The impact of macroeconomic uncertainty on inequality: An empirical study for the UK.

Angeliki Theophilopoulou

University of Westminister

February 2018

Abstract

The role of economic uncertainty on macroeconomic fluctuations has been studied extensively in the literature. In the aftermath of the financial crisis and in the process of its exit from the EU, the UK is facing high levels of uncertainty on future economic growth, investment, financial markets etc. In this paper I investigate whether macroeconomic uncertainty affects income, wage and consumption inequality. My findings suggest that the measures of inequality increase in the aftermath of the uncertainty shock but decrease in the medium to long run, converging to lower levels. Macroeconomic uncertainty appears to account significantly for the variation of income and consumption inequality. Using detailed micro data I decompose households' income to investigate transmission channels where uncertainty shocks affect differently the quintiles of income and consumption distributions. The financial segmentation and portfolio channels appear to play an important role in this heterogeneous response.

Keywords: Macroeconomic uncertainty, income inequality, consumption inequality, SVAR

JEL codes: C32, D3, D8, E32.

Preliminary draft

1 Introduction

A decade after the Great Recession, most economies are recovering slowly with the world economic growth in upward trend. Unemployment levels are low, fiscal balances have been improved substantially and one would expect a similar picture for the levels of income and wage inequality. However, OECD (2016) warns that income inequality remains at record high levels in many countries despite declining unemployment and improving employment rates. OECD finds that some key facts are persistent: long term employment in low income families, slow wage growth for low and middle earners but most importantly redistribution policies, which cushion the impact of crisis in its initial stage, have been weakened in many countries. It also states that high income households have been benefited the most by the recovery process.

The picture in the UK appears different: the fast economic recovery was abruptly interrupted by the European Union membership referendum in June 2016 and the subsequent economic and political uncertainty which surrounded the event. However, according to the latest data on income

distribution, income inequality has not increased but remains to pre crisis levels. IFS (2017) shows that income inequality is roughly at the same levels of 1990s. It has experienced two main reductions between 2007-8 and 2011-12 mainly due to loss of real earnings and rising social security benefits. However, since 2012 inequality reduced trends have been reversed. Real earnings for median and high incomes show a slow growth while real benefits for low income families have slowed down. These facts lead some studies to forecast that the equality gains gained during the Great Recession would be reversed by 2016 (see for example Brewer et al. 2013). According to IFS (2017) this did not happen because of weak average earnings growth, strong employment rates and more hours worked in low income households.

While income inequality seem to be in a downward trend, wage and consumption inequality have recovered much of their downward adjustments during the financial crisis (see Figure 1). The drivers of inequality have been studied extensively:. Skill biased technological change, trade openness and globalisation, financial deepening and credit constraints, changes in labour markets structure and trade unions' strength. Finally the importance redistributive role of the government is a strong contributor to equality. The role of monetary policy has been lately drawn research interest and findings suggest a possible positive impact of contractionary monetary policies and quantitative easing to inequality (Coibion et al. 2017; Mumtaz and Theophilopoulou, 2017)

We notice that the period after 2011 coincides also with periods of high uncertainty for the UK. The level of economic uncertainty decreased after the Great Recession to increase again in 2016. Uncertainty has been shown to influence dramatically. One may think whether high levels of uncertainty contributed to lower earnings and profits for median and high income household and may be a factor that contributed to

In this article I attempt to examine this relationship. More specifically, I investigate whether uncertainty shocks have affected earnings, income and consumption inequality in the UK. This paper has two distinctive features: First, a macroeconomic uncertainty index using 56 macroeconomic and financial time series for the UK, following Jurado et al. (2015), have been constructed for the UK. Second, quarterly inequality measures have been constructed by using survey micro data. Thus both macroeconomic uncertainty and inequality measures have been constructed by exploiting rich data environment, taking into account households' characteristics and macroeconomic activity.

By using a Structural Vector Autoregression (SVAR) I find that macroeconomic uncertainty shocks lead to lower inequality in earnings, income and consumption in the medium and long run. These results remain invariant to alternative specifications of the VAR. I also find that the uncertainty shock makes important contributions to forecast error variance in the inequality measures. In order to investigate the possible factors behind the increase in inequality we estimate the SVAR using data for households at different percentiles of the distribution. Results from this exercise suggest that the uncertainty shock decreases wages and income for households at the high end of the distribution while households at the lower end are less affected due mainly to redistributive policies and social security. This is consistent with richer households deriving a larger proportion of their income from investments and the reduction of investment income during periods of high uncertainty.

The rest of the paper is structured as follows: Section 2 describes the variables used, their

transformations and the construction of the inequality measures. Section 3 describes the estimation of the structural VAR model and the identification scheme. Section 4 presents the main results for earnings, income and consumption, while section 5 concludes.

2   Data

I construct inequality measures for three variables: disposable income, total consumption and gross wage. Income and consumption are at household level while the last one is at individual level. The micro data are drawn from the Family Expenditure Survey (FES) from 1970 to 2016. The FES is an annual survey which provides detailed information on demographics, income, expenditure and consumption for on average of a representative sample of 7,000 UK households per year. The households who participate on FES are asked to keep a diary with their spending of a two week period. In 2001 FES merged with the National Food Survey and became the Expenditure and Food Survey (EFS) and with the Living Costs and Food Survey (LCFS) in 2008[1]. Even though the FES has been running from 1957 there are discontinuities and small samples prior to 1968 and for this reason we start our sample from 1969. Some studies (see for example Foster, 1996, van de Ven, 2011) point out representation problems with the survey: FES tends to over represent mortgage holders, people living in the countryside, older households and under represents people living in council flats, institutions (e.g. retirement homes, military), no fixed address holders, ethnic minorities, self employed, manual workers and younger households.

The variable for disposable income is defined as weekly household income net of taxes and national insurance contributions. It is summed across all members living in the same household and it is referred throughout the text as Household's Disposable Income. After keeping only the positive values and trimming we have on average 6,900 households per year until 2006 and then the average drops to 5,600 per year. Thus, in total there are around 290,000 observations of household income for the whole sample period. The income variable is equivalised for the family size and composition by using the modified OECD scale taking as benchmark of living standard the income of a couple without dependent children.

The variable for gross wage is Gross Personal Earnings which is the normal gross wage from any type of occupation before taxes including national insurance contributions and other deductions and bonuses. Gross wage is at the individual level, converted to weekly amounts[2]. Taking into account only positive values there are on average 7,000 observations per year or around 300,000 observations over the 43 year period. Inequality measures constructed from data on wages have the smaller measurement error as gross wage is known to households with higher precision than other forms of income, however it has the disadvantage that it is only one source of income.

The definition for the total consumption variable is the one from the National Accounts which is the sum of housing, food, alcohol, tobacco, fuel, light and power, clothing and footwear, durable

---

[1] In 1993-94 the FES changes from a calender year to financial year (April to March) and the EFS goes back to the calender year in 2006.

[2] If the individual works full time, the weekly payment is defined as earnings, while in the case of a part time or odd job, the last payment is counted.

household goods, other goods, transport, vehicles and services. The consumption variable is then divided by the number of people that live in the household to construct consumption per capita.

The distributions of all three variables have been trimmed by removing the top and bottom 1%. Even though the tails of the distributions have important and complex relations with monetary policy they are likely to contain measurement errors as their inclusion causes erratic shifts in the inequality measures. Thus I follow the existing literature on this issue (see for instance Brewer and Wren-Lewis, 2012) and trim the tails by 1%.

The following macroeconomic variables are also used in the analysis below: (1) GDP per capita and in real terms (code=ABMI, ONS divided by population). (2) Inflation based on the Consumer Price Index (CPI). The CPI series is based on the seasonally adjusted harmonized index of consumer prices spliced with the retail price index excluding mortgage payments. These data are obtained from the Bank of England database. The three month treasury bill rate and the FTSEALL Index are obtained from Global Financial Data.

2.1 Measures of Inequality

I use two widely used measures of inequality: the Gini coefficient of levels which is one of the most commonly used measures of inequality and takes values between 0 (perfect equality) and 1 (perfect inequality). The second measure is the cross sectional standard deviation of log levels which removes zero values thus reducing sensitivity to extreme values. Following Cloyne and Surico (2017), I assign households to different quarters within a year based on the date of survey interview. This allows us to calculate the measures of inequality at a quarterly frequency.

Figure 1 shows the evolution of the Gini coefficients for disposable income, total consumption, consumption of non durables and gross personal wage. During the 1970s and until the end of the decade a decrease in the inequality measures is observed mostly through wages as high earners experienced fall of their wages relative to low earners. Relative earnings of women increased and so did the pension benefits. The second part of 1970s is characterised by monetary easing as the nominal interest rates were kept below the actual and perspective inflation rate (Nelson, 2000).

During the period from 1979 to 1989, monetary policies aiming to control inflation were introduced. Nelson (2000) notes that nominal interest rates were persistently below the inflation rate before 1980 and persistently above after. The same period is characterised by a dramatic increase of inequality especially in disposable income. This has been attributed to higher unemployment, increase of part time work and lower working hours of the employed and higher dispersion of wages between low and high earners (Brewer and Wren-Lewis, 2012). The highest increase was that of disposable income inequality. Even though income inequality was the lowest at the beginning of the sample period, it catches up rapidly with consumption inequality in the mid 1980s. It is interesting to note that from the mid-1980s to the early 1990s inequality in non-durable consumption was lower than income inequality. This possibly reflects the impact of financial liberalization that took place in mid-1980s and enabled greater access to consumer credit. In 1992 policies of inflation targeting were introduced and in 1997 the Bank of England gained operational independence. Inequality levels for income and earnings didn't change dramatically but the Gini coefficients for consumption

increased during this decade.

In the beginning of 2000s, inequality fell possibly due to a decrease of the investment income and the collapse of the dotcom bubble. In 2007 financial markets collapsed and the Great Recession followed resulting in a deep fall of inequality for all measures, especially for consumption. In 2008 the Bank of England implemented unconventional, zero bound monetary polices and Quantitative Easing. Interestingly, the Gini coefficients for consumption and earnings increase substantially after 2010 while the one for disposable income remains at low levels. Overall, during the sample period and from all the four variables, the Gini coefficient of disposable income experiences the highest rise.
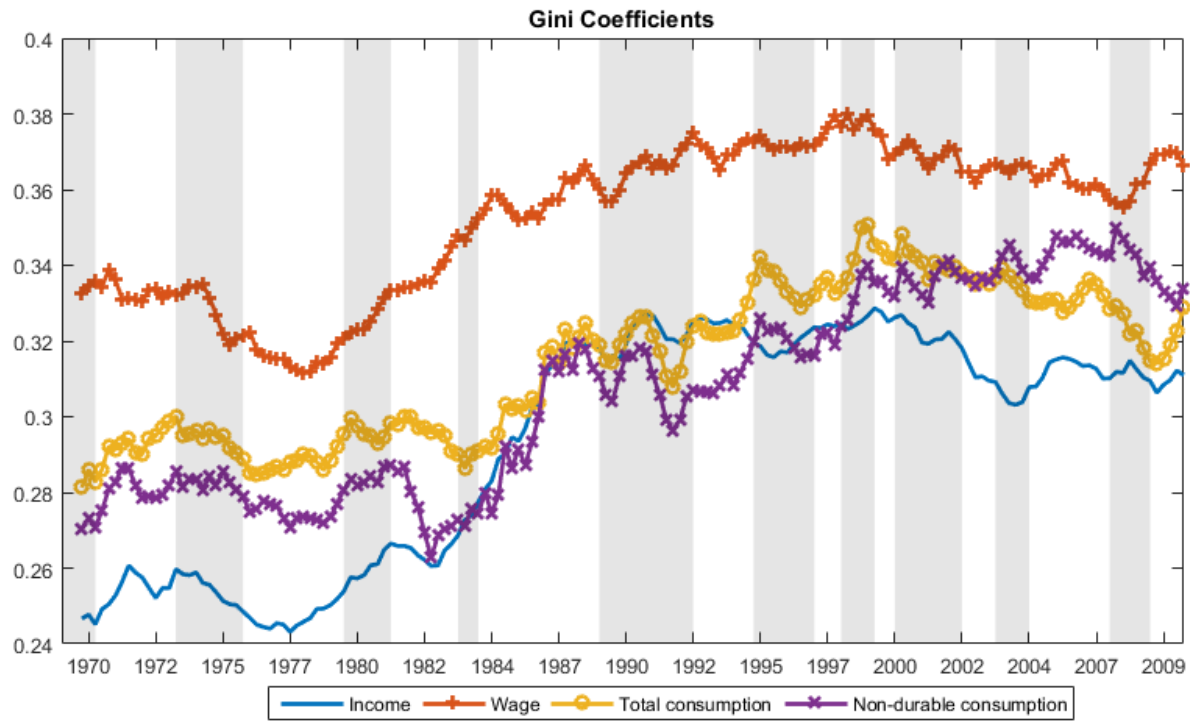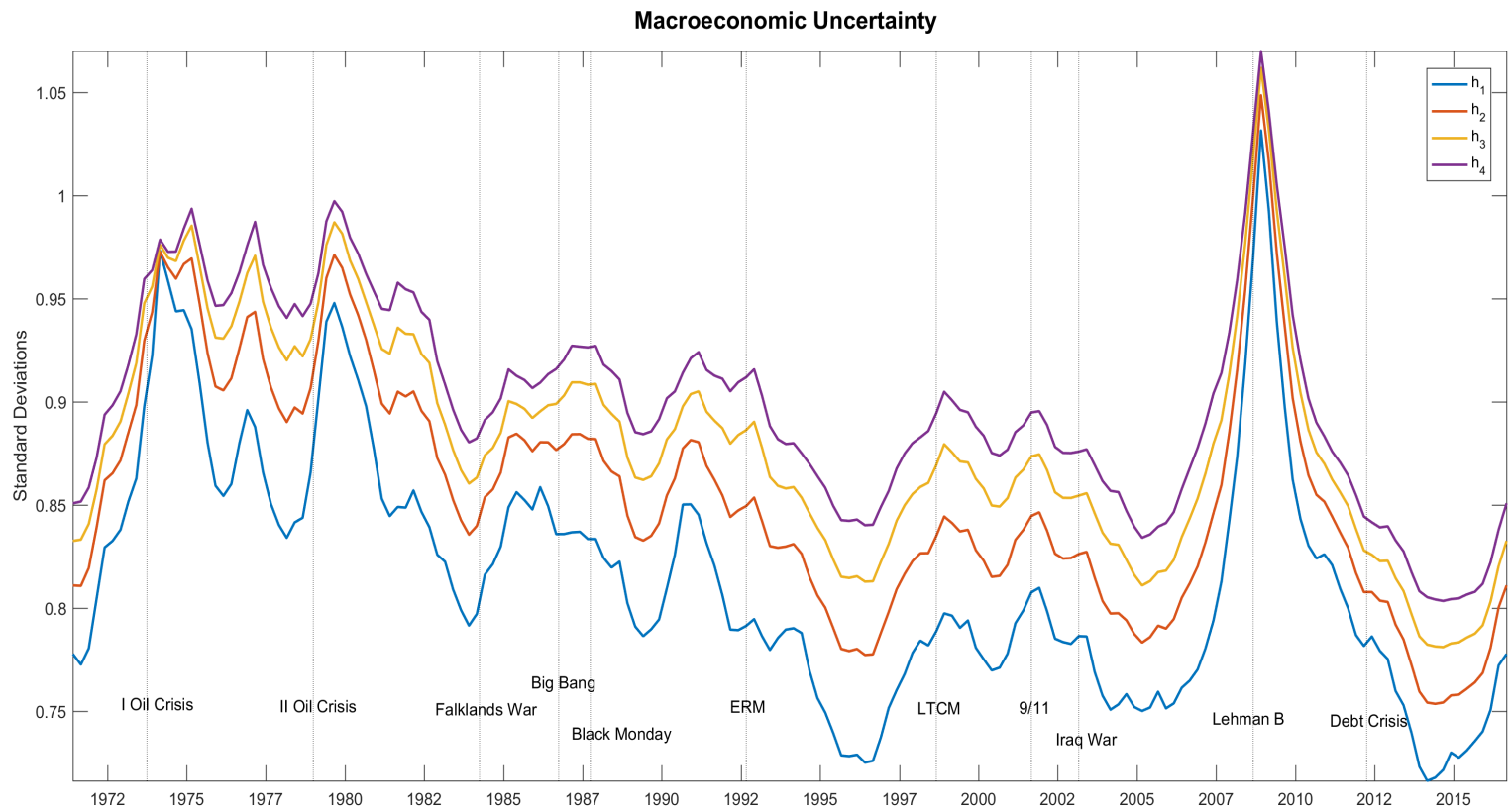
Gini Coefficients

Figure 1: Gini Coefficients (4 quarter moving average). Shaded areas represent recessions as identified by the OECD.

Macroeconomic Uncertainty

Macroeconomic Uncertainty for horizons h one quarter to four quarters ahead. The vertical lines indicate major economic and political events for the UK.

3   Empirical Model

In order to estimate the impact of uncertainty shocks on the constructed inequality measures we use a Structural VAR model. The benchmark model is defined as

$$Z_t = c + \sum_{j=1}^{P} B_j Z_{t-j} + v_t \tag{1}$$

where $v_t \tilde{} N(0, \Omega)$. The matrix of endogenous variables includes the standard set used for small open economies: i.e. the growth of real GDP per capita, CPI inflation, the three month treasury bill rate, the growth of the FTSE ALL index and the estimated index of uncertainty. More specifications have been tried in the sensitivity analysis. The VAR model is augmented with each of the inequality measures described above, in order to estimate the impact the uncertainty shock on inequality related to income, earnings or consumption. All variables except the interest rate and the inequality measure enter in log differences. The lag length P is set to 4 in the specifications above.

We adopt a Bayesian approach to estimation and use a Gibbs sampling algorithm to approximate the posterior distribution of the model parameters. As discussed in Uhlig (2005), this approach offers a convenient method to estimate error bands for impulse responses. However, the prior used is flat and, therefore, the results reported are data driven. The estimation algorithm is described in detail in the technical appendix to the paper.

3.1   Identification of the uncertainty shock

The covariance matrix of the residuals Ω can be decomposed as $\Omega = A_0 A_0'$ where A_0 represents the contemporaneous impact of the structural shocks ε_t:

$$v_t = A_0 \varepsilon_t \tag{2}$$

In the benchmark model we use Cholesky decomposition to calculate the A_0 matrix, ordering uncertainty last following Jurado et al. (2015). This implies that uncertainty shocks affect the rest of the variables after one period.
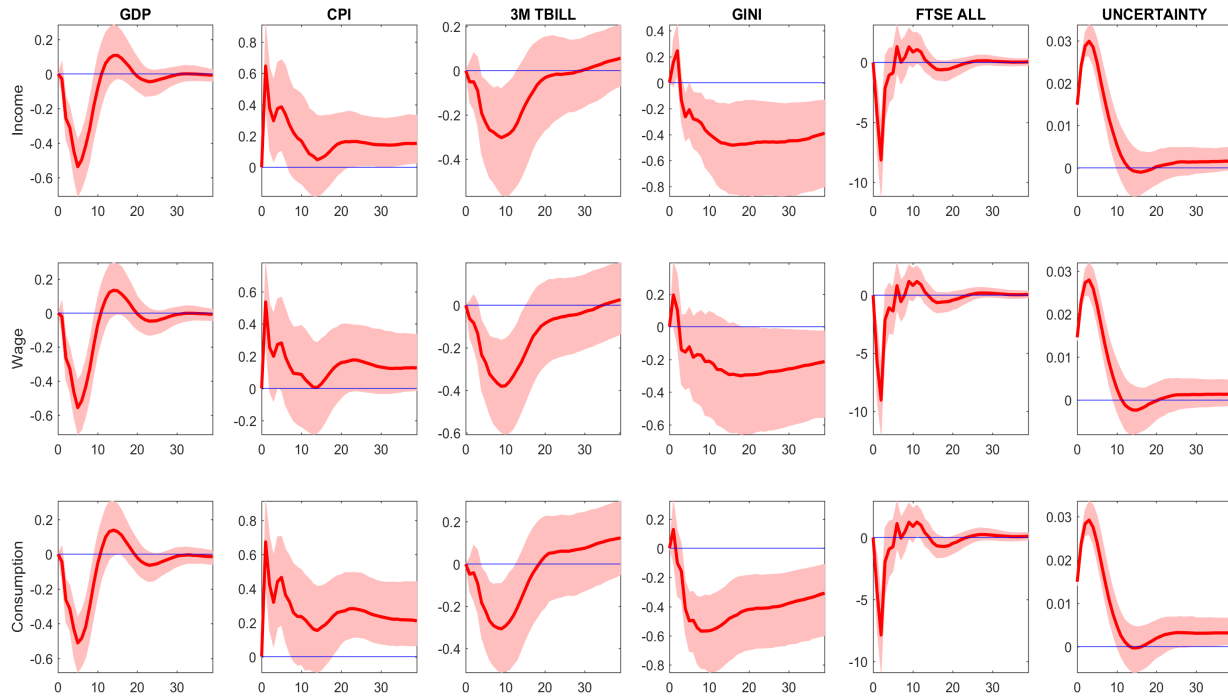
Figure 2: The impulse response of the Gini coefficient to a one standard deviation uncertainty shock. The vertical axis of each plot shows the response in percent. The red line is the median estimate and the shaded area is the 68% error band.

4 The response of inequality measures to uncertainty shocks

Figure 2 presents the results from the benchmark VAR model. Each row shows the response to a one standard deviation increase in uncertainty at $t = 0$ using the VAR model that includes the Gini coefficient derived from household data on income, wage and total consumption respectively.

The responses of the macroeconomic variables to the uncertainty shock are the following: In the first model where the Gini coefficient of net income has been used as a measure of inequality, a rise of 0.15 units of the uncertainty index depresses economic activity and output growth falls by 0.5 percent after a year, while the CPI inflation rate increases by 0.6 percent in the first quarter. This stagflation phenomenon is possibly due to the upward pricing bias channel where firms prefer to set prices toward their higher end of the price spectrum during periods of high uncertainty as it is less costly in terms of adjustment costs to increase them further if a large shock occurs (Fernández-Villaverde et al. ,2015). Mumtaz (2016) looks at the time varying impact of uncertainty shocks in the UK and finds a positive inflation response during the 1970s and 80s which becomes smaller in the subsequent two decades. The central bank seems to respond to the fall of output by lowering interest rates:.the 3 month T-Bill rate falls, reaching a maximum decline of 0.3 percent after two years. The stock market experiences losses and the FTSEALL is negatively effected with peak response of 8 percent after two quarters. These variables follow similar behaviour in the other two models.

The inequality measure follows an unexpected path: it increases in the short run but then it falls dramatically and remains at a lower level in the long run. More specifically, the Gini coefficient for income increases by 0.24 percent in the third quarter and then starts falling with peak decrease of around 0.5 percent after four years. The wage inequality follows a very similar path but becomes statistically significant after 19 periods. The more pronounced response is the one by the consumption inequality measure which has a maximum decrease of 0.6 percent after about two years. Even though inequality increases briefly for all measures, the long run effect of the uncertainty shock is a fall in all three measures of inequality and the null hypothesis that this effect is equal to zero can be rejected in all cases.

In order to test the robustness of these results, I conduct a sensitivity analysis. There the Gini coefficients in the VAR models are replaced with the standard deviation of logs as an alternative measure, the main results are preserved. Figure 1 in the technical appendix shows that the key results are preserved – inequality decreases after a macroeconomic uncertainty shock with the null hypothesis of a zero response rejected for most models. The detailed results from this analysis are presented in the on-line technical appendix to the paper.

4.1 Heterogeneity of responses to uncertainty shocks

In order to understand the possible reasons behind the response of inequality measures shown above we consider how households and individuals at different points on the distribution respond to the uncertainty shocks identified above. In particular, for each variable, we consider households and individuals that fall within the following percentiles in a given quarter: $P_1 = \left[2^{nd} : 19^{th}\right], P_2 = \left[20^{th} : 39^{th}\right], P_3 = [40^{th} : 59^{th}], P_4 = [60^{th} : 79^{th}], P_5 = [80^{th} : 98^{th}]$. I then construct measures

of average real wage, real income and real per-capita consumption within these percentiles. To examine how the shock moves the tails of each distribution relative to its median the differences between P_5 and P_3 and P_1 P_3 are constructed. These differences are then included in the SVAR along with the four macroeconomic variables used above and their response to the uncertainty shock is examined. The shock is identified by using the same recursive scheme discussed in section 3.1 above.

The heterogeneous responses of the uncertainty shock in the distributions of income ,wage and consumption can be seen in Figure 3. In the first panel of Figure 3 we can see that the difference between P_1 (low income households) from its median (P_3) falls substantially and to a much higher magnitude than the difference between high income households from the median ($P_5 - P_3$). More specifically, the peak response of $P_1 - P_3$ is -1% after 10 periods while the one for $P_5 - P_3$ is about -0.5 % indicating that inequality in terms of income falls by more in the low income households while higher and medium income households are negatively affected by the shock in a similar way. The null hypothesis that the differences are equal to zero for all horizons can be rejected.

In terms of earnings, we can see from the second panel of Figure 3 that the difference between low and median earners is decreasing after the shock while the response of the high earners is not statistically significant. This can possibly reflect the fact that during periods of high uncertainty high and median incomes decrease while the low incomes are supported by social security benefits. This argument is in line with the findings of Coibion et al. (2017) for the US and Mumtaz and Theophilopoulou (2017) for the UK who decompose households' income and find a bigger percentage of income coming from financial investments for the high income households while low income households are supported by social benefits when they experience loss of their income and wage in periods of high unemployment. Similar results are depicted by Belfield et al. (2017) explaining why the UK experienced lower inequality after the Great Recession.
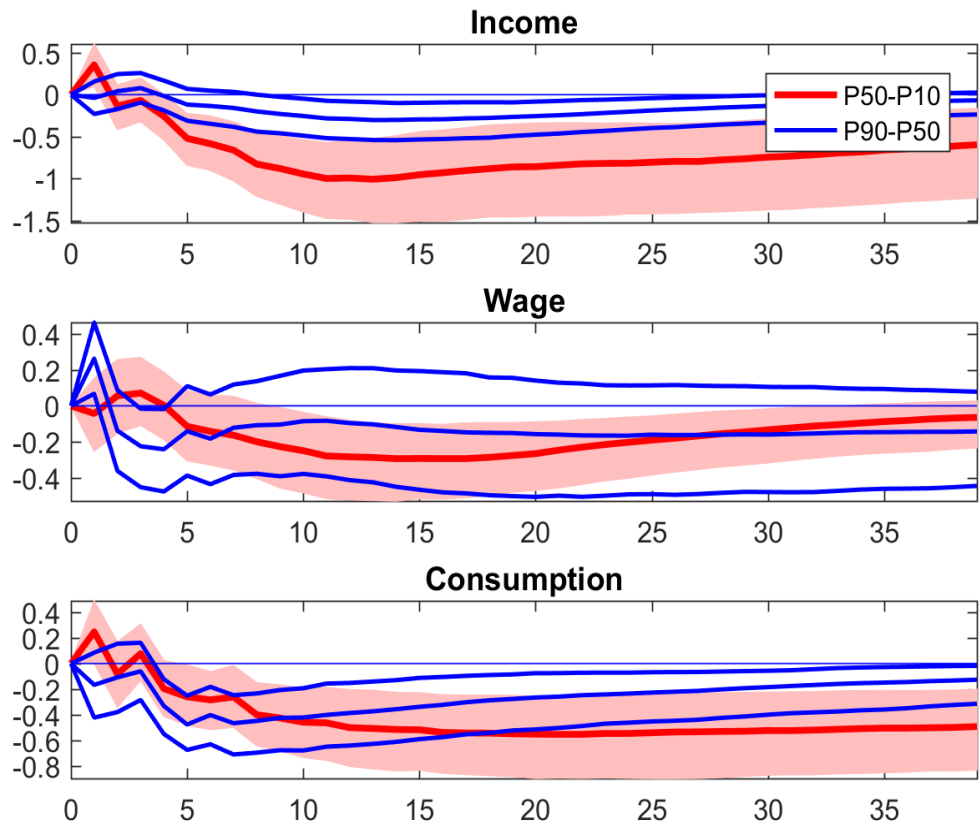
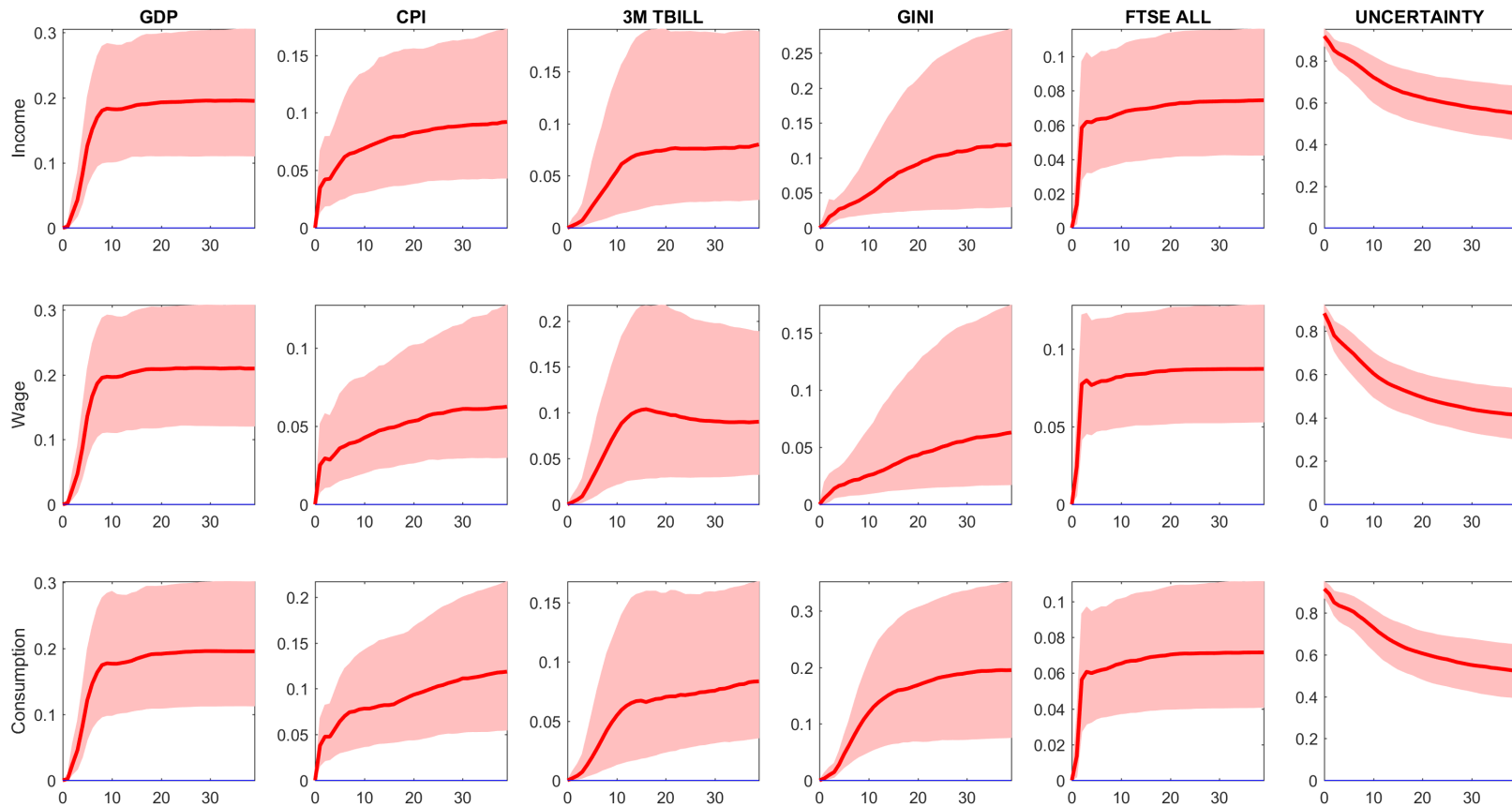Heterogeneous response of uncertainty shocks by percentiles.

Figure 4: Percentage contribution of uncertainty shocks to the forecast error variance of all macroeconomic variables and the Gini coefficient. The red line is the median estimate and the pink shaded area is the 68% error band.

13

4.2 The contribution of uncertainty shocks to inequality

Figure 4 plots the contribution of the monetary policy shock to the forecast error variance (FEV) of the Gini coefficients. The estimated median contribution of this shock ranges from around 10% at the two year horizon for income, wage and total consumption Gini to about 20% for non-durable consumption inequality. The technical appendix shows that similar estimates are found when the standard deviation of logs is considered instead. This suggests that the policy shock made a contribution to inequality that was important both from an economic and statistical perspective. It is interesting to note that these estimates are similar to those obtained by Coibion et al. (2012) for US data.

In Figure 5, we consider if the monetary policy shock has played a role in driving cyclical fluctuations in the Gini coefficient via a historical decomposition. The contribution of the structural shocks ε_t can be calculated by noting that deviations of each variable in the VAR from a baseline trend at horizon H are given as:

$$e_t\left(H\right) = \sum_{h=0}^{H-1} \tilde{A}^h \varepsilon_{t+H-h} \qquad (3)$$

where $\tilde{A}^h$ denote the impulse responses and ε_t are the shocks defined in equation 2. In Figure 5 we display this calculation for the Gini coefficient assuming that all elements of ε_t except the one corresponding to the monetary policy shock is zero. Each panel in the figure plots the four Gini coefficients in percentage deviations from the VAR implied baseline trend (black dashed line). This is compared with the counterfactual estimate of this variable under the assumption that only the monetary policy shock is operational in the VAR model (red line and shaded area). The contribution of the shock to fluctuations in the wage and income Gini are modest. It appears that policy shocks played a role during the mid and the late 1970s. During the second half of the 1970s, the UK monetary authorities cut the nominal interest rate aggressively and narrow money growth rose substantially (see Nelson, 2000). This expansionary policy appears to have made a contribution leading to a reduction in wage and income Gini over this period. A similar impact can be detected on the consumption inequality measures. It is interesting to note that after the late 1990s the median contribution of the policy shock is positive in sign for all inequality measures. One interpretation of this results is that the inflation targeting period was characterised by contractionary policy shocks as monetary authorities were more concerned with controlling inflation and this exerted upward pressure on the inequality measures.

5 Conclusions

This paper examines the impact of uncertainty shocks on earnings, income and consumption inequality in the UK. We build quarterly historical time series for measures of labour earnings, income and consumption inequality from the FES database. We then include these measures in a structural VAR model and estimate that uncertainty shocks lower inequality for these variables–a one standard deviation increase in uncertainty decreases the Gini coefficient by about 1% in the long run for income. Impulse responses of earnings, income and consumption at the lower and upper

tails of the distribution suggest that macroeconomic uncertainty has a larger adverse effect on these variables for the wealthier households. Uncertainty shocks explain a significant proportion of the fluctuations in the inequality measures with the contribution to the variance estimated to be from 10% to 20%.

References

[1] Belfield, C., Blundell, R., Cribb, J., Hood, A. and Joyce, R. (2017), Two Decades of Income Inequality in Britain: The Role of Wages, Household Earnings and Redistribution. Economica, 84: 157–179.

[2] Brewer, M., Browne, J., Hood, A., Joyce, R. and Sibieta, L. (2013), 'The short- and medium term impacts of the recession on the UK income distribution', Fiscal Studies, vol. 34, pp.179–201.

[3] Fernández-Villaverde, J., P. Guerrón-Quintana, K. Kuester, and J. Rubio-Ramírez. (2015). "Fiscal Volatility Shocks and Economic Activity." American Economic Review, vol. 105 (11): pp.3352-84.

[4] Jurado, K., S. C. Ludvigson, and S. Ng. (2015). "Measuring Uncertainty." American Economic Review, 105(3): 1177-1216.

[5] Mumtaz, H. 2016. "The Evolving Transmission of Uncertainty Shocks in the United Kingdom," Econometrics, MDPI, Open Access Journal, vol. 4(1), pp. 1-18.

[6] OECD (2016) "Income Inequality remains high in the face of weak recovery", Centre for Opportunity and Equality, November.

[7] Blundell, R. and B. Etheridge (2010). "Consumption, Income and Earnings Inequality in Britain," *Review of Economic Dynamics*, vol. 13 (1), pp. 76-102.

[8] Bound, J. and G. Johnson (1992). "Changes in the Structure of Wages in the 1980s: An Evaluation of Alternative Explanations." *American Economic Review* vol. 82 (3), pp.371-392.

[9] Brewer, M., L. Sibieta and L. Wren-Lewis (2008). "Racing away? Income inequality and the evolution of high incomes", Briefing Note No. 76, Institute for Fiscal Studies.

[10] Brewer, M. and L. Wren-Lewis (2012). "Accounting for changes in inequality since 1968: decomposition analyses for Great Britain", Working Paper, No 2012-17,ISER.

[11] Card, D. (2001). "The Effect of Unions on Wage Inequality in the U.S. Labor Market," *Industrial and Labor Relations Review, vol.54* (2), pp.296-315.

[12] Chah, E. Y., V. A. Ramey, and R. M. Starr.(1995). "Liquidity Constraints and Intertemporal Consumer Optimization: Theory and Evidence from Durable Goods". *Journal of Money, Credit and Banking*, vol. 27.(1), pp.272–287.

[13] Coibion, O., Y., Gorodnichenko, L. Kueng and J. Silvia (2012). "Innocent Bystanders? Monetary Policy and Inequality in the U.S", IMF Working Paper, WP/12/199.

[14] Cloyne, J. and P. Hürtgen, (2014). "The macroeconomic effects of monetary policy: a new measure for the United Kingdom," Working paper No 493, Bank of England.

[15] Cloyne, J. and P. Surico (2017). Household Debt and the Dynamic Effects of Income Tax Changes. Review of Economic Studies. Forthcoming.

[16] Department of Employment, Family Expenditure Survey, 1961 Colchester, Essex: UK Data Archive, August 1993. SN: 3042 , http://dx.doi.org/10.5255/UKDA-SN-3042-1

[17] Doepke, M. and M. Schneider (2006). "Inflation and the Redistribution of Nominal Wealth," *Journal of Political Economy,* vol.114 (6), pp.1069-1097.

[18] Feenstra, R., and G. Hanson, (2008). "Global Production Sharing and Rising Inequality: A Survey of Trade and Wages," *Handbook of International Trade.*

[19] Foster, K. (1996), 'A comparison of the Census characteristics of respondents and non-respondents to the 1996 FES', ONS Survey Methodology Bulletin, 38.

[20] Galbraith, J. K., (1998). "With Economic Inequality for All," The Nation, Sept. 7-14.

[21] Lubik, T and F.Schorfheide (2006). "A Bayesian Look at the New Open Economy Macroeconomics",in: NBER Macroeconomics Annual 2005, vol. 20, pp. 313-382.

[22] Mumtaz, H and A. Theophilopoulou (2017). "Monetary Policy and Inequality in the UK," Working Paper No 738, Queen Mary University of London, School of Economics and Finance

[23] Nelson, E. (2000). "UK Monetary Policy 1972-97: A Guide Using Taylor Rules," Discussion Paper No 2931, C.E.P.R. Discussion Papers.

[24] Rubio-Ramírez J., Waggoner D. and Zha T., (2008). "Structural vector autoregressions: theory of identification and algorithms for inference", Working Paper No. 2008-18, Federal Reserve Bank of Atlanta.

[25] van de Ven, J., (2011). "Expenditure and disposable income trends of UK households: evidence from micro-data", National Institute Economic Review, No 218.