labor market variables it enables me to preserve parsimony. Last but not least, it allows me to provide robust dynamic features without imposing i) any restrictions on the behavior of part-time variables and ii) any recursive structures to the model.

My main findings can be summarized as follows. First, my empirical models predict that the negative shock increases in a hump-shaped manner the part-time employment share. Second, the responses of transition probabilities strongly support the view that worker flows from full-time to part-time work is of highest importance in accounting for the recessionary increase in the part-time share. Third, the recessionary aggregate shock identified through the changes along the Beveridge curve accounts for a non-negligible fraction, around 30%, of the variance of endogenous variables. Along the lines of Borowczyk-Martins and Lalé

[1]For short, the number of people employed.

[2]For short, the number of hours worked by employed workers.

(2019), these new facts are suggestive that US firms do not only adjust their quantity of labor input by the "traditional" creation/destruction process of jobs, but also by changing the way they transform full-time to part-time work. In that sense, my results challenge the view of Mukoyama, Shintani, and Teramoto (2018) who suggest that flows from part-time to full-time are essential in explaining the counter-cyclical pattern of part-time employment.[3]

My paper contributes to, at least, two strands of literature. First, it participates to the recent debate fueled by Borowczyk-Martins and Lalé (2019) and Mukoyama, Shintani, and Teramoto (2018) on the importance and the "form" of adjustments at the intensive margin. Second, it adds to the VAR literature by including to such empirical models part-time related macro-variables, especially transition probabilities involving jointly full-time and part-time employment. In doing this, my framework offers an easy way to assess, conditional on an aggregate shock, which transition probability is of first interest to understand part-time share employment dynamics.

I organize the remainder of this paper as follows. Section 2 discusses the data and the empirical model. Section 3 presents the results and checks for their robustness. Finally, section 4 concludes the paper.

2 Empirical framework

2.1 Data

My empirical models rely on the following vectors of endogenous variables: $Y_t^A = \left(u_t, v_t, \omega_t^P\right)'$ and $Y_t^B = \left(u_t, v_t, p_t^{PF}, p_t^{FP}\right)'$. u_t is the unemployment rate, v_t the proxy for vacancies, ω_t^P the part-time employment share and p_t^{PF} and p_t^{FP} are transitions probabilities from part-time (resp. full-time) to full-time (resp. part-time) jobs. Except for the vacancy variable, which corresponds to the Composite Help-Wanted Index of Barnichon (2010), other variables are extracted from Borowczyk-Martins and Lalé (2019). In Borowczyk-Martins and Lalé (2019), the distinction between part-time and full-time workers is based on the notion of usual hours. More specifically, all workers declaring that they usually work less (resp. more) than 35 hours are classified as part-timers (resp. full-timers). Other sample restrictions apply: only workers aged of 16-64 y-o and working in the private sector are taken into account.[4] As commonly done in the worker flows literature, transition probabilities used in this paper are corrected

[3] Mukoyama, Shintani, and Teramoto (2018) build a New-Keynesian DSGE model incorporating search-and-matching frictions and dual labor markets of full-time and part-time workers. If they model the possibility of moving from part-time to full-time employment through on-the-job search, they do not model the opposite transition, namely the one from full-time to part-time jobs.

[4] As indicated by Borowczyk-Martins and Lalé (2019), an average 77.2% of employed people aged of 16-64 y-o work for the private sector over the 1976-2017 period.

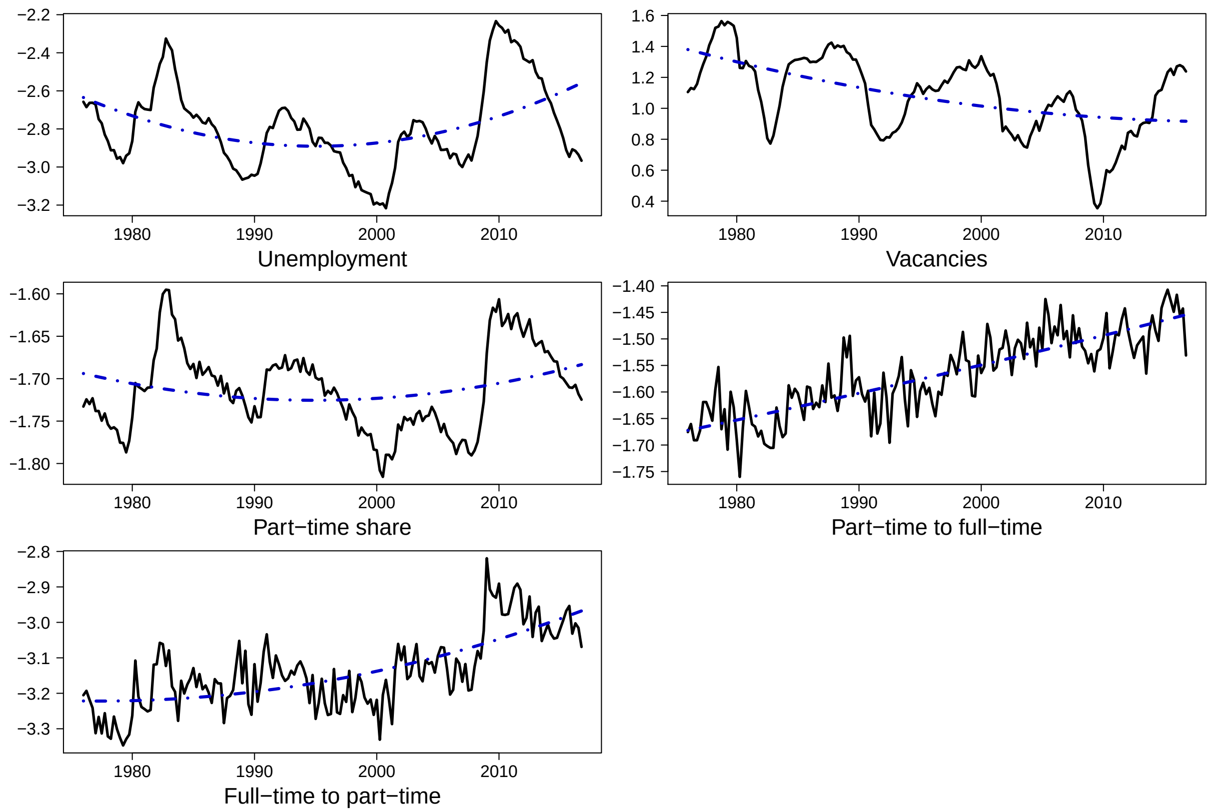

Figure 1: Time series (in logarithm) and their quadratic trend.
Sources: Borowczyk-Martins and Lalé (2019) for unemployment rate, part-time share and transitions probabilities between part-time and full-time jobs. Barnichon (2010) for vacancies. Author's own calculations for quadratic trends.
Notes: Vertical axis correspond to the logarithm of each time series.

for margin errors and for time aggregation bias (Elsby, Hobijn, and Şahin (2015) or Shimer (2012)). I limit my analysis to p_t^{PF} and p_t^{FP} because Borowczyk-Martins and Lalé (2019) find that they account for 70% of the variance of ω_t^P. In order to maximize the number of observations, I work with quarterly data spanning the 1976Q1-2016Q4 period. The beginning of the sample period follows Borowczyk-Martins and Lalé (2019) while its end is dictated by the availability of the vacancy variable.

2.2 Econometric specification

My baseline econometric strategy consists in the estimation of two VAR models (model A and model B) of the following form:[5]

$$\Psi(L)Y_t = \nu_t \tag{1}$$

[5]For the sake of simplicity, the superscript $j \in \{A, B\}$ on Y_t is drop.

With Ψ the matrix of coefficients, L the lag operator and ν_t the $(n, 1)$ matrix of reduced-form residuals (n being the number of endogenous variables included in Y_t^j). Assuming that $\Psi(L)$ is invertible, the VAR has a Wold moving-average representation:

$$Y_t = \Psi(L)^{-1}\nu_t = C(L)\nu_t \tag{2}$$

with $C(L)$ a matrix of polynomials in the operator L. The reduced-form residuals do not have meaningful economic interpretation because its variance-covariance Σ has no reason to be diagonal. The main purpose of the identification is to find a mapping that enables me to recover structural shocks ε_t from the reduced form residuals. Under standard assumptions,[6] reduced-form residuals and structural shocks are related by the following relationship:

$$\nu_t = D\varepsilon_t \tag{3}$$

In this paper, the identification of the contemporaneous matrix D follows Uhlig (2005) and sign restrictions are imposed directly on impulses responses. In particular, I impose $\tilde{D}Q = D$ with Q some orthogonal matrix, and so $\Sigma = \tilde{D}\tilde{D}^{'} = (DQ^{'})(QD^{'}) = DID^{'} = DD'$. As the matrix Q, which allows to fully characterize the model, is not unique, I perform a Bayesian estimation of $\Psi(L)$ and Σ by imposing a flat Normal inverted-Wishart prior. Then, I take 250 draws from the posterior distribution, and for each of them I evaluate 250 candidates for Q. When all sign restrictions are met, I keep the joint draw while I discard it in other cases. The procedure is stopped when I have 10000 impulse response functions that satisfy my restrictions.

Figure 1 displays time series along with their quadratic trends extracted from standard OLS regressions. Except for the part-time employment share, other variables exhibit noticeable low-frequency movements. In particular, transition probabilities increase secularly since the early 1980s. Such upward trends are suggestive that within-employment reallocation become an important way of adjustment in the labor market. In my preferred specification, all variables enter the VAR as logarithm deviations from quadratic trends. In doing so, I follow Fujita (2011) and Hairault and Zhutova (2018). In a step of robustness, I consider alternative detrending methods and find that the main message of the paper does not depend on them. As indicated by the Hannan–Quinn information criterion, my two VARs are estimated with 2 lags. All estimations include an intercept in each equation.

The structural shock is identified by means of sign restrictions from its implication for the co-movement between unemployment and vacancies. It is well-known that a negative rela-

[6]It is assumed that structural shocks are mutually independent. Furthermore, I adopt the standard normalization that $E(\varepsilon_t\varepsilon_t^{'}) = I$.

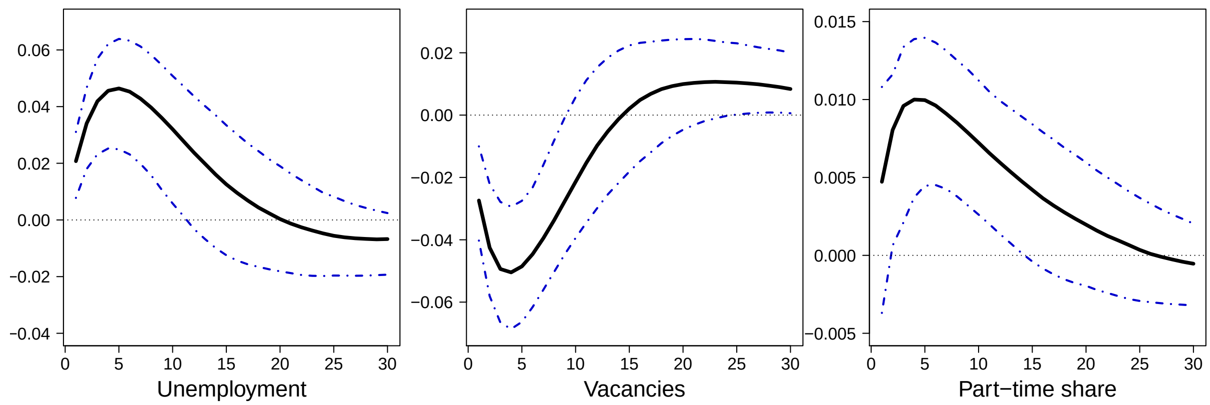

Figure 2: Labor market's response to a negative aggregate shock - Model A.
Sources: Author's own calculations.
Notes: Impulse response functions to a one standard-deviation increase of the negative aggregate shock. Black solid lines correspond to median responses, blue error bands represent the 16th and 84th percentiles of the posterior distribution.

tionship – the so-called Beveridge curve – governs co-variations between these two variables. Most prominently, a negative aggregate shock is identified as the one inducing an increase in u_t together with a fall in v_t during $k = 2$ periods. Such restrictions imply a movement along the Beveridge curve and are consistent with a large class of models. For example, it is in line with the shock to match profitability existing in the textbook search-and-matching model of Pissarides (2000) (chapter 1). In this kind of model, the negative aggregate profitability shock reduces return from a match leading firms to post fewer vacancies. As job separation is exogenous, the fall in vacancies induces a decline of the rate at which unemployed workers find a job and unemployment unambiguously increases.[7] It should be observed that the aggregate shock identified could originate from the supply side (e.g. technology shocks) but also the demand side (e.g. monetary shocks). My identification strategy does not deal with issues about this diversity. Instead, my purpose is to document robust dynamic responses of the part-time related macro-variables to a shock that is common to all jobs.

3 Results

3.1 The benchmark model

IRFs Figures 2 and 3 respectively display impulse responses of endogenous variables in model A and B. In each panel of both figures, solid black lines correspond to the median re-

[7]My restrictions are also consistent with the model of the second chapter of Pissarides (2000) (see also Hairault and Zhutova (2018)), RBC models including a frictional labor market (Merz (1995), Andolfatto (1996)) or New-Keynesian search-and-matching DSGE models (Walsh (2005), Trigari (2009), Blanchard and Galí (2010).

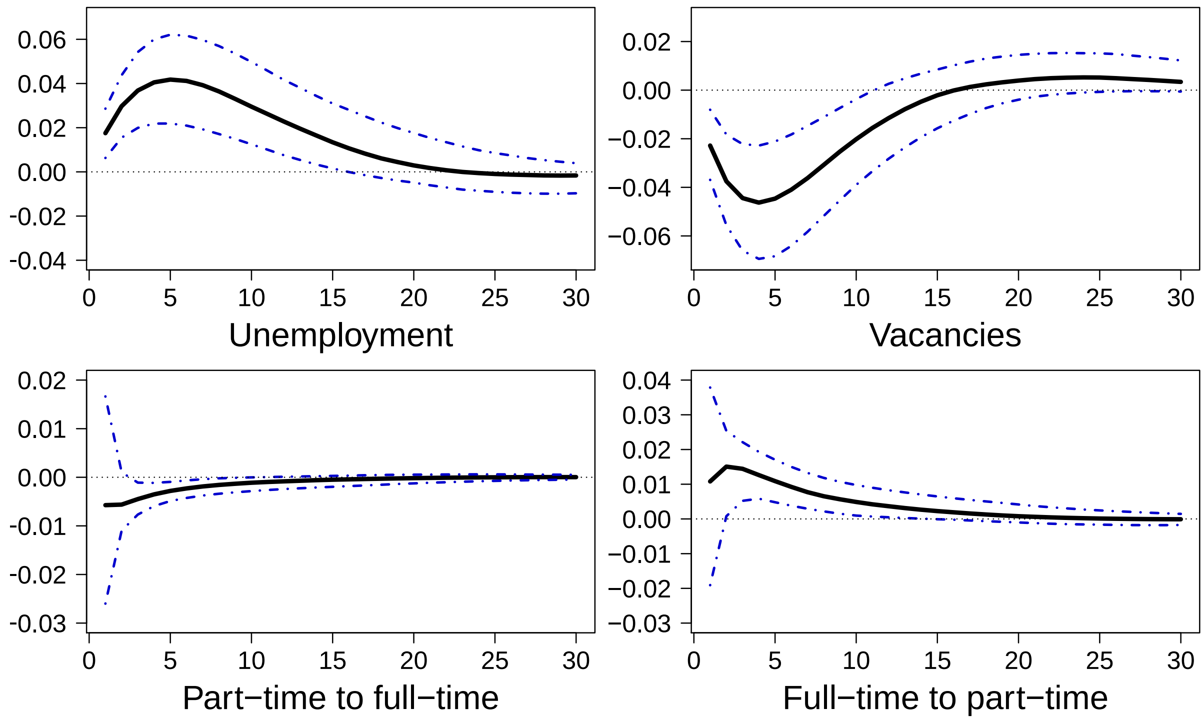

Figure 3: Labor market's response to a negative aggregate shock - Model B.
Sources: Author's own calculations.
Notes: Impulse response functions to a one standard-deviation increase of the negative aggregate shock. Black solid lines correspond to median responses, blue error bands represent the 16th and 84th percentiles of the posterior distribution.

sponses while blue dashed lines report the 68-percent error bands. In both models, responses of the unemployment rate and vacancies are similar from a quantitative and qualitative points of view. As imposed by my identifying restrictions, the recessionary aggregate shock increases unemployment and decreases vacancies. The response of unemployment (resp. vacancies) is hump-shaped (resp. u-shaped) reaching its maximum (resp. minimum) 5 quarters after the shock. Inspections of IRFs related to part-time variables lead to some straightforward comments. The first striking feature is about the dynamic of part-time share. The negative aggregate shock identified by the Beveridge curve relationship induces a hump-shaped response of ω_t^P. Its response is however indistinguishable from 0 during the first period following the impact. Thereafter, it becomes significant and reaches its maximum during the fifth quarter at around 1% relative to its steady-state value. Second, a look on IRFs of transition probabilities confirms the ambiguous response of part-time employment during periods that directly follow the impact. More precisely, the response of p_t^{PF} is not statistically significant for the first two quarters following the shock while the one of p_t^{FP} is ambiguous only during the first quarter. However, after these delays responses of transition probabilities become significant and IRFs provide interesting insights about the underlying mechanism leading to part-time employment variations. Throughout the adjustment path, the transition probability from part-time to full-time decrease only weakly while the reverse flow, namely the one from full-time to part-time, significantly increases. Unambigously, the largest deviation from steady-state (at 1.5%) is the one of p_t^{FP}, indicating that its contribution to the cyclical increase in the part-time share is by far dominant. As Borowczyk-Martins and Lalé (2019), I interpret this fact as a piece of evidence in favor of the view that US firms use part-time employment as an adjustment margin during bad times. As the VAR literature mainly focuses on the extensive margin, this fact is new and highlights that the transformation of full-time work into part-time work - occurring at the same firm/worker pair - is an alternative to adjustments through the extensive margin.[8] Such a result is at odds with Mukoyama, Shintani, and Teramoto (2018) and suggests the need to model transitions from full-time to part-time employment in theoretical models.

Horizons	1	4	8	16	32
Model A					
ω_t^P	28.2 [13.4 ; 57.5]	38.2 [23.0 ; 46.8]	35.6 [18.3 ; 58.3]	35.4 [16.7 ; 60.8]	36.7 [18.1 ; 56.7]
Model B					
p_t^{PF}	17.0 [3.6 ; 50.5]	19.3 [7.0 ; 46.4]	20.4 [8.0 ; 44.9]	20.9 [8.6 ; 44.0]	21.3 [8.9 ; 43.4]
p_t^{FP}	18.3 [6.4 ; 48.3]	25.6 [13.4 ; 39.2]	27.0 [14.0 ; 38.9]	27.1 [14.4 ; 38.9]	27.0 [14.5 ; 38.9]

Table 1: Forecast Error Variance Decomposition of part-time related macro-variable to a recessionary aggregate shock.
Sources: Author's own calculations.
Notes: Main figures represent the median of the posterior distribution. 68% confidence intervals are the 16th and 84th percentiles of the posterior distributions.

FEVDs The variance decompositions of table 1 assess the importance of the recessionary aggregate shock for part-time related macro-variables in both models.[9] Broadly in line with the IRFs exercises, FEVDs are estimated with lower precision for p_t^{PF}. However, the identified shock is estimated to be relevant for part-time variables. In model A, it explain up to 38% of the variance of the part-time share in employment. This contribution is shown to be high at all horizons. In model B, it accounts for a larger share of the variance of p_t^{FP} than p_t^{PF}, 27% against 21% at highest horizons. Such variance decompositions reveal that the negative

[8]To reinforce this statement, it should be mentioned that Borowczyk-Martins and Lalé (2019) find that 85.1% of transitions from full-time to part-time work involve the same employer/employee matched pair.

[9]For short, I do not report the variance decomposition for unemployment and vacancies. Complete results are however available upon request.

aggregate shock is empirically relevant in explaining fluctuations in part-time related macro-variables.

3.2 Robustness

Overall, models of the last subsection unveil that a negative aggregate shock induces important variations of part-time related macro-variables. These findings could be sensitive to different choices made when estimating those models. Here, I run an array of robustness check to confirm that my main message holds. Figure 4 reports the results of my alternative estimations.

Detrending method In my baseline models, I follow Fujita (2011) and Hairault and Zhutova (2018) by removing low-frequency movements by means of quadratic trends. Here, I evaluate the robustness of my results to this choice. I deal with this issue in two steps. In the first one, rather than using quadratic trends, I extract the trend component of each time series with the HP-filter ($\lambda = 1600$). In the second one, endogenous variables simply enter the VAR in logarithm. Corresponding IRFs are reported in blue squares in the first case and in green circles in the second one.

Number of lags Models of subsection 3.1 are estimated with two lags as suggested by the Hannan-Quinn criterion. Orange triangles of figure 4 show median impulse responses of models including four lags.

Restriction length It is important to establish whether my results survived to my short-lived identification procedure. To confirm this, I extend the length of sign restrictions. More specifically, I impose sign restrictions to hold for $k = 4$ quarters. IRFs for the corresponding models are displayed in pink diamonds.

Rejection method In the baseline specification, I use the algorithm developed by Rubio-Ramirez, Waggoner, and Zha (2010). In order to ensure that the general message of the paper does not depend on this choice, I re-estimate both models using the algorithm initially developed by Uhlig (2005). Results appear in brown crosses in figure 4.

Comments It is quite evident that results of baseline specifications are insensitive to my set of robustness check. Each time, responses of part-time variables in alternative specifications closely track those displayed in figures 2 and 3. From a qualitative point of view, I retrieve the hump-shaped response of the part-time employment share. From a quantitative point of

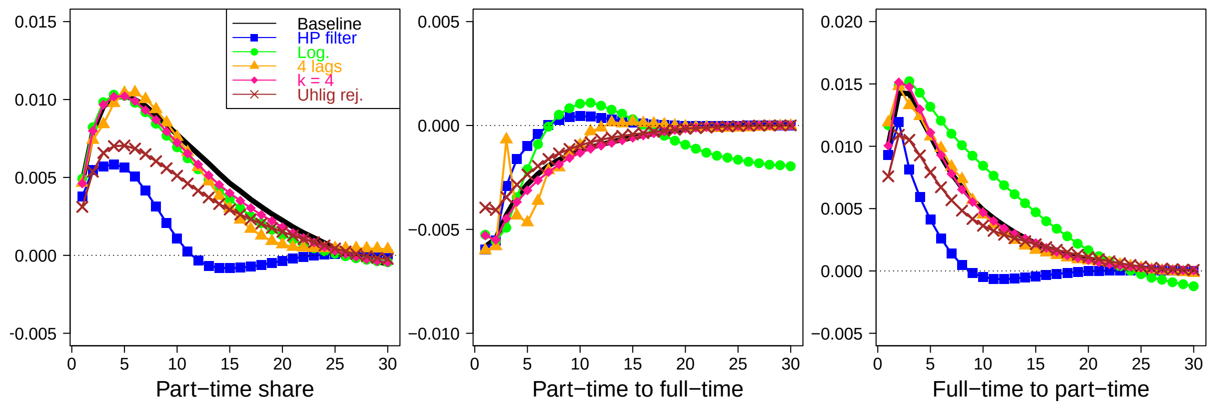

Figure 4: Responses of part-time variables to a negative aggregate shock - Robustness analysis.

Sources: Author's own calculations.

Notes: Median responses to a one-standard deviation negative aggregate shock are reported. Responses of the part-time share are obtained from a tri-variate VAR identical to model A. Responses of transition probabilities are obtained from a VAR including four variables as in model B.

view, the median responses of p_t^{FP} are approximately three time larger than those of p_t^{PF}, confirming that the former plays a major role in explaining fluctuations of the part-time employment share.

4 Concluding remarks

Using sign-restriction VARs, this paper shows that part-time employment appears as an important margin of adjustment when a negative aggregate shock hits the US economy. I provide robust evidence that the countercyclical response of the share of part-time employment is mainly due to the highest response of the transition probability from full-time to part-time work. As such transitions mainly take place at the same employer/employee pair, my findings confirm the importance of within-firm reallocation. This paper should be seen as a natural first step in the understanding of the conditional dynamics of part-time employment. A further step will consist in the study of the underlying dynamics leading to part-time share variations when the economy is hit by shocks of different nature (supply vs. demand shocks). Investigating such issues is promising but beyond the scope of the present letter.

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