WHAT CAUSED U.S. POSTPANDEMIC INFLATION? A FISCAL EXTENSION OF BERNANKE AND BLANCHARD (2025)

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Abstract. In this work, I make two main contributions. Firstly, I propose an extension of the empirical model introduced by Bernanke and Blanchard (2025) to account for fiscal policy. Determining endogenously the state of supply chains I show that its pure contribution to inflation is small and that it mediates a demand component attributable to accommodating fiscal policy. Through an historical decomposition I estimate this fiscal component to sum to 2.4 percentage points of price inflation over the period 2020Q1:2025Q1. I interpret this result within a standard aggregate supply-aggregate demand (AS AD) framework with supply constraints. Secondly, I provide an R replication package for all the results of Bernanke and Blanchard (2025). I integrated the possibility to derive confidence intervals for the responses of price inflation implied by the standard model through bootstrapping. I show that these are generally not statistically different from zero.

JEL classification: C30, C50, E12, E31, E62,

Keywords: Inflation, Fiscal Policy, Supply Chains

1. INTRODUCTION

What were the drivers of recent inflation? Was it supply or demand or both? Did fiscal policy play a role? Some recent works, chiefly Bernanke and Blanchard (2025), stress the importance of supply side explanations pointing to relative commodity price shocks as the main driver of inflation. These works treat commodity prices as exogenous and, while acknowledging the role of demand forces, including them in their frameworks remains an open question. Some other works, such as Giannone and Primiceri (2024), point instead to demand forces as the main driver of inflation, showing that the contribution of supply shocks has a demand component that can be identified when these supply factors become endogenous. In this work, I pick up the open issue of Bernanke and Blanchard (2025) (henceforth BB) and I show that in their framework the contribution of shortages–a variable proxied through Google Trend that captures the saliency of supply constraints–is not to be interpreted entirely as supply-side. Endogenously determining shortages I am able to capture its fiscal-driven component, which leads me to estimate a dynamic effect of accommodating fiscal policy of 2.4 percentage points of price inflation. Indeed, the shortages component is directly displaced by the fiscal one. I interpret this result through the lenses of a standard Keynesian mechanism, much in the spirit of Fornaro (2024). In an economy sensitive to supply constraints, fiscal policy stimulates aggregate demand and takes the economy to regions where these constraints bind, that is where the supply curve is steeper–even vertical–ultimately resulting in inflation. This happens because when firms try to increase production beyond their supply constraints, marginal costs increase and so do prices. Production under binding supply constraints is akin to an increase in markup, where inflation spikes with constant wages. This interpretation offers also a suitable solution to the disconnect between price and wage inflation, which raises some puzzles in a classical

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New-Keynesian framework such as Galí (2015). These demand forces thus make their way into inflation not through labor markets–whose contribution to inflation I estimate being small–but rather through supply chains. This gives a richer picture of inflation. It generally stems from a scarcity on the supply side relative to demand but, since there are both labor and non-labor inputs, the push on prices may well come mainly from non-labor inputs. Nevertheless, although it is commonly intuitive not to think so, this is still a form of demand-driven inflation. I call this mechanism–drawing from Lorenzoni and Werning (2023)–a "supply-constrained demand shock," which well captures the dynamics of the story I outline and highlights how the canonical intuitive dichotomy between demand and supply driven inflation is likely more nuanced. There may be other mechanisms at work, such as those referring to the Fiscal Theory of the Price Level (FTPL), which I do not incorporate in my model.

In estimating these results, I developed a smooth R replication package for Bernanke and Blanchard (2025), which is available on GitHub. [1] I also implemented a version of the paper with confidence intervals to test robustness. I find that, in general, the response to various shocks of inflation is not statistically different from zero and that the parameters are quite robust to changes in sample periods.

This paper is structured as follows: in Section 2, I briefly trace an outline of the events I analyze; in Section 3, I review the recent literature on the issue; in Sections 4 and 5, I delve into the technical details of my empirical approach, examining the model, data, and specifications I employ; in Section 6, I show my replication results; and lastly, in Section 7, I present an extension of the BB model and provide its empirical implications.

2. HISTORICAL BACKGROUND

The aim of this brief section is to quickly trace an outline of the events of the last 4 years concerning the pandemic, inflation, and the associated policy responses. In February 2020, the COVID-19 pandemic broke out, requiring strict lockdown measures that led to extreme consequences, including an all-time-high unemployment rate of 14% and falling economic activity. In the attempt to balance these worrying statistics and ensure appropriate response, the Trump administration passed the CARES Act, the largest fiscal stimulus in American history, amounting to US$2.2 trillion. It included, among others, immediate paychecks and increased unemployment benefits. This stimulus was followed by other unusual measures: the Consolidated Appropriation Act and the American Rescue Plan Act (ARPA), but also the Inflation Reduction Act (IRA). The fiscal effort observed in the last 4 years is unprecedented in recent American history, as shown in Figure 1. Outlays and deficit spiked up on impulse around the burst of the pandemic but are now also plateauing at an all-time-high level.

As pandemic pressures eased, the inflation rate started to increase steadily, along with headline components such as energy and food. The pressure on supply chain, which can be proxied through Google Trend, experienced a spike as well. The inflation rate gained momentum reaching its peak at 9% in June 2022 and then returned on a descending trend toward the 2% target. In the summer of 2022, monetary policy, both in the US and in the EA, started to respond with a rapid tightening, bringing the policy rates quickly to levels well above the zero-lower-bound where they have been stuck for a decade. Central banks have now started to cut them.

3. LITERATURE REVIEW

I aim to dialogue with two main strands of literature. The first one is a recent series of works accounting for postpandemic inflation, both theoretically and empirically. The other is the strand of literature investigating fiscal sources of inflation.

[1] https://github.com/luigilor/bernanke-blanchard23

FIGURE 1: Outlays as a percentage of GDP, by category (source: CBO)

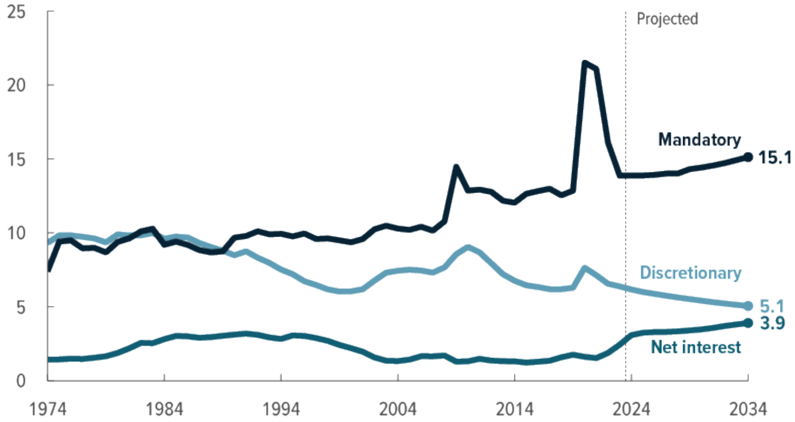
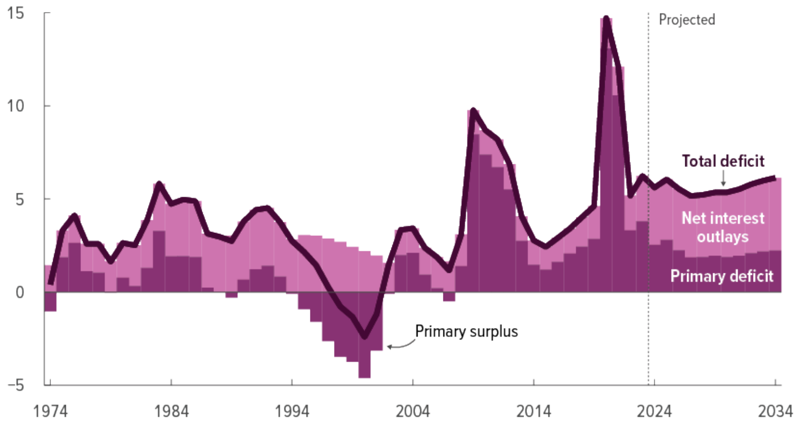


FIGURE 2: Deficit as a percentage of GDP, by category (source: CBO)

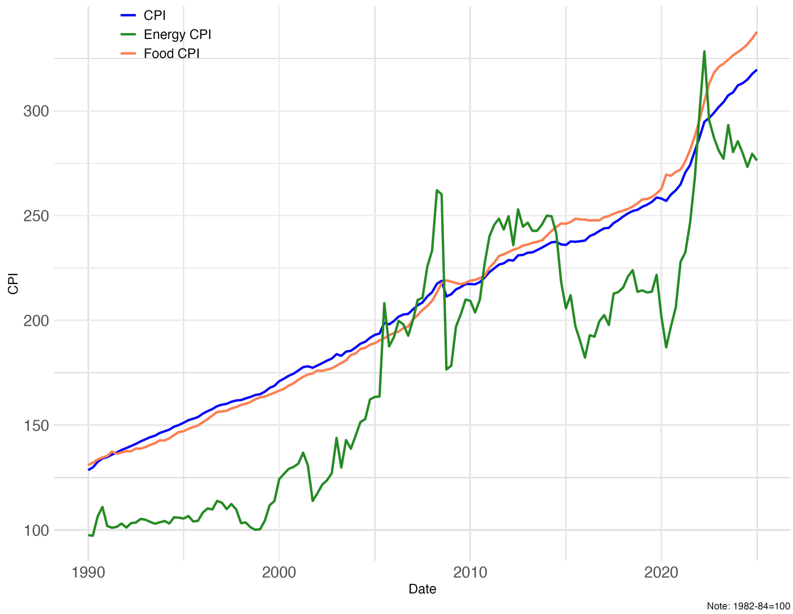


This literature review necessarily starts from the answer provided by Bernanke and Blanchard (2025) to the question opening this work. They develop a simple wage-price determination model (see Section 4), whose empirical counterpart–an approximation of a SVAR–has two main takeaways, both for the United States and for several other economies. Firstly, the source of the observed inflation was primarily the result of the relative price of inputs shocks (mainly energy) and supply chains disruptions.

These shocks did not alter expectations, which were–in contrast to the 1970s–well anchored. Thanks to this condition, the shocks did not immediately trigger a wage-price spiral. Secondly, the model yields a quite persistent response of prices to a labor market tightness shock (8d), though not statistically different from zero. Their result that postpandemic inflation was mainly supply-driven lies on the fundamental assumption of exogenous commodity prices, which is debatable. I discuss in greater detail this assumption in Section 7. Such assumption was indeed challenged in, for instance, Giannone and Primiceri (2024) and Lorenzoni and Werning (2023).

Gagliardone and Gertler (2023) show that the combination of FED's commitment to high employment and oil price shocks well accounts for the observed surge in inflation. Their explanation is partly in the spirit of BB when emphasizing the role of commodity prices, but partly highlights the role of monetary policy, which does not enter the model I treat here. Several other empirical papers have recently come out investigating the role of supply shocks. I mention here two papers with whom I share a particular emphasis on supply chain disruptions. Firstly, Bai et al. (2024) test

FIGURE 3: Consumer Prices Indexes: Energy prices (green), food prices (orange), aggregate index (blue) (source: FRED)



the relationship between the state of supply chains–proxied with a novel variable they constructed–and inflation, finding a link interpretable as causal. They think of supply chain disruptions as something "breaking the link" between production and consumption, which leads to a scenario of contemporaneous spare capacity and supply shortage. I instead interpret the shocks to the supply chain variable not merely as influencing transportation costs but more broadly as informative of the severity of supply constraints. Secondly, Comin et al. (2023) build a New-Keynesian model in which inflation stems from supply constraints. They are also able to disentangle supply-side versus demand-side explanations for binding supply constraints, finding that *"no single set of shocks can explain the inflation takeoff. Rather, shocks that tightened capacity set the stage for demand shocks–most importantly, monetary policy shocks–to trigger binding constraints and accelerate inflation in 2021"* (Comin et al., 2023). Such intuition is very much in the spirit of this work, though the frameworks we employ are different, and they have a greater emphasis on monetary policy, which does not enter my extension.

Benigno and Eggertsson (2023) impute the surge in price inflation to a non-linear Phillips curve (PC). They show that a non linear PC employing the vacancy-unemployment ratio–as BB do–well fits postpandemic data. This has important policy consequences, and suggests that monetary tightening may have a role when the economy is operating in non-linear regions. Non-linearities in supply, reflecting constraints, are crucial to the mechanism I look at.

Guerrieri et al. (2021) propose a model where inflation is characterized as stemming from structural reallocation between sectors. In such a setting, a preference shock (arguably the one that hit the economy during COVID) is equivalent to a cost-push shock generating inflation and unemployment–the former in the "growing" sector and the latter in the other. Reallocation is determined by two incentives–namely job-finding probability and real wage. Expansionary monetary policy stifles reallocation through lower unemployment in the dwindling sector but incentivizes it through wage inflation in the rising sector. The model, depending on which of the two effects dominates, prescribes opposite stances of monetary policy. Guerrieri et al. (2023) emphasize the role of supply, particularly energy, shocks in generating inflation. Their focus is on the uneven nature of

FIGURE 4: Policy rates for U.S. (blue) and EA (purple) (source: Haver Analytics)

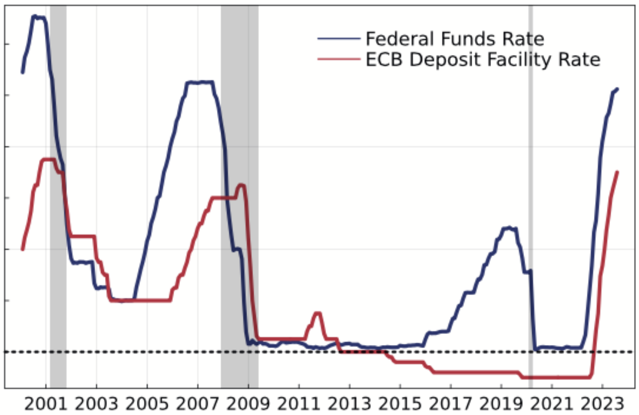
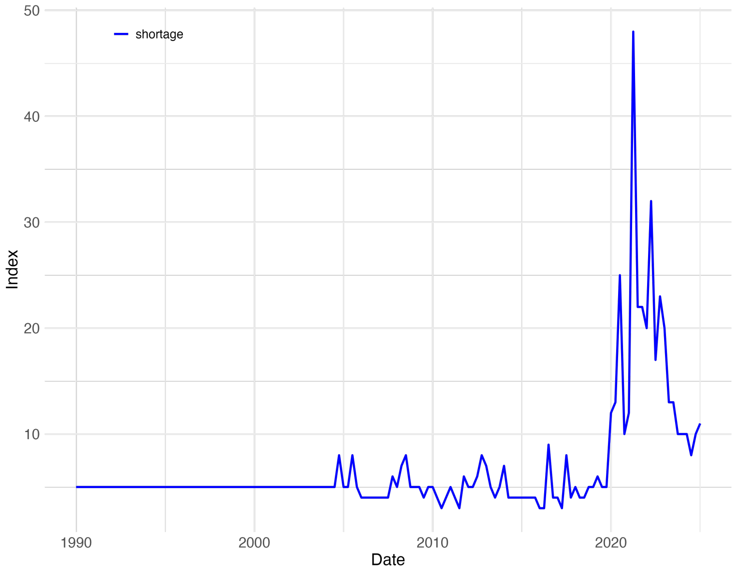


FIGURE 5: Saliency of supply constraints, proxied through Google Trend (source: Google Trend)



an energy shock and the consequent inflation heterogeneity across sectors. Such heterogeneity–in the spirit of Guerrieri et al. (2021)–gives empirical support to the argument against full tightening, as inflation is an adjustment mechanism favoring efficient allocation of resources within an economy. The focus of the paper is though mainly on the supply side, which, as I show in Section 7, is not entirely representative of postpandemic inflation drivers.

Another answer that gained momentum in the public debate goes under the name of *greedflation*, namely inflation being driven by increasing profits. Colonna et al. (2023) show that for Germany and Italy *markups* have been fairly constant or even decreasing in some sectors. Alvarez et al. (2024) show the same trend for the US. This does not invalidate increasing profits in the data, but puts them in perspective as–with constant markups–the increase in profits is mechanical with higher input costs. It shall though be noted that the ability to preserve markups vis-à-vis real wages is not trivial and is a relevant fact. This channel is accounted for in the Bernanke and Blanchard model through the variable *shortages*, as–in the authors' words–*"we are skeptical that* *firms systematically increased markups in non-shortage situations"* (English et al. (2024), p.297), and markup increases should happen only in shortages scenarios, with vertical supplies.

Theories of inflation vary widely. The most simple and emblematic understanding of inflation is summarized in Milton Friedman's words: "*Inflation is always and everywhere a monetary phenomenon*" (1963). This may though not be over-arching–as the papers in the previous paragraphs show–and was indeed challenged by Sargent et al. (1981) from a "fiscal" perspective. Sargent, in 2013, reformulated Friedman's mantra substituting *monetary* with *fiscal*. Sargent's seminal work opened a new strand of literature investigating the relationship between inflation and fiscal policy, featuring different approaches.

Cochrane (2021) shortly summarizes a long-standing effort of theorisation of the so-called Fiscal Theory of the Price Level (FTPL), which–as briefly as it could be said in the author's words–simply states "*the price level adjusts so that the real value of government debt equals the present value of real primary surpluses*"(Cochrane, 2021).[2] More intuitively, this is just another formulation of a No-Ponzi-Game condition, stating that the outstanding stock of public debt should be covered by a flow of expected future primary surpluses. This theorisation, however, encounters some controversies, treated for example by Angeletos et al. (2024). A simpler–yet effective–story, is the "Keynesian" one: with non-Ricardian agents, an increase in public spending stimulates aggregate demand; if this shift in aggregate demand (AD) takes the economy above its natural level, inflation follows. This is the mechanism underlying the textbook IS-LM framework and the Heterogeneous Agents New-Keynesian Model (HANK) literature. This was the mechanism at which Blanchard (2021) looked, and this is the mechanism I look at in Section 7. Angeletos et al. (2024) propose a model with the aim of bridging the gap between FTPL and the Keynesian mechanism within a HANK framework.

This theoretical effort was accompanied by an empirical one, which had mixed findings. Jørgensen and Ravn (2022) provide a thorough survey of the literature highlighting how time-series methods yield mixed findings on the effects of fiscal policy on inflation, as shown in Figure 6. One possible issue related to this literature–as highlighted by Hazell and Hobler (2024)–is that they do not incorporate monetary policy, whose response is crucial in "taking away the punchball" and preventing inflation or–when "late to the party"–letting it rise. My work still does not incorporate monetary policy. This, though, does not undermine the relevance of the "historical" claim I

FIGURE 6: From Jørgensen and Ravn (2022), survey of empirical estimates of inflation responses to fiscal shocks from papers employing a SVAR methodology.

Empirical estimates of inflation response.

Response of prices/inflation	Fiscal policy study
Inflationary	Edelberg et al. (1999), Caldara and Kamps (2008), Ben Zeev and Pappa (2017) and Ferrara et al. (2021).
Disinflationary or insignificant	Fatas and Mihov (2001a), Fatas and Mihov (2001b), Canzoneri et al. (2002), Perotti (2005), Mountford and Uhlig (2009), Nakamura and Steinsson (2014), Dupor and Li (2015), Ricco et al. (2016) and D'Alessandro et al. (2019).
Not reported	Blanchard and Perotti (2002), Burnside et al. (2004), Galí et al. (2007) and Ramey (2011)

Notes: All studies use U.S. data, though Perotti (2005) also considers other OECD countries. Canova and Pappa (2007) report evidence from the US and from Euro Area countries and obtain mixed price responses. See also Table A.1 in Appendix A.

[2] A bit more formally:

$$\frac{B_t}{P_t} = \sum_{i=0}^{\infty} \frac{(T_{t+i} - G_{t+i})}{(1+r)^i}$$

where B is nominal market value of outstanding public debt, P is the price level, T are taxes, G is government spending and r is a discount rate.

make, which highlights how–conditional on realized monetary policy–fiscal policy may be a driver of inflation. A possible extension of this paper would be to include monetary policy.

As the observed surge in inflation came just after the COVID pandemic, which saw the largest fiscal efforts in American history–about 4 trillions in around a year–the debate on the effects fiscal policy has on inflation recently naturally reignited. Sims (2024), in the spirit of FTPL, relates fiscal and inflation history of the United States highlighting qualitatively how fiscal policy may be a driver of inflation.

Barro and Bianchi (2023) test the FTPL mechanism on the postpandemic period for an OECD countries sample. They argue the mechanism was at work, and about half of excess spending was paid for with additional inflation. FTPL has two quite counterintuitive corollaries to the baseline mechanism. Firstly, a smaller debt-to-GDP ratio implies, everything else equal, a larger inflation rate; that is because a smaller stock of debt requires a *larger* inflation rate in order to balance the increase in primary deficits. Furthermore, a longer debt maturity T implies a smaller increase in the inflation rate. The reason lies in the fact that, with a longer maturity, and with the increase in Gand the necessary inflation rate across periods held constant, for longer T, the required increase in each period is smaller, that is, the devaluation is more evenly spread. Since these two mechanisms are empirically relevant, Barro and Bianchi (2023) interpret them as a robustness element in favor of FTPL.

Hazell and Hobler (2024) test the causal relationship between fiscal deficits and inflation exploiting the elections on January 5th, 2021 in Georgia awarding two seats in the Senate. These two seats would determine the possibility for Democrats to pass fiscal stimulus. In the paper, they find that an exogenous variations in the set of information on future deficits–namely the gain of a majority in Senate for Democrats–had a positive and sizeable effect on markets' inflation expectations. This result comes both from an event study, which estimates that the Georgia Shock statistically significantly increased inflation expectations at various time horizons, and from an IV strategy that uses winning probability to instrument likelihood of future fiscal stimulus, yielding an estimate of 0.65 p.p. price level increase over 1 year for a 50 p.p. increase in probability of win by the Democrats. The paper does not define a specific mechanism behind this result, be it Keynesian or FTPL.

Two recent papers find a significant role of fiscal policy in the recent inflation episode, coherent with the one I highlight in this paper. Mori (2025) shows in a VAR that fiscal shocks account for a large part of inflation not only in the postpandemic episode. My estimated fiscal contribution is coherent with its estimated trajectory of inflation under fiscal shocks, as both peak in 2021Q1. The estimates though quantitatively differ because of the different inflation measures we use and because of the different magnitude of fiscal shocks. Additionally, he interprets its findings within a New-Keynesian model à la Angeletos et al. (2024). My findings are instead more in the spirit of the model proposed by Fornaro (2024), where the aggregate supply curve has a shifting kink and fiscal policy takes the economy on the steeper region of the curve, thereby generating inflation.

4. THE BERNAKE–BLANCHARD EMPIRICAL MODEL

The empirical model proposed in Bernanke and Blanchard (2025) consists of four equations, which read as follows.

The wage equation

$$\begin{aligned}\Delta w_t = &\sum_{i=1}^{4} \beta_{1,i} \Delta w_{t-i} + \sum_{i=1}^{4} \beta_{2,i} (v/u)_{t-i} + \sum_{i=1}^{4} \beta_{3,i} \Delta p^E_{t-i} \\ &+ \sum_{i=1}^{4} \beta_{4,i} \left(\Delta^4 p_t - \Delta^4 p^E_{t-4}\right) + \beta_5 gpty_{t-1} + u_{1,t}\end{aligned} \tag{1}$$

where the following restriction is imposed $1-\sum_{i=1}^{4}\beta_{1,i}=\sum_{i=1}^{4}\beta_{3,i}$. This restriction can be thought of as imposing that–in the long run–there is no trade-off between inflation and employment, or that the economy operates at the natural rate of employment.

The price equation

$$\begin{aligned}\Delta p_t = & \sum_{i=1}^{4}\gamma_{1,i}\Delta p_{t-i} + \sum_{i=0}^{4}\gamma_{2,i}\Delta w_{t-i} + \sum_{i=0}^{4}\gamma_{3,i}grpe_{t-i} \\ & + \sum_{i=0}^{4}\gamma_{4,i}grpf_t + \sum_{i=0}^{4}\gamma_{5,i}\text{ shortages }_t + \gamma_6\text{ gpty }_{t-1} + u_{2,t}\end{aligned} \tag{2}$$

where the following restriction is imposed $1-\sum_{i=1}^{4}\gamma_{1,i} = \sum_{i=1}^{4}\gamma_{2,i}$, which as above posits a long-run vertical Phillips curve.

The inflation expectations equations

$$\Delta^4 p_t^E = \sum_{i=1}^{4}\delta_{1,i}\Delta^4 p_{t-i}^E + \sum_{i=0}^{4}\delta_{2,i}\Delta^{40}p_{t-i}^E + \sum_{i=0}^{4}\delta_{3,i}\Delta p_{t-i} + u_{3,t} \tag{3}$$

$$\Delta^{40}p_t^E = \sum_{i=1}^{4}\delta_{5,i}\Delta^{40}p_{t-i} + \sum_{i=0}^{4}\delta_{6,i}\Delta p_{t-i} + u_{4,t} \tag{4}$$

where the following restrictions are imposed $\left(1-\sum_{i=1}^{4}\delta_{1,i}=\sum_{i=0}^{4}\delta_{2,i}+\sum_{i=0}^{4}\delta_{3,i}\right)$; $(1-\sum_{i=1}^{4}\delta_{5,i}=\sum_{i=0}^{4}\delta_{6,i}$. More intuitively, they impose that, in the long run, expected inflation converges to realized inflation.

5. DATA AND METHODOLOGY

5.1. Methodology

The empirical approach taken by the authors is–in their own words–"*a hybrid approach that approximates the results of a structural vector autoregression with added exogenous variables*." Indeed, it would approximate a SVAR-X. The model though has contemporaneous variables. Thus, it can simply be described as a system of equations whose coefficients are estimated via ordinary least squares and then simulated.

5.1.1. *Impulse Response Functions* To derive responses of inflation to exogenous shocks, I run dynamic simulations for the four (then five) equations both in a baseline scenario and adding five different types of shocks:

1. Energy price shock
2. Food price shock
3. Shortages index shock
4. Labor market tightness (V/U) shock
5. Fiscal deficit shock (see Section 7)

The difference between the "shocked" and the baseline simulations yields the IRFs provided below. That is, more formally, I am using–as authors of the paper do–Hamilton (1994) conditional forecast difference formulation of an IRF:

$$\text{IRF}\,(t,h,\boldsymbol{a}_i) = \mathbb{E}(\boldsymbol{y}_{t+h}\mid \boldsymbol{u}_t=\boldsymbol{a}_i) - \mathbb{E}(\boldsymbol{y}_{t+h}\mid \boldsymbol{u}_t=\mathbf{0}) \quad h=0,1,2,\ldots\mathbf{T} \tag{5}$$

where $\mathbf{T}$ is the length of the simulation (21 in my case), and $\boldsymbol{a}_i$ changes with the properties of the shocks.

5.1.2. *Historical Decomposition* The most interesting contributions of Bernanke and Blanchard (2025) and Bernanke and Blanchard (2024) is the historical decomposition of price inflation for the United States and 10 other economies. In this setting, the contribution each variables gives to inflation is derived as the difference between the "baseline" dynamic simulation–which has all the observed values for exogenous variables–with a dynamic simulation, which has one component kept fixed at an arbitrary value. A bit more formally, we have the following:

Note that, with x_j being an exogenous regressor, the system in each period may be written as

$$\boldsymbol{y}_t = \boldsymbol{\beta}_0 + \sum_{k=1}^{k=4} \boldsymbol{\beta}_1 \boldsymbol{y}_{t-k} + \sum_{k=0}^{k=4} \boldsymbol{\beta}_2 x_{1t-k} + \ldots + \sum_{k=0}^{k=4} \boldsymbol{\beta}_j x_{jt-k} + \boldsymbol{u}_t$$

Then, the dynamic contribution χ of the j-th variable to the system in each period is

$$\chi_{j;t+h} = \mathbb{E}(\boldsymbol{y}_{t+h} \mid x_{j;t+h} = x_{j;t+h}) - \mathbb{E}(\boldsymbol{y}_{t+h} \mid x_{j;t+h} = \overline{x}_j) \quad h = 0, 1, 2, \ldots \mathbf{T}$$

where $\mathbf{T}$ is the length of the simulation (21 in my case) and $\overline{x}_j$ is an arbitrary value as in Table 1. Initial conditions are derived in the same way, but with the difference that *all* variables are *simultaneously* set at the arbitrary value. It is worth to note that the contribution of the j-th variable is derived exactly as an impulse response (see 5), that is, through a difference of two conditional simulations. This gives a deeper understanding of the functioning of a historical decomposition: it tracks the contribution in each period of a single shock in driving a variable away from its initial conditions.

Table 1: Arbitrary values for exogenous variables employed in the historical decomposition.

Variable	**Value**
Energy prices (growth)	0
Food prices (growth)	0
Shortages index	Pre-COVID mean
Productivity (growth)	Pre-COVID mean
V/U ratio	Pre-COVID mean
Fiscal surplus (deficit)	Pre-COVID mean

5.2. **Data**

The data I use in this work are the same as those in Bernanke and Blanchard (2025), updated to 2025Q1. In particular,

- Price inflation (Δp) is derived from the Consumer Price Index regarding all items in US cities, taken from FRED.
- Wage inflation (Δw) is derived from the Employment Cost Index (ECI), taken from the Bureau of Labor Statistics (BLS).
- Inflation expectations (Δp^E), at 1 year and at 10 years, are taken from the Cleveland FED.
- The catch-up term is derived as the difference between expected and realized inflation.
- Energy inflation ($grpe$) is derived from an energy CPI, taken from FRED. Notably, the model is estimated using relative prices of energy. I thus normalize this CPI by the ECI.

- Food inflation ($grpf$) is derived from a food CPI, taken from FRED. Even food prices are normalized by ECI.
- The vacancy/unemployment (v/u) ratio is taken from the BLS job openings and labor turnover survey (JOLTS) and the BLS Employment Report. As the series is truncated, it is reconstructed using data from Barnichon (2010). While V/U generally comoves strictly with unemployment during COVID, the two diverged. V/U was chosen as it better captures–for a given number of unemployed people–the increase in workers' bargaining power through increased search efforts and the consequent upward pressure on wages. This was a choice made also in Benigno and Eggertsson (2023) in a non-linear Phillips Curve framework and is generally standard in models with search.
- The state of supply chain ($shortages$) is proxied with Google Trend. In practice, this approach simply consists in using Google estimated saliency of some words on the search engine. In particular, here, the word is "shortages" and is used to proxy the stress of supply chains.
- Trend productivity growth ($gpty$), measured by the change in the eight-quarter moving average of nonfarm business value added divided by nonfarm employee hours, from the BLS.
- Fiscal surpluses ($fiscal$) are normalized to GDP and de-seasoned using a rolling mean adjustment. The source for both the numerator and the denominator is FRED.

6. REPLICATION

To answer the question opening this work, I have developed a R script that fully replicates the results of Bernanke and Blanchard (2025). The advantage of this package is that it works in a single

TABLE 2: Wage equation.

	Wage equation
Constant	−0.27 (0.21)
gw_l1	0.16 (0.10)
gw_l2	0.12 (0.10)
gw_l3	0.17 (0.10)*
gw_l4	0.00 (0.10)
vu_l1	3.75 (1.97)*
vu_l2	−1.84 (3.61)
vu_l3	−3.56 (3.63)
vu_l4	2.33 (2.09)
exp1_l1	0.34 (0.14)**
exp1_l2	−0.03 (0.15)
exp1_l3	0.21 (0.16)
exp1_l4	0.03 (0.16)
catch_up_l1	−0.01 (0.08)
catch_up_l2	0.01 (0.08)
catch_up_l3	−0.00 (0.08)
catch_up_l4	−0.02 (0.07)
gpty_l1	0.03 (0.06)
eq1: R^2	0.56
eq1: Adj. R^2	0.49
Num. obs. (total)	120

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

NOTES. Wage equation. Sample period is 1990Q1:2019Q4. An homogeneity restriction was imposed to ensure that, in the long run, wage Phillips curve is vertical. Standard errors in parentheses.

Table 3: Price equation.

	Price equation
Constant	-0.12 (0.22)
gp_l1	0.06 (0.11)
gp_l2	0.22 (0.10)**
gp_l3	0.27 (0.11)**
gp_l4	-0.11 (0.09)
gw	0.35 (0.10)***
gw_l1	0.17 (0.11)
gw_l2	0.02 (0.11)
gw_l3	0.01 (0.11)
gw_l4	-0.03 (0.06)
grpe	0.09 (0.00)***
grpe_l1	-0.00 (0.01)
grpe_l2	-0.02 (0.01)*
grpe_l3	-0.02 (0.01)**
grpe_l4	0.01 (0.01)
grpf	0.11 (0.04)***
grpf_l1	-0.01 (0.04)
grpf_l2	-0.00 (0.04)
grpf_l3	-0.01 (0.04)
grpf_l4	0.03 (0.04)
gpty_l1	-0.07 (0.06)
shortage	0.10 (0.02)***
shortage_l1	-0.03 (0.02)
shortage_l2	-0.00 (0.02)
shortage_l3	-0.03 (0.02)
shortage_l4	-0.02 (0.02)
eq1: R^2	0.94
eq1: Adj. R^2	0.93
Num. obs. (total)	133

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

Notes. Price equation. Sample period is 1990Q1:2023Q1. Notably, the price equation is estimated on a longer sample than the other equations, permitting to capture the effects of "shortages," which had low variability in the pre-pandemic sample. This justifies the different number of observations. A homogeneity restriction was imposed, ensuring that coefficients on past price inflation and on wage inflation sum to 1. Standard errors in parentheses.

environment and it allows for smoother replication of the results, as well as faster modifications of the model. Moreover, I have also built a version of the model-implied impulse responses with confidence intervals, which I derive through bootstrapping. In this Section, I show the results of these two exercises, along with some other robustness checks. In addition to the tables provided below, in Appendix 1, I provide plots of my replicated coefficients against those of the paper as a robustness check. These plots refer to the same sample used in BB. Notably, coefficients match (almost) perfectly except for some minor differences in the price equation estimates. The tables also permit to verify the validity of the restrictions I imposed in Section 4, by simply adding the coefficients.

With the estimated coefficients in hand, I run dynamic simulations for the four equations both in a baseline scenario and adding four exogenous shocks:

1. Energy price shock

2. Food price shock

Table 4: Short-run inflation expectations

	1y exp equation
exp1_l1	0.30 (0.09)***
exp1_l2	−0.23 (0.10)**
exp1_l3	0.18 (0.10)*
exp1_l4	0.12 (0.07)
exp10	1.20 (0.14)***
exp10_l1	−0.47 (0.23)**
exp10_l2	0.02 (0.23)
exp10_l3	0.14 (0.23)
exp10_l4	−0.38 (0.17)**
gp	0.04 (0.01)***
gp_l1	0.10 (0.01)***
gp_l2	0.00 (0.02)
gp_l3	0.01 (0.02)
gp_l4	−0.02 (0.02)
eq1: R^2	0.90
eq1: Adj. R^2	0.89
Num. obs. (total)	120

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

Notes. Short-run (1y) expectations equation. Sample period is 1990Q1:2019Q4. A homogeneity restriction was imposed to ensure that, in the long run, expected and realized price inflation converge. Standard errors in parentheses.

Table 5: Long-run inflation expectations

	10y exp equation
gp	0.03 (0.01)***
gp_l1	0.01 (0.01)
gp_l2	−0.01 (0.01)
gp_l3	−0.00 (0.01)
gp_l4	−0.00 (0.01)
exp10_l1	0.85 (0.09)***
exp10_l2	−0.05 (0.12)
exp10_l3	0.20 (0.12)
exp10_l4	−0.03 (0.09)
eq1: R^2	0.93
eq1: Adj. R^2	0.92
Num. obs. (total)	120

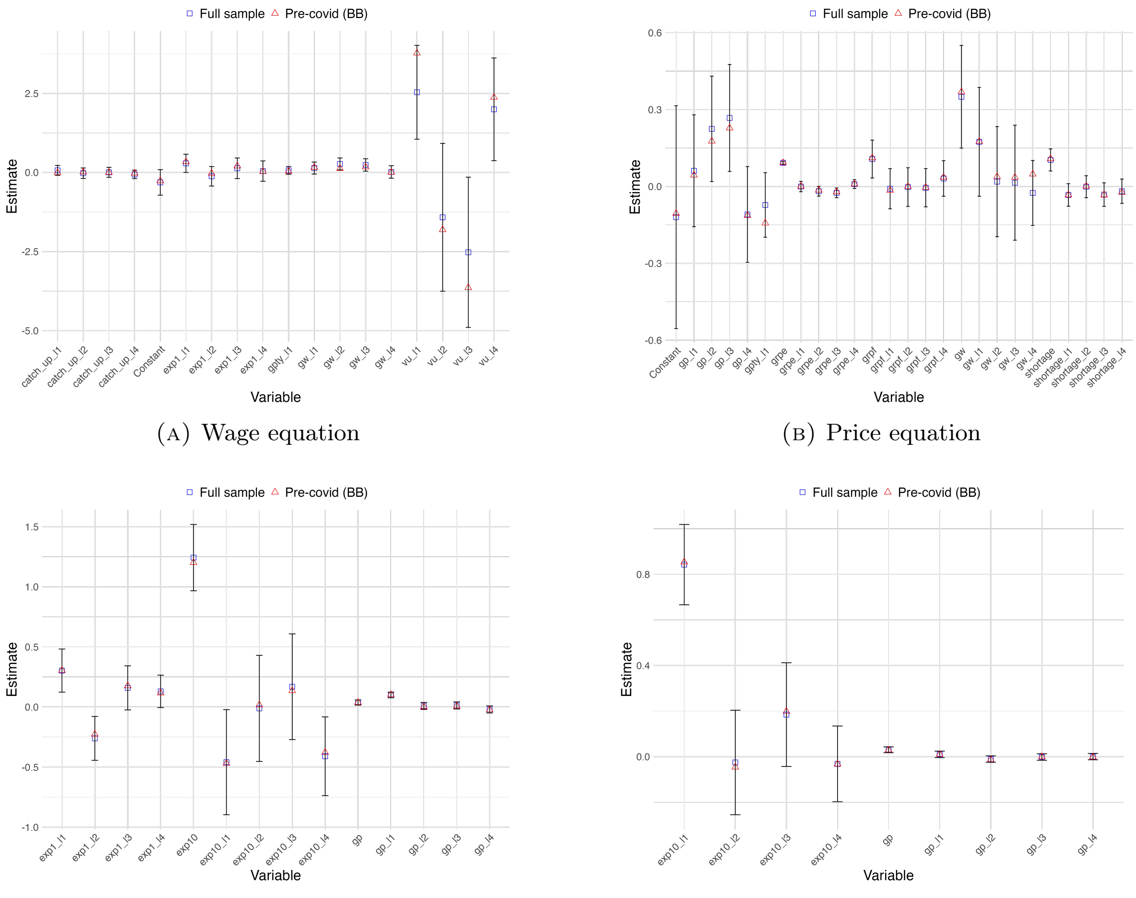
$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

Notes. Long-run (10y) expectations equation. Sample period is 1990Q1:2019Q4. A homogeneity restriction was imposed to ensure that, in the long run, expected and realised price inflation converge. Standard errors in parentheses.

3. Shortage index shock
4. Labor market tightness (V/U) shock

As the paper estimates three of the four equations on a truncated sample (up to 2019:Q4), with only the price equation being estimated on the full sample, I investigate how this choice affected the results estimating parameters on the full sample and plotting the two estimates one against the other. It turns out that this had minor effects, as can be seen in Figure 7. The only effect seems to be a bias toward zero of the labor-market variable in the full sample. Confidence intervals refer to my estimates.

FIGURE 7: Confrontation of estimated coefficients on full (up to 2023:Q1) v. Pre-COVID (up to 2019:Q4) sample.



(A) Wage equation

(B) Price equation

(C) Short-run (1y) expectations equation

(D) Long-run (10y) expectations equation

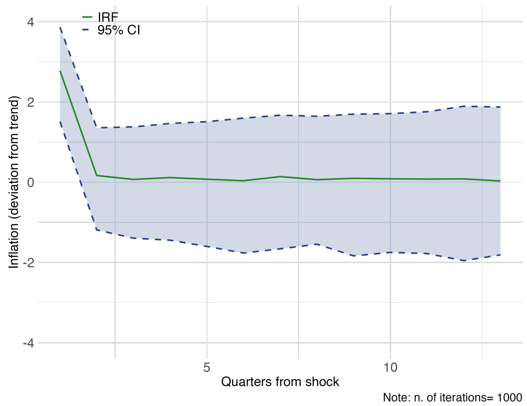
In Figure 8, adding to the results of the paper, I build confidence intervals by bootstrapping. I draw with replacement *rows* of the residual matrix to preserve the row correlation among the four equations, and simulate the equations using resampled residuals. I run n=1000 iterations and select the estimate and the upper and lower bound through quantiles. A convenient feature of bootstrapping is the fact that it allows inference without having to make assumptions on the underlying distributions. Appendix 3 shows the implied residuals distributions for the four equations. As one can see, the response of inflation to the shocks is generally not statistically different from zero. An exception is the first three quarters response induced by a one standard deviation shock to energy prices.

Figure 9 replicates the historical decomposition of price and wage inflation provided in Bernanke and Blanchard (2025) using the methodology described in Section 5.1.2. The replication of these exercises is the basis for extensions of the model, as the one I propose in the next Section.

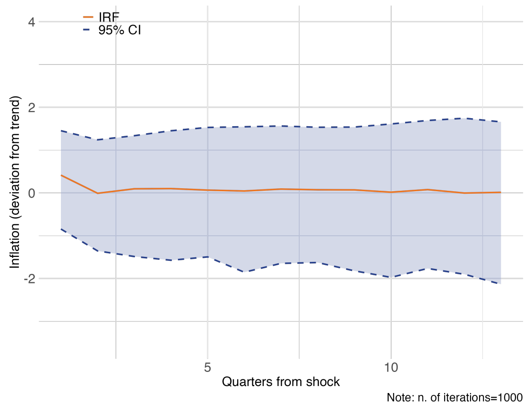
7. AN EXTENSION

In relation with the literature presented in Section 3, I propose an extension of the simple wage-price determination model introduced in Bernanke and Blanchard (2025) that accounts for fiscal policy.

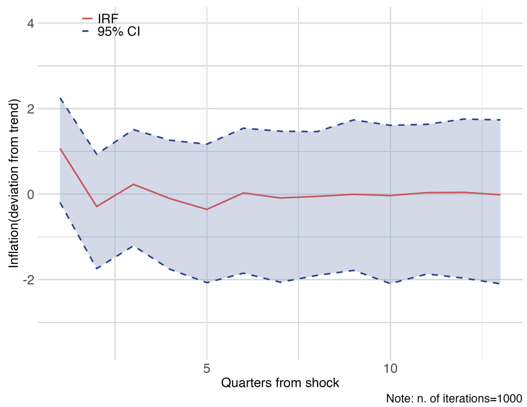
FIGURE 8: Impulse responses of price inflation to four exogenous shocks with confidence intervals. Shaded areas represent 95% confidence intervals derived through bootstrapping.



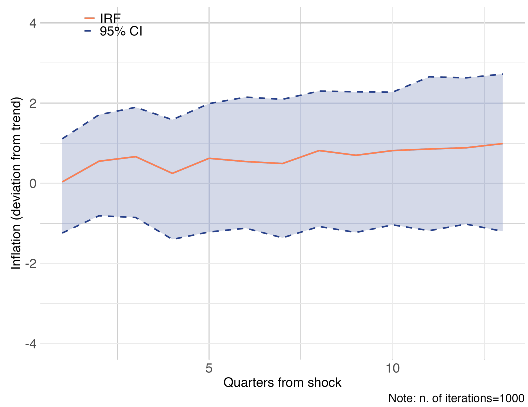
(A) 1 sd temporary energy prices inflation shock



(B) 1 sd temporary food prices inflation shock



(C) 1 sd temporary shortages index shock



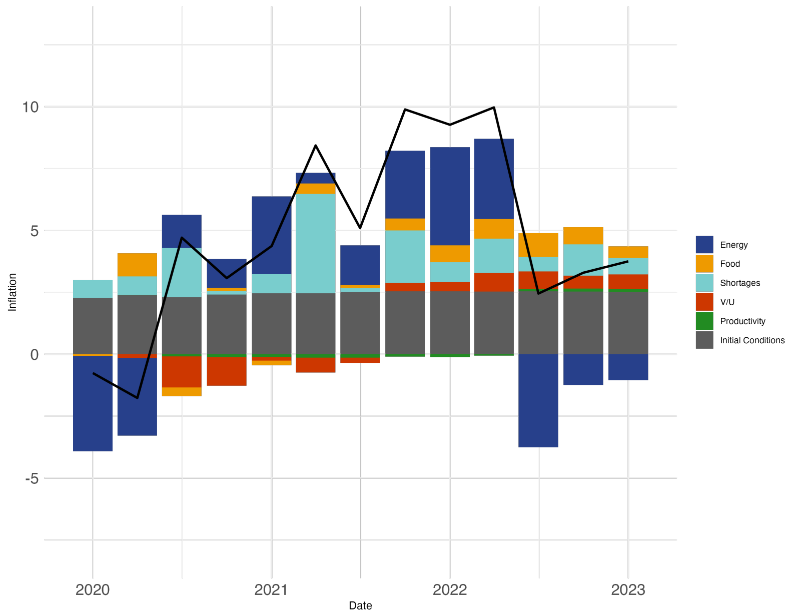
(D) 1 sd permanent V/U shock

Adding one equation to the model outlined in Section 4, I endogenize the variable *shortages* as follows

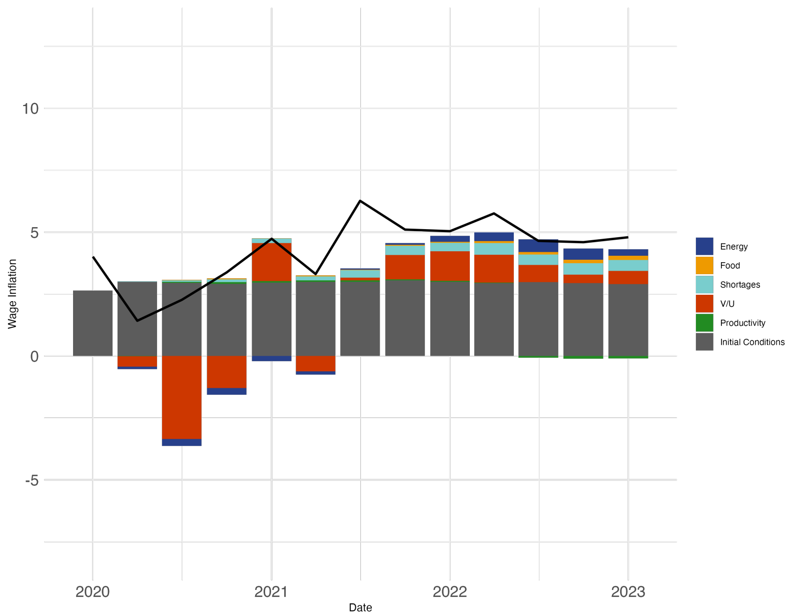
$$shortages_t = \sum_{i=1}^{4} \gamma_{1,i} shortages_{t-i} + \sum_{i=0}^{4} \gamma_{2,i} fiscal_{t-i} + u_{5,t} \tag{6}$$

where $fiscal$ is the de-seasoned fiscals-surplus-to-GDP ratio, constructed from data available on FRED. It is particularly appropriate to use the fiscal surplus rather than government purchases to measure fiscal stance because it captures movements in taxes and transfers, which were particularly relevant in the postpandemic response of fiscal policy, as highlighted by Mori (2025). Figure 11 shows the two series with two different seasonal adjustments. The series I estimate the model with is the rolling mean adjustment. Estimated coefficients for this equation are reported in Table 6. With this new system in hand, it is possible to replicate all the standard exercises provided above. A possible threat to identification here is simultaneity bias; that is, to say both the saliency of supply constraints and fiscal policy are determined by unobservables. I partially address it including lags for fiscal deficits, but this is clearly a limitation to the identification strategy. Figure 12 shows the shortage simulation, while the simulation of the other four equations does not differ much from the standard one provided in Section 6 and is included in Appendix 2, as well as implied

Figure 9: Historical decomposition of price inflation (panel A) and wage inflation (panel B), replication of Bernanke and Blanchard (2025). Each bar represents the fully dynamic–both direct and indirect–contribution of each component to price and wage inflation. The black line represents the actual path of inflation. The difference between the bars and the actual values line represents model residuals.

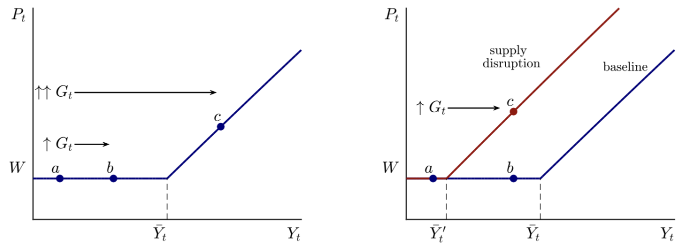


(a) Price inflation



(b) Wage inflation

FIGURE 10: From Fornaro (2024), a framework with fiscal policy and supply constraints.



IRFs (5). Figure 13 shows the historical decomposition of price and wage inflation within the new specification of the system. There is one notable differences with Figure 9 and with the conclusions drawn in Bernanke and Blanchard (2025): the major role played by shortages in the paper is largely displaced by the fiscal variable. While energy prices appear to remain the main driver of the (dis)inflation path in the United States, supply chains seem not to be a driver of inflation *per se*. Rather, it is demand that pushes the economy against its supply constraints. This is the story I tell in this paper. In an economy sensitive to supply constraints, as many globalized ones after the pandemic, it is plausible to think that an impulse to aggregate demand in the form of unprecedented public spending takes the economy in regions where these constraints are binding, ultimately resulting in inflation. The Google Trend variable measures precisely the saliency of such supply constraints. This mechanism is formalized in Fornaro (2024), and its intuition can be grasped from Figure 10. The coincidence of an unprecedented expansionary fiscal stance and major supply disruptions can be easily seen in this framework to pave the way for a surge in inflation. This happens because when firms try to increase production beyond their supply constraints, marginal costs increase and so do prices. Production under binding supply constraints is akin to an increase in markup, where inflation spikes with constant wages.

FIGURE 11: Fiscal surplus/GDP ratio, original and de-seasoned series. (Source: FRED)

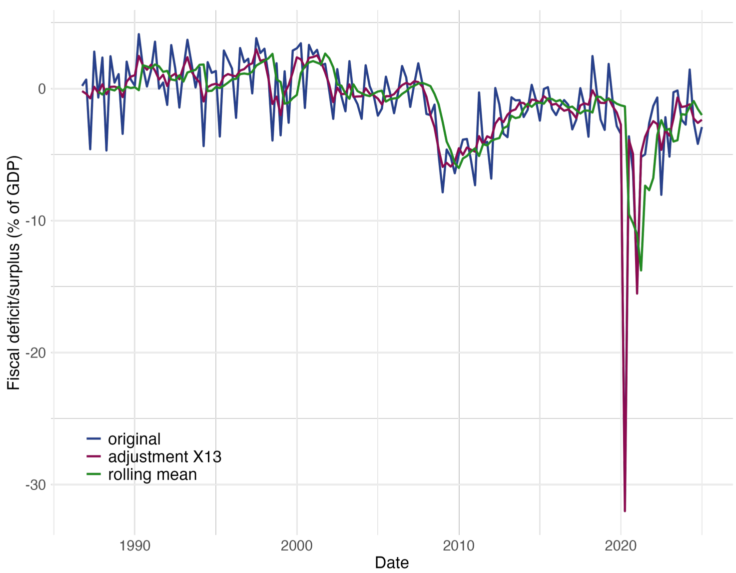
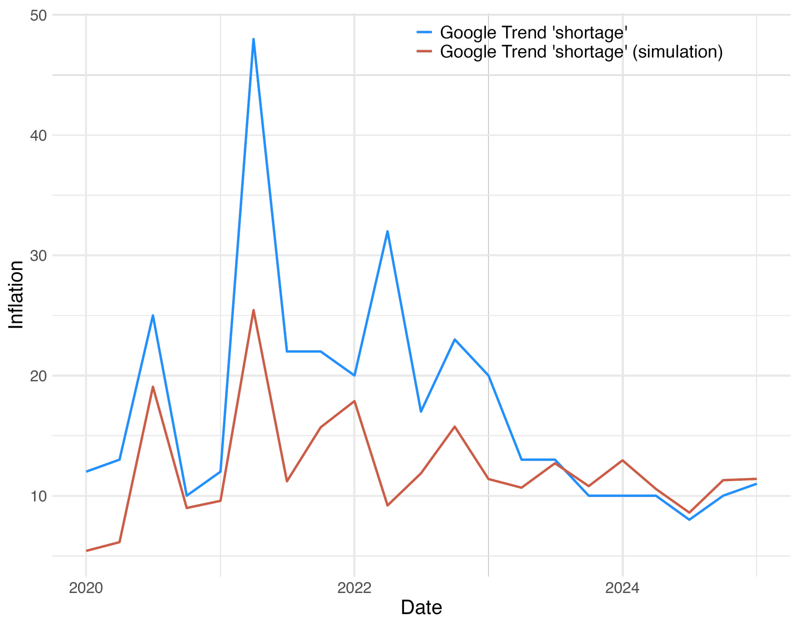


TABLE 6: Shortages equation (see (6)) estimated coefficients. Sample period is 1990Q1:2025Q1. Sample period includes the pandemic as the variation in shortages in the prepandemic period was low. Standard errors in parentheses.

	Shortages equation
Constant	0.65 (0.46)
shortage_l1	0.27 (0.08)***
shortage_l2	−0.03 (0.09)
shortage_l3	0.16 (0.09)*
shortage_l4	0.46 (0.08)***
fiscal	−1.61 (0.27)***
fiscal_l1	1.78 (0.41)***
fiscal_l2	−0.40 (0.43)
fiscal_l3	−1.22 (0.42)***
fiscal_l4	1.08 (0.29)***
eq1: R^2	0.74
eq1: Adj. R^2	0.73
Num. obs. (total)	141

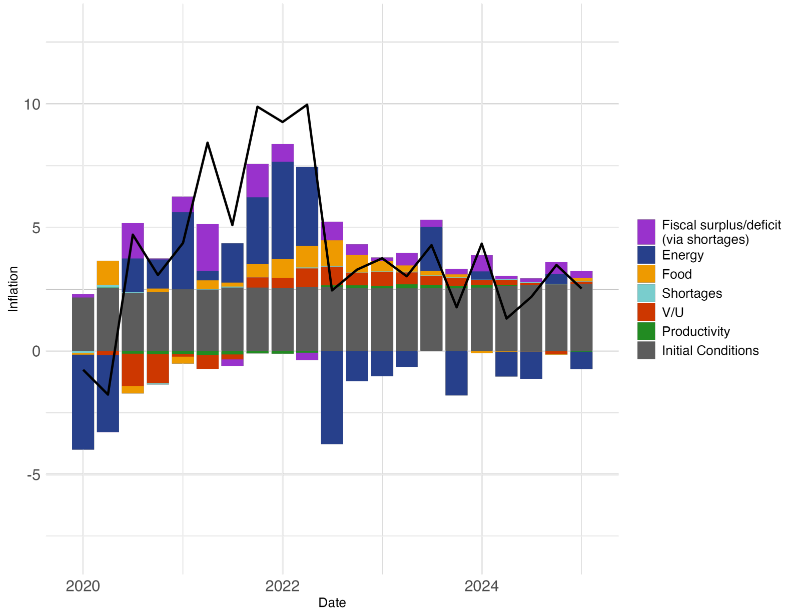
$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

FIGURE 12: Shortages: real v. dynamic simulation (source: Google Trend)

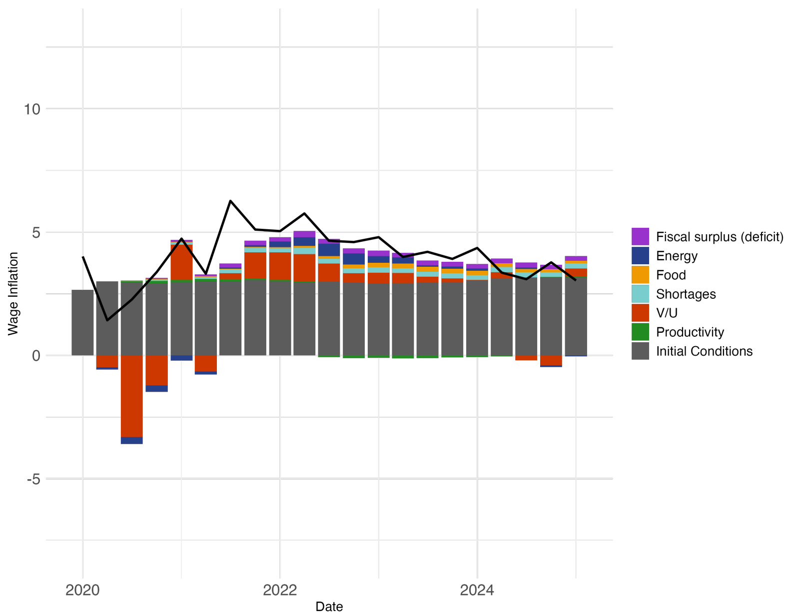


Even though a historical decomposition as that proposed by BB makes the case for supply, there seems to be an underlying *demand* mechanism that did not operate via the traditional labor market channel, whose relevance remains low. Indeed, as shortages become determined endogenously, one is able to estimate a "fiscal component" of shortages. What previously looked as being entirely determined by supply-side factors now can be disentangled. Fiscal shocks are seen to have a positive and significant effect on price inflation on impulse, which soon becomes non-statistically significant (see Figure 20b). Fiscal stance has driven a non-negligible share of inflation in the last five years and its influence is still present in the most recent data. Indeed, it sums in the period

FIGURE 13: Price inflation decomposition (Panel A) and wage inflation decomposition (Panel B). I extend Bernanke and Blanchard (2025) endogeneizing the shortages variable with the inclusion of a fiscal proxy. This permits to estimate a fiscal (via shortages) component of inflation. Each bar represents the fully dynamic–both direct and indirect–contribution of each component to price and wage inflation. The black line represents the actual path of inflation. The difference between the bars and the actual values line represents model residuals. Decomposition goes from 2020Q1 to 2025Q1.

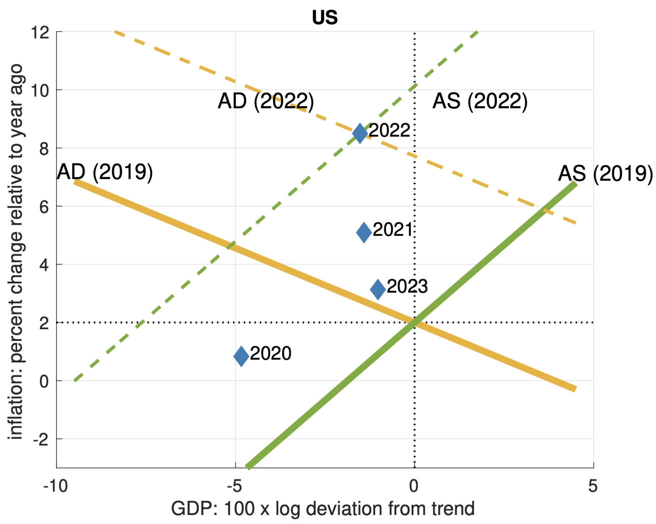


(A) Price inflation



(B) Wage inflation

FIGURE 14: From Giannone and Primiceri (2024): a simple AS-AD framewor.k



2020Q1:2025:Q1 to 2.4%. Notably, inflation expectations were unaltered, and the implied impulse response function of inflation expectations to fiscal shocks is flat (see Appendix 6).

The result I provide fits well in the mosaic of some recent works arguing how postpandemic inflation shall not be thought as mainly driven by supply factors. Above all, this is the thesis of Giannone and Primiceri (2024). In the paper, the authors estimate a bi-variate VAR identifying demand and supply shocks through sign restrictions. They show in a historical decomposition analogous to the one provided above that inflation in the US and the Euro-area was mainly driven by general demand factors. They rationalize this empirical finding in a simple aggregate supply-aggregate demand (AS-AD) framework, as in Figure 14. The pandemic induced an inward shift of both AS and AD. The credibility of the FED, modeled through a relatively flatter AD curve[3], led to initially observe large output effects with small effects on inflation. In this simple context, the only way to rationalize the surge in inflation with low output disturbances observed after 2020 is through either an outward shift of AD or a change in its slope–which the authors argue to be the same thing from a monetary policy perspective, namely a (too) ease monetary policy. More precisely, it was the case that AD bounced back *relatively faster* than AS. As said above, expansionary fiscal policy–what I look at in this work–enters this framework as a force shifting outward AD (but should not generally influence the slope of AD).

This interpretation of inflation is not necessarily in contradiction with the one provided by Bernanke and Blanchard. Rather, superficially, inflation was due to commodity prices and rising supply-chain pressures [4]. However, it is quite a strong assumption to treat these components as fully exogenous, as BB do. Thus, endogenizing these factors, one sees that the *pure* contribution of supply shocks is small, and the effect previously observed was mediating a demand component. This is an exercise done both in Giannone and Primiceri (2024) and in this work. BB indeed acknowledge the role of demand forces (including fiscal policy) in determining supply-side factors, but integrating them in their framework remains an open question that I have picked up in this work. Even if Giannone and Primiceri (2024) focus on energy prices and monetary policy and I

[3]In the extreme case of the most credible central banker possible, one that does not inflation deviate from its target, we would observe output fluctuations without any inflation at all; that is, to say the economy would be moving horizontally on a flat AD curve.

[4]"*in an accounting or reduced-form sense*"(Giannone and Primiceri, 2024)

look at supply chains and fiscal policy and the magnitudes are different, the two results seem to be similar in spirit and pointing to the same AS-AD mechanism.

A similar mechanism is formalized in Lorenzoni and Werning (2023). They propose a New-Keynesian model in which a demand shock (be it preference, monetary, or fiscal) hits an economy that produces employing a supply-constrained non-labor input whose price is endogenous. In this context, a "*supply-constrained demand shock*" would generate a dynamic response of inflation in three phases: firstly, a fast increase in non-core inflation, driven mainly by the supply-constrained input(s), followed by a period of sustained price and wage inflation (where prices outpace wages), with a third period of wage inflation and real wages "catching-up." Despite the fact that it is commonly intuitive to think of demand shocks as working mainly through output effects, labor market overheating, and wage inflation, in an economy sensitive to supply constraints, this may not be the case. Excess demand may make its own way to inflation without passing primarily through the "traditional" labor market channel but through endogenous commodity prices. Although not immediately intuitive, this is still demand-driven inflation. In this spirit, imagine again an AS-AD framework as the one in Figure 14. Lorenzoni and Werning (2023) nicely summarize this particular manifestation of excess demand as follows: "*inflation is in general caused by some form of scarcity on the supply side, relative to existing demand pressures. But there are multiple inputs on the supply side, labor inputs and non-labor inputs. Depending on the episode, scarcity can manifest itself more strongly in labor inputs or in non-labor inputs. When non-labor input scarcity dominates, price inflation will be faster than wage inflation*"(Lorenzoni and Werning, 2023). In this light, the classical intuitive distinction between "supply-driven" and "demand-driven" inflation looks more nuanced, and inflation may stem from the interaction between these two forces at play.

Some more technical notes: Firstly, a notable point is that when simply adding the fiscal variable on the Right-Hand side of Equation 2, the historical decomposition did not look very different from the one provided in Figure 13, with a direct displacement of the shortage component and other components mostly unaltered (see Appendix 7). This drove the choice to discipline demand shocks through shortages, but may be informative of some deeper dynamics. In particular it remains to figure out why the pure role of other commodity prices is robust to the inclusion of the fiscal variable. It would, in fact, be intuitive to think that as long as it is appropriate to endogenize the state of supply chains, so it is for commodity prices. The fiscal component here relates to the price level through a Keynesian mechanism, that is shifting outward aggregate demand. In this framework, credibly testing empirically an FTPL-like mechanism would be less immediate. Secondly, the relevance of the case for endogenizing variables treated as exogenous is a function of the size of the economy being treated. For what concerns commodity prices, treating them as exogenous is a sound approximation for a small open economy, as it hardly affects the determination of prices on global markets. The same does not hold for a large open economy, as the United States, which likely does not operate atomistically in the determination of the prices of, for example, energy. The same line of reasoning may be extended to the state of supply chains: a large economy reasonably influences the state of global supply chains, including through its aggregate demand.

It should be noted that Bernanke and Blanchard (2025) state in their paper: "*The collision of high demand and limited supply in some sectors can account for at least some of the increase in markups observed during the pandemic period. While other factors no doubt influenced markups, including for example the fiscal transfers that directly affected demand in product markets, at least in this simple specification we do not find that including these factors is needed to explain the behavior of pandemic-era inflation.*" While it is true that the inclusion of other regressors does not influence much the simulation of price inflation (see Appendix 3), coefficients vary a lot both in magnitude and significance (confront Appendies 1 and 7), which decomposition-wise is a key fact yielding the direct displacement we observe in Appendix 7.

The evidence I provide and the theory introduced in Fornaro (2024) imply various lessons for fiscal policy. Firstly, the "fiscal Phillips multiplier"–broadly intended as the increase in inflation induced by government spending–is large when supply constraints bind, or in presence of adverse supply shocks. Secondly, government spending concentrated on some sectors implies higher Phillips multipliers, as it is more likely to push the few firms to which it is directed on their supply constraints. Thirdly, government spending is not all the same: expenditures that foster innovation and productivity–e.g., R&D investments–are not as inflationary as transfers, that are funneled directly into consumption. Further empirical evidence is needed to evaluate more thoroughly these hypotheses.

8. CONCLUSIONS

The BB replication package I developed for this work and the extension I proposed will–hopefully–be useful for future research and deeper understanding of the topic. There are various open paths that could be taken to improve my approach: testing FTPL-like mechanisms; verify whether there are other demand components at play to disentangle working through, say, energy prices; taking the model to other countries, e.g., to Italy (extending Pisani and Tagliabracci, 2023), to see whether the recent significant increase in public expenditure translated into inflation; polish the specification so as to be able to estimate a global demand component and not capture only one single channel; integrate the criticisms to the BB approach put forward in Bergholt et al. (2023); and integrate monetary policy in this framework. I hope these will be the starting points of many interesting future works.

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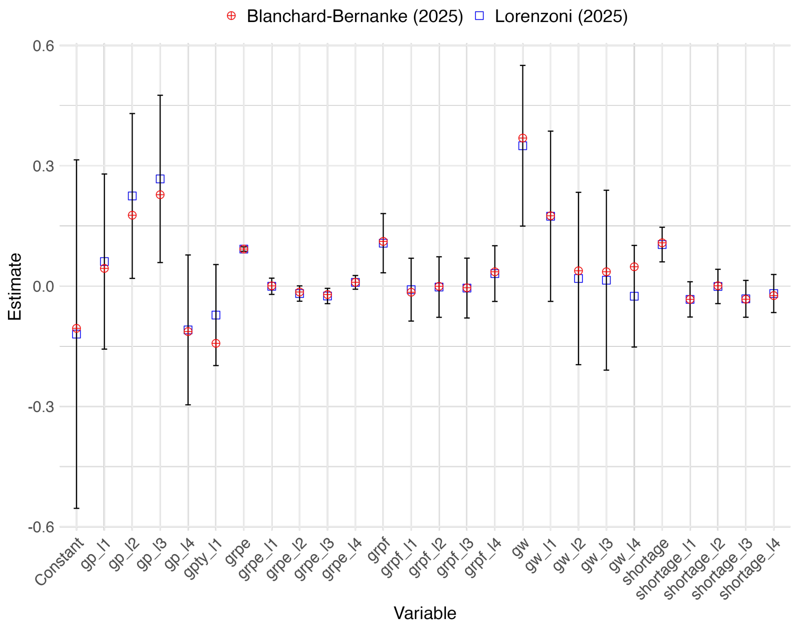
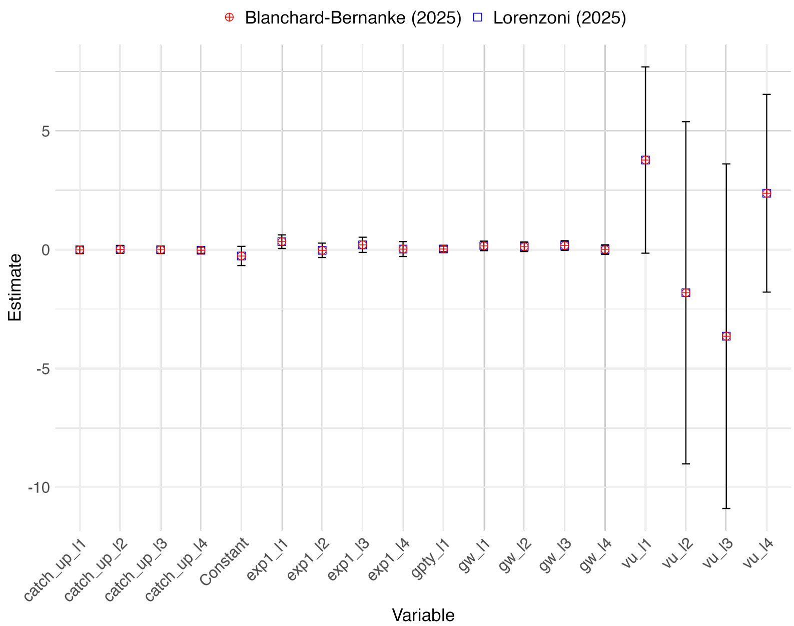
APPENDIX

1.

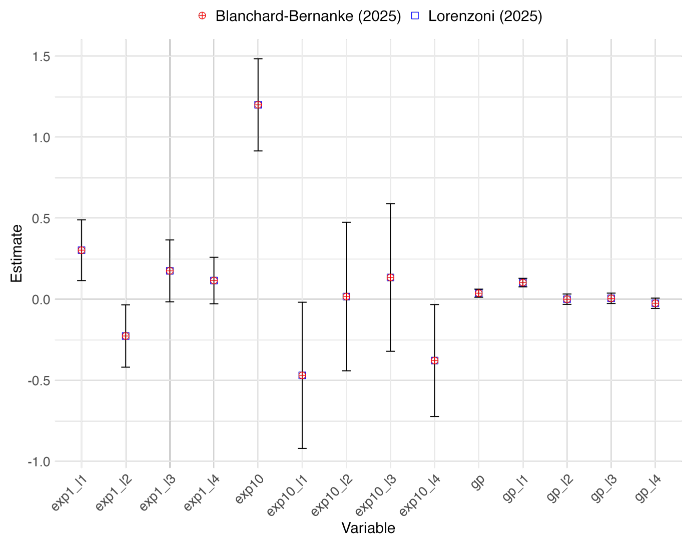


(A) Price equation

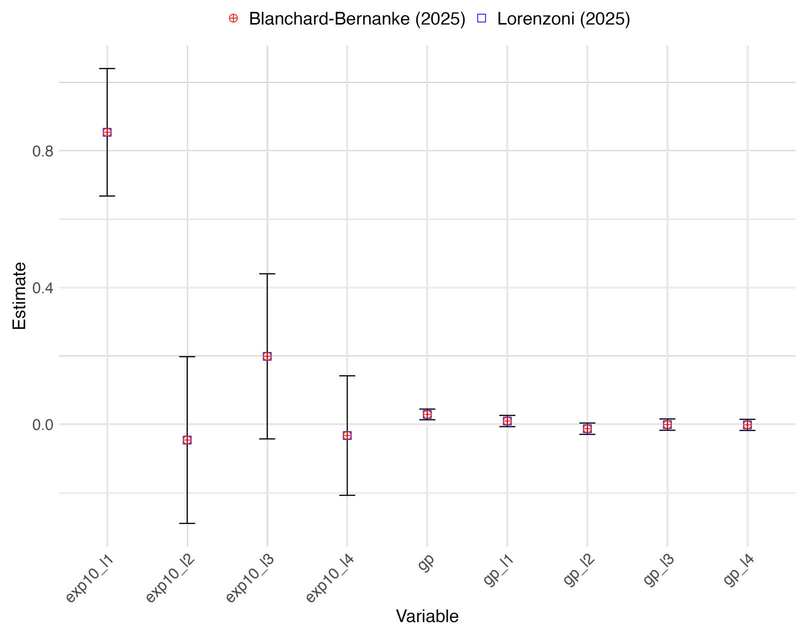


(B) Wage equation

FIGURE 15: Replication coefficients for U.S. (i). Confidence intervals refer to my estimates. Sample period is 1990Q1:2019Q4 for the wage equation and 1990Q1:2023Q1 for the price equation–as in Bernanke and Blanchard (2025).



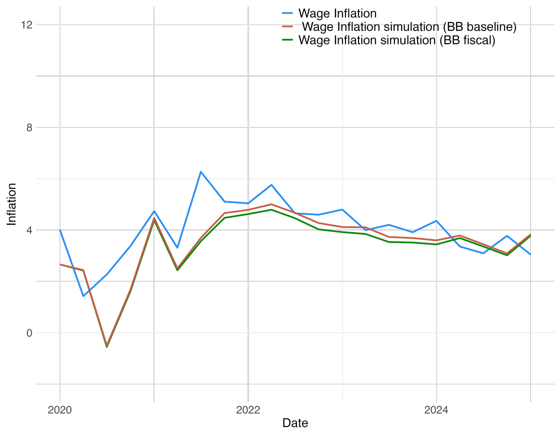
(A) 1y expectation equation



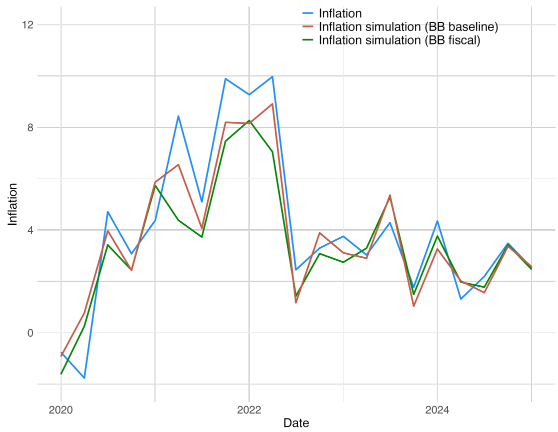
(B) 10y expectation equation

FIGURE 16: Replication coefficients for U.S. (ii). Confidence intervals refer to my estimates. Sample period is 1990Q1:2019Q4.

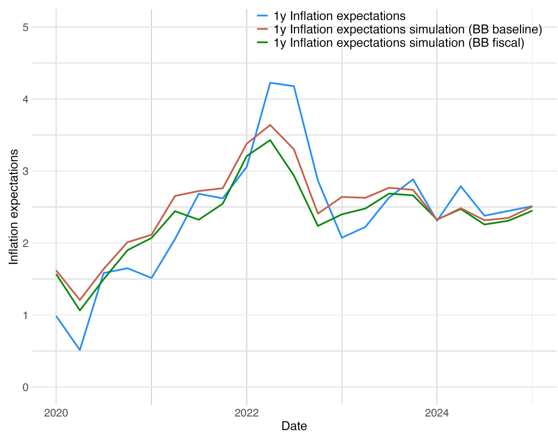
2.



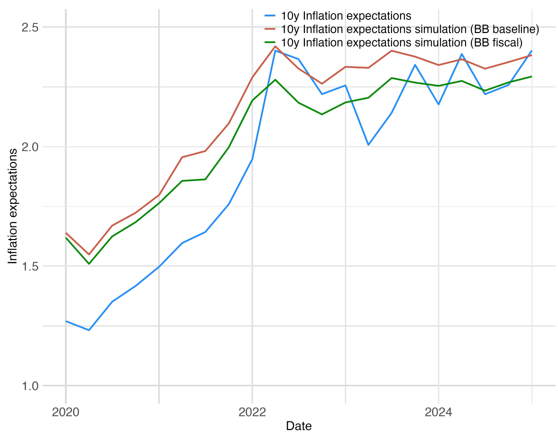
(A) Wage equation



(B) Price equation



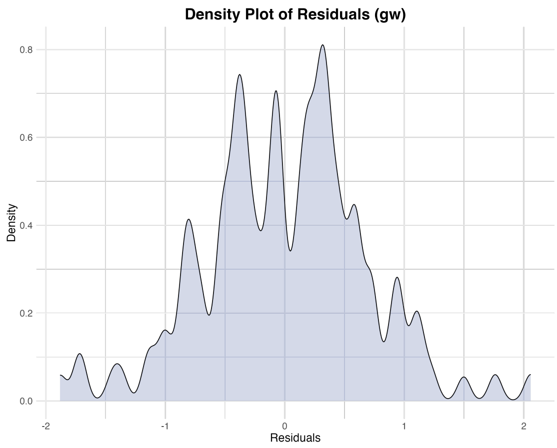
(C) 1y expectations equation



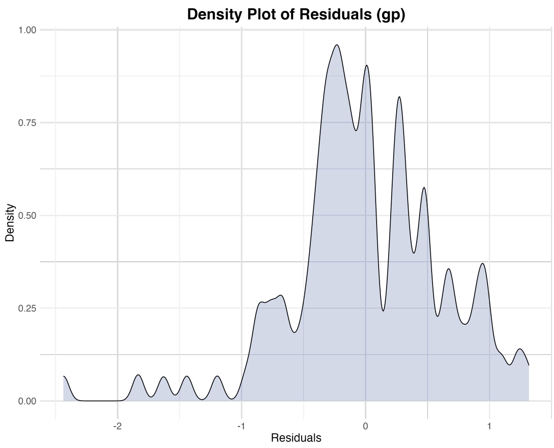
(D) 10y expectations equation

FIGURE 17: Dynamic simulation of the system. Simulations run from 2020Q1:2025Q1. Blue lines refer to actual values, orange lines refer to BB baseline simulation, and green lines refer to simulations of the system extended with a shortages equation.

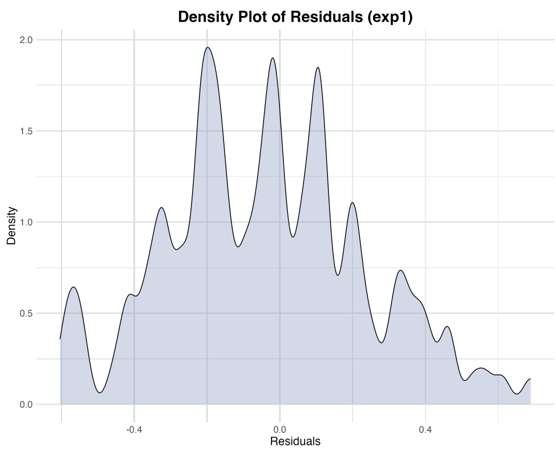
3.



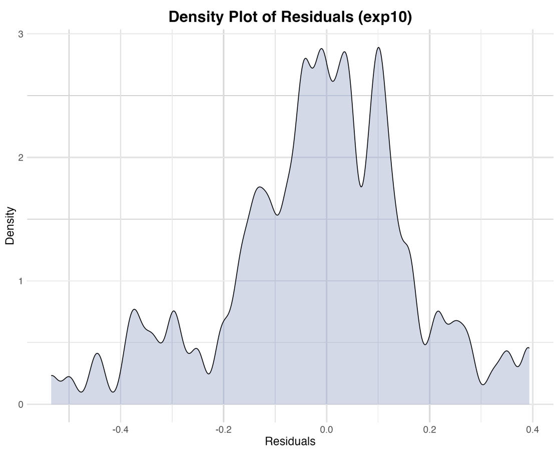
(A) Wage equation



(B) Price equation



(C) 1y expectations equation



(D) 10y expectations equation

Figure 18: Distribution of the residuals of each of the four equations.

4.

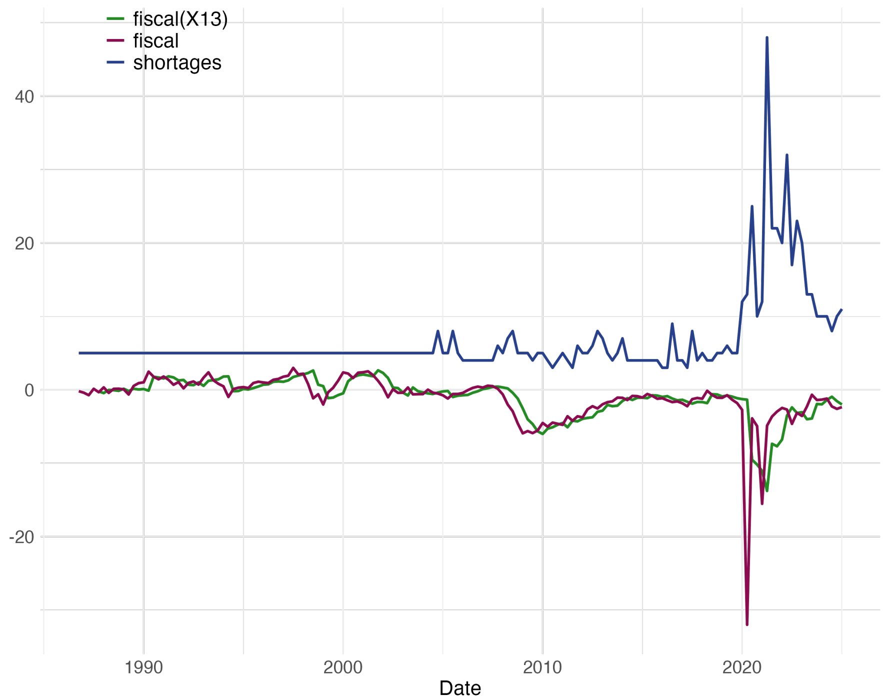
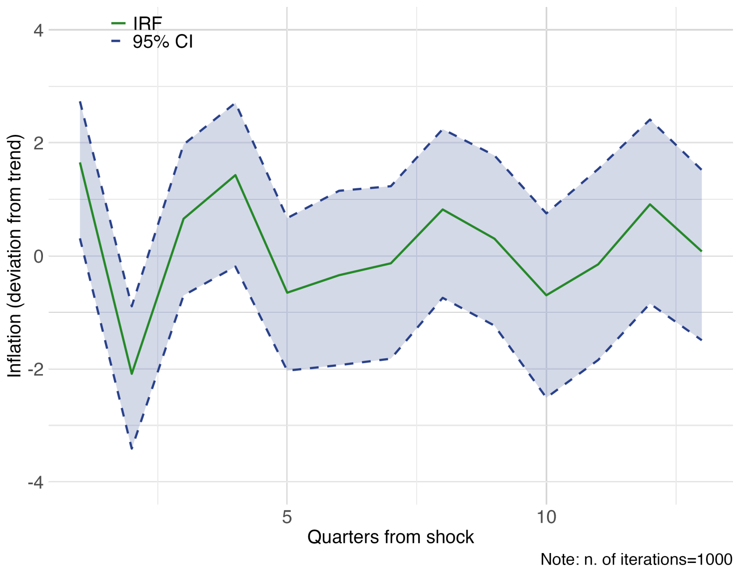
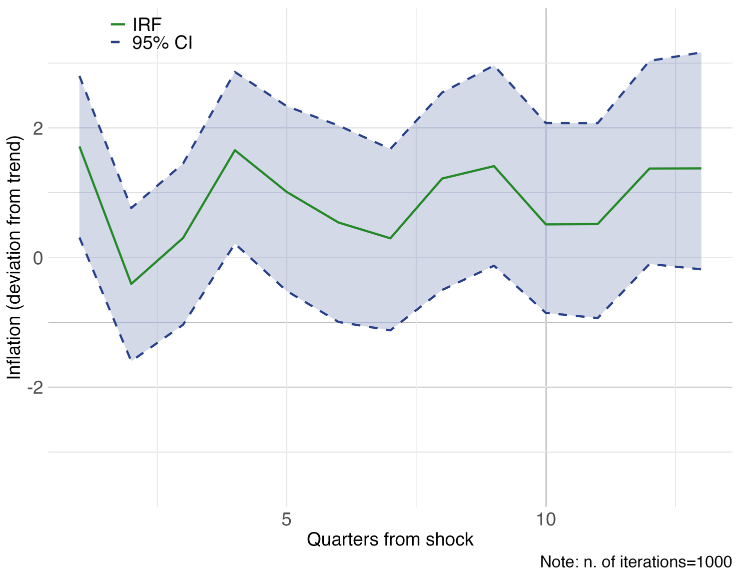


FIGURE 19: Fiscal defict/GDP ratio (Source: FRED) and shortages index (Source: Google Trend). There are two different seasonal adjustments for the fiscal variable. Rolling mean (green) and an adjustment implemented through X13(purple). The model was estimated employing the rolling-mean adjusted series.

5.



(A) 1sd temporary shock

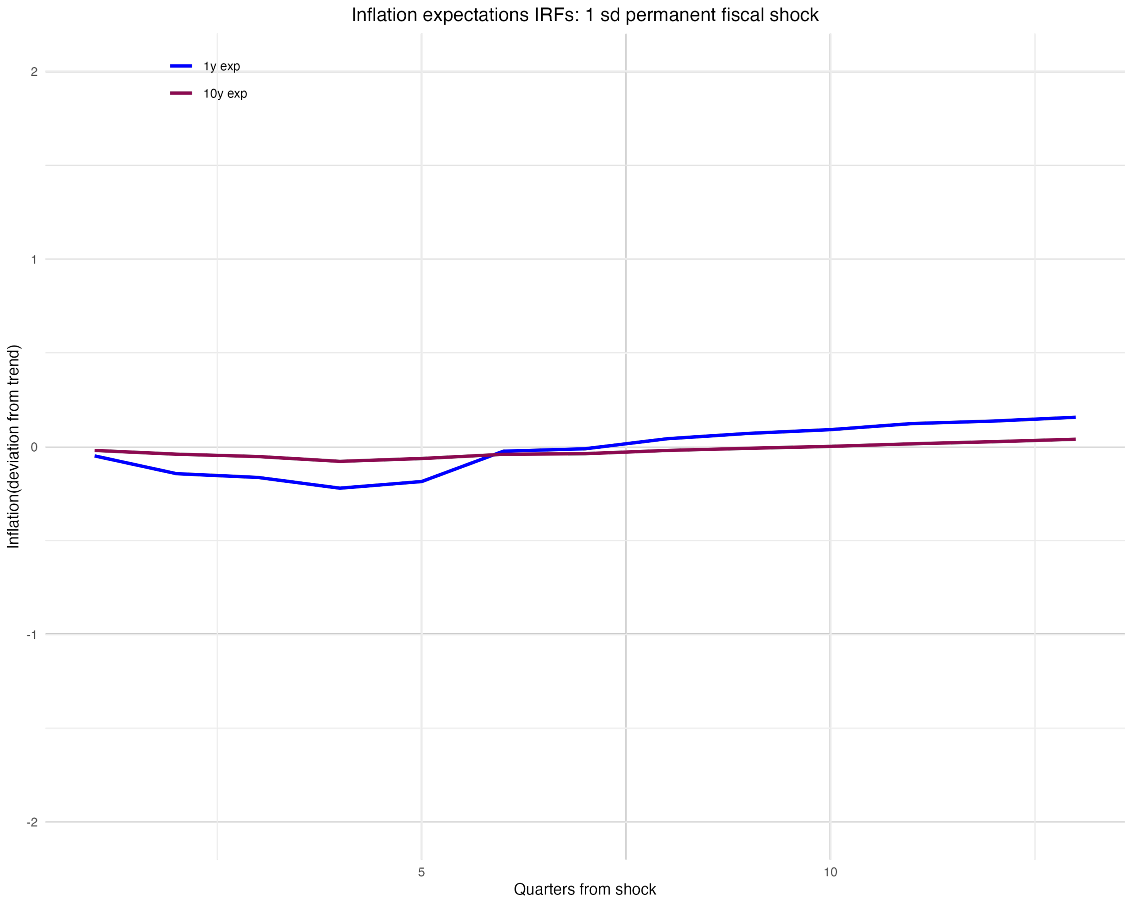


(B) 1sd permanent shock

FIGURE 20: Impulse responses of price inflation to a 1 standard deviation temporary (Panel A) and permanent (Panel B) fiscal deficit shock. Shaded areas represent 95% confidence intervals derived through bootstrapping.

6.

Figure 21: IRF of inflation expectations (long and short term) to a 1sd permanent fiscal deficit shock.



7.

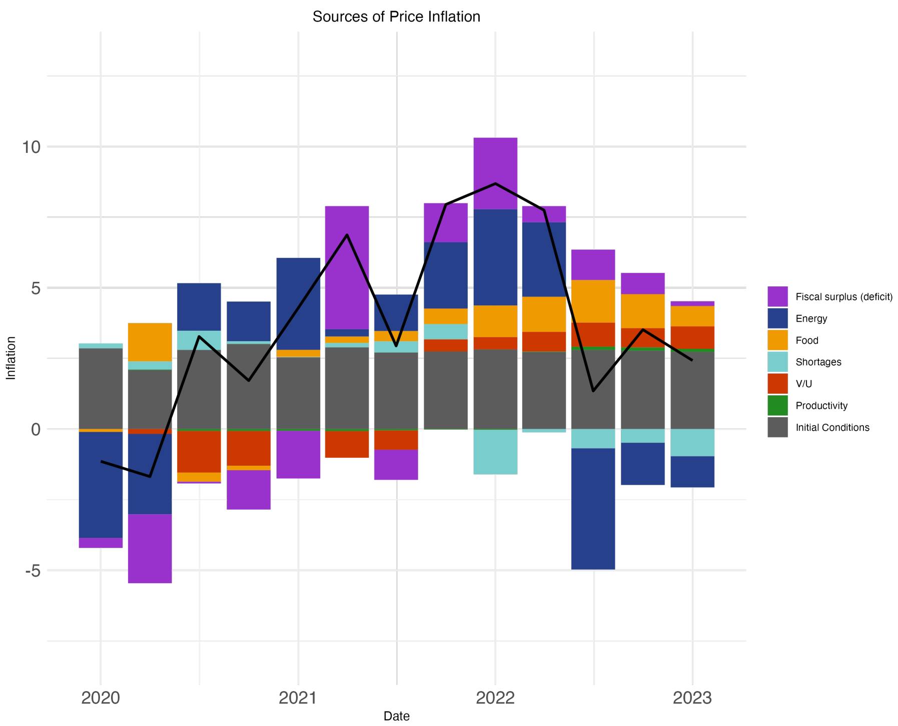


FIGURE 22: Price inflation historical decomposition. Model with "rough" inclusion of the fiscal variable on Right-Hand side of the price equation (as in (7)). Each bar represents the fully dynamic–both direct and indirect–contribution of each component to price and wage inflation. The black line represents the simulated path of inflation.

The price equation was modified as

$$\Delta p_t = \sum_{i=1}^{4} \gamma_{1,i} \Delta p_{t-i} + \sum_{i=0}^{4} \gamma_{2,i} \Delta w_{t-i} + \sum_{i=0}^{4} \gamma_{3,i} grpe_{t-i}$$
$$+ \sum_{i=0}^{4} \gamma_{4,i} grpf_t + \sum_{i=0}^{4} \gamma_{5,i} \text{ shortage }_t + \gamma_6 \text{ gpty }_{t-1} + \sum_{i=0}^{4} \gamma_{7,i} \text{ fiscal }_t + u_t \tag{7}$$

	Price equation
Constant	−0.15 (0.21)
gp_l1	0.05 (0.10)
gp_l2	0.20 (0.10)**
gp_l3	0.32 (0.10)***
gp_l4	−0.12 (0.09)
gw	0.37 (0.10)***
gw_l1	0.19 (0.10)*
gw_l2	0.01 (0.11)
gw_l3	−0.01 (0.11)
gw_l4	−0.02 (0.06)
grpe	0.09 (0.00)***
grpe_l1	0.00 (0.01)
grpe_l2	−0.02 (0.01)*
grpe_l3	−0.03 (0.01)***
grpe_l4	0.01 (0.01)
grpf	0.11 (0.04)***
grpf_l1	0.00 (0.04)
grpf_l2	0.00 (0.04)
grpf_l3	−0.02 (0.04)
grpf_l4	0.02 (0.03)
gpty_l1	−0.07 (0.06)
shortage	0.11 (0.02)***
shortage_l1	−0.04 (0.02)*
shortage_l2	−0.00 (0.02)
shortage_l3	−0.04 (0.02)**
shortage_l4	−0.00 (0.02)
eq1: R^2	0.94
eq1: Adj. R^2	0.93
Num. obs. (total)	141

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

Table 7: Price equation with "rough" inclusion of the fiscal variable on the Right-Hand side. Sample period is 1990Q1:2023Q1. A homogeneity restriction was imposed in order to ensure that past price inflation and wage inflation sum to one. Standard errors in parentheses.