University of Groningen

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Published in:
Economic Analysis and Policy

DOI:
10.1016/j.eap.2023.09.018

IMPORTANT NOTE: You are advised to consult the publisher's version (publisher's PDF) if you wish to cite from it. Please check the document version below.

Document Version
Publisher's PDF, also known as Version of record

Publication date:
2023

Link to publication in University of Groningen/UMCG research database

Citation for published version (APA):
Xu, C. (2023). Do households react to policy uncertainty by increasing savings? *Economic Analysis and Policy*, *80*, 770-785. https://doi.org/10.1016/j.eap.2023.09.018

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Download date: 05-12-2023

Economic Analysis and Policy 80 (2023) 770–785

Contents lists available at ScienceDirect

Economic Analysis and Policy

journal homepage: www.elsevier.com/locate/eap

Modelling economic policy issues

Do households react to policy uncertainty by increasing savings?☆

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A R T I C L E I N F O

Article history:
Received 10 May 2023
Received in revised form 5 September 2023
Accepted 16 September 2023
Available online 22 September 2023

JEL classification:
D14
D80
E21

Keywords:
Policy uncertainty
Household saving rates
Local projections
Business cycle
Financial development
Institutional quality

A B S T R A C T

Studying the impact of policy uncertainty on household savings is essential to understanding how policymaking affects households' economic behavior. Previous studies suggest that policy uncertainty could dampen consumption and encourage savings. However, these studies did not consider the effects of the business cycle and endogeneity and the roles of financial development and institutional quality in the uncertainty-saving nexus. Using quarterly data from 21 countries from 1987–2021, we find that a one-standard-deviation rise in policy uncertainty increases household saving rates by three percentage points within six quarters. This effect persists even after accounting for the business cycle and endogeneity. In addition, high financial development and institutional quality mitigate the policy uncertainty effect on savings by about 1.1 and 0.7 percentage points, respectively. This study enriches the study on policy uncertainty and household savings while also providing new insights to better identify the impact of policy uncertainty.

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1. Introduction

The COVID-19 pandemic has resulted in an increase in policy uncertainty and household savings, leading to a growing interest in understanding the effect of uncertainty on household savings, (see Al-Thaqeb et al., 2022; Christelis et al., 2020; Martin et al., 2020, for example). This relationship is illustrated by Fig. 1 showing that household saving rates and policy uncertainty have been positively related over the past three decades across 21 countries. This relation is particularly evident during specific events such as wars and financial crises.

According to the 'precautionary saving' theory, increased uncertainty positively affects savings because households are prudent and want to seek protection from uncertainty, which causes a significant adverse impact on current consumption and positive impact on savings. Previous research have tested this theory using different uncertainty measures (Aaberge et al., 2017; Giavazzi and McMahon, 2012; Morikawa, 2019; Coibion et al., 2021). A key challenge unaddressed in the literature to quantifying the policy uncertainty effect on household savings is the role of business cycle, as both uncertainty and savings tend to increase during economic downturns (Adema and Pozzi, 2015; Duca and Saving, 2018; Ludvigson

☆ Acknowledgments: We are thankful to Prof. Sushanta Mallick (Co-editor) and two anonymous referees for constructive feedback that has helped to improve the paper. This paper has benefited from comments and suggestions from Jakob de Haan and Andreas Steiner. An earlier version of this paper was presented at the ifo Dresden Workshop on Macroeconomics and International Finance 2023 and the 2023 annual meeting of the Society of Economics of the Household. We thank all participants for useful comments. Any errors or omissions are the responsibility of the authors.

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https://doi.org/10.1016/j.eap.2023.09.018
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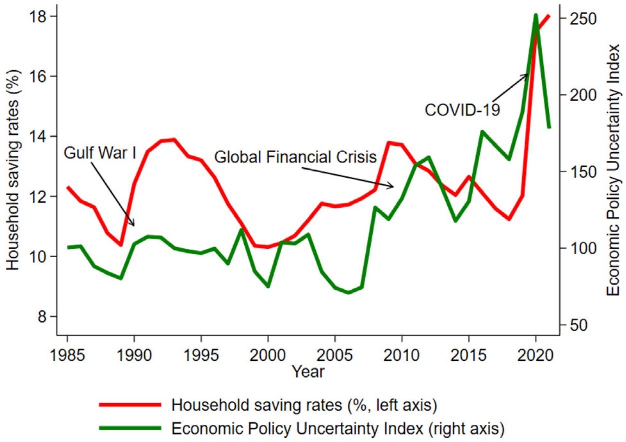

Fig. 1. Evolution of household saving rates and policy uncertainty.
Notes: This figure displays the average household saving rate and policy uncertainty across 21 advanced and emerging countries from 1985 to 2020. These countries include Australia, Belgium, Brazil, Canada, China, France, Germany, Greece, India, Ireland, Italy, Japan, Mexico, the Netherlands, Russia, Singapore, South Korea, Spain, Sweden, the United Kingdom, and the United States. Concerning classification of countries, we followed the guidelines from the World Economic Outlook by IMF. Household saving rates are defined by the ratio of net household saving net disposable household income. The policy uncertainty is measured by the Economic Policy Uncertainty index by Baker et al. (2016).

et al., 2021). This counter-cyclicality can bias the estimates of the policy uncertainty effect on household savings, which is especially true for media-based policy uncertainty measures (e.g. Economic Policy Uncertainty index), as they might reflect the effect of uncertainty related to the business cycle rather than policy-making uncertainty. Secondly, there might be endogeneity concern in regressing household savings on policy uncertainty due to reverse causality. While increased uncertainty may encourage households' precautionary savings, increased savings may in turn lead to investment growth, which can stimulate economic growth and reduce economic policy uncertainty. Therefore, the positive effect of policy uncertainty on household savings may be dampened by the negative effects of savings on uncertainty, leading to downward-biased estimates of the policy uncertainty effect.

Several recent studies suggest that a high level of financial development and institutional quality might moderate the influence of policy uncertainty on economic activity and lead to heterogeneous policy uncertainty effects across countries (Ahir et al., 2022; Karaman and Yıldırım-Karaman, 2019; Ma and Hao, 2022; Shabir et al., 2021). What remains unclear is to what degree financial development and institutional quality condition the impact of policy uncertainty on household savings. On the one hand, financial development may ease credit constraints for households in the same way as it does for firms (Karaman and Yıldırım-Karaman, 2019; Ma and Hao, 2022), which should offset the adverse effect of uncertainty on household consumption and lead to a smaller reaction of household savings to uncertainty. On the other hand, a high level of institutional quality implies a stronger safeguarding role of social security (Ahir et al., 2022; Hatzinikolaou and Tsoka, 2016), which might reduce household savings' response to an uncertainty increase.

To address the research gap, this paper aims to better explore the impact of policy uncertainty on household saving rates. We employ the most-used newspaper-based Economic Policy Uncertainty (EPU) index created by Baker et al. (2016) as a measure of policy uncertainty for 21 advanced and emerging countries over 1987–2021. Our results indicate that policy uncertainty has a significant positive effect on household saving rates in the short and medium run. This positive effect is even stronger after we control for the business cycle and possible reverse causality from savings to uncertainty. A one-standard-deviation rise in policy uncertainty promotes household saving rates by around three percentage points within one and half years. Moreover, we find that the impact of policy uncertainty on household saving rates is stronger when financial development or institutional quality is relatively low. As an illustration, high financial development and institutional quality mitigate the policy uncertainty effect on savings by about 1.1 and 0.7 percentage points, respectively, whereas low financial development and institutional quality strengthen the policy uncertainty effect on savings by about 0.85 and 1.08 percentage points, respectively.

This paper has the following methodological contributions. First, we use a local projections (LP) framework to examine the dynamic effect of policy uncertainty on household savings. A major advantage of the LP approach is that it is more adaptable and more robust to model misspecification than conventional vector autoregression (VAR) models (Jordà, 2005). We show that the policy uncertainty has a significantly positive and enduring impact on household saving rates. Second, we apply the Two-Stage Least Squares (2SLS) estimator and use global policy uncertainty as an instrumental variable (IV) in the LP framework to manage the endogeneity of policy uncertainty. This approach is new in the household savings literature. Our results indicate that our global policy uncertainty is an ideal instrument for national policy uncertainty. This approach allows us to estimate the dynamic causal effect of policy uncertainty on household savings by exploiting the exogenous variation in national policy uncertainty. Third, we consider a LP framework augmented with interaction effects to examine how the relationship between policy uncertainty and household savings varies across different levels of financial development and institutional quality.

Our study has three crucial implications for researchers and policymakers. Firstly, we provide new empirical evidence at the macro level that policy uncertainty has a positive and persistent effect on household saving rates. By implication, when implementing new policies policymakers have to take the side-effects on households' saving behavior into account. Secondly, we alleviate concerns raised by some researchers about the impact of the business cycle and the endogenous nature of policy uncertainty measures. Our results show that the macroeconomic effect of policy uncertainty is hardly reduced by the business cycle or the endogeneity issue, at least for household savings. Therefore, our results support the continued use of the EPU index and support the use of global policy uncertainty as an IV for domestic policy uncertainty for empirical research. Lastly, our findings highlight the crucial role played by financial development and institutional quality in mitigating the impact of policy uncertainty on household saving rates. Policymakers can leverage these insights to implement measures aimed at enhancing financial development and institutional quality to alleviate the impact of policy uncertainty on household savings.

The rest of this paper proceeds as follows. Section 2 summarizes related literature. Section 3 introduces the data and empirical methods. Section 4 presents and discusses the empirical results. Section 5 reports the results of the robustness checks, and Section 6 concludes.

2. Literature review

Various studies have assessed the effects of policy uncertainty on households' consumption and saving behaviors. Some micro-level studies use specific historical events as a measure of policy uncertainty (for example, Aaberge et al. (2017) considers China's political shock in 1989, and Giavazzi and McMahon (2012) focus on the German election in 1998) and show that policy uncertainty has a positive impact on household savings. The main restriction of these studies is that their findings might only be applicable to specific countries at particular points in time and cannot be easily applied to other countries. Other macro-level studies consider broader measures of policy uncertainty such as consumer confidence forecasts (Kłopocka, 2017), inflation rates (Opoku, 2020), and unemployment rates (Levenko, 2020; Opoku, 2020) and yield a similar qualitative conclusion. These macro-level studies, however, focus on the effects of economic uncertainty in general rather than policy uncertainty. Overall, these studies provide reasonably consistent evidence of a positive association between uncertainty and household savings, but the generalizability of these findings is problematic. More recently, macro studies have employed the EPU index by Baker et al. (2016) as a more comparable and accurate measure of policy uncertainty across countries to investigate the effect of policy uncertainty on households' economic activities (Wu and Zhao, 2022; Nam et al., 2021; Chen et al., 2022; Babiarz and Robb, 2014), yet no attempt has been made to use this measure to quantify the effect of policy uncertainty on household savings.

Despite evidence pointing to a positive response of household savings to an uncertainty increase, few papers have considered the role of the business cycle even though there is evidence that the business cycle influences both policy uncertainty and household savings. For example, an important paper by Adema and Pozzi (2015) shows that household saving rates are counter-cyclical: households save a larger portion of their disposable incomes when real GDP growth declines.[1] Other papers highlight similar counter-cyclical characteristics of policy uncertainty. Using data from the U.S. and Europe, Duca and Saving (2018) find that about 40% of the movements in EPU are attributable to economic variables, implying that EPU is endogenous to the business cycle. Likewise, Ludvigson et al. (2021) find that EPU is highly counter-cyclical and rises in response to negative real economic shocks. Given this evidence, it is clear that failing to control for the business cycle would risk contaminating the estimates of the policy uncertainty effect on household saving rates.

While many studies treat policy uncertainty as an exogenous shock, others highlight the reverse effect of economic activity on policy uncertainty. In particular, Perić and Sorić (2018), Duca and Saving (2018), Funashima (2020) show that policy uncertainty reacts to fluctuations in real economic activity, implying that policy uncertainty might be endogenous to economic variables. From this perspective, it is hard to rule out the possibility of reverse causality from savings to uncertainty when household saving rates are regressed on policy uncertainty. In addition, some researchers find that the efficacy of policy uncertainty constructed based on newspaper information is affected by media bias (see Perić and Sorić, 2018; Funashima, 2020, for example), which causes measurement errors and leads to endogeneity problems and less accurate estimates. In short, there are doubts about the exogeneity of policy uncertainty. Nevertheless, previous studies have not taken this issue into account when investigating the impact of uncertainty on household saving rates.

This paper is also motivated by literature that focuses on the role of financial development in shaping the effect of policy uncertainty on economic activities. For example, Ma and Hao (2022) and Vo et al. (2021) use firm data and find that financial development could mitigate the adverse effect of uncertainty on firms' performances. They argue that improvements in financial markets could alleviate the rise in the cost of capital and the decline in cash flow brought by rising uncertainty. Phan et al. (2021) show that policy uncertainty has a significant negative effect on financial stability, and this effect varies with the characteristics of the financial system, such as size, competition, and regulations. Choi et al.

[1] In contrast, research like that of Kumar et al. (2020) suggests that an uptick in economic growth is accompanied by rising saving rates, hinting at a cyclical nature of savings. Regardless of these varied empirical results, all emphasize the significant role the business cycle plays in shaping household saving behavior.

(2021) find support for a negative effect of policy uncertainty on FDI inflows and show that this negative effect is stronger when the economy has a lower level of financial development. As of now, most research on how financial development could moderate the effects of policy uncertainty has focused on firms or the overall economy, with little attention being paid to the household sector's response.

Another line of research explores the role of institutional quality in assessing the effects of policy uncertainty. For example, Hou et al. (2021) find that firms are more likely to engage in corporate fraud when facing high policy uncertainty, yet a better institutional environment can weaken the positive association between policy uncertainty and corporate fraud. Other studies indicate that the impact of policy uncertainty varies significantly across countries or states, as shown in the works of Bahmani-Oskooee and Nayeri (2020), Gupta et al. (2018), Perić and Sorić (2018). This variability may be attributed to differences in institutional quality. For instance, Ahir et al. (2022) demonstrate that policy uncertainty's adverse effects on output, investment, and productivity are more significant and enduring in countries with weaker institutional quality. Similarly, Hatzinikolaou and Tsoka (2016) suggest that low institutional quality leads to more corruption and a greater sense of self-insurance among individuals, which can eventually result in stronger precautionary savings motives.

Collectively, these studies outline the critical role of policy uncertainty in shaping households' saving behavior. However, there remain two aspects of this relationship about which relatively little is known. The first concerns the role of the business cycle and the endogeneity of policy uncertainty, while the second pertains to the mediating role of financial development and institutional quality in the relationship between policy uncertainty and household savings. This study aims at filling these two gaps in the literature.

3. Data and empirical methods

3.1. Data description

We examine the effect of a policy uncertainty on household saving rates in 21 advanced and emerging countries.[2] The coverage, which varies across countries due to data availability, spans from as early as 1987Q1 to as late as 2021Q4.

The dependent variable in our empirical analysis is the ratio of household savings to household disposable income. The primary explanatory variable, policy uncertainty, is measured by the EPU index created by Baker et al. (2016) using the word count of newspaper articles related to economic policy uncertainty. To be specific, the authors collect texts from the most widely circulating national newspapers in which they search for the following trio of terms "uncertainty" or "uncertain"; "economic" or "economy"; and one of the following policy terms such as "Congress", "deficit", "Federal Reserve", "legislation", "regulation", etc. The count of articles containing these terms is then used to construct the final EPU index. One of the key advantages of this index over earlier policy uncertainty measures is that it is effectively a real-time measure that is not subject to data revision and is easily replicable and comparable across countries. In addition, this index is a model-free measure with minimal assumptions. We construct a quarterly EPU measure by taking the simple average over the monthly EPU indexes provided by Baker et al. (2016). The quarterly EPU index is then standardized to have a mean of zero and a standard deviation of one, which helps us to observe the response of household saving rates to an EPU increase of one standard deviation.

To ensure the validity of our analysis, we take several control variables into account. Specifically, our analysis incorporates five variables that capture the macroeconomic and demographic features of the economy: the inflation rate, the real interest rate, fiscal balances, the dependency ratio, and population growth. Table 1 provides the definitions and sources of the data, and Table 2 reports descriptive statistics of our key variables. Notably, the average household saving rate in our sample is 12.34%. This indicates that households, on average, save approximately 12% of their income and consume the rest.

How is increased policy uncertainty related to household saving rates? To shed light on this relationship, Fig. 2 shows two distinct aspects of the relationship between uncertainty and savings over the recent decades. Panel A of the figure shows the cross-country contemporaneous correlations between the average standardized EPU and average household saving rates. The upward slope of the regression line shows that the unconditional correlation of policy uncertainty with household saving rates is positive, indicating that households tend to save more when policy uncertainty is high.

Panel B of Fig. 2 depicts the evolution of the average country-specific correlation between policy uncertainty at time Q and household saving rates from Q to $Q+6$. Unlike Panel A, which shows the contemporaneous relationship between policy uncertainty and household saving rates, Panel B demonstrates how past changes in policy uncertainty relate to household saving rates in subsequent periods. What can be clearly seen is that the positive correlation in the uncertainty-saving nexus reaches its peak at $Q+2$, suggesting that a surge in policy uncertainty has the strongest positive relation with household saving rates within the first two quarters. However, the downward-sloping line from $Q+2$ in Panel B implies that the positive correlation weakens after the first two quarters.

Taken together, the findings in Fig. 2 provide preliminary evidence to support the hypothesis that policy uncertainty has a positive relation with household saving rates and that this positive relation persists over time. Moreover, these results motivate the use of a dynamic modeling approach to better understand the impact of policy uncertainty on household saving rates. By incorporating the dynamic nature of household saving rates and accounting for the lagged effects of policy uncertainty, such models can provide more nuanced insights into the relationship between policy uncertainty and household saving behavior.

[2] These countries are Australia, Belgium, Brazil, Canada, China, France, Germany, Greece, India, Ireland, Italy, Japan, Mexico, the Netherlands, Russia, Singapore, South Korea, Spain, Sweden, the United Kingdom, and the United States.

Table 1
Variable definition.

Variable	Definition	Source
Household saving rates (%)	Ratio of net household saving to net disposable household income.	OECD database & Datastream
EPU index	See detailed definition in Baker et al. (2016).	https://www.policyuncertainty.com
Inflation rate (%)	Annual consumer price index growth.	International Monetray Fund
Real interest rate (%)	The real interest rate is calculated as $(i - P)$, where i is the nominal lending interest rate and P is the inflation rate.	Author's calculation. The nominal interest rate is obtained from the OECD Economic Outlook database.
Fiscal balances (% of GDP)	Government revenues minus government spending	Datastream
Dependency ratio (%)	Ratio of dependent people younger than 15 or older than 64 to the working-age population aged between 15 and 64. Annual data were interpolated to a quarterly frequency.	World Bank
Population growth (%)	Population growth rate. Annual data were interpolated to a quarterly frequency.	World Development Indicators
Financial development (% of GDP)	Ratio of credit to private sectors at market value to GDP.	Bank of International Settlement
Institutional quality	The average value of six sub-indices. Annual data were interpolated to a quarterly frequency.	The Worldwide Governance Indicators project

Table 2
Descriptive statistics.

Variable	Observations	Mean	Standard deviation	Min	Max
Household saving rate (%)	2931	12.34	7.76	−12.99	34.22
EPU index	2338	123.70	74.05	17.57	706
Inflation rate (%)	2906	3.79	6.32	−10.10	98.22
Real interest rate (%)	2443	1.41	4.17	−71	52.46
Fiscal balance (% of GDP)	2616	−3.02	4.60	−35.96	17.95
Dependency ratio (%)	2931	50.07	8.01	26.99	85.94
Population growth rate (%)	2931	0.75	0.71	−2.49	5.32
Output gap (HP filter)	2870	−0.05	2.16	−28.73	10.48
Output gap (Boosted HP filter)	2870	−0.03	1.81	−28.73	10.57
Output gap (Hamilton filter)	2665	−0.28	4.39	−34.64	20.84
Financial development	2850	135	59.20	14.90	401.40
Institutional quality	1841	0.89	0.77	−0.85	1.90

Notes: Output gaps variables are calculated using different filters (Hamilton, 2018; Phillips and Shi, 2021) and measured as a percentage of GDP.

3.2. Empirical strategy

3.2.1. Local projections approach

To better explore the dynamic nature of the policy uncertainty effect on household saving rates, we use the local projections approach, many of which have been used for different research purposes due to its high flexibility and need for fewer assumptions. For example, Aastveit et al. (2017) use time-series local projections to show that the macroeconomic effect of U.S. monetary policy is less pronounced in times of high uncertainty. Choi and Shim (2019) use local projections in a panel data framework to compare the influences of policy uncertainty and financial markets uncertainty in emerging market economies. Stolbov and Shchepeleva (2021) adopt the quantile local projections to investigate the impact of policy uncertainty on growth rates in European economies. The local projections approach is similar to a classical VAR model, both of which are suitable to reveal the dependent variable's response to an increase in the key explanatory variable. Unlike the VAR model, however, the local projections approach does not impose any restrictions on impulse responses (Jordà, 2005). Therefore, the primary benefits of the local projections approach are that it is less prone to model misspecification and it can easily be augmented with non-linear specifications (for example, to implement a 2SLS estimator or to include interaction effects).[3]

[3] For a discussion of the pros and cons of both methods, we refer to Plagborg-Møller and Wolf (2021).

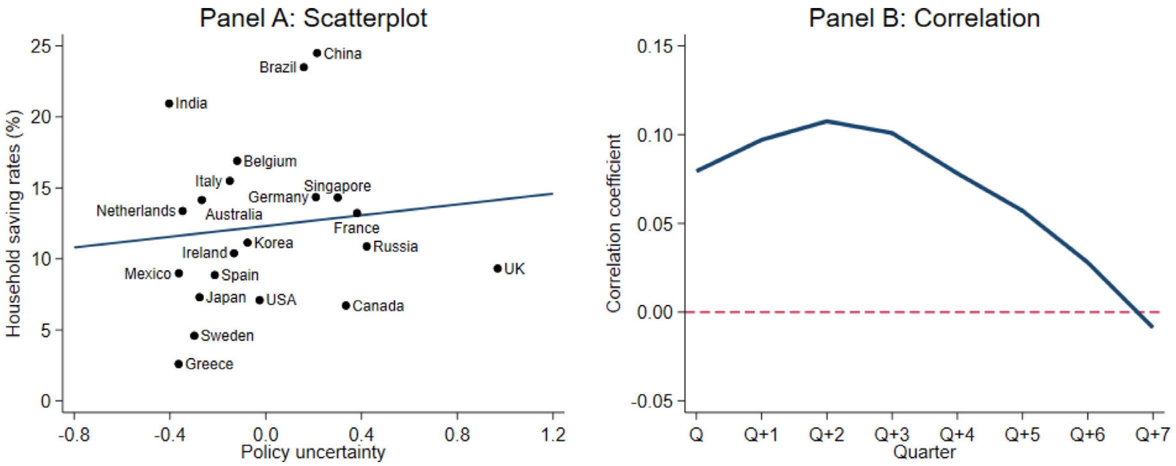

Fig. 2. Instantaneous and subsequent effects of policy uncertainty on household saving rates.
Notes: Panel A displays the average household saving rates against standardized EPU across countries. The line represents the fitted OLS regression. Panel B displays the evolution of the correlation coefficient between the EPU index at time t and household saving rates in the contemporaneous period and subsequent quarters.

The baseline model specification is as follows:

$$S_{i,t+h} - S_{i,t} = \gamma^h \Delta S_{i,t-1} + \sum_{n=0}^{N} \beta_n^h EPU_{i,t-n} + \kappa^h \boldsymbol{X}_{i,t-1} + \boldsymbol{\theta}_i^h + \varepsilon_{i,t}^h, \tag{1}$$

where S represents the household saving rate and $h = 1, \ldots, 10$ (in quarters) represents the forecast horizon.[4] Accordingly, the dependent variable $S_{i,t+h} - S_{i,t}$ denotes the cumulative changes in household saving rates over the forecast horizon of length h. The lagged first-differenced household saving rate ($\Delta S_{i,t-1}$) is included to allow for partial adjustment. $EPU_{i,t}$ is the standardized EPU index for country i at time t with a mean of zero and a standard deviation of one. We also include lags of EPU to capture the influence of policy uncertainty in previous periods and use Akaike's information criterion (AIC) to choose the optimal lag length. The maximum lag length M is set at eight, which is equivalent to two years. $\boldsymbol{X}_{i,t-1}$ includes control variables lagged by one period to alleviate endogeneity concerns. $\boldsymbol{\theta}_i^h$ are the country fixed effects. Based on Eq. (1), the Impulse Response Functions (IRF) are obtained by plotting the resulting estimates for β_0^h for different forecast horizons, while the corresponding confidence interval is calculated using the standard errors of β_0^h. We use Newey–West standard errors that take into account both autocorrelation and heteroskedasticity.

To isolate the impact of the business cycle on household saving rates, we choose to add it as a control variable in our estimation. Our benchmark analysis uses the output gap as the measure of the business cycle obtained from the traditional Hodrick–Prescott (HP) filter with a smoothing parameter λ set at 1600. In view of the concerns about the commonly-used HP filter approach (see details in Hamilton, 2018), we also use two alternative approaches to construct the output gap: the Hamilton filter and the boosted HP filter proposed by Phillips and Shi (2021). It turns out that there is a strong correlation among the three measures employed to measure the business cycle. In specific, the correlation between the output gap generated by the HP filter and by the boosted HP filter exhibits the highest of the three, 0.92. Next comes the correlation between the output gap produced by the HP filter and the Hamilton filter, which is 0.61. The lowest correlation is the one between the boosted HP filter and the Hamilton filter, which amounts to 0.54.

Since policy uncertainty might be endogenous to household savings, we adopt a modified local projections approach to deal with the endogeneity issue. More specifically, we construct a country-varying global policy uncertainty measure and use it as our IV and use 2SLS estimators. This choice is inspired by Ongsakul et al. (2021) and Wu and Zhao (2022) who use global policy uncertainty measured by the GDP-weighted average of national policy uncertainty as an instrument to obtain a consistent estimate of the coefficient of national EPU. According to these authors, global policy uncertainty is potentially an ideal instrument for national policy uncertainty because it likely satisfies two validity conditions. First, global policy uncertainty is correlated with (domestic) policy uncertainty. This is evidenced by multiple studies indicating the existence of spillover effects of policy uncertainty (Biljanovska et al., 2021, for example), arguing that one country's policy uncertainty has mutual effects on policy uncertainty in other countries. Second, global policy uncertainty measures the uncertainty at a global level, which is unlikely to induce endogeneity as any global policy uncertainty shock is probably not determined by any national household saving rate.

[4] Therefore the forecast horizon is equivalent to a maximum of two and half years.

Table 3
Panel Granger causality test.

Panel Granger causality order	Chi-squared statistic	p-value	Grange causality
Policy uncertainty → Household saving rates	6.664	0.04	YES
Household saving rates → Policy uncertainty	7.732	0.02	YES
Policy uncertainty → Global policy uncertainty	0.204	0.90	NO
Global policy uncertainty → Policy uncertainty	20.02	0.00	YES
Global policy uncertainty → Household saving rates	0.119	0.73	NO
Household saving rates → Global policy uncertainty	0.136	0.71	NO

Notes: The arrows in the first column indicate the Granger causality directions. The null hypothesis is that there does not exist a Granger causal relation. We follow the consistent moment and model criterion by Andrews and Lu (2001) to determine the lag length.

The use of global policy uncertainty as an instrument for EPU, however, suffers from two potential weaknesses. First, the widely-used global policy uncertainty measure is possibly endogenous because the countries used in the construction of global policy uncertainty are the main economies in the world whose policies might strongly and inversely affect the dynamics of world uncertainty. This is especially true for big economies such as the United States, China, Japan, and Germany. Second, the global policy uncertainty index is measured as a weighted average and therefore does not differ across countries and fails to take into account the heterogeneous sources that lead to uncertainty across countries. To address these shortcomings, our method introduces variation across countries by constructing a global policy uncertainty index for each country in the way that this country is not included when calculating the index. More specifically, our global policy uncertainty is constructed as follows:

$$Global\,EPU_{it} = \sum_{j \neq i,t}^{N} \frac{GDP_{jt}}{\sum_{j \neq i,t}^{N} GDP_{jt}} EPU_{jt}, i, j = 1, \ldots, N, t = 1, \ldots, T \tag{2}$$

To gain a basic understanding of the relationship between domestic policy uncertainty, modified global policy uncertainty, and household saving rates, we begin by conducting a panel Granger causality test before proceeding to run regressions. We employ the panel VAR approach developed by Holtz-Eakin et al. (1988) to conduct Granger causality tests. Table 3 presents the results. The first part of the results shows that (domestic) policy uncertainty Granger causes household saving rates and vice versa, indicating a possible reverse causality concern when regressing household saving rates on (domestic) policy uncertainty. The second part of the results examines the Granger causality between (domestic) policy uncertainty and global policy uncertainty, the latter being used as an IV in our estimations in the next section. We find that there is a Granger causality from global policy uncertainty to (domestic) policy uncertainty but not vice versa. This indicates that our global policy uncertainty measure could predict (domestic) policy uncertainty but not the other way around, showing that global policy uncertainty is an ideal instrument for (domestic) policy uncertainty. Finally, the third part of the table examines the Granger causal relation between global policy uncertainty and household saving rates. We find no evidence of Granger causality between these variables, which further signals the exogeneity of global policy uncertainty as a good IV.

In addition, we perform a battery of standard tests to examine the validity of our global policy uncertainty measure as an IV for domestic policy uncertainty. Firstly, we employ the under-identification test using standard Kleibergen–Paap rk LM statistics to assess whether the excluded IV are correlated with the endogenous regressors. Secondly, we use the Kleibergen–Paap rk Wald F statistic to test the weak exogeneity of the instruments employed.

As the validity assumption that IVs are not correlated with unobserved error terms cannot be tested in a setting with only one IV, we follow the approach proposed by Conley et al. (2012), which provides bounds on an endogenous variable with as few as one IV that does not necessarily have a zero correlation with the unobserved error term. To briefly illustrate the idea behind this method, consider the following simplified version of Eq. (1):

$$S_{i,t+h} - S_{i,t} = \beta_0^h EPU_{i,t} + \lambda Z_{i,t} + \boldsymbol{\xi} + \varepsilon_{i,t}^h \tag{3}$$

where β_0^h measures the response of household saving rates to a domestic policy uncertainty increase at time t and $\boldsymbol{\xi}$ includes all other explanatory variables in Eq. (1) such as lagged domestic policy uncertainty, lagged first-differenced household saving rates, a group of control variables, and fixed-effects. Compared with Eq. (1), this new equation has an additional term $\lambda Z_{i,t}$ in which $Z_{i,t}$ is our IV (global policy uncertainty) and λ is a parameter capturing the size of the violation of the exclusion restriction. The standard IV estimates assume that $\lambda = 0$, meaning that $Z_{i,t}$ does not affect the dependent variable through any channel other than through the endogenous variable. However, if the exclusion restriction is not satisfied, so that $\lambda \neq 0$, we can still obtain inference about β_0^h by forming alternative priors about λ. This is done by using $Z_{i,t}$ as an IV for $EPU_{i,t}$ to estimate the following specification:

$$(S_{i,t+h} - S_{i,t} - \lambda Z_{i,t}) = \beta_0^h EPU_{i,t} + \boldsymbol{\xi} + \varepsilon_{i,t}^h \tag{4}$$

We are able to examine how inference about β_0^h would be contaminated by different degrees of violation of the exclusion restriction proxied by various priors about λ. Meanwhile, we can also investigate how strong a violation would have to be for inference to become completely uninformative about the causal effect of domestic policy uncertainty on household saving rates.

There are different ways of constructing prior information about λ. To enhance the interpretability of our results, we follow Bonfiglioli et al. (2022) to set λ to be a function of parameter δ in such a way that we generate increasingly stronger violations of the exclusion restriction. Specifically, $\delta = 0$ implies the benchmark case in which the exclusion restriction is satisfied. $\delta = x > 0$ corresponds to a violation of the exclusion restriction such that a change in $Z_{i,t}$ by one interquartile range has a direct effect on household saving rates equal to the effect of a change in $EPU_{i,t}$ by x interquartile ranges. λ is increased by intervals of 0.01 starting from 0. For each different degree of λ, we estimate the confidence interval of β_0^h for both the lower and upper end of the support $[-\lambda, \lambda]$.

3.2.2. Local projections approach with interaction effects

What roles do financial development and institutional quality play in household saving rates' responses to a rise in policy uncertainty? To address this question, we employ a modified LP approach allowing for an interaction between policy uncertainty and financial development and institutional quality. Here we follow the five-step approach proposed by Iacoviello and Navarro (2019) to construct the appropriate interaction terms in local projections. An advantage of this approach is that it enables us to distinguish between the effects of the interaction variables and multiple interaction effects in a single estimation. This feature is particularly useful in our analysis, given that financial development and institutional quality are often correlated. By incorporating the interaction terms into our analysis, we can identify the differential effects of policy uncertainty on household saving rates for different levels of financial development and institutional quality. This will help us to gain a more nuanced understanding of the underlying mechanisms that drive the relationship between policy uncertainty, financial development, institutional quality, and household saving rates.

Let $FD_{i,t}$ and $IQ_{i,t}$ denote financial development and institutional quality of country i at time t, respectively. To estimate how these two variables affect the response of household saving rates to an EPU increase, we extend Eq. (1) so that policy uncertainty interacts with financial development or institutional quality. In particular, the following equation is estimated:

$$S_{i,t+h} - S_{i,t} = \gamma^h \Delta S_{i,t-1} + \sum_{n=0}^{N} \beta_n^h EPU_{i,t-n} + \sum_{v \in \{FD,IQ\}} \beta^{h,v} (\boldsymbol{I}_{i,t}^v EPU_{i,t})^{\perp} + \kappa^h \boldsymbol{X}_{i,t-1} + \boldsymbol{\theta}_i^h + \varepsilon_{i,t}^h, \tag{5}$$

where $\boldsymbol{I}_{i,t}^v$ is the interaction variable, namely financial development or institutional quality. We construct the interaction term $(\boldsymbol{I}_{i,t}^v EPU_{i,t})^{\perp}$ in the way that β^h measures the response of household saving rates to an increase in policy uncertainty when the interaction variables are at their median values. In the meantime, $\beta^{h,v}$ captures the marginal response of household saving rates to the policy uncertainty increase in case of high $\boldsymbol{I}_{i,t}^v$.

According to Iacoviello and Navarro (2019), there are five main steps to construct the interaction term $(\boldsymbol{I}_{i,t}^v EPU_{i,t})^{\perp}$. First, the original interaction variables, $FD_{i,t}$ and $IQ_{i,t}$, are standardized as $v_{i,t}^s$ to generate a mean of zero and variance of one. This standardization step makes all responses to the interactive shocks comparable. Second, we apply a logistic transformation to the standardized variable ($v_{i,t}^s$) as $L_{i,t}^v = \frac{exp\{v_{i,t}^s\}}{1+exp\{v_{i,t}^s\}}$. This transformation step maps variables to the unit interval which has the advantage that variables are expressed in distributional or probabilistic terms. Third, we re-center $L_{i,t}^v$ in terms of the distance between its 50*th* and its 95*th* percentile: $\boldsymbol{I}_{i,t}^v = \frac{L_{i,t}^v - l_{50}^v}{l_{95}^v - l_{50}^v}$, where l_{50}^v and l_{95}^v denote the 50*th* and its 95*th* percentile of $L_{i,t}^v$, respectively. This re-centering step allows interpreting the coefficients as deviation from median levels of the interaction variable. In particular, β^h is the response to the policy uncertainty increase when both financial development and institutional quality are at their median value, and $\beta^{h,v}$ captures the response of household saving rates when the interaction variable v is at the 95*th* percentile of its distribution. Fourth, the interaction term is constructed as $(\boldsymbol{I}_{i,t}^v EPU_{i,t})$. Finally, a recursive procedure is used to orthogonalize $(\boldsymbol{I}_{i,t}^v EPU_{i,t})$. More specifically, for the first interaction variable v_1, we first regress $(\boldsymbol{I}_{i,t}^{v1} EPU_{i,t})$ on $[EPU_{i,t-1}, \boldsymbol{X}_{i,t}]$ and obtain the residual $(\boldsymbol{I}_{i,t}^{v1} EPU_{i,t})^{\perp}$. For the second variable v_2, the term $(\boldsymbol{I}_{i,t}^{v2} EPU_{i,t})$ is regressed on $[EPU_{i,t-1}, \boldsymbol{X}_{i,t}, (\boldsymbol{I}_{i,t}^{v1} EPU_{i,t})^{\perp}]$ and the corresponding residual $(\boldsymbol{I}_{i,t}^{v2} EPU_{i,t})^{\perp}$ is obtained. This orthogonalization step eases the interpretation and comparison with our previous results. In fact, the β^h in Eq. (5) is identical to the one in Eq. (1) because all the interaction terms are orthogonal to $EPU_{i,t}$.

The approach of Iacoviello and Navarro (2019) compares the responses when the interaction variables are at their median and high levels. We extend this approach as follows. First, we additionally compare the responses when the interaction variable is at its median and low levels to a more complete picture of the interaction effects. To do so, we simply use a reverse re-centering method as $\boldsymbol{I}_{i,t}^v = \frac{l_{50}^v - L_{i,t}^v}{l_{50}^v - l_5^v}$, where l_{50}^v and l_5^v denote the 50*th* and its 5*th* percentile of $L_{i,t}^v$, respectively. In this way, β^h is still the response to the uncertainty increase when both financial development and institutional quality are at their median value, while $\beta^{h,v}$ now captures the response when the interaction variable v is at the 5*th* percentile of its distribution. Second, to address the possible endogeneity problem, we use 2SLS in our local projections instead of regular OLS as in Iacoviello and Navarro (2019). More precisely, we treat the interaction term $(\boldsymbol{I}_{i,t}^v EPU_{i,t})^{\perp}$ as endogenous since it includes policy uncertainty, our endogenous variable of interest. We then include the interaction term between financial development/institutional quality and global policy uncertainty in the set of instruments.

Table 4
Impulse responses of household saving rates to a policy uncertainty increase.

Forecast horizon	(1)	(2)	(3)	(4)	(5)
	LP-FE	Extended LP-FE			LP-2SLS
$h = 1$	0.117*	0.118*	0.119*	0.106*	0.695***
	(0.061)	(0.062)	(0.062)	(0.061)	(0.210)
$h = 2$	0.374***	0.377***	0.379***	0.359***	1.377***
	(0.104)	(0.105)	(0.106)	(0.103)	(0.339)
$h = 3$	0.493***	0.499***	0.507***	0.470***	1.808***
	(0.131)	(0.133)	(0.134)	(0.130)	(0.465)
$h = 4$	0.367***	0.373***	0.390***	0.330***	2.101***
	(0.123)	(0.128)	(0.128)	(0.118)	(0.562)
$h = 5$	0.491***	0.501***	0.523***	0.449***	2.864***
	(0.150)	(0.154)	(0.156)	(0.145)	(0.648)
$h = 6$	0.469***	0.483***	0.506***	0.419**	2.956***
	(0.180)	(0.179)	(0.180)	(0.176)	(0.687)
$h = 7$	0.376**	0.263*	0.299*	0.317**	2.393***
	(0.155)	(0.154)	(0.156)	(0.147)	(0.789)
$h = 8$	0.367**	0.232	0.281*	0.305**	2.308***
	(0.159)	(0.153)	(0.157)	(0.150)	(0.866)
$h = 9$	0.226	0.092	0.147	0.171	1.727**
	(0.174)	(0.170)	(0.172)	(0.166)	(0.858)
$h = 10$	0.150	0.029	0.090	0.099	1.382
	(0.155)	(0.151)	(0.154)	(0.146)	(0.863)
With the business cycle	NO	YES	YES	YES	YES
HP filter ($\lambda = 1600$)		YES			YES
Boosted HP filter			YES		
Hamilton filter				YES	
Average adjusted R squared	0.103	0.141	0.123	0.114	

Notes: The dependent variable is the cumulative change in the household saving rates over the forecast horizon $S_{i,t+h} - S_{i,t}$. $h = 1, \ldots, 10$ represents the forecast horizon. The model is based on Eq. (1) and incorporates lags of policy uncertainty, and country-fixed effects. All columns include the inflation rate, the real interest rate, fiscal balances, the dependency ratio, and population growth as control variables. Columns (2) to (5) also include the business cycle as control. The lag structure is determined by Akaike's information criterion. Newey–West standard errors are in parentheses. *, **, *** represents the 10%, 5% and 1% significance level, respectively.

For the analysis of the role of financial development and institutional quality in impacting the positive effect of policy uncertainty on household saving rates, we adopt several measures to ensure the validity of our results. In the main analysis, we measure financial development as the ratio of private credit to GDP which considers credit to firms and households. A higher ratio of private credit to GDP implies higher financial development in the sense that households have access to more possibilities to smooth their consumption. This, in turn, might mitigate the positive impact of policy uncertainty on household saving rates. For institutional quality, we use an average of six indices from the Worldwide Governance Indicators database provided by the World Bank. These six indices measure the institutional quality of a country in terms of its voice and accountability, political stability and absence of violence/terrorism, government effectiveness, regulatory quality, the rule of law, and control of corruption. We also use each of these sub-indexes as alternative measures for institutional quality.

4. Results

4.1. Results from baseline local projections

Table 4 summarizes the impulse responses of household saving rates to a policy uncertainty increase across different forecast horizons in different model specifications based on Eq. (1). For all specifications, the dependent variable is the change in household saving rates from $t = 0$ to $t = h$. First, we begin our analysis with the benchmark fixed-effects specification with all controls except for the business cycle. The results are given in column (1), showing that the responses are positive and statistically significant for forecast horizons ranging from $h = 1$ to $h = 8$ at the 90% confidence level. Furthermore, the magnitude of the coefficients increases as the forecast horizon extends from $h = 1$ to $h = 5$, reaching a maximum value of 0.491 when the forecast horizon is equal to 5. To illustrate, an increase in the EPU index by one standard deviation raises household saving rates by around 0.5 percentage points within five quarters. These results indicate a strong positive association between policy uncertainty and household saving rates, particularly in the first eight quarters following the initial increase in policy uncertainty.

Second, in columns (2) to (4) we add the business cycle as a control variable to account for any possible cyclical effects on household saving rates. We do this by using various measures of the output gap. The extended LP-FE analysis

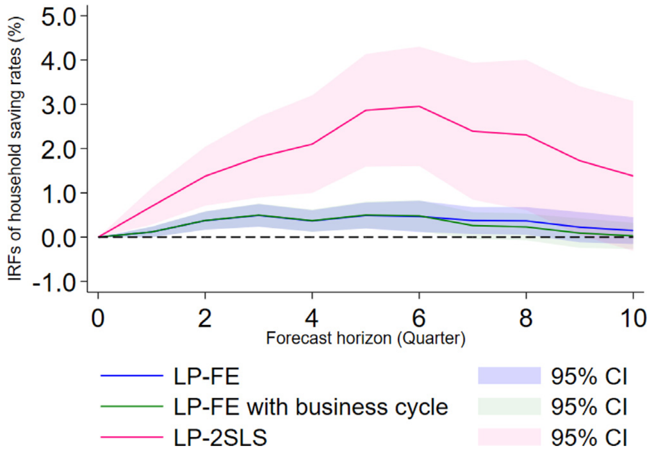

Fig. 3. Impulse responses of household saving rates to policy uncertainty increases.
Notes: This figure shows the effect of a one-standard-deviation increase in policy uncertainty on household saving rates. The shaded area represents the 95% confidence interval.

reveals that the average adjusted R squared is higher in columns (2) to (4) as compared to column (1), indicating an improved model fit when we control for the business cycle. Looking at the estimates, we find that the signs and statistical significance of the responses are not substantially different from our benchmark specification. However, the magnitude of the coefficients in columns (2) and (3) is relatively higher than that in column (1) over the first five forecast horizons, suggesting that the positive effect of policy uncertainty on household saving rates may be partially concealed by the business cycle in the short run. Interestingly, we do not find this pattern when comparing columns (4) and (1). Nevertheless, we find the impulse responses of household saving rates to a policy uncertainty increase do not change significantly after adding the business cycle as a control. This indicates that the confounding effect of the business cycle on the relationship between policy uncertainty and household saving rates is limited.

Finally, we consider how our results change when the estimation is undertaken via 2SLS. In particular, we estimate the dynamic effect of policy uncertainty but with global policy uncertainty as an IV for domestic policy uncertainty. Column (5) of Table 4 presents the results for the LP model based on 2SLS estimates. Not surprisingly, the impulse responses of household saving rates to a policy uncertainty increase are positive and significant for the first nine horizons. In addition, the magnitude of the coefficients in column (5) is higher than that in other columns. This comparison shows that the impulse responses might be underestimated due to the endogeneity problem. The adjusted coefficient reaches its maximum at a forecast horizon of six with a value of 2.956, indicating that a one-standard-deviation policy uncertainty increase could lead to an increase in household saving rates by around three percentage points. Taken together, our results show that the use of global policy uncertainty as an IV for domestic policy uncertainty does not significantly alter the signs and statistical significance of the coefficients, which is consistent with our earlier findings. Furthermore, the implementation of 2SLS results in a higher impact of policy uncertainty on household saving rates, further supporting the positive effect of policy uncertainty on household saving rates. Hence, our conclusions regarding the positive relationship between policy uncertainty and household saving rates remain robust, even after considering potential endogeneity concerns.

To give a visual impression of the impact of policy uncertainty on household saving rates, Fig. 3 displays the IRFs of household saving rates to a policy uncertainty increase in different model specifications. What stands out in this figure is that all IRFs are above zero in the first eight quarters, indicating a significant positive effect of policy uncertainty on household saving rates in the short and medium run. In particular, we find that the IRFs from LP-FE with and without the business cycle are considerably similar, indicating an insignificant effect of the business cycle on our estimates. Moreover, the IRFs from LP-2SLS are higher than the other two, indicating that addressing endogeneity issues substantially strengthens the observed positive responses.

4.2. Is global policy uncertainty a good IV?

Before answering this question, we conduct the Hausman tests to identify the existence of endogeneity in our model. As the Hausman tests in the first eight equations of Table 5 (columns (1) to (8)) indicate, there are systematic differences in coefficients between LP-FE and LP-IV, and the null hypothesis of no endogeneity is rejected, therefore confirming the endogeneity of domestic policy uncertainty.

Having this endogeneity concern in mind, we now shift our focus to discussing the validity of our global policy uncertainty as an IV. A strong instrument variable needs to satisfy two conditions: relevance and exogeneity. That is,

Table 5
First-stage results of LP-2SLS and tests of IV.

	(1) $h=1$	(2) $h=2$	(3) $h=3$	(4) $h=4$	(5) $h=5$
Global policy uncertainty	0.326***	0.328***	0.329***	0.332***	0.349***
	(0.051)	(0.051)	(0.051)	(0.049)	(0.048)
Observations	2,156	2,136	2,116	2,096	2,077
Hausman test (p-value)	36.09 (0.00)	49.39 (0.00)	41.88 (0.00)	34.88 (0.00)	54.51 (0.00)
Kleibergen–Paap rk LM statistic (p-value)	16.5 (0.00)	16.64 (0.00)	16.84 (0.00)	17.1 (0.00)	17.3 (0.00)
Kleibergen–Paap rk Wald F statistic	44.14	45.66	47.21	50.1	57.78

	(6) $h=6$	(7) $h=7$	(8) $h=8$	(9) $h=9$	(10) $h=10$
Global policy uncertainty	0.369***	0.359***	0.355***	0.369***	0.372***
	(0.047)	(0.048)	(0.049)	(0.050)	(0.047)
Observations	2,057	2,037	2,017	1,997	1,976
Hausman test (p-value)	57.12 (0.00)	29.45 (0.01)	23.42 (0.04)	14.80 (0.32)	8.31 (0.82)
Kleibergen–Paap rk LM statistic (p-value)	17.65 (0.00)	16.93 (0.00)	16.59 (0.00)	16.78 (0.00)	17.03 (0.00)
Kleibergen–Paap rk Wald F statistic	65.03	52.94	53.18	55.56	60.92

Notes: The dependent variable is EPU_{it}. $h = 1, \ldots, 10$ represents the forecast horizon. The Hausman test of endogeneity tests the null hypothesis that policy uncertainty is not endogenous. The Kleibergen–Paap rk LM statistic tests whether the excluded instruments are correlated with the endogenous regressors. The Kleibergen–Paap rk Wald F statistic of weak exogeneity test the validity of the instruments employed. Robust standard errors are in parentheses. *, **, *** represents the 10%, 5% and 1% significance level, respectively.

the appropriate IV has to be correlated with the explanatory variable of interest (domestic policy uncertainty) and uncorrelated with the error term (ε in Eq. (1)).

We first examine the relevance of our IV. Table 5 presents the first-stage estimation results and some statistics which can be used to evaluate the endogeneity of (domestic) policy uncertainty and the relevance of our IV. The Kleibergen–Paap rk LM statistic and Kleibergen–Paap rk Wald F statistic and corresponding p-values provide information on the validity of our global policy uncertainty as the IV for domestic policy uncertainty. The null hypothesis of the Kleibergen–Paap rk LM test is that the equation is under-identified, which indicates that global policy uncertainty has insufficient explanatory power to predict domestic policy uncertainty. A rejection of the null hypothesis suggests that the instrument is correlated with the endogenous variable. We find that the associated p-values are below 0.05, implying that global policy uncertainty is a relevant IV for domestic policy uncertainty in all cases. The Kleibergen–Paap rk Wald F statistics examine the weak exogeneity of the instrument used in each column. It is shown that these statistics are all larger than ten, implying that the null hypothesis of a weak instrument is rejected, which further confirms the validity of global policy uncertainty as an IV for domestic policy uncertainty.

Another important characteristic of a valid instrument is the exogeneity, or exclusion restriction, which assumes that IV is correlated with the dependent variable solely through its correlation with the endogenous variable of interest; so the IV is uncorrelated with the error in the outcome equation. We examine this characteristic using the approach of Conley et al. (2012) and Bonfiglioli et al. (2022). The results are reported in Fig. 4, which plots the estimated β_0^h and its associated 95% confidence intervals corresponding to different values of δ.[5] When $\delta = 0$, the confidence intervals at different forecast horizons are the same ones reported in column (5) of Table 4. The confidence interval progressively widens as δ increases and departs from the benchmark, which indicates a stronger violation of the exclusion restriction. We calculate the critical value of δ for different forecast horizons, above which the lower bound of the confidence interval becomes negative, and find an average value of around 1.94. This value suggests that the direct impact of global policy uncertainty would need to be approximately more than twice as large as the impact of a commensurate exogenous change in (domestic) policy uncertainty for our β_0^h to become statistically insignificant and thus uninformative. Therefore, our results confirm that our inference remains informative even if there were a strong violation of the exclusion restriction.

4.3. Do financial development and institutional quality matter?

Fig. 5 shows the responses of household saving rates to a policy uncertainty increase conditional on the level of financial development and institutional quality. Table 6 provides the full estimated coefficients. The blue dashed lines in Fig. 5 and column (1) in Table 6 represent the estimated impulse responses of household saving rates to a policy uncertainty increase under the assumption that both financial development and institutional quality are at their median levels. In contrast, the red and green solid lines give the estimated responses when the interaction variable (financial development or institutional quality) is high or low, respectively. In particular, the top panels display how high (left side) or low (right

[5] We do not show the results for $h = 10$ because the IRF of household saving rates is insignificant in our benchmark estimation, where $\delta = 0$.

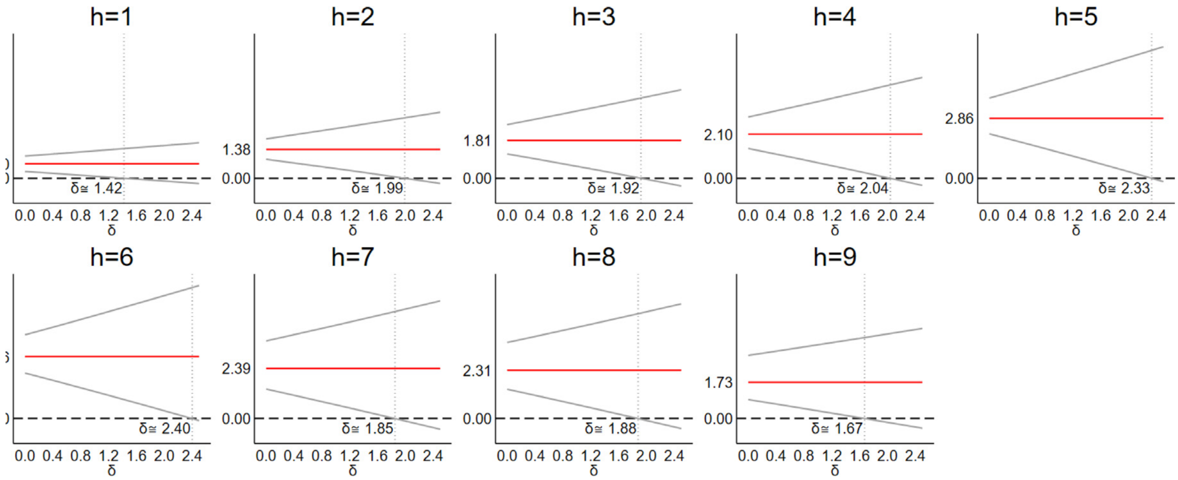

Fig. 4. Sensitivity of inference about β_0^h to violation of the exclusion restriction.
Notes: This figure plots 95% confidence intervals (the gray lines) around the baseline coefficient on EPU_{it} (the red solid lines) across different forecast horizons for different priors about degrees of violation of the exclusion restriction. The horizontal axis δ gives the parameter that determines the priors. $\delta = 0$ implies that the exclusion restriction is perfectly satisfied. $\delta = x > 0$ implies a violation of exclusion restriction such that a change in the IV (global policy uncertainty) by one interquartile range has a direct effect on the dependent variable (household saving rates) equal to the effect of a change in our key endogenous variable (domestic policy uncertainty) by x interquartile ranges. The critical value of δ is labeled in the graph above which the lower bound of the confidence interval becomes negative, meaning that β_0^h is not statistically significant at 95% level. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

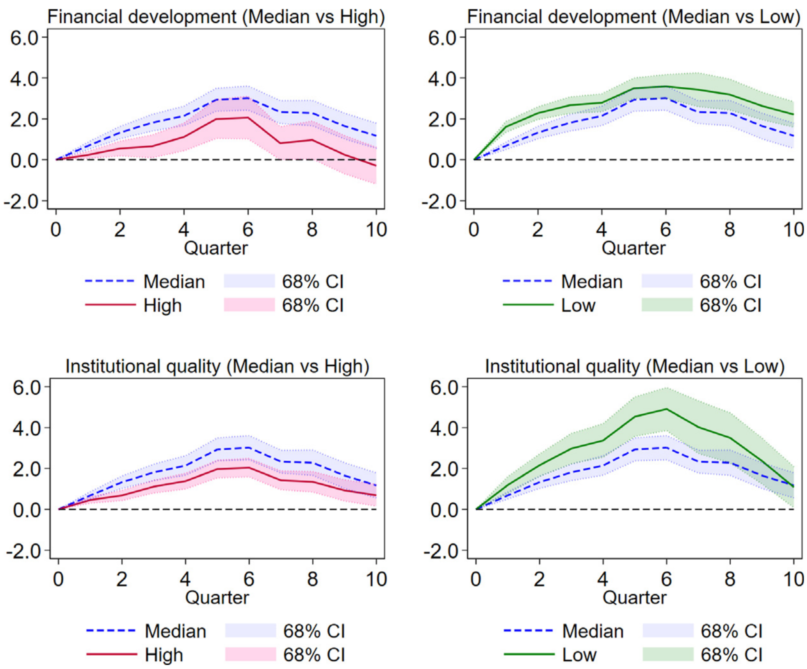

Fig. 5. LP with interactions.
Notes: This figure shows the effect of a one-standard-deviation increase in policy uncertainty on household saving rates with different levels of financial development or institutional quality. The shaded area represents the 68% confidence interval. Financial development is measured by credit to the private sector as a percentage of GDP and institutional quality is measured by the institutional quality index from the Worldwide Governance Indicators project. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

side) financial development affects the household saving rates responses, while the bottom panels display the estimated results when we use institutional quality as the interaction variable.

We first focus on the effect of financial development, as shown in the top panels. It can be seen that when financial development moves from its median to a high level, the responses of household saving rates decrease by approximately

Table 6
LP with interactions.

	(1)	(2)	(3)	(4)	(5)
	Median	When financial development is		When institutional quality is	
		High	Low	High	Low
$h = 1$	0.681[a]	0.237[a]	1.609[a]	0.458[a]	1.188[a]
	(0.179)	(0.170)	(0.266)	(0.157)	(0.414)
$h = 2$	1.328[a]	0.548[a]	2.279[a]	0.680[a]	2.157[a]
	(0.301)	(0.360)	(0.309)	(0.251)	(0.552)
$h = 3$	1.810[a]	0.658[a]	2.667[a]	1.113[a]	2.972[a]
	(0.404)	(0.556)	(0.405)	(0.315)	(0.742)
$h = 4$	2.146[a]	1.118[a]	2.788[a]	1.381[a]	3.369[a]
	(0.475)	(0.681)	(0.438)	(0.385)	(0.823)
$h = 5$	2.933[a]	1.991[a]	3.496[a]	1.973[a]	4.536[a]
	(0.560)	(0.952)	(0.499)	(0.433)	(0.965)
$h = 6$	3.015[a]	2.062[a]	3.587[a]	2.039[a]	4.907[a]
	(0.589)	(1.045)	(0.580)	(0.453)	(1.050)
$h = 7$	2.332[a]	0.811[a]	3.428[a]	1.419[a]	4.022[a]
	(0.558)	(0.801)	(0.826)	(0.458)	(1.288)
$h = 8$	2.283[a]	0.968	3.189[a]	1.346[a]	3.494[a]
	(0.620)	(0.925)	(0.753)	(0.500)	(1.226)
$h = 9$	1.651[a]	0.251	2.635[a]	0.928[a]	2.365[a]
	(0.628)	(0.938)	(0.674)	(0.519)	(1.119)
$h = 10$	1.172[a]	−0.290	2.213[a]	0.686[a]	1.089[a]
	(0.615)	(0.900)	(0.623)	(0.527)	(1.002)

*Notes:*The dependent variable is the cumulative change in the household saving rates over the forecast horizon $S_{i,t+h} - S_{i,t}$. $h = 1, \ldots, 10$ represents the forecast horizon. The model is based on Eq. (5) and incorporates lags of policy uncertainty, and country-fixed effects. All columns include the inflation rate, the real interest rate, fiscal balances, the dependency ratio, and population growth as control variables. All columns also include the business cycle as control. The lag structure is determined by Akaike's information criterion. Newey–West standard errors are in parentheses.
[a] Represents the 68% significance level.

one percentage point over the first six quarters, while the confidence intervals are closer to zero. Moreover, from the seventh quarter, the IRFs in case of high financial development become negative and the associated confidence intervals include zero. Taken together, this comparison implies that financial development leads to a smaller and less significant effect of policy uncertainty on household saving rates. By contrast, the top right panel compares household saving rates' responses for the median and low levels of financial development. We find that moving from median to low financial development almost doubles the positive responses of household saving rates, implying that a lower level of financial development encourages households to save more when facing policy uncertainty. Typically, when there is a high level of financial development, the influence of policy uncertainty on household saving rates diminishes by about 1.1 percentage points. Conversely, with limited financial development, the effect of policy uncertainty on saving rates increases by roughly 0.85 percentage points.

The bottom panels of our analysis provide insights into the impact of institutional quality on household saving rates' responses to a policy uncertainty increase. The bottom left panel shows that, over the entire forecast horizon, moving from the median to high institutional quality reduces the response of household saving rates to the uncertainty increase. As a comparison, the bottom right panel gives the results when institutional quality moves from its median to a low value, showing that low institutional quality amplifies the responses of household saving rates. A noteworthy finding is that low institutional quality has a greater impact on the increase in IRFs than high institutional quality has on the reduction of IRFs. This contrast could indicate that institutional quality has an asymmetric effect on household savings behavior, where weaker institutions exert a more significant influence than stronger ones. On average, a high level of institutional quality lessens the impact of policy uncertainty on household saving rates by around 0.73 percentage points whereas a low level of institutional quality strengthens the policy uncertainty effect by approximately 1.08 percentage points.

All in all, the results of the interaction effects analysis indicate that the positive effect of policy uncertainty on household saving rates is less pronounced in countries with higher financial development and/or higher institutional quality. These results of the interaction effects are consistent with studies documenting an important role of financial development in reducing the effect of uncertainty on economic activities (Ahir et al., 2022; Karaman and Yıldırım-Karaman, 2019; Ma and Hao, 2022). All these results indicate that high financial development could mitigate the macroeconomic effect exerted by policy uncertainty. Our results with regard to institutional quality coincide with those of Ahir et al. (2022) who find that uncertainty matters more in countries with relatively lower institutional quality, and Hatzinikolaou and Tsoka (2016) who report that low institutional quality strengthens households' saving incentives via reducing the safeguarding role of social security. Overall, our findings suggest that high financial development and high institutional quality can mitigate the macroeconomic effects of policy uncertainty on household saving rates. This has important policy implications for policymakers in countries with lower levels of financial development and institutional quality, as they may need to consider implementing measures to improve these factors to reduce the impact of policy

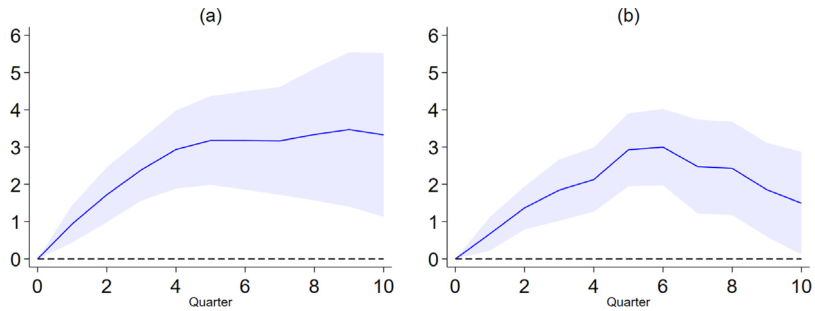

Fig. 6. Robustness check.
Notes: Panel A displays the IRFs of household saving rates to a WUI increase from LP-2SLS in which global WUI is used as an IV. Panel B displays the IRFs of household saving rates to a policy uncertainty increase from LP-2SLS in which global policy uncertainty and political stability are used as IVs. Shaded areas represent 95% confidence intervals.

uncertainty on household saving rates. A developed financial system and well-functioning institutions might help to keep the saving rate close to its "golden rule" level even in the face of elevated economic policy uncertainty.

5. Robustness checks

In the first robustness check, we use a different policy uncertainty measure developed by Ahir et al. (2022): the World Uncertainty Index (WUI). Instead of using news text from newspapers in each country as (Baker et al., 2016) do, Ahir et al. (2022) use the Economist Intelligence country report as the data source to construct a country-level uncertainty index. The WUI is available on a quarterly basis for each country. Notably, the correlation between EPU and WUI is moderately positive, with an average country-specific correlation coefficient of 0.34. We estimate LP-2SLS in which we use the GDP-weighted average of global WUI as IV for domestic WUI.[6] Panel A of Fig. 6 displays the IRFs of household saving rates to a WUI increase from LP-2SLS. Our results indicate that household saving rates again respond positively to the WUI increase.

Second, we check whether the results are sensitive to extreme values and two major events: the Global Financial Crisis in 2007–2008 and the Covid-19 pandemic. Firstly, each variable is winsorized to prevent extreme values from distorting the estimates. Secondly, two dummies for these crises are included in the local projections. The results, which are available on request, indicate that the exclusion of extreme values and the inclusion of event dummies do not change our conclusion. The coefficients of EPU are significantly positive in the first few quarters, indicating that the positive effect of EPU on household saving rates is robust to the crisis events. Moreover, to ensure that the results are robust to the selection of countries, the estimations are repeated with one country dropped each time. The results confirm that the findings are robust to the exclusion of each country.

Third, we consider an additional variable to our IV set to address the endogeneity of policy uncertainty: political stability. A strand of literature uses political variables as IVs for policy uncertainty. For example, Berger et al. (2022) and Gulen and Ion (2016) use political polarization as an IV for policy uncertainty, while Julio and Yook (2016) and Choi et al. (2021) choose to use election timing. Given our sample and data availability, we use political stability as an additional IV measured by the political stability score from the country risk ranking database and the political stability index from the Worldwide Governance Indicators. Our results shown in Panel B of Fig. 6 indicate that the positive effect of policy uncertainty on household saving rates is unchanged even if we use an alternative IV set. However, our tests show that political stability does not have a significant impact on policy uncertainty in the first-stage regression, implying that adding political stability as an additional IV does not help in our case because our results show that the new IV is not relevant.

Finally, to check the robustness of the findings regarding the interaction effects, we use alternative measures for financial development and institutional quality. First, we use stock market capitalization instead of household credit to proxy financial development. Second, we use each sub-index from the Worldwide Governance Indicators to measure a country's institutional quality. The results of using alternative measures of interaction variables are similar to, and not statistically different, from the baseline results. In addition, we test the robustness by employing different thresholds in the third step of constructing the interaction terms (90*th* and 99*th* percentile instead of default 95*th* percentile). Overall, the results obtained from additional robustness checks are not substantially different from the baseline results, further confirming that high financial development and institutional quality mitigate the positive response of household saving rates to a policy uncertainty increase.

6 Likewise, the country itself is excluded in the calculation of global WUI for this country.

6. Conclusion

This study adds to the literature on the relationship between policy uncertainty and household saving rates by addressing endogeneity concerns and exploring the roles of financial development and institutional quality. Our analysis covering 21 countries over a 30-year period reveals that policy uncertainty has a significantly positive and enduring impact on household saving rates, which confirms the precautionary saving theory. We find that this effect is even more pronounced after controlling for the business cycle and endogeneity. When policy uncertainty rises by one standard deviation, household saving rates go up by three percent points within a span of six quarters. Hence, our research underscores that policy uncertainty significantly affects household saving behavior, even after controlling for the effects of the business cycle. This emphasizes the pivotal role of policy uncertainty in shaping the real economy.

Our findings also indicate that high levels of financial development and institutional quality can mitigate the positive effect of policy uncertainty on household saving rates, suggesting that households in countries with robust financial systems and institutional quality may be better equipped to withstand fluctuations in policy uncertainty. By way of illustration, high financial development and institutional quality mitigate the policy uncertainty effect on savings by about 1.1 and 0.7 percentage points, respectively, whereas low financial development and institutional quality strengthen the policy uncertainty effect on savings by about 0.85 and 1.08 percentage points, respectively. Our findings emphasize the crucial roles of developed financial markets and robust institutions in buffering households' responses to increased uncertainty.

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