Do Deficits Cause Inflation?
A High Frequency Narrative Approach*

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Abstract

This paper measures the causal effect of deficits on inflation using a "high frequency narrative approach". We identify an event that released news about the 2021 deficits in the United States—the Georgia Senate election runoff. We calculate the size of the shock using new narrative data from investment banks. We then study the high frequency response of inflation forecasts from asset prices, in order to separate deficits from other factors affecting inflation. We estimate an "inflation multiplier" of 0.18% price level growth over two years, for a 1% deficit-to-GDP shock. Our estimate implies that the 2021 deficits caused around 30% of the 2021-22 inflation—meaning deficits were important but not the only cause. A standard heterogeneous agent New Keynesian model quantitatively matches the size and dynamics inflation multiplier.

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1 Introduction

One classic question in macroeconomics is whether fiscal deficits raise inflation. The question has become even more important in recent years. Around the world, governments ran large budget deficits. Inflation followed. For instance, in December 2020 and March 2021, the United States carried out deficit financed stimulus worth 13% of GDP. Inflation rose soon afterwards.

There is a debate about how much deficits contributed to the post-Pandemic inflation. Some research finds that deficits was a primary cause (e.g. Barro & Bianchi 2023). Others argue that factors such as supply constraints and commodity prices were more important (e.g. Bernanke & Blanchard 2023). These other factors act as omitted variables, making the effect of deficits on inflation hard to measure. More generally, it is hard to estimate the causal effect of a single, episode-specific shock. Several shocks typically hit the economy during a given episode, and isolating one shock is difficult.

Certain episodes are a crucible for macroeconomic models. The Great Depression and the 1960s-80s inflation both led economists to question the prevailing model (Keynes 1936, Friedman 1968). The post-Pandemic inflation may prove just as influential. The setting—a large, deficit financed transfer—is a powerful test of state-of-the-art macroeconomic models, which often study precisely this shock. As a result, the post-Pandemic inflation has already motivated new theoretical work (e.g. Kaplan et al. 2023, Angeletos et al. 2024). Clearly, methods to estimate the cause of important episodes like the post-Pandemic inflation are valuable.

This paper measures the causal effect of the 2021 deficits on inflation, using a "high frequency narrative approach" designed to study individual episodes. As in the narrative method of Friedman & Schwartz (1963), we identify an event that released news about the 2021 deficits—the Georgia Senate election runoff of January 2021. We measure the shock to expected deficits from this event using new narrative data. We then study the high frequency response of inflation forecasts from asset prices, similar to Gertler & Karadi (2015) and others. High frequency variation separates news about deficits from other factors affecting inflation. We estimate an "inflation multiplier"—the price level response to a 1% deficit-to-GDP shock—of 0.18% over two years. This multiplier suggests the 2021 deficits caused around 30% of 2021-22 inflation. As such, deficits were important for the post-Pandemic inflation, though not the only cause.

The first, *narrative* step of our approach is to identify an event that released news about deficits, and then calculate the size of the associated shock. Our event is the Georgia Senate election runoffs of early 2021. In November 2020, Democrats won the presidency and held 48 seats in the Senate. Both Georgia Senate seats were to be decided by runoff elections on January

5th, 2021. The main implication of the runoff was for fiscal policy. If Democrats won both seats they would have a majority in the Senate for fiscal stimulus. Under Senate procedure, only fiscal legislation can be passed with a simple majority. Non-fiscal legislation requires a supermajority of 60 votes, unattainable regardless of the runoffs. By January 7th, Democrats won both seats. Afterwards, in March 2021 Democrats passed $1.9 trillion of deficit financed fiscal stimulus (8.8% of GDP). This stimulus added to the $900 billion (4.2% of GDP) passed in December 2020, for a total of 13% of GDP in stimulus during late 2020 and early 2021. Shortly after, inflation started to rise.[1]

We then measure the size of news about deficits due to the Democrat victory. The challenge is determining how much deficit spending was expected on the eve of the election—not only if Democrats, but also Republicans, were to win. We introduce a new dataset: hand collected reports from 20 investment banks and other macroeconomic research groups. Investment banks distribute time stamped reports widely, around market moving events, with quantitative information about various scenarios.

Using the reports, we size the deficit news from the Georgia runoff. The median investment bank expected Democrats to win both seats with 50% probability, and to spend $900 billion of stimulus if they won. If Republicans had won at least one seat, banks expected no stimulus. Therefore the Democrat victory was a shock to expected deficits of $450 billion, or 2.1% of GDP. Banks expected that the stimulus would be deficit financed in the short run. 70% of stimulus was expected to be transfers, such as "stimulus checks"; with the remainder government spending. According to the reports, the main consequence of a Democrat victory was fiscal stimulus.

The second, *high frequency* step of our approach involves inflation forecasts from swaps (Cieslak & Pflueger 2023). We use two identification strategies. Our first is a single event study examining inflation swaps in a window around the runoff. This strategy is unaffected by omitted variables that affected inflation in 2021 and 2022. For instance, oil price shocks will not confound our estimate, unless news about these shocks occurred in the window.

We estimate that the Democrat victory led to an increase in expected prices of 0.38% (standard error of 0.05%) over 2 years. The shock is expected to have a persistent effect, culminating in an increase in expected prices of 0.77% (standard error of 0.18%) over 10 years. The shock seems to have increased demand, since dividend futures suggest strong expected real GDP growth (Gormsen & Koijen 2020), and investment banks significantly revise their growth forecasts upward because of the Democrat victory. The identification concern is that other in-

[1]Previously, Mian et al. (2024) used this event to study the response of convenience yields on government debt to deficits. We focus on the effect of deficits on inflation.

flationary shocks happened during the window around the runoff. The main candidate is the January 6th Capitol Hill riots. However, some evidence suggests the riots do not confound our estimates. First, our estimates are similar in a window that excludes the riots. Second, narrative evidence agrees that the riots were not a major determinant of asset prices. Third, strong expected growth in real outcomes seems inconsistent with a major effect from the riots. Fourth, credit default swaps—a proxy for US political risk—were stable.

The drawback of the event study is that it relies on a single, high-powered observation. Our second identification strategy uses instrumental variables. Our motivation is that between the November presidential election and the January runoff, there were large changes in the chance of Democrats winning, and markets paid attention. Therefore we use the daily probability of Democrat victory, measured from betting markets, as an instrument for news about deficits. The second strategy leads to similar estimates to the first, albeit 40% larger.

Our high frequency approach assumes that inflation expectations from swaps are an unbiased forecast of true inflation, as in past work (e.g. Nakamura & Steinsson 2018). In practice, expectations comove with but slightly under-react actual inflation over this period, as expectations tend to in historical data (Coibion & Gorodnichenko 2015). As such, the high frequency response of swaps is a conservative estimate of the change in actual inflation.

To complete the approach, we combine narrative and high frequency information to calculate the causal effect of the 2021 deficits on inflation. We summarize our estimates with an "inflation multiplier", which divides the high frequency response by the narrative measure of the shock. The inflation multiplier is a price level increase of 0.18% over 2 years (0.37% over 10 years), after a 1% deficit-to-GDP shock. The effect of the stimulus is the product of the inflation multiplier and the 13% of GDP from the 2021 deficits. The result is an increase in prices of 2.3% over 2021-22, which is around 30% of the total 2021-22 headline inflation. We conclude that the 2021 deficits were important for the post-Pandemic Inflation, but not the only cause. Our calculation does not include the effect of the April 2020 CARES Act, which was $2.2 trillion (10% of GDP). If the same inflation multiplier applies, the CARES Act raised prices by another 1.8% over 2 years. Our finding aligns with papers like Barro & Bianchi (2023) finding deficits were important, but suggests that other inflationary shocks such as oil prices probably mattered too (Gagliardone & Gertler 2023).

In the past, influential episodes led macroeconomists to re-evaluate their models. We ask how the state of the art model addressing deficits and inflation, the Heterogeneous Agent New Keynesian (HANK) model, fares after the Pandemic. Specifically, we ask whether the standard HANK model can quantitatively match the inflation multiplier at various horizons. It is well known that in HANK models, stimulus raises inflation—qualitatively matching our findings. What is less clear is whether the model can *quantitatively* match the size and dynamics of the inflation response.

We consider a simple and standard HANK model similar to Wolf (2021) and Angeletos et al. (2023). We calibrate the model to pre-2020 statistics, including a flat but upward sloping Phillips Curve (Hazell et al. 2022), and "intertemporal marginal propensities to consume" from data (Fagereng et al. 2021; Auclert, Rognlie & Straub 2023). In the model, the response of the central bank to fiscal shocks matters. Therefore we estimate the response of interest rates to the Georgia shock. We find that short term nominal interest rates did not change, suggesting loose monetary policy in response to the fiscal shock.

We show that the standard model can match the size and dynamics of the inflation multiplier. We feed the shock to deficits from the Georgia runoff into the model, including the share of stimulus due to government spending versus transfers; and the change in interest rates after the shock. We pin down the path of debt repayment with information from the Congressional Budget Office and changes in long term interest rates. The model quantitatively matches both the size and the persistence of inflation dynamics, even though these dynamics are not directly targeted. The dynamics of output in the model are "plausible" in the sense of Orchard et al. (2023)—being broadly consistent with how the Georgia shock affects real GDP inferred from dividend futures, how banks increased their GDP forecasts due to the Georgia shock, and contemporaneous estimates of the multiplier associated with the 2021 deficits. One part of the mechanism is loose monetary policy.[2]

According to narrative reports, a secondary consequence of the Democrat victory—alongside the primary impact of the stimulus—was a delayed and deficit-neutral infrastructure bill. We consider an extension of the model with infrastructure. Consistent with past work, the effect of infrastructure spending is small relative to the stimulus (Boehm 2020, Ramey 2021), and hardly affects our calculations about the inflation multiplier.

Our results have two lessons for macroeconomic models. First, in HANK models deficits can generate significant inflation in empirically relevant cases—supporting recent work advancing this view (Angeletos et al. 2024).[3] Second, a flat but upward sloping Phillips Curve is consistent with the post-Pandemic inflation, as some time series evidence suggests (Beaudry et al. 2024).[4]

[2] Other work also finds that monetary policy was relatively loose around this time and accommodated the fiscal shock (e.g. Gagliardone & Gertler 2023, Bianchi et al. 2023, Cieslak et al. 2024).

[3] We also show that a simple version of the fiscal theory of the price level, adapted from Cochrane (2023) or Bianchi et al. (2023), can fit the inflation response.

[4] See Ball et al. (2022) , Cerrato & Gitti (2022), Benigno & Eggertsson (2023) or Gitti (2024) for the opposite view that the Phillips Curve became steeper after the Pandemic.

One important caveat is that the standard model can no longer explain the inflation multiplier when calibrated to lower and more transitory intertemporal marginal propensities to consume (e.g. Orchard et al. 2023; Boehm et al. 2023). In this case, in order to rationalize the inflation multiplier with the model, one would need additional mechanisms such as a non-linear Phillips Curve (Boehm & Pandalai-Nayar 2022).

Related literature. A defining challenge in empirical macroeconomics is how to estimate the causal effect of aggregate shocks. One method is the narrative approach: searching the historical record for moments when an important shock happened, and studying the response of the economy (e.g. Friedman & Schwartz 1963, Romer & Romer 1989, Ramey & Shapiro 1998, Velde 2009, Romer & Romer 2010, Ramey 2011, Mertens & Ravn 2013, Coglianese et al. 2023, Drechsel 2024). A second method is the high frequency approach: studying movements in asset prices around a series of events such as monetary policy announcements or macroeconomic data releases (Gürkaynak et al. 2004, Krishnamurthy & Vissing-Jorgensen 2011, Gertler & Karadi 2015, Nakamura & Steinsson 2018, Boehm & Kroner 2021, 2023, Känzig 2021, 2023, Swanson & Jayawickrema 2023). Both the high frequency and the narrative approach have limitations for understanding single, episode specific shocks. The narrative approach typically studies the economy at a monthly or quarterly frequency. At this lower frequency, other confounding shocks may matter. The high frequency approach typically studies a time series of shocks, spanning a range of episodes. However the behavior of the economy during a single episode is often of particular interest. Combining high frequency and narrative information, as in this paper, is a way to estimate the causal effect of single, episode specific shocks. We apply the approach to the 2021 deficits, but one can apply the same method to other important episodes and shocks.

There is previous academic work that also combines high frequency and narrative identification, such as Velde (2009), Bahaj (2020) and Gomez Cram et al. (2023). One distinguishing feature of our approach is to measure the size of the shock associated with the event, using new narrative data from investment banks. Combining the narrative measure of the shock and the high frequency response, one can calculate moments such as the inflation multiplier, which are useful targets for quantitative models.

There are many papers on the causes of the post-Pandemic inflation. Some argue that deficits were important (e.g. Reis 2022, Cochrane 2022, Bianchi et al. 2023, Barro & Bianchi 2023, di Giovanni et al. 2023, Giannone & Primiceri 2024). Other papers emphasize different causes of inflation, and occasionally suggest that deficits were not important (e.g. Faberman et al. 2022, Bernanke & Blanchard 2023, Gagliardone & Gertler 2023, Guerrieri et al. 2023, Ferrante et al. 2023, Bagga et al. 2023, Crump et al. 2024). But disentangling the effect of deficits from the other shocks is challenging with monthly or quarterly data. We believe that higher frequency information combined with narrative methods can advance the debate. Our main result is that deficits were important for inflation but not its sole cause.

Finally, there is a large literature studying how fiscal shocks affect inflation, using lower frequency time series data (e.g. Jørgensen & Ravn 2022, Cloyne et al. 2023). More closely related to our method, Gomez Cram et al. (2023) ask how inflation forecasts respond at high frequency to a series of announcements about deficits from the Congressional Budget Office. We believe that the response of inflation to deficits after the Pandemic is of special interest, and develop an estimate for this episode.

Paper outline. Section 2 introduces the data. Section 3 identifies an event that released news about deficits, the Georgia Senate runoff, and measures the size of the shock with new narrative data. Section 4 studies the high frequency response of asset prices. Section 5 combines narrative and high frequency information into a well identified inflation multiplier. Section 6 shows that a standard HANK model can quantitatively match the inflation multiplier.

2 Data

This paper uses three main datasets. The first dataset is new hand collected narrative data, from which we will measure the shock: markets' expectations about stimulus during the Georgia Senate runoffs. Investment banks such as Goldman Sachs or Barclays Capital provide regular information about market news, as do other macroeconomic research outfits such as Bloomberg Economics or Moody's Analytics. Banks tend to issue reports directly before and after market moving events, such as major data releases, monetary policy announcements, and electoral events. Banks also provide regular summaries and discussion of market behavior. We hand collected these data by contacting the chief economist of each bank. We assembled reports from 20 organizations in total. Typically a bank gave us access to a research portal, containing the universe of reports written by the bank.

There are three qualities of these reports which will let them proxy markets' expectations about stimulus. First, the reports are widely distributed. They are available to be sent by email, for free, to anyone who trades with an investment bank, which likely includes most inflation swaps traders (Bahaj et al. 2023). Many investment banks distribute these reports to journalists, who discuss the contents of the reports in the media. Since the reports are available widely, they are a reasonable proxy for markets' expectations. Second, the reports are time stamped.

Therefore one can use these reports to gauge when information has been revealed to markets. For instance, emailed reports discussing major data releases are normally released within an hour of the release. Finally, banks discuss quantitative statements about various scenarios as well as their likelihood, including around market moving events such as fiscal and monetary policy announcements. Appendix Figure B.1 gives the example of a report from Goldman Sachs that illustrates these qualities.

The second dataset contains asset prices measured at the daily and intra-daily level, to measure high frequency responses. One asset price is inflation swaps, with which we measure inflation expectations. An inflation swap is a financial derivative used to exchange a fixed cash flow, for a cash flow linked to the US Consumer Price Index (CPI). Inflation swaps allow parties to hedge against or speculate about future inflation levels, and as such provide a measure of markets' inflation expectations, albeit including risk premia. Over this period, inflation risk premia seem to be stable (Cieslak & Pflueger 2023), and we will interpret movements in inflation swaps as changes in expected inflation at various horizons.[5] We obtain zero coupon inflation swaps for inflation over the following 1, 2, 5 and 10 years. The data are reported at ten minute intervals during market hours, as the median price quoted by broker-dealers in Bloomberg.[6]

We measure expectations about dividends following Gormsen & Koijen (2020), by using dividend futures on the S&P 500 stock market index. S&P dividend futures allow investors to speculate on or hedge against the future dividends paid by the companies in the S&P 500 index. The one year contract settles based on the actual dividends distributed by the index's companies during over the course of the year. The n year ahead dividend futures price satisfies $F_t^n = E_t D_{t+n}/(1+\theta_t^n)$, where $E_t D_{t+n}$ is the expected dividend n years from now and θ_t^n is the excess premium of n period dividend risk. In general, dividend risk premia at short horizons are stable (Gormsen et al. 2021), and we will interpret movements in dividend futures as changing expectations about dividends. We obtain dividend futures for 1 and 2 years ahead (longer horizon futures are not traded at intraday frequency). The data are reported at ten minute intervals during market hours, based on transactions from the Chicago Mercantile Exchange (CME).

We measure intraday interest rates on government bonds. Specifically we purchase transaction prices on all 2, 3, 5, 7 and 10 year positive coupon bonds from CME Group. We aggregate to ten minute windows and then infer the zero coupon yield curve using the procedure of Cieslak

[5]See also the measure of inflation risk premia from the Cleveland Federal Reserve, which was unchanged between December 2020 and February 2021.

[6]Pflueger & Viceira (2016) and Cieslak & Pflueger (2023) discuss how an alternative measure of expected inflation—the gap between inflation protected (TIPS) and nominal government bonds—is less reliable due to illiquidity.

et al. (2019), which pins down the short end of the yield curve using 3 month treasury bills. We will also use daily end-of-day data on swaps, rates and futures.

The third dataset is election probabilities from online betting exchanges. Our main source is PredictIt. PredictIt is an online exchange that allows traders to buy and sell securities whose value is indexed to political events. The market-clearing price represents the market's probability of the political event. PredictIt provides intradaily and daily information on the likelihood that Democrats would win both Senate seats in Georgia and hence overall control of the Senate. We supplement PredictIt with election probabilities from BetFair, a second betting exchange, provided by ElectionBettingOdds.com. BetFair provides daily probabilities that each individual Senate election would be won in Georgia, though not a probability that Democrats would win both Senate seats or intraday information.

3 A Narrative Shock: the 2021 Georgia Senate Runoffs

The first ingredient of our approach involves identifying a shock: searching the narrative for an event that releases information about the 2021 deficits. We first discuss the event—i.e. the 2021 Georgia Senate election runoffs—and its context. We then use investment bank reports to size the shock. Finally we discuss narrative evidence that the Democrat victory mainly operated as a shock to expected deficits.

3.1 The Georgia Senate Election Runoffs and the 2021 Deficits

The key event that released information about the 2021 deficits was the Georgia Senate election runoffs of early 2021. In November 2020, Democrat Joe Biden won the presidency, while Democrats held a total of 48 seats in the Senate. In November, there were elections for both Senate seats in Georgia, but neither produced a majority for one candidate. By Georgia law, the top two candidates in each election—Democrat Jon Ossoff and Republican David Perdue in the first, and Democrat Raphael Warnock and Republican Kelly Loeffler in the second—would contest runoff elections on January 5th.

The Georgia Senate runoff would determine fiscal policy over the next two years, but matter less for other policy. If Democrats were to win, they would have 50 seats in the Senate. Given Democratic Vice President Harris as a tie-breaking vote, they would have a majority. Under Senate procedure, legislation relating to fiscal policy can be passed by a simple majority, through a procedure known as budget reconciliation. For this procedure, fiscal policy is defined as legislation related to spending, taxes and the federal debt limit. Other legislation that does not relate to fiscal policy requires a supermajority of 60 votes to pass in the Senate. Therefore other legislation would be impossible for Democrats, regardless of the runoffs. A Senate majority also allows the President to confirm appointments without bipartisan support.

In December, between the presidential election and the Georgia runoffs, bipartisan stimulus was passed. This bill, the Consolidated Appropriations Act, involved $900 billion of stimulus, or 4.2% of 2020Q4 annualized GDP. 70% of the stimulus was transfers, principally unemployment insurance, stimulus checks of $600 and transfers to businesses; while the remainder was government spending, principally education and pandemic-related funding for tests and vaccines.

Before the Senate runoffs, Democrats campaigned for additional support for the economy through stimulus checks.[7] However Senate Republicans did not support the stimulus. To the contrary, an attempt by Democrats at the end of December 2020 to pass "stimulus checks" was blocked by the then Republican Senate majority leader, Mitch McConnell.[8]

Immediately after the November presidential election, a Democrat victory in both races seemed unlikely. However, the probability of a Democrat victory increased, particularly in the days just before the election. Appendix Figure B.2 plots the daily probability of Democrat victory from betting markets.

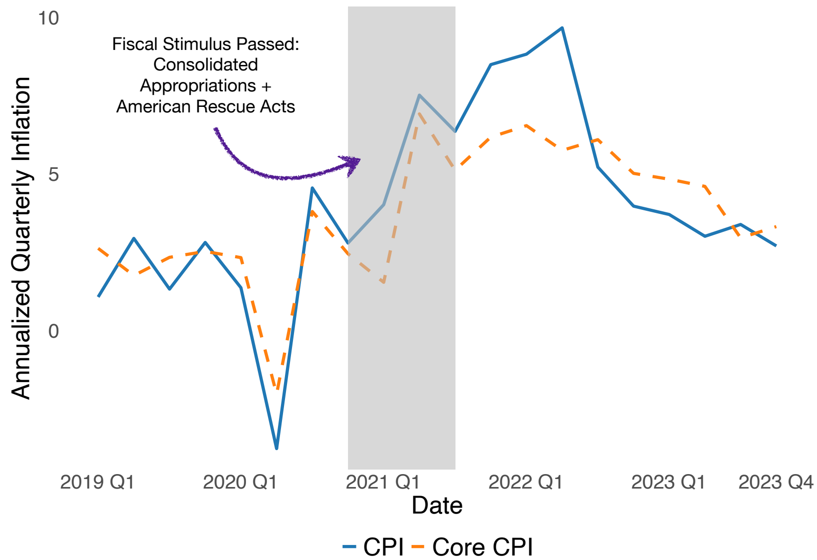
Democrats won both seats. On January 5th, the election took place. Networks confirmed that Warnock had won by the early hours of January 6th, and determined that Ossoff had also won by the late afternoon. As such, the Democrat victory released news about deficits. Beforehand, there was some chance that Democrats would win and pass stimulus. Afterwards, given that Democrats had won, some kind of stimulus would likely pass.

Another major event happened at 2 PM on January 6th. Protestors against Democrat victory in the presidential election hurdled barricades and invaded buildings on Capitol Hill, in Washington DC. This moment initiated the Capitol Hill Riots of January 6th.

The Democrat majority led to two significant pieces of legislation. In March 2021 Democrats passed $1.9 trillion of deficit financed fiscal stimulus through the American Rescue Plan (8.8% of 2020Q4 annualized GDP). The Plan was 60% transfers, primarily "stimulus checks" of $1400 dollars and an extension of the generous unemployent insurance benefits of the Pandemic. The remaining 40% was government spending, primarily state and local aid (Edelberg & Sheiner 2021). This stimulus added to the 900 billion (4.2% of GDP) passed in December 2020 in a bipartisan bill, for a total of 13% of GDP in stimulus during late 2020 and early 2021 (collectively the

[7]See, for instance, this article on January 4th.
[8]See here for a discussion.

Figure 1: Deficits and the Post-Pandemic Inflation



Notes: this figure contains annualized quarterly CPI headline and core inflation from the start of 2019 until the end of 2023.

"2021 deficits"). The 2021 deficits were a distinct piece of legislation from the earlier stimulus of the March 2020 CARES Act. The second consequential piece of legislation passed by Democrats was the $891 billion Inflation Reduction Act (IRA). Passed in August 2022, the IRA was an approximately deficit neutral bill that increased infrastructure spending financed by prescription drug price reform and corporation tax. The IRA was accompanied by the smaller, $280 billion CHIPS and Science Act, designed specifically to boost domestic research and construction of semiconductors.

After fiscal stimulus, in the spring and summer of 2021, inflation started to rise. Figure 1 plots headline and core CPI inflation, as well as a shaded area for when the two stimulus packages were passed. As Figure 1 shows, inflation had been around 2% prior to fiscal stimulus. During and after the stimulus, inflation rose towards its peak of 8% in the summer of 2022.

3.2 Sizing the Shock to Deficits after the Democrat Victory

Clearly, the Democrat victory in Georgia led to some news about stimulus—but how much? One needs a range of information to measure the deficit news shock. One must measure not only expectations about how much Democrats would spend if they were to win, but also what would happen in the counterfactual scenario in which Republicans were to win, as well as the likelihood of each scenario. Additional information, such as whether the stimulus was expected to be deficit financed, is also important. Our new narrative information from investment bank reports contains this information.

In brief, we find that Democrat victory represented a shock to expectations of fiscal stimulus worth 2.1% of GDP. Banks expected the stimulus to be deficit financed in the short run, with 70% transfers and the remainder government spending. Markets also expected a delayed and tax-financed infrastructure bill, and believed that there were no other significant consequences of the Democrat victory.

To arrive at the narrative information, we search each investment bank's reports for information about the Georgia runoff and deficit spending, in a window from a week before to a week after Democrats' victory.[9] We extract by hand from the reports each bank's view about the relevant aspects of fiscal policy. As we discuss, investment banks often but not always discuss key information both before and after the election. In many cases banks provided only qualitative information about certain variables, which we discard.

The main objective is to measure news about stimulus. One requires three pieces of information: (i) the expected stimulus if Democrats were to win both seats, (ii) the expected stimulus if Republicans were to win at least one seat, and (iii) the probability that Democrats would win.

First, we measure expected stimulus if Democrats were to win. In total, 11 investment banks forecasted the size of the Democrat stimulus in the week after the election. The median stimulus size is $900 billion, or 4.2% of 2020Q4 annualized GDP. Table 1 and Figure 2 summarize this information. A typical quote, from JPMorgan, reads "our best guess ... is a spending package of around $900 billion passed in the next few months." All reports expect that the stimulus will be passed early in 2021. We will interpret the $900 billion number as an expectation. Table 1 shows that banks use language consistent with this interpretation, with phrases like "expect" and "anticipate".[10] The stimulus expected in January was smaller than the $1.9 trillion eventually passed in the American Rescue Plan. The stimulus ended up being unexpectedly large, relative to beliefs in early January, due to successful efforts by party leadership to sway moderate Democrats in February and March.[11]

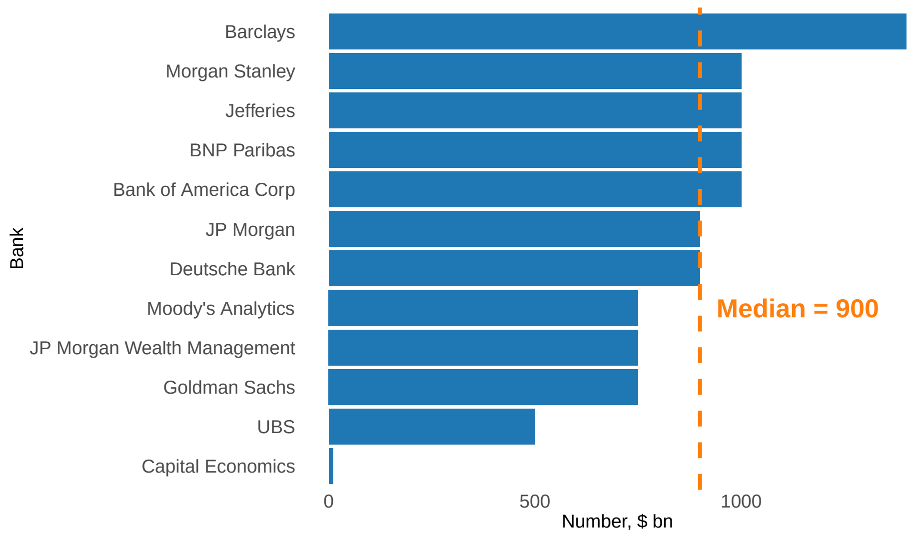
Next, we measure the stimulus that before the election, banks expected would pass with divided government. 5 investment banks forecasted stimulus in the case of divided government, prior to the election. The median forecast was no further stimulus, as Appendix Table B.2 summarizes. A typical quote, from Rabobank on 5th January, reads "in this case Republicans are

[9] We do not consider reports from more than a week after the Georgia election, since the Biden administration released the first details of the American Rescue Plan on January 15th.

[10] Only 3 investment banks provided a numerical forecast of the size of the Democrat stimulus before the election, with a median of 700 billion (Appendix Table B.1). Pooling pre- and post-election forecasts, the median remains $900 billion.

[11] See, for instance, an account of how President Biden persuaded moderate Democratic Senator Joe Manchin to vote.

Figure 2: Expected Stimulus after Democrat Victory



Notes: this graph contains expected stimulus after Democrat victory, taken from reports of investment banks after the election. The sample is restricted to be from 6th of January until 13th of January.

likely to shoot down the ambitious spending plans of the Democrats". This forecast is consistent with a casual reading of political events, since as we discussed, Senate Republicans were unwilling to pass further stimulus.

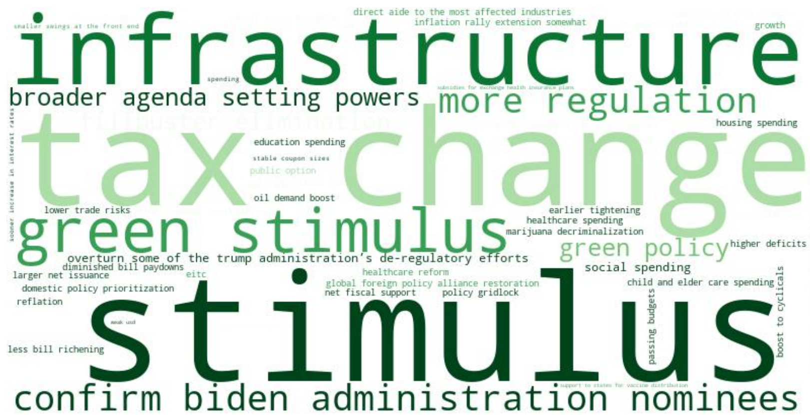
We then measure the probability that Democrats would win both seats. Six investment banks provided a probability of Democrat victory before the election (Appendix Table B.3). No bank commits to a specific numerical probability. However, five of the banks use language such as "toss-up", "very close" and "a very slim advantage" which we interpret as a 50% chance of Democrat victory in both seats. Consistent with this interpretation, several reports cite prediction markets, which had a 50% probability of Democrat victory in both seats. A typical quote, from Goldman Sachs on 5th January, states that the "race remains a toss-up with a slight Republican lean".

With this information, we can calculate the news to deficits from the Democrat victory in Georgia. The reports imply a shock to expected deficits worth $450 billion, or 2.1% of 2020Q4 annualized GDP.

The reports provide additional information that is useful for interpreting the stimulus. First, five banks stated what they expect the composition of stimulus will be (Appendix Table B.4). The median bank expects that the stimulus will be 70% transfers, principally unemployment insurance and stimulus checks; and the remainder government spending, principally state and local aid.[12] One bank provided this information before the election and the rest afterwards, pro-

[12]Many banks mention an "other" component that cannot be classified as transfers or spending. We assume this component has the same proportion of spending versus transfers as the rest of the package.

Figure 3: Outcomes after the Democrat Victory



Notes: this figure contains a word cloud of outcomes of the Democrat victory discussed by investment banks in the week after the election. In the cloud, an outcome is larger if more banks discuss it, and darker if banks on average assess that it is more likely.

viding similar numbers in each case. The expected breakdown between spending and transfers would prove to be roughly the same as the final American Rescue Plan. 7 investment banks discuss financing, and agree that the stimulus was going to be partly or perhaps entirely deficit financed (see Appendix Table B.5).[13]

According to banks, the main other outcome of the election is a delayed and tax financed environment and infrastructure bill, which is quantitatively less important than the stimulus. Before the election five banks discuss expected infrastructure spending (Appendix Table B.6). On the whole, the banks suggest that infrastructure spending would happen with either a Democrat majority or divided government, albeit more with the Democrat majority. No bank commits to a numerical forecast. After the election, 8 banks forecast a specific size of the infrastructure package (Appendix Table B.7). The median bank expected a $1 trillion dollar stimulus, and banks generally expected that the infrastructure would take place in late 2021 or 2022. Banks agree that the infrastructure package would be partly or wholly financed by tax increases, especially corporation and capital gains taxes (Appendix Tables B.8 and B.9). Therefore an upper bound for the news about infrastructure after the Democrat victory is $1 trillion. This bound is not tight because some of the infrastructure was expected even if Republicans were to win in Georgia. Consistent with banks' expectations, a tax-financed infrastructure and environment bill of roughly $1 trillion would pass in 2022, i.e. the Inflation Reduction Act. In Section 6, we will see that the effect of the infrastructure bill is small even at its upper bound value of $1 trillion, and will not meaningfully affect our calculations. This result is consistent with previous work finding that the effect of infrastructure tends to be small (Boehm 2020; Ramey 2021).

[13] Banks do not provide a time path over which they expect debt to be paid back, which is crucial in HANK models (Auclert, Rognlie & Straub 2023). In the quantitative exercise of Section 6, we discipline the path of debt with information from the Congressional Budget Office and long term rates.

Our contention is that the main effect of the Democrat victory was to raise expected deficits. We now provide evidence for this view. For each bank we read their discussion of what would happen after the Democrats won. We then manually collect the various outcomes and their perceived likelihood. We do the exercise for all banks, but for illustration Appendix Table B.10 contains a summary for a single bank, Barclays. We find that the main outcome discussed by banks was the stimulus, followed by tax rises and infrastructure spending. Banks hardly discuss other outcomes. To visualize this information, Figure 3 presents a word cloud. In the word cloud, a word is larger if more banks discuss this outcome. The word is shaded darker if banks typically believe the outcome is more likely. Evidently banks believe that stimulus is important and likely. The second most important policies are tax changes and infrastructure (as well as the related green stimulus), though they are less likely. Other issues are less important.[14]

4 The High Frequency Response of Inflation

We have the first ingredient of our approach: a shock to news about the 2021 deficits from the Georgia Senate election runoffs, identified and sized from the narrative. We now turn to the second ingredient of our approach: the high frequency response. This section studies how inflation forecasts from swaps, as well as other asset prices, responded in a narrow window around the election.

There is an important advantage to studying movements in inflation forecasts from swaps. The high frequency variation eliminates lower frequency omitted variables. At monthly or quarterly frequency, several potentially inflationary shocks hit the economy during the post-Pandemic inflation, such as oil shocks or bottlenecks. Disentangling these omitted variables from the effect of deficits is challenging. However movements in inflation forecasts in a narrow window around the election will not be affected by these confounders—unless news about the confounders coincidentally occurred at the same time as the election. As such, one can estimate the causal effect of a single and episode specific shock, such as the release of deficit news during the post-Pandemic inflation.

Our method requires that inflation forecasts from swaps are an unbiased measure of actual inflation. If so, then inflation forecasts from swaps produce an unbiased estimate of how the Georgia runoffs affected actual inflation. One reason why swaps and actual inflation might dif-

[14] Some banks do believe that confirming Biden administration nominees is important. The main appointments that matter for the macroeconomy are the Federal Reserve Board. We will assess how the Georgia shock affected beliefs about monetary policy in Section 5.

fer is inflation risk premia, which leads swap prices to vary even if expected inflation does not change. However as we have discussed, inflation risk premia are stable over this period, meaning changes in swaps represent changes in inflation expected by markets. A second reason why swaps and actual inflation could differ is that expectations of inflation from swaps are biased. A large literature finds that inflation expectations are biased, and tend to underreact macroeconomic variables (Coibion & Gorodnichenko 2015). Consistent with this literature, Appendix Table B.11 finds that swap prices comove closely with but slightly underreact actual inflation over this period. As a result, using swaps to estimate the response of inflation to deficits is conservative: actual inflation tends to react somewhat more strongly to macroeconomic shocks than do swap prices.

We use two identification strategies to measure how news about deficits affected inflation: a single event study, from a narrow window around the election itself; and an instrumental variables strategy, exploiting news about deficits released in the previous months.

4.1 Identification Strategy 1: Single Event Study

We now introduce our framework for a single event study. Single event studies of this kind are common in corporate finance, meaning we can use standard methods (e.g. MacKinlay 1997). We assume that around the Georgia shock, an asset price y_t follows the process

$$y_t = \begin{cases} \varepsilon_t & \text{if } t < T \\ \varepsilon_t + \alpha_t & \text{if } t \geq T. \end{cases}$$

In this equation, the event happens at time T. Before time T, the "typical" movement in the asset price is some process ε_t, due to factors such as the liquidity shocks that are common in inflation swaps markets (Bahaj et al. 2023). Then, α_{T+j} is the causal effect of the election on asset prices, j periods after the event occurs.

The estimate of the causal effect is

$$\hat{\alpha}_{T+j} = y_{T+j} - \mathbb{E}_T \left[y_{T+j} | \{\alpha_{T+k}\}_{k\geq 0} = 0 \right].$$

That is, the estimate of the causal effect is the actual asset price y_{T+j}, minus the expectation of what the asset price would have been, using information from just prior to the event, and supposing that the event had not come to pass. In pratice, one estimates $\mathbb{E}_T \left[y_{T+j} | \{\alpha_{T+k}\}_{k\geq 0} = 0 \right]$ using a simple ARIMA process estimated in a relatively short window before the event date T.

The identification assumption is that the distribution of typical shocks to asset prices, ε_t, did not change from just before versus just after the event date T. That is, there where no other "atypical" shocks to asset prices just after the Senate runoff. However typical shocks to asset prices are allowed after the Senate election. Information on the distribution of the typical shocks—measured from asset prices before the election—will let us construct a confidence interval for the estimate of the causal effect, based on the null hypothesis that movements in asset prices around the election were typical.

With this identification strategy, the key decision is the width of the event window. The event window should be wide enough to capture the full effect of the shock on asset prices. However it should be narrow enough to exclude other atypical shocks that otherwise would confound estimates of the causal effect.

In our baseline analysis, the event window begins on the morning of election day, January 5th, and ends at the end of January 7th. This window is our baseline because state of the art estimates, from Bahaj et al. (2023), suggest that inflation swaps markets take 2-3 days to incorporate news about inflation. Therefore the window should be 2-3 days long to account for the full effect of the shock. The election outcome was known in the early morning of January 6th. For instance, Goldman Sachs wrote a report at 2:01 AM on January 6th stating "[d]emocratic Senate control looks likely". Similarly, high frequency data from betting markets suggests that the Democrat victory was known in the small hours of January 6th (see Appendix Figure B.3). Therefore ending the window two full days after the early morning of January 6th seems reasonable. We start on the morning of January 5th in order to account for "pre-announcement drift". Two factors suggest some drift. First, Democrats' best poll of the campaign was released after markets closed on January 4th, and after investment banks had released their pre-election reports. Given this news, betting markets moved towards Democrats on January 5th (see Appendix Figure B.3), as did financial markets.[15] Second, "smart money" such as hedge funds often have advance information around major political events, for instance by purchasing exit polls.[16]

Consistent with the identification assumption, narrative evidence suggests that the Georgia election was the main shock to asset prices within this window. Consider for instance Goldman Sachs' *Global Rates Trader* report, which summarizes the main movements in macro-related markets over the last week. For the week around the election, Goldman Sachs wrote: "[t]he

[15]See here for details about polls, and here for coverage of financial markets.

[16]This practice was common around the Brexit election in the United Kingdom (see here). Consistent with this possibility, we will see that pre-announcement drift is present in short duration inflation swaps, where hedge funds are active (Bahaj et al. 2023); but absent in long duration inflation swaps, where less well-informed pension funds are active.

Georgia senate runoff results remain the key event of the week for rates, notwithstanding the pandemic-driven drop in December payrolls."

The latter event, an unexpectedly low value for the December employment data release, happened on January 8th i.e. directly after the event window. Consistent with this view, Bloomberg releases an intraday "data surprise" index, which releases information about whether an important macroeconomic news announcement surprised consensus forecasts. This index does not register surprises until January 8th (Appendix Figure B.4).

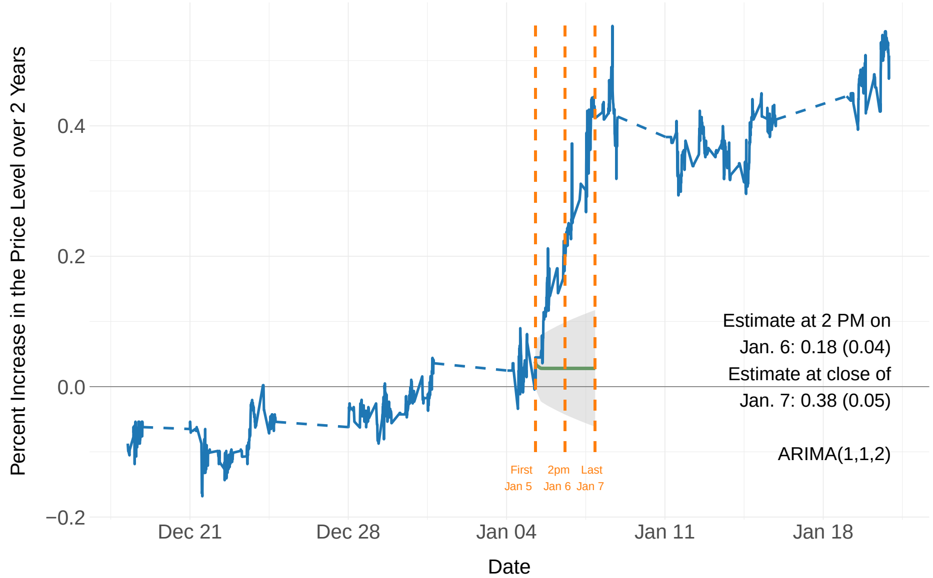
One potential confounder, which is infrequently mentioned by investment banks but nevertheless could be important, is the January 6th Capitol Hill Riots. To avoid this confounder, we consider a specification that ends the event window at 2 PM on January 6th, i.e. before the riots began—as well as other robustness exercises to be discussed.

4.1.1 Single Event Study: Causal Effect of Georgia Shock on Inflation Expectations

Figure 4 graphs the results for the single event study, The figure shows a jump in inflation expectations around the election, representing the causal effect of the Georgia shock. The outcome variable is the expected increase in the price level over two years, which is calculated from the two year inflation swap, deducting the first value on January 5th. In the two weeks prior to January 5th (vertical dashed orange line), expected price level growth is fairly constant, meaning there is no pre-trend. From January 5th to January 7th—as news about the Georgia election is released—the inflation swap jumps upwards. Afterwards, the inflation swap price is stable, suggesting that transitory factors such as market liquidity were not responsible for the jump.

The graph also contains the estimate of the causal effect. The green line is the estimate of what would have happened to inflation expectations absent the Georgia election, with the shading representing the 95% confidence interval. The estimate is generated from an ARIMA(1,1,2) estimated on the prior two weeks of data; the order is selected separately for each series using using Akaike's Information Criterion and allowing for trends. The difference between the blue and green lines is the causal effect of the election on inflation expectations. Therefore in our baseline estimate the election causes an increase in expected price level growth over the next 2 years of 38 basis points. Excluding data after 2PM on January 6th leads to a qualitatively similar but smaller estimate of 18 basis points. The standard error of the baseline estimate is 0.05, meaning that the jump in expectations around the election is far outside the typical range. Appendix Figures B.5-B.7 show similar event plots for the 1 year, 5 year and 10 year expected increase in the price level. These figures have the same distinctive pattern, i.e. stable swaps prices prior to the election shock, followed by a jump around the election that continues to

Figure 4: Expected Percent Increase in the Price Level Over 2 Years



Notes: this plot is the intraday percent increase in price level over the next two years implied by the 2 year inflation swap, subtracting the first value on January 5th. Dashed lines are missing data from holidays and weekends. The green line is the forecast if the policy had not taken place, the gray shade is the 95% confidence interval.

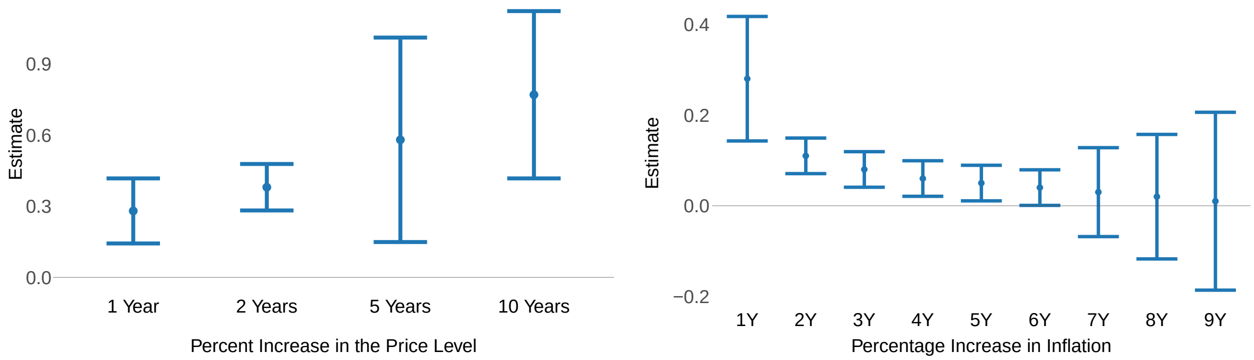
affect prices afterwards.[17]

Table 2 reports the estimates associated with the event studies. In the first column, we report the baseline estimate for the percent increase in prices over 1 year (first row) through 10 years (last row). The other columns report robustness tests. In column 2 we end the event window at 2 PM on January 6th, before the Capitol Hill Riots. The result is always directionally similar, albeit smaller. In Column 3, we calculate the causal effect as the difference in the price level expectations between the start and the end of the window, using the distribution of differences in the 2 weeks before the event to construct standard errors. The estimates are similar. In Column 4, we impose that the ARIMA process is stationary, with similar but more precise results. Finally in Column 5 we drop missing data from observations that are overnight, weekend or public holidays (the baseline ARIMA process handles missing data with the Kalman filter). The point estimates are similar and the standard errors larger.

The main message from Table 2 is that, as one might expect, the causal effect of the shock on prices grows with the horizon of price growth. We summarize this information in Figure 5a. This figure plots the change in the expected price level growth over 1, 2, 5 and 10 years, with 95% confidence intervals. In effect, the figure is the "expected impulse response" of the

[17]Inflation swaps index to inflation with a lag. For instance, the 1 year inflation swap price measures expected inflation between months $t-3$ and $t+9$. We adjust swaps prices by a factor that converts them into annual units and accounts for the fact that inflation prior to time t is pre-determined with respect to the shock. For instance we adjust the 1 year swap price by a factor of (4/3), the 2 year swap price by a factor of (8/7) and so on. We apply this adjustment to swaps prices in all of the analysis that follows.

Figure 5: Single Event Study—Effect on Price Level and Inflation by Horizon



(a) Effect on price growth (b) Effect on inflation

Notes: Panel a) plots the effect of deficits on the price level at the 1, 2, 5 and 10 year horizon from the single event study. Panel b) plots the effect on interpolated inflation rates.

Georgia shock on price level expectations. In the figure, one can see that the effect of the shock on expected prices is persistent and grows with the horizon.

An alternative way to see that the shock is persistent is to measure its effect on expected forward inflation rates—i.e. how markets expect inflation will change in each year after the shock. To construct expected inflation in each year for swaps, we impute the forward yield curve for swaps following Cieslak et al. (2019). Figure 5b reports the result. The figure shows that expect inflation increases significantly over the first year, but also is expected to persistently increase over the subsequent 6 years, albeit by smaller amounts.

4.1.2 Single Event Study: Real Outcomes

One question is whether the deficit shock caused markets to expect real outcomes, such as GDP growth, to increase. If so then the Georgia election would seem to have operated as a demand shock. We study two pieces of information on real outcomes, from narrative reports and dividend futures. Both suggest that real growth increased after the Georgia shock.

First, we study dividend futures. As we have discussed, the S&P500 n year ahead dividend future is a contract whose value is indexed to the value of nominal dividends paid by S&P 500 companies in year n.[18] Existing evidence suggests that dividend futures are a good proxy for expected dividends (Gormsen et al. 2021). As such, movements in the 1 and 2 year ahead dividend measures how expected dividends change around the shock.

Appendix Figure B.8 presents the single event study for 2022 dividends and shows that expected nominal dividends increased. The outcome variable is the percent increase in S&P500

[18] The value of the n year ahead dividend future depends on dividends paid throughout the year. Since the Georgia shock took place at the beginning of a year, there are no time aggregation issues.

dividends. The event study suggests that nominal dividends in 2022 grew by 3.32% due to the shock. Again, there is no pre-trend before the shock, and the price remains persistently high after the shock. Appendix Figure B.9 shows a similar graph for the 2021 dividend future. Table 3 summarizes these estimates and provides various robustness tests.

Dividend futures are nominal and not real. However, their behavior suggests that expected real dividends increased over 2021-23 as well. To approximate this behavior, we subtract from the estimate of the effect of the shock on nominal dividends, the effect of the shock on the price level at the same horizon from Table 2. Table 4 reports the result. Expected real dividends rose by 2.4% in 2021 and by 2.9% in 2022 due to the Georgia shock.

Under more speculative assumptions, one can use dividend futures to estimate how the shock affected expected real GDP growth. In particular, at quarterly frequency and using a long time series, Gormsen & Koijen (2020) show that a percent increase in dividends associates with a 0.67% increase in real GDP. If the same relationship holds at high frequency, then one can use the 0.67 factor to convert changes in dividend into changes in real GDP. This method suggests that markets expected real GDP to be 1.6% higher in 2021 and 1.9% higher in 2022 due to the Georgia shock. This method to infer real GDP from dividend futures should be treated with caution, since the relationship between dividends and GDP may change over time.

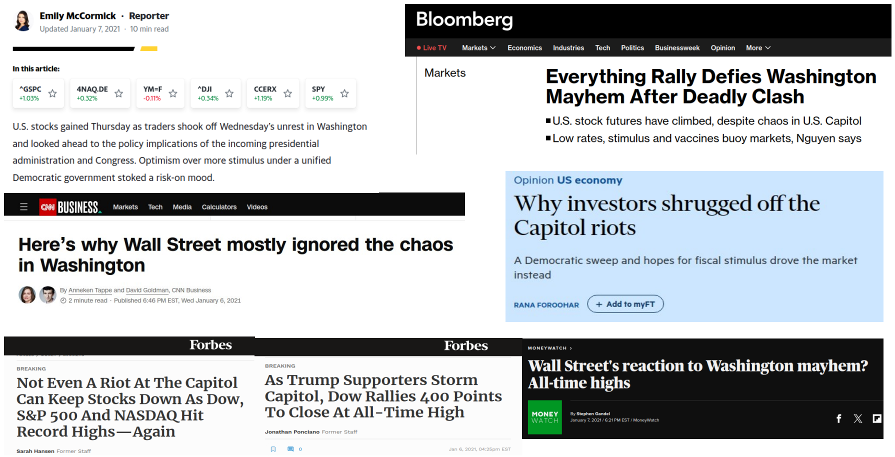
A second way to gauge the effect of the Georgia shock on real outcomes is to use information on how investment banks revised their real GDP forecasts in response to the Georgia shock. 7 investment banks who provided quantitative information on how they changed their growth forecasts after the Democrat victory in Georgia. The median bank states that over 2 years, real GDP is expected to grow by 1.9% more due to the Georgia shock (Appendix Table B.12). This estimate is similar to the estimates from dividend futures. Many other banks provide similar, qualitative information, but do not immediately update their quantitative forecast.[19]

4.1.3 Single Event Study: Robustness and Capitol Hill Riots

The identification assumption of the single event study is that no other atypical events occurred during a narrow window around the election. As we have discussed, the main potential confounder is the Capitol Hill Riots. We have already seen three pieces of evidence suggesting that this potential confounder does not affect our estimates. First, results are qualitatively similar excluding the January 6th riots from the window. Second, the event study plots show that asset prices remain persistently different after the event, even when the Capitol Hill riots have subsided. Third, information on real variables suggests that expected real GDP growth increased

[19]Banks do not update their forecasts of inflation at a high enough frequency to be useful.

Figure 6: Capitol Hill Riots—Mentions in Media



around the Georgia election. If the riots were expected to be important, they presumably would have contracted real GDP.

We now present two further pieces of evidence suggesting that the Capitol Hill Riots do not confound our estimate. First, narrative evidence from news suggests that the Capitol Hill Riots did not affect asset prices. Figure 6 is a collage of news articles, which summarize the prevailing view that the Capitol Hill Riots were not important. One quote, from Bloomberg Economics on January 19th, reads: "[t]he markets appear to be putting zero probability on the U.S. becoming a banana republic ... [o]n Jan. 6, as a mob stormed the Capitol, the S&P 500 merely trimmed its gains."

Second, Appendix Figure B.10 plots how credit default swaps on 5 year US government debt evolved around the Capitol Hill Riots. Credit default swaps measure the likelihood of default on US government debt. Presumably, if the Riots were perceived to be important, then extreme outcomes such as default on government debt would become more likely. In the event, credit default swaps were stable and fell slightly.

4.2 Identification Strategy 2: Instrumental Variables

Our first identification strategy is a simple event study. The main drawback is that it relies on a single, high-powered observation. We therefore turn to a second identification strategy based on instrumental variables.

Our motivation is that between the presidential election of November, and the Georgia election in January, markets paid a great deal of attention to the likelihood of Democrat victory. As we have discussed, markets knew that if Democrats were to win, fiscal stimulus was likely.

Moreover, the perceived probability that Democrats would win varied between the presidential election and the runoff election. Appendix Table B.13 illustrates these points, using information from a single investment bank, Barclays. Barclays discussed the likelihood of Democrats winning in Georgia no less than 5 times between the November election and the runoff—clearly, Barclays was paying attention. Barclays' perceived probability varies significantly, from 0.2 after the presidential election, to 0.5 just before the runoff.

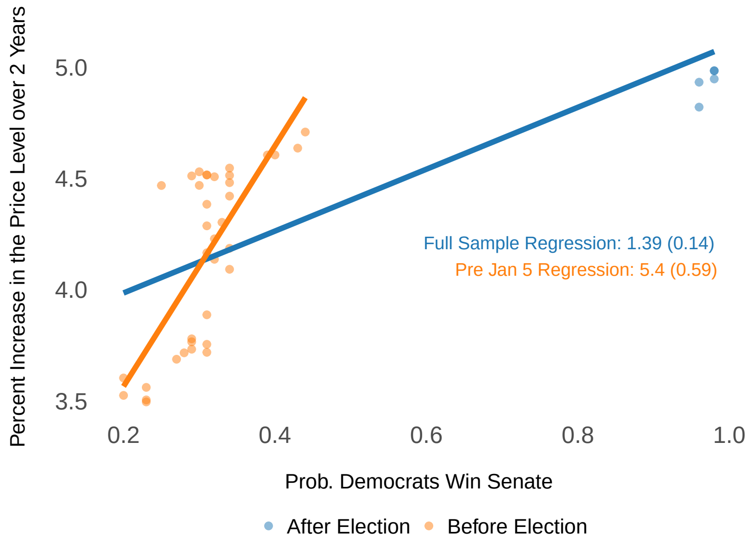
With this motivation, we use the daily probability of Democrat victory from betting markets as an instrument for news about deficits (see Appendix Figure B.3 for a plot of the daily probability). We run the regression

$$y_t = \alpha + \beta \text{probability}_{t-1} + \varepsilon_t. \tag{1}$$

Here, y_t is an asset price such as an inflation swap, and probability_{t-1} is the end of day probability that Democrats would control the Senate after the Georgia elections, from PredictIt. β is the coefficient of interest—how changing news about Democrat victory affects inflation expectations. We expect β to be positive: a higher chance that Democrats would win in Georgia means fiscal stimulus is more likely, presumably leading to higher inflation. The sample is daily data, from one week after the November presidential election to one week after the Georgia election. The identification assumption is that changes in the probability of Democrat victory was not caused by macroeconomic factors, and that there were no other correlated shocks to both macroeconomic factors and to the probability of Democrat victory. The identification assumption is plausible: as we shall see, changes in the probability that Democrats would win was driven in part by factors such as better polls. Regarding terminology, equation (1) is a "reduced form" regression. The "endogenous variable" for which probability_{t-1} is an instrument is news about fiscal deficits. However we cannot observe this variable directly, since daily variation in the expected size of deficits is not available.

Figure 7 presents the results from the regression in a scatter plot, and finds that a higher probability of Democrat victory leads to more expected inflation. In the graph, the y axis variable is the expected percent increase in the price level over the subsequent two years. The x-axis is the end of day probability that Democrats would win the Senate after the Georgia election, from PredictIt. Each dot is the observation from a single day. One can see that there is a strong positive relationship between the win probability and price level growth. The blue line, the regression line for the full sample, has a slope of 1.39 with a standard error of 0.14. Restricting to data before January 5th, i.e. before the election, leads to similar although larger results. Ap-

Figure 7: Instrumental Variables—Effect on Price Level Growth over 2 Years



Notes: this graph plots the end-of-day expected percent increase in prices over two years, implied by the 2 year inflation swap, against end of day probability of Democrat victory from PredictIt. The regressions use Newey-West standard errors with 3 lags.

pendix Figures B.11-B.13 show similar figures for expected price level growth over 1, 5 and 10 years.[20]

Table 5 collects the regression results and provides robustness. In Panels A through D of the table we study the percent increase in prices over 1, 2, 5 and 10 years. In the first column we study the baseline specification. In the second column we restrict to before January 6th. In the third we drop outlier observations—i.e. the election days of the 6th and 7th, as well as days when news about December's Consolidated Appropriations Act was released. In the final column we estimate the regression in daily differences. For all specifications, the response of the price level grows with the horizon, i.e. prices respond by more over 10 years than 1 year. The estimates are larger restricting to before January 6th, and smaller in differences—though still statistically significant except for 1 year price level growth.

We now consider additional robustness tests. The main identification concern is that other macro factors affected asset prices at the same time as news about the Democrat victory was released. To deal with this concern we adopt a strategy in two parts. First, we instrument for the likelihood of Democrat victory with daily polling data. Specifically, we use FiveThirtyEight.com's daily measure of polls for Jon Ossoff's campaign. Given that this measure is available only before the election, we restrict to before January 6th. The idea behind this instrument is to isolate movements in Democrat victory likelihood that are only due to polling information. Secondly, we control for various other determinants of inflation expectations. We control for the

[20] One concern is data quality from PredictIt. In Appendix Figure B.14 we report similar plots for 2 year price level growth using data from an alternative online prediction market, BetFair, for Jon Ossoff's Senate election; and in Appendix Figures B.15 we report our estimate for PredictIt data, using the sample for which BetFair is available.

first lag of the 10 year US government bond, Bloomberg's daily data surprise index, the Oil price, the S&P500 index value, a dummy variable for important dates of vaccine announcements, and daily data from the Cleveland Fed of households expectations of the effect of Covid-19 on the economy. Since the regression only has 30 observations, we add each these controls in separate specifications. Table 6 contains the results. The estimates are large and more imprecise, but qualitatively consistent with the benchmark specification. The main caveat is that the effect on 1 and 2 year expectations is positive but imprecisely estimated with the Surprise Index or the S&P500 as controls, and substantially falls in magnitude with oil prices as a control. The effect on 5 and 10 year expectations is always large, positive and significant.

How do the magnitudes of the two identification strategies compare? To visualize the comparison, Appendix Figure B.16 plots the estimated coefficients and confidence intervals from the baseline instrumental variables specification, for price level growth over 1, 2, 5 and 10 years, after dividing the coefficients and confidence sets by 2. Therefore the figure plots the "expected impulse response" from a change in probability of Democrat victory of 0.5. One can naturally compare to the impulse response estimated from the single event study of Figure 5b, which measures the response of asset prices to a change in probability of Democrat victory 0.5. The magnitudes of the coefficients are similar across the two designs. The IV estimates are around 40% larger at all horizons. One reason why the IV estimates are bigger could be that the expected size of deficits, if Democrats won, may also have changed between November and January. Our estimates cannot account for such changes, because daily measures of the expected size of deficits are not available. In our quantitative estimates, we will target the smaller numbers from the single event study.[21]

5 The Inflation Multiplier and the Causal Effect of the 2021 Deficits

At this stage, we have both ingredients of our high frequency narrative approach: a shock, identified and sized from the narrative; and a response, measured with high frequency methods. We now combine the shock and response into a well-identified "inflation multiplier", which summarizes the causal effect on inflation of a 1% deficit-to-GDP shock. We then use this multiplier to calculate the total effect of the 2021 deficits on inflation.

We calculate the inflation multiplier by combining high frequency and narrative information as follows. The narrative of Section 3 implies a shock to expected deficits worth 2.1% of

[21] Appendix Figures B.17-B.18 show that our findings for the response of dividend futures also hold with the IV strategy.

GDP. The high frequency response of Section 4 implies a response of expected prices of 0.38% over 2 years or 0.77% over 10 years. The inflation multiplier divides the response by the shock. Therefore for a 1% of GDP shock to deficits, expected prices grow by 0.18% over 2 years or 0.37% over ten years.

The inflation multiplier summarizes the causal effect of deficits on inflation during 2021. To calculate the causal effect of the whole 2021 deficits, one needs the product of the inflation multiplier with the total size of deficits. The 2021 deficits were 13% of 2020Q4 annualized GDP. Therefore with our estimate of the multiplier, total deficits caused 13% × 0.18 = 2.3% inflation, cumulatively over 2021-22.

This calculation implies that deficits were an important contributor to the subsequent inflation. Cumulatively, between the start of 2021 and the end of 2022, the price level increased by about 7.5% in excess of the normal rate.[22] Our calculations suggest that deficits accounted for around 30% of the excess increase in headline prices over this period.

We conclude that deficits were important for inflation over this period. However deficits were not the only cause—other factors must explain the remaining 70% increase in headline inflation. For instance, energy shocks in the aftermath of the Russia-Ukraine war were also probably important for inflation (e.g. Gagliardone & Gertler 2023).

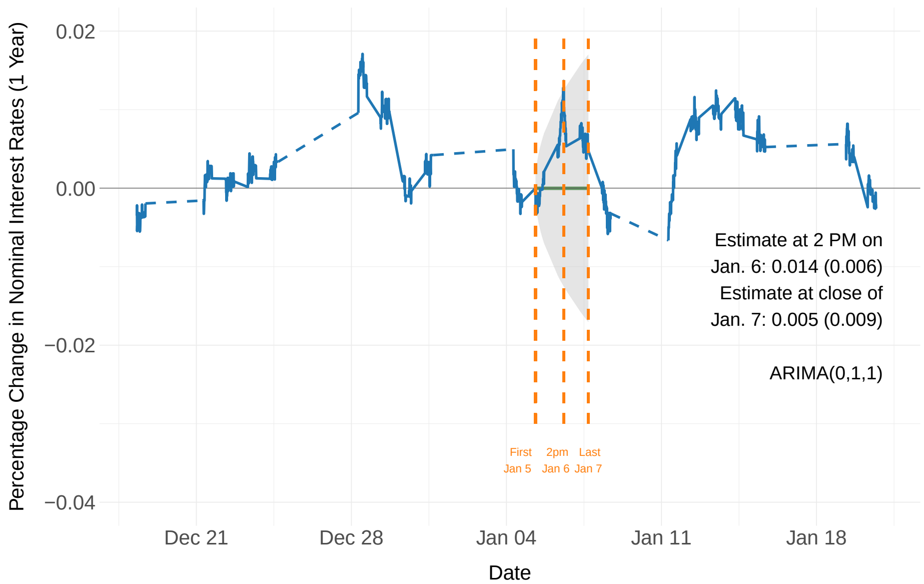
The total contribution of deficits to the post-Pandemic Inflation could have been even higher. The March 2020 CARES Act was an additional stimulus worth 10.2% of GDP. Applying the same inflation multiplier to the CARES Act implies a further 1.8% increase in prices over 2 years. However this calculation is harder to interpret because the inflation multiplier could have been different for the CARES Act.

This calculation highlights that deficits were a significant contributor to the post-Pandemic inflation in part because they were so large. The inflation multiplier, of 0.38 over 2 years, does not seem particularly big. But the size of the 2021 stimulus, at 13% of GDP, was big by recent standards. For instance the sum of the Economic Stimulus Act of 2008 and the American Recovery and Reinvestment Act of 2009, the stimulus in response to the Great Recession, was only 6.7% of 2008 GDP.

Let us also repeat a caveat. This calculation assumes that the causal effect of deficits on inflation forecasts, from swaps, is the same as the causal effect of deficits on actual inflation. This assumption may well not be correct. However in Section 4 we review evidence suggesting that actual inflation could have responded by even more than inflation forecasts.

[22]Typical annual inflation is 2% for PCE inflation and 2.4% for CPI inflation. Headline CPI prices grew by 14% over 2021-22, or 9.2% more than typical. Core CPI grew by 11.5%, or 6.7% more than typical. Headline PCE grew by 11.5%, or 7.5% more than typical. Core PCE grew by 10%, or 6% more than typical.

Figure 8: Single Event Study—1 Year Nominal Interest



Notes: This plot shows the intraday increase in 1 year nominal interest rates, subtracting the first value on January 5th. Dashed lines indicate missing data from holidays and weekends. The green line is the forecast if the policy had not taken place, and the grey shade is the 95% confidence interval. The dashed orange lines mark the first observation on January 5th, 2 PM on January 6th, and the final observation on January 7th.

5.1 Inflation Multiplier: The Role of Interest Rates

In the coming section, we will ask whether standard models can quantitatively explain the inflation multiplier that we have estimated. However in order to interpret the inflation multiplier with a standard model, one additional piece of evidence is useful. In standard models, the inflation multiplier is partly determined by monetary policy. To gauge the behavior of monetary policy in response to the fiscal shock, we estimate how interest rates responded to the Georgia shock.

We find that short term nominal interest rates did not change after the Georgia Shock, whereas long term interest rates rose. Figure 8 presents the single event study using intraday 1 year nominal interest rates on government bonds as the outcome variable. Clearly, one year nominal interest rates do not respond to the Georgia shock. Figure B.19 is the single event study for the 5 year forward 5 year nominal interest rate, which rises significantly in response to the shock—as originally discovered by Mian et al. (2024).[23]

These moments will be crucial for the quantitative model of the next section. Since nominal interest rates did not change in the short term, and inflation expectations rose, real interest rates must have fallen—suggesting loose monetary policy in the short run. On the other hand, long term rates rose, consistent with an increase in the stock of government debt, as Mian et al.

[23] Appendix Figures B.20-B.21 show similar results with the IV specification.

(2024) previously argued.

6 HANK Models and the Inflation Multiplier

To recap: in Section 5 we found that the 2021 caused a significant share of the post-Pandemic inflation. This episode is a test for the standard Heterogeneous Agent New Keynesian (HANK) model, which was conceived in part to address issues such as inflation and deficit financed stimulus. It is well known that in HANK models, deficit financed fiscal stimulus raises inflation—clearly the model can qualitatively match our finding. In this Section, we ask whether the model can pass a more powerful test: quantitatively matching the size and dynamics of the inflation multiplier.

A simple and standard HANK model does seem to pass the test. Calibrated with pre-2020 parameters, and with the shock to deficits and monetary policy from the Georgia runoff as input, the HANK model closely matches the inflation multiplier at various horizons.

6.1 A Standard HANK Model

Time is discrete, with $t \in \{0, 1, ...\}$. We study linearized dynamics in response to a shock that is realized at date 0. The economy is at steady state prior to the shock. A variable X_{ss} denotes the steady state value of X_t prior to the shock.

Households. Following Wolf (2021) and Angeletos et al. (2023), there is a unit mass of households, comprising of two types: hand-to-mouth and overlapping generations (OLG) agents.

There is a mass $1-\mu$ of perpetual-youth, overlapping-generations households as in Blanchard (1985). Each period, households die with probability $1-\phi$, with $\phi \in (0, 1]$. New households replace those that die, and deceased households do not value the utility of new born households. Given mortality risk, OLG household i in period t has expected utility

$$\mathbb{E}_t \sum_{s=0}^{\infty} (\beta\phi)^s \left[u\left(C_{i,t+s}\right) - v\left(N_{i,t+s}\right) \right]$$

where $C_{i,t+s}$ and $N_{i,t+s}$ denote the consumption and labor supply of OLG household i, given that they survive. Utility over consumption and labor supply take standard forms $u(C) = C^{1-\frac{1}{\sigma}} / \left(1 - \frac{1}{\sigma}\right)$ and $v(N) = N^{1+\frac{1}{\varphi}} / \left(1 + \frac{1}{\varphi}\right)$.

Households use a risk-free and actuarially fair nominal annuity in order to save and borrow. If households survive, they have a nominal rate of return $(1 + I_{t-1}) / \phi$, where I_{t-1} is the net nominal interest rate on government bonds. Additionally, households receive real labor income $W_{it}N_{it}$ net of labor income tax τ_y and given real wage W_{it}. OLG households also pay lump sum taxes T_t. A negative lump sum tax is equivalent to a transfer from the government such as a "stimulus check". Last, newborn households receive contributions from a "social fund" to which older households contribute.

As such, the budget constraint of household i at date t is

$$C_{it} + A_{it} = \frac{1}{\phi}\frac{1+I_{t-1}}{\Pi_t}A_{i,t-1} + \left(1-\tau_y\right)W_{it}N_{it} - T_t + Z_{it},$$

where A_{it} is the end of period real saving of agent i at date t; and Π_t is the gross inflation rate between periods t and $t-1$. Here, Z_{it} is the contribution towards, or transfer away from the social fund. We have $Z_{it} = Z^{\text{new}} > 0$ for newborns and $Z_{it} = Z^{\text{old}} < 0$ for older households, with $\left(1-\phi\right)Z^{\text{new}} + \phi Z^{\text{old}} = 0$. We also set $Z^{\text{new}} = (1+r_{ss})A_{ss}$, where A_{ss} denotes the steady state level of assets held by savers and r_{ss} is the steady state real interest rate. As Angeletos et al. (2023) explain, the role of the social fund is to ensure that all generations have the same wealth and consumption in steady state.

The remaining mass μ of households are hand to mouth. These households do not participate in asset markets. The budget constraint of a hand to mouth household i is $C^H_{it} = (1-\tau_y)W_{it}N^H_{it} - T^H_t$, where C^H_{it} is the consumption of hand to mouth households, N^H_{it} is the labor supply, and T^H_t is their lump sum tax. The steady state lump sum taxes on OLG and hand to mouth households, T_{ss} and T^H_{ss}, ensure that steady consumption is the same for both types of households.

As in Wolf (2021) and Angeletos et al. (2023), OLG households provide a parsimonious form of the standard HANK model. Mortality risk can be interpreted as the probability that a borrowing constraint might bind in the future, or more generally as a finite lifetime or planning horizon. As a result, deficits affect aggregate demand, and Ricardian Equivalence breaks. Relative to the canonical permanent income model, households have a larger marginal propensity to consume (MPC) in the short run, and discount future income more heavily. By adding a share μ of hand to mouth households, our model will be able to match "intertemporal marginal propensities to consume" and approximate the behavior of a richer HANK model (Auclert, Rognlie & Straub 2023).

Firms. Firms operate in perfectly competitive goods markets, selling output at a flexible price P_t. Each firm has a production function that is linear in a single input, which is produced by a "labor packer" and sold to firms at a real price W_t. Aggregate output Y_t satisfies $Y_t = N_t$, where N_t is the aggregate output of the labor packer. Output is sold to either household consumption or the government. That is, we have $Y_t = C_t + G_t$, where G_t is government purchases and C_t is aggregate consumption across OLG and hand to mouth households.

Nominal Wage Rigidity. There is nominal wage rigidity, modeled as in Erceg et al. (2000), and Auclert, Bardóczy & Rognlie (2023). Since the ingredients are standard, we discuss them only briefly. Appendix Section A.1.2 presents a detailed derivation of the Phillips Curve. There is a continuum of unions k, and each worker i belongs to a union. Within the union, all workers are of equal productivity, receive equal after-tax wages, and work the same number of hours. Each union is representative of the entire population. Unions have quadratic costs of adjusting wages as in Rotemberg (1982), and set the nominal wage in order to maximize the equally weighted utility of their members, discounted by β. The labor packer then combines the labor from each union into aggregate employment, using a standard CES aggregator.

The Phillips Curve linking price inflation to real variables takes a familiar form. Since prices are flexible, wage and price inflation coincide absent shocks to total factor productivity. To first order around the zero inflation steady state, inflation satisfies

$$\pi_t = \kappa \left\{ y_t - \frac{\varphi}{\varphi + \sigma \frac{C_{ss}}{Y_{ss}}} g_t \right\} + \beta \pi_{t+1}, \tag{2}$$

where κ is the "slope" of the Phillips Curve defined in Appendix Section A.1.2, and $y_t = \frac{Y_t - Y_{ss}}{Y_{ss}}$ and $g_t = \frac{G_t - G_{ss}}{Y_{ss}}$ are deviations of output and government spending from their steady state values, normalized by steady state output. Equation (2) is the Phillips Curve, with the standard adjustment for how government spending alters wealth effects on labor supply.

Policy and Equilibrium. The government carries out two kinds of policy: fiscal policy, involving government spending, debt and taxes; and a monetary authority that sets nominal interest rates. Regarding monetary policy, the central bank sets the nominal interest rate I_t.

Regarding fiscal policy, the government issues nominal one period bonds B_t, spends G_t on final goods output, levies total lump sum taxes $\mu T_t^H + (1-\mu) T_t$ on hand to mouth and OLG households, and collects labor income taxes $\tau_y Y_t$. As a result, the government budget constraint is

$$B_t = \frac{1 + I_{t-1}}{\Pi_t} B_{t-1} - S_t, \tag{3}$$

where $S_t \equiv \left(\mu T_t^H + (1-\mu) T_t + \tau_y Y_t\right) - G_t$ is the primary budget surplus.

Given these elements, an equilibrium is (i) a sequence of consumption, employment, wages and savings for OLG and hand to mouth households; as well as prices, aggregate output, and government debt; which (ii) satisfies household optimality, the Phillips Curve, asset and goods market clearing and the government's budget constraint (as well as a no-Ponzi condition).

The equilibrium is conditional on the "policy block"—a sequence $\{I_t, T_t, T_t^H, G_t\}_{t=0}^{\infty}$ of nominal interest rates, lump sum taxes on OLG and hand to mouth households, and government spending. In Appendix Section A.2, we present the full set of linearized equations associated with the equilibrium of the model.

Calibration. We calibrate the model to standard parameters from before 2020. Most important are the parameters governing household spending and the slope of the Phillips Curve. As Auclert, Rognlie & Straub (2023) point out, intertemporal marginal propensities to consume should match in the model and data, in order to generate the correct consumption response to fiscal shocks. We calibrate the share of hand to mouth consumers μ, and the OLG mortality rate ϕ, in order to match the first and second year MPCs from Fagereng et al. (2021). We calibrate the slope of the Phillips Curve to the standard value of Hazell et al. (2022), with $\kappa = 0.055$.[24]

Additionally, we calibrate the discount factor, the intertemporal elasticity of substitution and the Frisch elasticity of labor supply to standard values: $\beta = 0.99$, $\sigma = 1$ and $\varphi = 1$; and also choose r_{ss} so that $\beta(1 + r_{ss}) = 1$. We calibrate the steady state debt-to-GDP ratio, the steady state government spending to GDP ratio, and the labor income tax rate to 2019 values from CBO (2019). We report our calibration in Table 8, which also contains parameters about fiscal policy to be discussed directly.

6.2 Modeling the 2021 Deficits

The main exercise will be to feed the shock to deficits from the Georgia election into the model. We will then ask whether the model, with its standard calibration to pre-2020 data, can replicate the inflation multiplier that we have estimated. We therefore discuss how we discipline the policy block of the model, i.e. $\{I_t, T_t, T_t^H, G_t\}_{t=0}^{\infty}$, using our narrative and high frequency evidence as well as additional information sources.

Size of deficit shock. We take the size of the deficit shock, 2.1% of steady state output, from our reading of narrative information in Section 3.

Composition of deficit shock: spending vs. transfers. We now allocate the total deficit shock between transfers and government spending. The narrative reports provide information about the expected composition of deficits. From Appendix Table B.4, the median bank expects that the stimulus will be 70% transfers, with the remainder government spending, principally

[24] Hazell et al. (2022) report the slope of the Phillips Curve, at annual frequency and including housing, in Footnote 24 of the paper.

state and local aid. We opt for similar, but more precise information, based on the realized composition of spending and transfers from the American Rescue Plan (Edelberg & Sheiner 2021). The American Rescue Plan had four major components: (1) federal spending, state aid, and COVID-19 containment (40%) (2) direct aid to families (30%) (3) aid to financially vulnerable households (21%) and (4) aid to businesses (8%). We allocate (1) as government spending and (2)-(4) as transfer payments. Therefore, we assume that 60% of the shock to deficits around Georgia is transfers—similar to the expectations from the narrative reports. We assume that per capita transfers are the same for OLG and hand to mouth households, consistent with the lump sum behavior of "stimulus checks", and consider other forms of distribution in robustness.

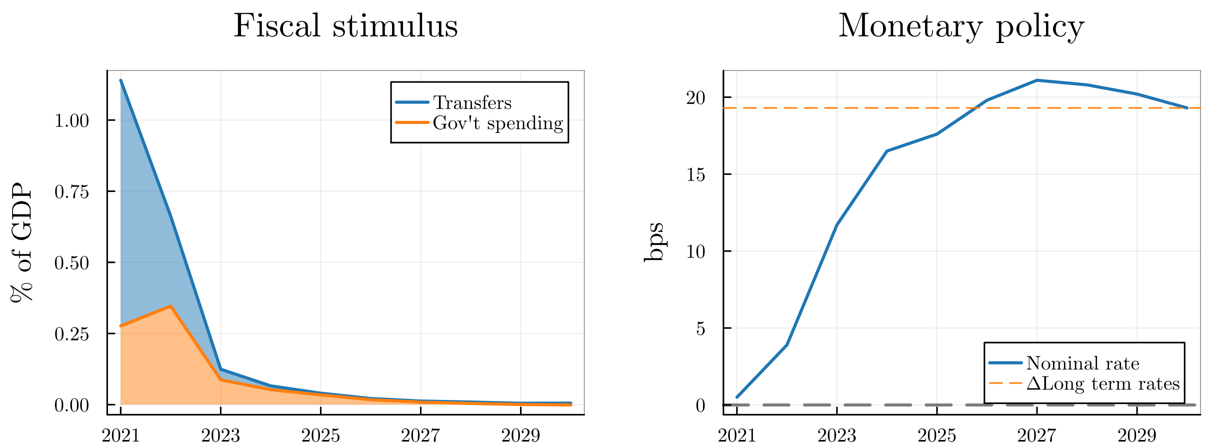
Timing of deficit shock. We now allocate when the components of the deficit shock are expected to be spent. The narrative reports do not provide information about how quickly they expect the shock to deficits around the Georgia election to be spent. Instead, we study the time path of how the overall American Rescue Plan was spent, and assume that the expected time path of deficits after the Georgia election was the same. CBO (2021*a*) (detailed Tables 1-11) projects how quickly various detailed components of the American Rescue Plan would be spent over the subsequent 10 years. We aggregate the detailed components into the broad categories of Edelberg & Sheiner (2021), which results in a projected spending path for government spending and transfers. The CBO provides the spending path of appropriations—that is, when spending would be allocated from the American Rescue Plan towards its intended purpose. However there is typically a lag between appropriations and realized government spending. Following Ramey (2021), we assume a "time to spend" delay between appropriations and realized spending of 1.5 years. We assume that spending on COVID-19 containment does not have this delay.

Together, our information on the size, composition and timing of the deficit shock defines the fiscal stimulus. We will denote fiscal stimulus—the sequence of innovations to taxes and government spending—by $\{\tilde{T}_t, \tilde{T}_t^H, \tilde{G}_t\}_{t=0}^{\infty}$. Fiscal stimulus is associated with an innovation that lowers the primary surplus $\varepsilon_t \equiv \tilde{G}_t - \left(\mu \tilde{T}_t^H + (1-\mu)\tilde{T}_t\right)$. Figure 9, left panel, plots the sequence of fiscal stimulus $\{\varepsilon_t\}_{t=0}^{\infty}$ normalized by steady state output along with its split into government spending and transfers.

Fiscal Rule and Path of Debt. We now specify the fiscal rule associated with our model, which describes how debt will be paid back as well as the initial stimulus. Our fiscal rule specifies the entire sequence of fiscal policy, $\{T_t, T_t^H, G_t\}_{t=0}^{\infty}$, as follows:

- **When t ≤ H:** government spending, and lump sum taxes on OLG households and hand to mouth households are determined entirely by fiscal stimulus. That is, we have that $\{T_t, T_t^H, G_t\}_{t=0}^{H} = \{T_{ss} + \tilde{T}_t, T_{ss}^H + \tilde{T}_t^H, G_{ss} + \tilde{G}_t\}_{t=0}^{H}$.

Figure 9: Fiscal and Monetary Shocks



Notes: the left panel shows total fiscal stimulus shocks $\{\tilde{T}_t, \tilde{T}_t^H, \tilde{G}_t\}_{t\geq 0}$ divided into transfer payments and government spending. The right panel shows the interest rate path estimated in the data.

- **When t > H:** government spending and lump sum taxes on hand to mouth households continue to be determined by fiscal stimulus. Lump sum taxes on OLG households contain an additional component T_t^{repay}, set in order to pay back debt. That is, we have $\{T_t, T_t^H, G_t\}_{t=H+1}^{\infty} = \{T_{ss} + \tilde{T}_t + T_t^{\text{repay}}, T_{ss}^H + \tilde{T}_t^H, G_{ss} + \tilde{G}_t\}_{t=H+1}^{\infty}$, where T_t^{repay} is set so that primary surpluses satisfy

$$S_t = \tau_B \left(B_{t-1} - \bar{B}\right) + r_t B_{t-1} - \varepsilon_t. \tag{4}$$

This fiscal rule has various features that suit our setting. First, the fiscal rule has two phases. Before period H, there is a stimulus phase: lump sum taxes are set to provide stimulus transfers. After period H, there is a repayment phase: lump sum taxes are associated with an additional component in order to pay back debt. This feature, which is shared by the fiscal rule of Angeletos et al. (2023), matches the data. In Figure 9, left panel, stimulus transfers take place almost entirely within years 0, 1 and 2 (i.e. 2021-23). Meanwhile the CBO (2021*a*) (Summary Table 1) forecasts that increases in taxes to partially pay for the American Rescue Plan would start in year 3 (i.e. 2024). Given these features, it is natural to calibrate $H = 3$.

Second, during the repayment phase, the fiscal rule of equation (4) takes a normal form. Following standard practice (e.g. Blanchard 2023), the fiscal rule is written in terms of primary surpluses. Taxes change, so that primary surpluses gradually move towards a level that is consistent with the steady state level of debt, $\bar{B}$. The speed of adjustment is parameterized by τ_B. We will allow the steady state level of debt after the shock, $\bar{B}$, to potentially be higher than the level of debt before the shock. This aspect of the fiscal rule is motivated by our finding that long term interest rates rise, which in HANK models is consistent with steady state debt increases (e.g. Campos et al. 2024). With higher steady state debt, and higher accompanying interest rates, primary surpluses must also be higher in the new steady state. The penultimate term in equation (4) allows the fiscal rule to accommodate these extra interest costs, again similar to Blanchard (2023). The final term is the continual impact of the fiscal stimulus on primary deficits.

Finally, we assume that the long term fiscal adjustment takes place entirely through lump sum taxes on OLG households. This assumption is appealing because consumption and output will be unchanged in the new steady state with higher debt, after the shock. According to the text of the legislation itself, the eventual tax rises associated with the American Rescue Plan would be taxes on high income individuals and corporations. We will consider fiscal adjustment via distortionary taxes and cuts in government spending in robustness exercises.

We calibrate the fiscal rule as follows (see the last three rows of Table 8). As discussed, we set $H = 3$. We calibrate $\bar{B}$, the increase in steady state debt after the shock, in order to match the increase in the 9 year ahead 1 year interest rate from the data. We calibrate τ_B to match the long-horizon persistence of debt forecasted by the CBO (2021*b*). We elaborate on this procedure in Appendix Section A.3, where we show how to identify τ_B from the CBO debt projections.

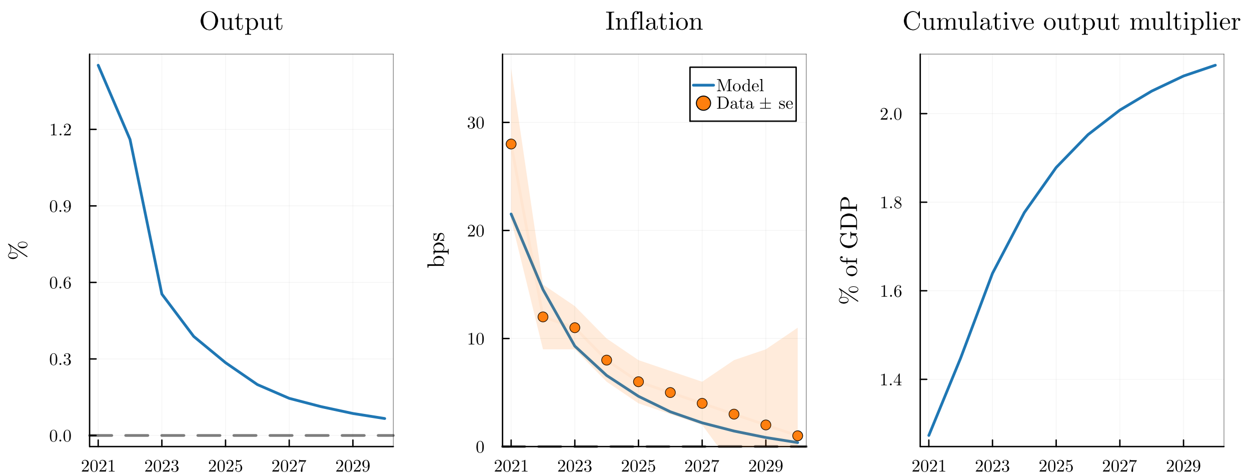
Monetary policy. Estimates from Section 4 pin down expectation of future short-term nominal interest rates up to 10 years. In Figure 9, right panel, we convert these estimates into 1 year forward rates, between 0 and 9 years after the shock. After 10 years we assume a discretionary policy that implements steady state output and inflation in the economy.

Overall shock. The previous information is enough to describe the shock to the 2021 deficits, around the Georgia elections, summarized in the top panels of Figure 10. Specifically, the fiscal rule and the path of interest rates define the shock to the policy block $\{I_t, \tilde{T}_t, \tilde{T}_t^H, \tilde{G}_t\}_{t=0}^{\infty}$, which we will feed into the model.

6.3 Matching the Inflation Multiplier in the Model

Figure 10 plots the impulse response of the economy to the shock after the Georgia election. The model fits the size and dynamics of the response of inflation well. This finding is in the middle panel. The orange circles are the response of inflation in the data, as estimated in Section 4. The blue line is predicted inflation from the model. The two series match closely, both in the initial and later stages of the stimulus, and the model prediction is always within one standard error of

Figure 10: Impulse Response to Georgia Shock



Notes: this graph plots impulse responses of output y_t in percentage deviation from steady state, and inflation π_t in basis point deviations from steady state; as well as the cumulative output multiplier. All responses are to the shocks shown in Figure 9. Inflation estimates from the data are shown with bands of one standard error.

the data (shaded orange area).[25] As a result, the standard HANK model seems to quantitatively match the size and dynamics of the inflation multiplier.

In the standard model, inflation increases via the Phillips Curve: higher output raises marginal costs and therefore inflation. Consistent with this logic, output increases significantly and persistently in our calibration, as the left panel of Figure 10 shows. The right panel shows the cumulative output multiplier. The cumulative output multiplier is defined as $\sum_{j=0}^{t} \beta^j y_{t+j} / \sum_{j=0}^{t} \beta^j \tilde{\varepsilon}_{t+j}$, where $\tilde{\varepsilon}_t \equiv \varepsilon_t / Y_{ss}$ is the sum of government spending and transfers normalized by steady state output, plotted in Figure 9. The cumulative output multiplier starts at 1.3 and gradually rises with the horizon.

One question is whether the changes in output predicted by the model are reasonable. We draw on three pieces of evidence to argue that the output response is indeed plausible. First, in the spirit of Orchard et al. (2023), we consider how private sector forecasts of real GDP changed. As we discussed in Section 4, forecasters revised their forecasts of real GDP upwards after the Georgia election. The median forecaster predicted that 2022 output would be 1.8% higher due to the Georgia election. Second, consider dividend futures. We found in Section 4 that markets predicted real GDP in 2022 would be roughly 1.9% higher due to the Georgia shock. The model predicts that output would be 1.2% higher in 2022 due to the shock, which is similar albeit smaller than the narrative and dividend evidence. Third, contemporary accounts predicted a similar multiplier to what we have found. In particular Blanchard (2021) predicted a short run multiplier associated with the American Rescue Plan. His central tendency was a multiplier of

[25] Appendix Figure B.22 plots the same graph with price levels, and with similar results.

1.2, with high and low values of 2 and 0.4. The short run output multiplier predicted by the model is well within this range.

Our estimates are at least somewhat consistent with historical estimates of the multiplier. In her survey of empirical work, Ramey (2019) suggests that cumulative output multipliers with respect to government spending during periods of accommodative monetary policy could be 1.5 or higher. Our estimates are within this range within the first three years. However the 2021 stimulus comprises of various kinds of transfers as well as government spending, meaning the multiplier from our exercise is not directly comparable to pure government spending multipliers. Aggregate evidence on transfer multipliers is relatively scarce (Ramey 2019).

6.4 The Role of Monetary Policy

We now show that the model can match the inflation multiplier from the data in part because of loose monetary policy. In general, monetary policy determines how fiscal policy affects the economy in standard New Keynesian models. For instance, a sufficiently tight monetary policy can entirely offset the effects of fiscal policy. One advantage of our approach is that we can directly observe the expected behavior of monetary policy in response to the shock to 2021 deficits around the Georgia election.

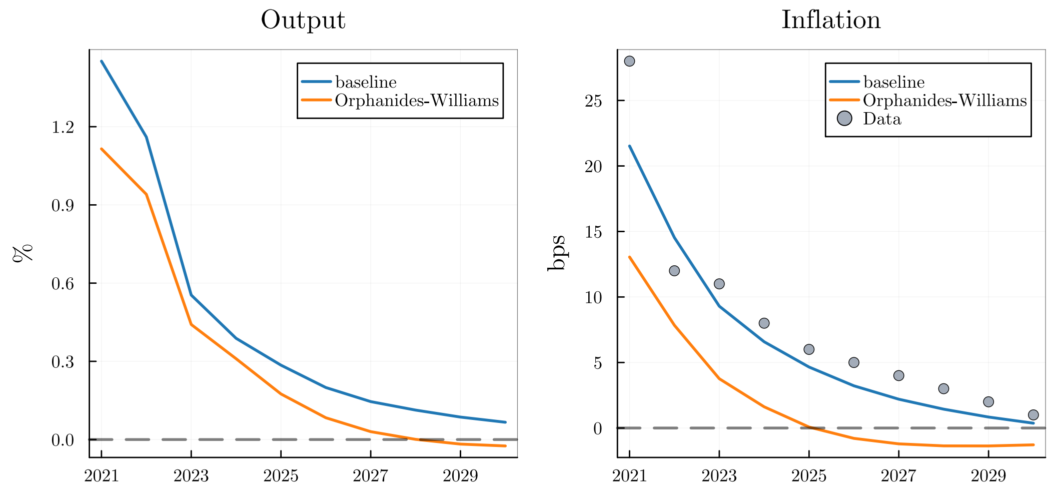
As we have discussed, monetary policy was expected to be loose in response to the 2021 deficits. Consider the behavior of interest rates in the right panel of Figure 9. 1 year nominal interest rates were unchanged, and rose by little in the short term, meaning real interest rates fell in the short term after the Georgia shock.

To quantitatively evaluate the role of relatively loose monetary policy, one must specify "normal" monetary policy—in order to ask how much inflation increased due to looser-than-normal behavior. Our model of normal monetary policy is the Orphanides & Williams (2002) rule, recently popularized by Campos et al. (2024). By this rule, nominal interest rates are set according to $i_t = i_{t-1} + \phi_\pi \pi_t$, with $\phi_\pi = 1.5$. As Campos et al. (2024) explain, this rule is appealing because it allows nominal interest rates to respond to increases in inflation away from the central bank's target. However, the rule does not require information about the steady state level of real interest rates—which according to our model, rises after a steady state increase in government debt.[26]

We show that with the historical monetary policy rule, the response of inflation to monetary policy would have roughly halved. Figure 11 reports this result. In the blue line we plot the

[26] By contrast, a standard Taylor Rule requires information on the steady state real interest rate, which may not be available to the central bank.

Figure 11: Impulse Response with Alternative Monetary Policy



Notes: the figure plots the impulse responses of output y_t and inflation π_t in the model with the monetary policy stance taken from the data (blue), or under the assumption that the monetary authority follows a robust policy rule as in Orphanides & Williams (2002) (orange).

impulse response from the baseline model. In the orange line we plot the impulse response under the alternative, historical monetary policy rule. The right panel shows that the response of inflation would have halved or more in each year of the stimulus. In the left panel the reason is evident. Tighter monetary policy under the historical rule leads to a smaller output boom, which dampens the rise in inflation.

As such, we conclude that one reason for the response of inflation to deficits observed in the data is relatively loose monetary policy. This message is shared by other work about the post-Pandemic inflation. For instance, using a vector autoregression and a structural model based approach, Gagliardone & Gertler (2023) finds that monetary policy was an important contributor to the post-Pandemic inflation. Narrative accounts also find that monetary policy was loose over this period (e.g. Cieslak & Pflueger 2023).

6.5 Robustness and Discussion

The main takeaway is that standard HANK models are capable of matching the size and dynamics of the inflation multiplier—the causal effect of the 2021 deficits on inflation at various horizons. We now consider various robustness exercises that support this message. We also discuss an important caveat. If the HANK model is calibrated to match lower and more transitory intertemporal MPCs in line with some estimates, then it can no longer match the inflation multiplier. Finally, we show that an alternative theory linking deficits and inflation—the fiscal theory of the price level—can also match the inflation multiplier.

Infrastructure investment. As we discussed in Section 3, a second component of the Democrat victory was the likelihood of greater infrastructure spending. So far, we have omitted infrastructure spending from our analysis. The reason is that, as we show in Appendix Section A.4.1, the effect of the infrastructure package on the economy is small according to the model. In the Appendix, we extend the model to include infrastructure, following a simplified version of the model of Ramey (2021), which in turn builds on Leeper et al. (2010) and Boehm (2020). In this extended model, we look at the impulse response to the combined shock of the policy shocks from Figure 9 and the upper bound for the infrastructure spending shock discussed in Section 3. We pin down the path for infrastructure spending from detailed projections from Moody's Analytics. According to the model, infrastructure increases the first year response of inflation by 0.07 percentage points or less, depending on our calibration, and the first year response of output by 0.02 percentage points or less.

As we discuss in the Appendix, the small effect of infrastructure is for three reasons. First, the infrastructure program was balanced budget, and the tax rises dampen the output multiplier. Second, the wealth effects induced by greater infrastructure spending dampen the effects on inflation and output. Third, following Ramey (2021), we incorporate a realistic "time to build" lag, meaning little of the infrastructure is spent in the first three years.

Taxes to pay back debt. In the baseline model, we assume that the taxes to pay back the debt are entirely levied as lump sum transfers on OLG households. Some plausible alternative assumptions are that the primary surplus is raised (i) by cutting government spending or (ii) via distortionary taxation on labor. Appendix Figure A.3 studies the impulse response of the economy under these alternative assumptions, and finds that the inflation response changes little.

Alternative allocations of transfers in the American Rescue Plan. In the baseline, we assume that transfers from the American Rescue Plan are allocated equally to OLG and hand to mouth households. Other assumptions are possible. For instance, unemployment insurance could have been received only by hand to mouth households. Similarly, aid to businesses potentially went to lower MPC households. With these alternative assumptions, the impulse response of inflation changes little, as Appendix Figure A.5 shows. The output response is more front loaded but less persistent. As the inflation response is based on the net present value of the output response these two effects roughly cancel.

Alternative monetary policy. Instead of assuming that monetary policy implements steady state output and inflation after 10 years, we allow monetary policy to follow a standard Taylor Rule after 10 years. Appendix Figure A.7 plots the impulse response under this alternative terminal condition, which changes little.

Alternative consumption models. Our baseline model assumes a mix of OLG and hand to mouth households. In robustness, we explore two other natural possibilities. The first is a mix of hand to mouth and bond-in-utility households, following Auclert, Rognlie & Straub (2023). The second is three types of OLG households who differ in their mortality risk, following Wolf (2021) and Angeletos et al. (2024). The third is sticky information as in Auclert et al. (2020), which has been shown to be important to produce hump shaped aggregate responses while being consistent with responses at the micro-level. Appendix Section A.4.3 describes these alternative possibilities and Figure A.4 shows that when these alternative models match the same intertemporal marginal propensities to consume, the implications for output and inflation are similar.

Calibrating to alternative intertemporal marginal propensities to consume. Our baseline model calibrates to the intertemporal marginal propensities to consume of Fagereng et al. (2021), following standard practice (e.g. Angeletos et al. 2023; Auclert, Rognlie & Straub 2023). Fagereng et al. (2021) find a marginal propensity to consume of 0.51 after 1 year and 0.16 after two years. However, other work estimates a smaller and more transitory consumption response to transfers (e.g. Orchard et al. 2023; Boehm et al. 2023). Matching the alternative consumption response means that the HANK model can no longer match the inflation multiplier. For instance, Boehm et al. (2023) estimate a marginal propensity to consume of 0.23 in the first quarter, and zero afterwards. We calibrate the model to this alternative moment, and present the results in Appendix Section A.4.5. Figure A.6 shows that with the alternative calibration, the inflation response in the model is significantly lower than the data. This result is an important qualification to our finding that HANK models perform well during the post-Pandemic Inflation. One reason to prefer our baseline calibration is that it matches the fact that long horizon interest rates rise after the fiscal shock, given the increase in the long-run stock of government debt. As we discuss in the Appendix, the alternative calibration requires an implausibly low intertemporal elasticity of substitution in order to account for the long term behavior of interest rates.

Fiscal Theory of the Price Level. We now discuss how our results relate to the fiscal theory of the price level (FTPL). We have shown that the standard HANK model can match our estimates of the causal effects of deficits on inflation. One question is how a leading alternative model linking deficits to inflation fares, namely the FTPL. In Appendix Section A.4.7 we explore a simple FTPL model similar to Bianchi et al. (2023), with partly unfunded deficits, long term debt, and a Taylor Rule. The alternative model is also capable of matching our estimate of the size and response of inflation dynamics to the deficit shock. Our result echoes a message from

Angeletos et al. (2024), that both HANK and FTPL models are capable of matching the response of inflation to deficits.

7 Conclusion

An important question in macroeconomics is whether deficits raise inflation, especially in the context of the recent, post-Pandemic inflation. This paper proposes a "high frequency narrative approach", to measure the causal effect of the 2021 deficits on inflation. We identify an event that released news about the 2021 deficits—the Georgia Senate election runoff. We calculate the shock to expected deficits from the runoff, using new narrative data from investment banks. We next measure the high frequency response of inflation forecasts, using inflation swaps. The value of high frequency variation is in separating news about deficits from other factors that affected the economy around the same time. We combine the high frequency and narrative information to estimate an inflation multiplier of 0.18% over two years. The multiplier suggests the 2021 deficits caused around 30% of the excess inflation in 2021 and 2022. We conclude that deficits were important for the post-Pandemic inflation, albeit not the only cause. Last, we confront standard HANK models with our estimate of the inflation multiplier. With a standard calibration, HANK models successfully match the size and dynamics of the inflation response.

We have used the high frequency narrative approach in order to evaluate whether deficits cause inflation. We believe this approach could be fruitfully applied to estimate the causal effect of other single, episode specific shocks on the economy. We believe this method is useful because certain episodes, such as the 1980s Disinflation or the Great Depression, are particularly influential to macroeconomists.

8 Tables

Table 1: Expected Stimulus after Democrat Victory

Date	**Bank**	**Number, $(billion)**	**Exact Phrasing**
06.01.2021	Goldman Sachs	750	"With control of the Senate by a narrow margin, Democrats are likely to pass further fiscal stimulus in Q1 that we expect to total about $750bn."
06.01.2021	BNP Paribas	1000	"We expect the unified Democratic government to enact significantly more near-term spending – upwards of $1trn, split between Covid-19 and non-Covid related fiscal support – than under our previous assumption of a GOP-led Senate and divided government."
06.01.2021	Jefferies	1000	"Jefferies LLC economists ... see Democratic victories in both seats spurring an additional $1 trillion of stimulus in the next few months."
06.01.2021	Capital Economics	0	"We are not going to be factoring in any further fiscal stimulus into our forecasts yet."
07.01.2021	JP Morgan Wealth Management	750	"We are assuming another support bill of around $750 billion will be passed sometime between February and early April."
07.01.2021	JP Morgan	900	"Our best guess ... is a spending package of around $900 billion passed in the next few months."
07.01.2021	Deutsche Bank	900	"In the first quarter, we anticipate passage of a bill of approximately $900bn."
08.01.2021	UBS	500	"We would expect a fiscal package of roughly $500bn following the inauguration."
08.01.2021	Barclays	1400	"We assume over $1.4trn in additional aid following the outcome of this week's Senate runoffs in Georgia."
10.01.2021	Moody's Analytics	750	"Fiscal support from the new Biden administration and Congress is expected to include an additional $750 billion to help the economy through to the end of the pandemic."
11.01.2021	Bank of America Corp	1000	"A Blue Wave increases the likelihood of an immediate $1 trillion Covid stimulus."
11.01.2021	Morgan Stanley	1000	"We expect an additional US$1 trillion for Covid-19 aid in the near term."

Median of Expected Stimulus after Democrat Victory: $900 bn

Notes: The number is taken from the reports of investment banks after elections. The sample is restricted to be from 6th of January until 13th of January. For cases where the range is given, the median of the range is taken.

Table 2: Single Event Study—Effect on Inflation Forecasts from Swaps

	Jan 7, non Stationary	Jan 6, non Stationary	Difference	Jan 7, Stationary	Drop missing
	(1)	(2)	(3)	(4)	(5)
Panel A: Percent increase in the price level from inflation swaps over 1 year					
Jump in Expectations	0.28	0.18	0.28	0.28	0.28
	(0.07)	(0.05)	(0.03)	(0.03)	(0.12)
Observations	231	231	231	232	231
Panel B: Percent increase in the price level from inflation swaps over 2 years					
Jump in Expectations	0.38	0.18	0.37	0.45	0.38
	(0.05)	(0.04)	(0.04)	(0.05)	(0.09)
Observations	659	659	659	660	659
Panel C: Percent increase in the price level from inflation swaps over 5 years					
Jump in Expectations	0.58	0.29	0.58	0.76	0.58
	(0.22)	(0.16)	(0.08)	(0.08)	(0.23)
Observations	1048	1048	1048	1049	1048
Panel D: Percent increase in the price level from inflation swaps over 10 years					
Jump in Expectations	0.77	0.44	0.74	0.99	0.75
	(0.18)	(0.14)	(0.12)	(0.11)	(0.49)
Observations	647	647	647	648	647

Note: Each panel corresponds to the expected percent increase in the price level over a specific maturity. The data for inflation expectations come from the intraday prices of zero-coupon inflation swaps at 10-minute frequency, sourced from Bloomberg. In all panels, we adjust the price of the inflation swap to take into account the 3-month lag of the inflation index used in the contracts. In all panels, we calculate the increase in inflation expectations compared to the counterfactual scenario where the series would have continued to behave as before beginning of January 5th, 2021, just before the announcement of the Georgia election results. In column (4) we force the algorithm to choose a stationary ARIMA model, in all other columns we let the algorithm to choose either a stationary or non-stationary ARIMA model, using Akaike's Information Criterion. In Column (1), we fit a non-stationary ARIMA model to the data from the start of December 18th, 2020 to the start of January 5th. Column (2) sets the counterfactual at 2:00 PM on January 6th, 2021 and fits a non-stationary ARIMA model as well. In Column (3), we simply take the difference between the swap prices at the end of January 7th and the beginning of January 5th. Column (4) fits a stationary ARMA model to the data from December 18th, 2020 to January 7th, 2021. Column (5) drops all missing values and then fits the non-stationary ARIMA model. In Columns 1,2,4, and 5 the standard error, in brackets, is the ARIMA standard error. In Column 3, we calculate the standard error empirically by calculating the standard deviations of the price series before January 5th, over periods equal in length to the time between the start of January 5th and the end of January 7th.

Table 3: Single Event Study—Effect on Nominal Dividend Futures

	Jan 7, non Stationary	Jan 6, non Stationary	Difference	Jan 7, Stationary	Drop missing
	(1)	(2)	(3)	(4)	(5)
Panel A: 2021 Log Dividend Future					
Jump in Expectations	2.74	1.09	2.79	2.79	2.89
	(1.63)	(1.27)	(0.31)	(0.54)	(1.55)
Observations	77	77	77	78	77
Panel B: 2022 Log Dividend Future					
Jump in Expectations	3.32	1.23	2.88	3.32	3.49
	(0.51)	(0.51)	(0.52)	(0.51)	(0.51)
Observations	76	76	75	76	76

Note: Each panel corresponds to the increase in the 100*Log(Dividend Future) for a specific year. The data for dividend futures come from Bloomberg-CME. In all panels, we calculate the increase in the the 100*Log(Dividend Future) compared to the counterfactual scenario where the series would have continued to behave as before last observation on January 4th, 2021. In column (4) we force the algorithm to choose a stationary ARIMA model, in all other columns we let the algorithm to choose either a stationary or non-stationary ARIMA model, using Akaike's Information Criterion. In Column (1), we fit a potentially non-stationary ARIMA model to the data from the start of December 18th, 2020 to the end of of January 4th. Column (2) sets the counterfactual at 2:00 PM on January 6th, 2021. In Column (3), we simply take the difference between the expected dividends at the end of January 7th and the beginning of January 4th. Column (4) fits a stationary ARMA model to the data from December 18th, 2020 to January 7th, 2021 to estimate the counterfactual. Column (5) drops all missing values and then fits the non-stationary ARIMA model for 2021 dividends and stationary ARMA model for 2022 dividends. In Columns 1, 2, 4, and 5 the standard error is the ARMA prediction's standard error at the point of calculating the effect. In Column 3, we calculate the standard error empirically by calculating the standard deviations of the expected dividends series before January 4th, over periods equal in length to the time between the end of January 4th and the end of January 7th.

Table 4: Single Event Study—Effect on Real Dividends

	Jan 7, non Stationary	Jan 6, non Stationary	Difference	Jan 7, Stationary	Drop missing
	(1)	(2)	(3)	(4)	(5)
Panel A: 2021 Real Dividend Growth					
Jump in Expectations	2.46	0.91	2.51	2.51	2.61
Panel B: 2022 Real Dividend Growth					
Jump in Expectations	2.94	1.05	2.51	2.87	3.11

Note: Each panel corresponds to the increase in the expected real S&P 500 dividends for a specific year. We subtract the increase in inflation expectations, from Table 2, from estimates for the increase in dividend futures at the same horizon, from Table 3.

Table 5: Instrumental Variables: Effect on Inflation

	Full Sample	Before Jan 5	Outliers Dropped	Diff
	(1)	(2)	(3)	(4)
Panel A: Percent increase in the price level from inflation swaps over 1 year				
Democrat Win Probability	0.87	3.42	0.95	0.08
	(0.09)	(0.40)	(0.14)	(0.04)
Observations	40	35	35	38
Panel B: Percent increase in the price level from inflation swaps over 2 years				
Democrat Win Probability	1.39	5.40	1.50	0.23
	(0.14)	(0.59)	(0.22)	(0.07)
Observations	41	36	36	40
Panel C: Percent increase in the price level from inflation swaps over 5 years				
Democrat Win Probability	2.12	8.24	2.33	0.33
	(0.22)	(0.91)	(0.33)	(0.10)
Observations	41	36	36	40
Panel D: Percent increase in the price level from inflation swaps over 10 years				
Democrat Win Probability	2.84	12.30	3.16	0.64
	(0.34)	(1.60)	(0.51)	(0.19)
Observations	41	36	36	40

Note: Each panel in the table presents a different horizon for changes in the price level. In all panels, we adjust the price of the inflation swap to take into account the 3-month lag of the inflation index used in the contracts. For all panels, we regress the expected increase in the price level on the lagged probability of a Democratic win in the 2021 Georgia Senate election. We use Newey-West standard errors with three lags. Our dataset is daily, sourcing expected increases in the price level from zero-coupon inflation swaps from Bloomberg, and probabilities of a Democratic victory from PredictIt's 2020 Senate election betting prices. The data spans from November 17, 2020, to January 12, 2021. Column (1) analyzes the entire dataset. Column (2) considers only data gathered before January 5, 2021. Column (3) omits data from outliers, namely the 6th and 7th of January and the 2nd-4th December. Lastly, in Column (4), the analysis uses the differenced values of both dependent and independent variables. Counts refer to the number of daily observations.

Table 6: Polling Instrument Specification, With and Without Controls

Controls	1 Year	2 Years	5 Years	10 Years
1. No Control	3.93	5.78	10.31	16.41
	(0.70)	(1.17)	(1.81)	(3.12)
Observations	29	30	30	30
2. 10-year Bonds	2.12	2.77	6.30	10.97
	(0.84)	(1.39)	(1.60)	(2.91)
Observations	29	30	30	30
3. Surprise Index	0.90	1.38	5.90	11.84
	(0.63)	(1.20)	(1.83)	(3.50)
Observations	23	23	23	23
4. Oil Price	-0.05	-0.003	4.39	9.13
	(1.29)	(1.87)	(1.59)	(3.36)
Observations	29	30	30	30
5. S&P 500	1.1	1.03	5.34	10.46
	(1.03)	(1.71)	(1.89)	(3.67)
Observations	28	29	29	29
6. Vaccine Dummy	3.77	5.51	9.96	15.9
	(0.66)	(1.11)	(1.7)	(2.95)
Observations	29	30	30	30
7. COVID Effect	3.96	5.76	10.39	16.5
	(0.74)	(1.22)	(1.97)	(3.45)
Observations	29	30	30	30

Note: Each panel in the table represents a different control variable added to the baseline IV specification. In all panels, we adjust the price of the inflation swap to take into account the 3-month lag of the inflation index used in the contracts. For all panels, we regress the expected increase in the price level on the lagged probability of a Democratic win in the 2021 Georgia Senate election, instrumented by polling data for the Georgia Senate election from FiveThirtyEight.com. We use Newey-West standard errors with three lags. Our dataset is daily, sourcing expected increases in the price level from zero-coupon inflation swaps from Bloomberg, and probabilities of a Democratic victory from Predictit's 2020 Senate election betting prices. The data spans from Nov 17, 2020, to Jan 12, 2021. The first panel does not have any controls. All controls are lagged one day. The 2nd panel controls for the zero-coupon yield of 10-year US government bonds from Bloomberg. The 3rd panel controls for the economic surprise index from Bloomberg, which measures the difference between professional forecasters' expectations and realized values. Panel 4 controls for the price of Brent crude oil from FRED. Panel 5 controls for the S&P 500 index from Bloomberg. Panel 6 controls for a dummy variable for important dates of vaccine announcements, sourced from the CDC's timeline, specifically on Dec 11, 18, 23 of 2020, and Jan 6 of 2021. The last panel uses data from the Cleveland Fed. The robust first stage F-statistics are 18.96, 12.5, 35.06, 3.94, 4.997, 19.35, and 17.7 respectively.

Table 7: Single Event Study—Effect on Nominal Interest Rates

	Jan 7, non Stationary	Jan 6, non Stationary	Difference	Jan 7, Stationary	Drop missing
	Panel A: Percentage increase in nominal interest rates over 1 year				
	(1)	(2)	(3)	(4)	(5)
Jump in Interest Rate	0.005	0.014	0.0047	0.005	0.005
	(0.009)	(0.006)	(0.0051)	(0.005)	(0.015)
Observations	570	570	570	571	570
	Panel B: Percentage increase in nominal interest rates over 5 years, after 5 years				
Jump in Interest Rate	0.202	0.161	0.2024	0.202	0.202
	(0.08)	(0.059)	(0.0213)	(0.025)	(0.106)
Observations	570	570	570	571	570

Note: Each panel corresponds to the percentage increase in the interest rate over a specific maturity. The data for interest rates come from the intraday prices of US government treasuries at 10-minute frequency, sourced from CME group. We calculate the zero-coupon yield of the treasuries using bootstrapping and interpolate using a cubic smoothing spline. In all panels, we calculate the increase in interest rates compared to the counterfactual scenario where the series would have continued to behave as before the beginning of January 5th, 2021, just before the announcement of the Georgia election results. In column (4) we force the algorithm to choose a stationary ARIMA model, in all other columns we let the algorithm to choose either a stationary or non-stationary ARIMA model, using Akaike's Information Criterion. In Column (1), we fit a non-stationary ARIMA model to the data from the start of December 18th, 2020 to the start of January 5th. Column (2) sets the counterfactual at 2:00 PM on January 6th, 2021 and fits a non-stationary ARIMA model as well. In Column (3), we simply take the difference between the interest rate at the end of January 7th and the beginning of January 5th. Column (4) fits a stationary ARMA model to the data from December 18th, 2020 to January 7th,2021 to estimate the counterfactual. Column (5) drops all missing values and then fits the non-stationary ARIMA model. In Columns 1, 2, 4, and 5 the standard error is the ARMA prediction's standard error at the point of calculating the effect. In Column 3, we calculate the standard error empirically by calculating the standard deviations of the interest rate series before January 5th, over periods equal in length to the time between the start of January 5th and the end of January 7th.

Table 8: **Calibration of Model**

Parameter	Description	Value	Target
Households			
μ	Share of hand-to-mouth	0.275	1 & 2 year intertemporal MPC
ϕ	OLG survival rate	0.68	
σ	Intertemporal elasticity of substitution	1	Standard
φ	Frisch elasticity	1	Standard
β	Discount factor	0.99	Standard
Nominal rigidities			
κ	NKPC slope	0.055	Hazell et al. (2022)
Steady State Fiscal			
B_{ss}/Y_{ss}	Steady state Debt-to-GDP	0.8	OMB (2024)
τ_y	Marginal tax rate	0.27	CBO (2019)
G_{ss}/Y_{ss}	Gov't spending-to-GDP	0.2	BEA (2024)
Fiscal Rule			
τ_B	Response of surpluses to debt	0.189	Persistence of debt, CBO (2021*b*)
H	Period where debt repayment starts	3	CBO (2021*a*)
$\bar{B}/Y_{ss}$	Steady state Debt-to-GDP after shocks	80.6%	9 year ahead 1 year interest rate

Notes: this table reports each parameter and its source for the calibration. The intertemporal MPCs are from Fagereng et al. (2021). We discuss in Appendix Section A.3 how we calibrate τ_B to match the long horizon persistence of debt, after the American Rescue Plan, from CBO (2021*b*).

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Appendix (For Online Publication)

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A Model Appendix

A.1 Additional Derivations

This subsection contains additional derivations for the consumption and wage setting blocks of the model. We will need these derivations in order to present the full set of log-linearized equations characterizing the equilibrium of the model, which we present in the next section.

A.1.1 Consumption Block

It will be convenient to index household i by the cohort j that they belong to. As age is the only source of heterogeneity amongst savers this can be done without loss of generality. A household in cohort j chooses the sequence of consumption and savings to maximize

$$\max_{\{C_{j+s,t+s}, A_{j+1+s,t+s}\}} \sum_{s=0}^{+\infty} (\beta\phi)^s \frac{C_{j+s,t+s}^{1-\frac{1}{\sigma}} - 1}{1-\frac{1}{\sigma}} \tag{A.1}$$

subject to

$$C_{j,t} + A_{j+1,t} = \frac{1+R_t^p}{\phi} A_{j,t-1} + Y_t^d + Z_{jt}, \tag{A.2}$$

where $1 + R_t^p = \frac{1+I_{t-1}}{\Pi_t}$ denotes the ex-post real return on the nominal asset, $Y_t^d = (1-\tau_y)Y_t - T_t$ denotes disposable income of OLG households, and $Z_{j,t}$ the cohort-specific social fund payments.

Optimality conditions. The first order condition of the household problem gives the standard Euler equation as annuity markets compensate households for the mortality risk

$$C_{j,t}^{-\frac{1}{\sigma}} = \beta\left(1 + R_{t+1}^p\right) C_{j+1,t+1}^{-\frac{1}{\sigma}}. \tag{A.3}$$

Combining the Euler equation with the net present value budget constraint lets us characterize the consumption function for a household in cohort j as

$$C_{j,t} = \left[\sum_{s=0}^{+\infty} (\phi\beta^\sigma)^s \mathscr{R}_{t,t+s}^{\sigma-1}\right]^{-1} \left(\frac{1+R_t^p}{\phi} A_{jt-1} + \Omega_{j,t}^h + \Omega_{j,t}^z\right), \tag{A.4}$$

where $\mathscr{R}_{t,t+s} = \prod_{k=1}^{s}(1 + R^p_{t+k})$ with the normalization $\mathscr{R}_{t,t} = 1$, and human wealth is defined recursively

$$\Omega^h_{j,t} = Y^d_t + \frac{\phi}{1 + R^p_{t+1}} \Omega^h_{j+1,t+1}, \tag{A.5}$$

and the net present value of social fund payments is given by

$$\Omega^z_{j,t} = Z_{j,t} + \frac{\phi}{1 + R^p_{t+1}} \Omega^z_{j+1,t+1}. \tag{A.6}$$

The budget constraint (A.2) completes the characterization of the individual cohort problem.

Aggregation. Next we aggregate individual policies across cohorts. As is well known, the constant survival probability gives rise to a geometric distribution across cohorts. Summing over households, let us define aggregates as

$$C_t = \sum_{j=0}^{+\infty} (1-\phi)\phi^j C_{j,t}$$
$$A_t = \frac{1}{\phi} \sum_{j=1}^{+\infty} (1-\phi)\phi^j A_{j,t}$$
$$\Omega^h_t = \sum_{j=0}^{+\infty} (1-\phi)\phi^j \Omega^h_{j,t}$$
$$\Omega^z_t = \sum_{j=0}^{+\infty} (1-\phi)\phi^j \Omega^z_{j,t}$$

First, since assets are defined in terms of end of period and cohorts are born with zero assets, aggregation of assets starts at $j = 1$ and is pre-multiplied by $1/\phi$. Noting that the social fund payments net out on aggregate, the budget constraint aggregates to

$$C_t + A_t = (1 + R^p_t) A_{t-1} + Y^d_t. \tag{A.7}$$

On aggregate current generations need to fund the social fund payments for future newborn generations. Specifically, the social fund must raise $(1-\phi)Z^{\text{new}}$ in the next period to fund transfers to the mass of $1-\phi$ newborn households. This must be financed by households that are currently alive. As households need to pay this cost only in the next period it is discounted by $\frac{1}{1+R^p_{t+1}}$. It follows that the dynamics of the net present value of the aggregate social fund payments of households currently alive is given by

$$\Omega^z_t = -\frac{1-\phi}{1 + R^p_{t+1}} Z^{\text{new}} + \frac{\phi}{1 + R^p_{t+1}} \Omega^z_{t+1}. \tag{A.8}$$

Given these elements and for a given sequence of disposable aggregate income and ex-post real rates $\{Y_t^d, R_t^p\}$, we can fully characterize the aggregate consumption function as

$$C_t = \left[\sum_{s=0}^{+\infty} (\phi\beta^\sigma)^s \mathscr{R}_{t,t+s}^{\sigma-1}\right]^{-1} \left((1+R_t^p)A_{t-1} + \Omega_t^h + \Omega_t^z\right), \tag{A.9}$$

where the net present value of human wealth is given by

$$\Omega_t^h = Y_t^d + \frac{\phi}{1+R_{t+1}^p}\Omega_{t+1}^h, \tag{A.10}$$

and the net present value of social fund payments Ω_t^z is given by (A.8). Finally, the aggregate budget constraint is given by (A.7).

Savings. Finally, we derive an expression for the steady state level of savings of households in the baseline overlapping generations model. From equations (A.10) and (A.8) we have $\Omega_{ss}^h = \frac{1}{1-\frac{\phi}{1+r_{ss}}} Y_{ss}^d$ and $\Omega_{ss}^z = -\frac{1}{1-\frac{\phi}{1+r_{ss}}} \frac{1-\phi}{1+r_{ss}} Z^{\text{new}}$. Plugging into the aggregate consumption function and using the fact that $Y_{ss}^d = C_{ss} - r_{ss}A_{ss}$ and $Z^{\text{new}} = (1+r_{ss})A_{ss}$ yields

$$A_{ss} = \frac{\frac{\phi}{1+r_{ss}}\left((\beta(1+r_{ss}))^\sigma - 1\right)}{(1-\phi)\left[1-\frac{\phi}{1+r_{ss}}(\beta(1+r_{ss}))^\sigma\right]} C_{ss} + \frac{1}{1+r_{ss}} Z^{\text{new}}. \tag{A.11}$$

The elasticity of steady state savings with respect to the real rate is $\frac{\partial \log A}{\partial \log(1+r)} = \sigma \frac{\phi\beta}{(1-\phi)(1-\phi\beta)} \frac{C_{ss}}{A_{ss}} - 1$, which we use to pin down the new steady state value of government debt $\overline{B}$.

A.1.2 Wage Setting

We follow standard practice and assume that wages are sticky as in Erceg et al. (2000) and Auclert, Rognlie & Straub (2023). The exposition in this Appendix follows Auclert, Rognlie & Straub (2023). There is a continuum of unions k set nominal wages and uniform working hours for their members. Each worker i is part of a union k and there is no sorting of workers into unions. Workers are homogeneous and do not differ in their productivity. A competitive labor packer combines labor from each union into an aggregate input using the standard CES aggregator

$$N_t = \left(\int N_{kt}^{\frac{\varepsilon-1}{\varepsilon}} dk\right)^{\frac{\varepsilon}{\varepsilon-1}}. \tag{A.12}$$

These services are sold to firms at a nominal wage W_t^n.

Union maximizes the utility of their members by setting the nominal wage W_{kt}^n subject to a

Rotemberg adjustment cost

$$\max_{\{W^n_{kt+s}\}_{s\geq 0}} \sum_{s\geq 0} \beta^s \left\{ \int \left[u(C_{i,t+s}) - v(N_{k,t+s}) \right] di - \frac{\psi}{2} \left(\frac{W^n_{k,t+s}}{W^n_{k,t+s-1}} - 1 \right)^2 \right\}, \tag{A.13}$$

subject to

$$N_{kt} = \left(\frac{W^n_{kt}}{W^n_t} \right)^{-\varepsilon} N_t \tag{A.14}$$

$$W^n_t = \left(\int (W^n_{kt})^{1-\varepsilon} dk \right)^{\frac{1}{1-\varepsilon}} \tag{A.15}$$

and

$$C_{i,t} = \begin{cases} (1-\tau_{y,t}) \frac{W^n_{kt}}{P_t} N_{kt} - T^H_t & \text{if } i = H, \\ \frac{1}{\phi} \frac{1+I_{t-1}}{\Pi_t} A_{i,t-1} + \left[(1-\tau_y) \frac{W^n_{kt}}{P_t} N_{kt} - T_{i,t} + Z_{i,t} \right] - A_{i,t+1} & \text{if } i \subset \mathscr{S}. \end{cases} \tag{A.16}$$

where $\mathscr{S}$ denotes the indices of savers. For generality we include time-varying distortionary labor taxation.

By an application of the Envelope Theorem unions only consider the direct effect of wages on household utility and set a wage that satisfies the first order condition

$$\begin{aligned} \left(\int u'(c_{i,t+s}) di \right) \frac{1-\tau_{y,t+s}}{P_{t+s}} \frac{\partial [W^n_{kt+s} N_{kt+s}]}{\partial W^n_{kt+s}} - v'(N_{kt_s}) \frac{\partial N_{kt+s}}{\partial W^n_{kt_+s}} \\ - \psi \left(\frac{W^n_{kt+s}}{W^n_{kt+s-1}} - 1 \right) \frac{1}{W^n_{kt+s-1}} + \beta\psi \left(\frac{W^n_{kt+s+1}}{W^n_{kt+s}} - 1 \right) \frac{W^n_{k_{t+s+1}}}{(W^n_{kt+s})^2} = 0 \end{aligned} \tag{A.17}$$

Next, we know from the labor demand that $\frac{\partial [W^n_{kt+s} N_{kt+s}]}{\partial W^n_{kt+s}} = (1-\varepsilon) N_{kt+s}$. Plugging back in, multiplying both sides by W^n_{kt+s}, using the fact that $\frac{W^n_{t+s} N_{t+s}}{P_{t+s}} = Y_{t+s}$, and focusing on a symmetric equilibrium we obtain the Wage New Keynesian Phillips Curve

$$\pi^w_t (1+\pi^w_t) = \frac{\varepsilon}{\psi} \left\{ N_t v'(N_t) - \frac{\varepsilon - 1}{\varepsilon} (1-\tau_{y,t}) Y_t \left(\int u(c_{i,t}) di \right) \right\} + \beta \pi^w_{t+1} (1-\pi^w_{t+1}). \tag{A.18}$$

Linearizing around the zero inflation steady state $\pi^w = 0$, using the fact that all households have the consumption level in steady state and plugging in the functional forms for u and v

$$\pi^w_t = \kappa_W \left\{ \frac{1}{\varphi} \frac{dN_t}{N_t} + \frac{1}{\sigma} \frac{dC_t}{C} - \left(\frac{dY_t}{Y} - \frac{dN_t}{N} \right) + \frac{d\tau_{y,t}}{1-\tau_y} \right\} + \beta \pi^w_{t+1}, \tag{A.19}$$

where $\kappa_w = \frac{\varepsilon}{\psi} v'(N) N$ and $dX_t = X_t - X_{ss}$ denote deviations from steady state. Since prices are flexible, firms target a constant markup of one and $\pi_t = \pi_t^w$. In the baseline model, we abstract from distortionary taxation, changes in TFP, and assume constant returns to scale in aggregate labor

$$\pi_t^w = \kappa_w \left\{ \frac{1}{\varphi} \frac{dN_t}{N} + \frac{1}{\sigma} \frac{dC_t}{C} \right\} + \beta \pi_t^w. \tag{A.20}$$

Calibration. Let $y_t = dY_t / Y_{ss}$ and $g_t = dG_t / Y_{ss}$. From the aggregate resource constraint $c_t = y_t - g_t$. From the production function $y_t = n_t$. Then, we can rearrange equation (A.19) as

$$\pi_t = \kappa_w \left(\frac{1}{\varphi} + \frac{1}{\sigma} \frac{1}{C_{ss}/Y_{ss}} \right) \left(y_t - \frac{\varphi}{\varphi + \sigma \frac{C_{ss}}{Y_{ss}}} g_t \right) + \beta \pi_{t+1}. \tag{A.21}$$

We calibrate $\kappa = \kappa_w \left(\frac{1}{\varphi} + \frac{1}{\sigma} \frac{1}{C_{ss}/Y_{ss}} \right)$ to match the empirical estimate from Hazell et al. (2022) of $\kappa = 0.055$ and determine $\kappa_w = \frac{\varepsilon}{\psi} v'(N) N$ residually given our parametrization of φ, σ, and the steady state values for the consumption to output share. The disutility of labor is set to be consistent with a zero inflation steady state.

A.2 Model Summary

This subsection reports the linearized equations that characterize the equilibrium of the model. We linearize the model around the initial steady state. Quantity variables are expressed as deviations from the initial steady state normalized by steady state output and denoted by lower case letters, e.g. $x_t = \frac{X_t - X_{ss}}{Y_{ss}}$.

Household block. Given a sequence of disposable after-tax income $y_t^d = (1-\tau_y) y_t - t_t$ and ex-post real interest rates r_t^p aggregate consumption and asset dynamics are characterized by:

(i) *Aggregate consumption function.*

$$c_t = (1-\phi\beta) \left((1+r_{ss}) a_{t-1} + \frac{A_{ss}}{Y_{ss}} r_t^p + \omega_t^h + \omega_t^z \right) - (\sigma - 1) \phi\beta \left(\frac{C_{ss}}{Y_{ss}} \right) \sum_{s=0}^{+\infty} (\phi\beta)^s \frac{r_{t+s+1}^p}{1+r_{ss}}, \tag{A.22}$$

where the net present value of the aggregate human capital of households is given by

$$\omega_t^h = y_t^d - \frac{\beta\phi}{1-\beta\phi} \left(\frac{Y_{ss}^d}{Y_{ss}} \right) \frac{r_{t+1}^p}{1+r_{ss}} + \beta\phi\omega_{t+1}^h, \tag{A.23}$$

and the net present value of social fund payments is given by

$$\omega_t^z = \frac{1}{1-\phi\beta} \left(\frac{(1-\phi) A_{ss}}{Y_{ss}} \right) \frac{r_{t+1}^p}{1+r_{ss}} + \beta\phi\omega_{t+1}^z. \tag{A.24}$$

The aggregate consumption function is standard with the modification of the social fund. Households have a marginal propensity to consume $1-\phi\beta$ out of the total of their financial wealth: $(1+r_{ss})a_{t-1}+\frac{A_{ss}}{Y_{ss}}r_t^p$, their human wealth ω_t^h and the net present value of social fund payments ω_t^z. Larger interest rates increase the net present value of social fund payments as future contributions to the fund are discounted more strongly. The last term in (A.22) reflects the standard income and substitution effects of changes in the interest rate.

(ii) *Aggregate budget constraint.* As social fund payments net out on aggregate, the aggregate budget constraint is given by

$$c_t + a_t = (1+r_{ss})a_{t-1} + \left(\frac{A_{ss}}{Y_{ss}}\right) r_t^p + y_t^d. \tag{A.25}$$

Further details of the consumption and saving policies of cohorts are shown in Appendix A.1.1.

New Keynesian Phillips Curve. As shown in Appendix A.1.2 the New Keynesian Phillips Curve is

$$\pi_t = \kappa\left(y_t - \frac{\varphi}{\varphi+\sigma\frac{C_{ss}}{Y_{ss}}} g_t\right) + \beta\pi_{t+1}. \tag{A.26}$$

Fiscal Policy. The linearized dynamics of government debt are

$$b_t = (1+r_{ss})b_{t-1} + \frac{B_{ss}}{Y_{ss}} r_t^p - s_t. \tag{A.27}$$

As described in the main text, surpluses are set according to:

(i) *Stimulus phase.* No additional taxes are levied and the government provides stimulus $\{\tilde{t}_t, \tilde{t}_t^H, \tilde{g}_t\}$, with $\tilde{t}_t, \tilde{t}_t^H < 0$ and $\tilde{g}_t >$. The primary surplus therefore is

$$s_t = \mu\tilde{t}_t^H + (1-\mu)\tilde{t}_t - \tilde{g}_t. \tag{A.28}$$

(ii) *Repayment phase.* The government levies additional taxes $\hat{t}_t$ on OLG households to stabilize debt dynamics. Specifically, $\hat{t}_t$ is set such that

$$s_t = r_{ss}b_{t-1} + \frac{B_{ss}}{Y_{ss}} r_t^p + \tau_B(b_{t-1}-\Delta b) - \left[\mu\tilde{t}_t^H + (1-\mu)\tilde{t}_t - \tilde{g}_t\right], \tag{A.29}$$

where $\Delta b := \frac{\overline{B}-B_{ss}}{Y_{ss}}$ denotes the change in the target debt-to-output ratio.

Fisher equation. The ex-post real rate is given by the Fisher equation

$$\frac{r_t^p}{1+r_{ss}} = \frac{i_t}{1+I_{ss}} - \frac{\pi_t}{\Pi_{ss}}. \tag{A.30}$$

Market clearing. The supply of nominal government bonds is absorbed by the OLG households. That is,

$$b_t = (1-\mu)a_t. \tag{A.31}$$

By Walras' Law, the good's market clearing condition $c_t + g_t = y_t$ is redundant.

A.3 Mapping CBO Projections to Fiscal Rule

We elaborate on how we use the CBO projections on the time path of debt to calibrate τ_B in the fiscal rule (4). We present the derivations for the case in which real rates are known ex-ante since in our analysis we consider a time zero MIT shock and $H > 0$. For $t > H$, the fiscal rule is

$$S_t = r_t B_{t-1} + \tau_B (B_{t-1} - \overline{B}) - \varepsilon_t. \tag{A.32}$$

Combining the fiscal rule with the government budget constraint (4) gives

$$\begin{aligned} B_t &= (1+r_t)B_{t-1} - \left[\tau_B(B_{t-1} - \overline{B}) + r_t B_{t-1} - \varepsilon_t\right] \\ &= \tau_B \overline{B} + (1-\tau_B)B_{t-1} + \varepsilon_t. \end{aligned} \tag{A.33}$$

Subtracting the initial steady state value from both sides and dividing by the initial steady state level of output Y_{ss} implies

$$\frac{B_t - B_{ss}}{Y_{ss}} = \tau_B \frac{\overline{B} - B_{ss}}{Y_{ss}} + (1-\tau_B)\frac{B_{t-1} - B_{ss}}{Y_{ss}} - \frac{\varepsilon_t}{Y_{ss}}. \tag{A.34}$$

CBO (2021*b*) (Table 1) implies a time series for the increase in the debt per GDP ratio $\left\{\frac{B_t - B_{ss}}{Y_{ss}}\right\}$ under the assumption of constant output, due to the American Rescue Plan, between 2021 and 2031. CBO (2021*a*) provides an estimate of ε_t, the change in primary deficits due the American Rescue Plan. We estimate the persistence of debt $1-\tau_B$ via a time series regression of $\frac{B_t - B_{ss}}{Y_{ss}}$ on its first lag using projections from 2024 onward, consistent with our selection of H.

The CBO forecast holds fixed output and therefore ignores effects from an expansion from the tax base. We restrict estimation to 2024 onwards, at which point according to our model changes in output due to the American Rescue Plan are relatively small.

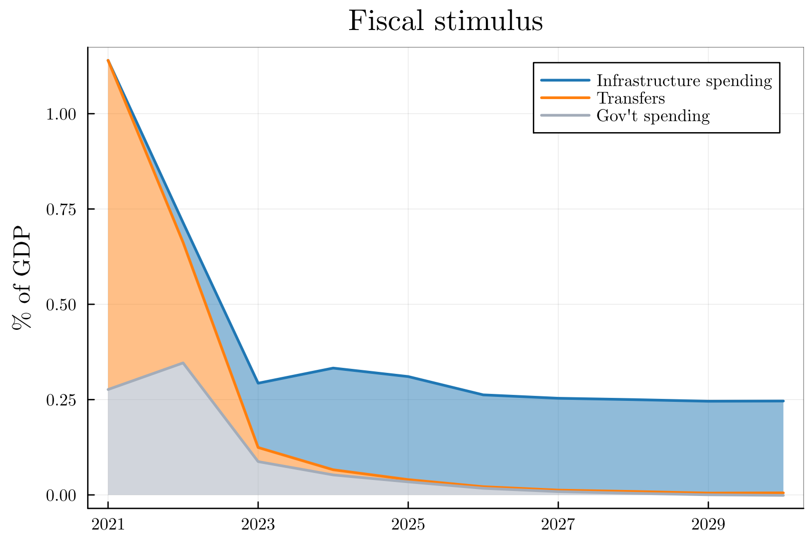


Figure A.1: Total fiscal stimulus including infrastructure spending.

Notes: Total combined fiscal news from American Rescue Plan Act (ARPA) and the infrastructure spending. Section 3 details how we size the shocks. Section 6 details how we pin down the time path for the fiscal news from ARPA while we take the time path for the infrastructure spending from detailed projections by Moody's Analytics.

A.4 Robustness and Extensions

A.4.1 Effects of Infrastructure Spending

In this Section, we extend the baseline model to introduce infrastructure spending. As discussed in Section 3, Democrat victory increased expectations of infrastructure spending by an upper bound of \$1 trillion. We then size shock to the expectation of infrastructure spending as \$500 billion, given the 50% chance that Democrats would win. We take the time path of infrastructure spending from from detailed projections of Moody's Analytics, which is part of our narrative evidence. A distinctive feature is that infrastructure spending was expected to be delayed with most of the spending not expected until after 4 years. The total fiscal stimulus shock is shown in Figure A.1.

As is standard (e.g. Leeper et al. 2010, Boehm 2020, Ramey 2021), we model infrastructure spending as productive government investment that increases public capital which, due to its non-rivalrous nature, increases total factor productivity (TFP) of firms. We also include time to build delays which have been found to be both empirically relevant and important for model dynamics (Ramey 2021).

Denote government investment by G_t^I, public capital K_t^G, and let public capital be accumulated via

$$K_{t+1}^G = \Phi(L) G_t^I + (1-\delta) K_t^G,$$

Table A.1: Calibration of additional parameters with infrastructure

Parameter	Description	Value	Target
γ	Elasticity of output to public capital	0.065	Ramey (2021)
δ	Depreciation of public capital	0.04	Ramey (2021)
G^I_{ss}/Y_{ss}	Ratio of gov't investment of GDP	0.035	Ramey (2021)

where the operator $\Phi(L) = \sum_{k=0}^{+\infty} \omega_k L^k$ captures "time to build" and L denotes the standard lag operator. In our calibration, we set $\omega_0 = \omega_1 = 1/2$ with $\omega_k = 0$ for $k > 1$ such that $\Phi(L) = (1/2)(I + L)$ to target a time to build of 1.5 years (Ramey 2021). Total factor productivity (TFP), denoted by Θ_t, has two components: (i) a constant scaling factor $\overline{\Theta}$ and (ii) a term capturing the contributions of public capital K^G_t. That is, $\Theta_t = \overline{\Theta}(K^G_t)^\gamma$, where γ denotes the elasticity of output with respect to public capital and is found to be small but positive (Ramey 2021). Then, to first order, government investment and TFP are related via

$$\hat{\Theta}_t = \frac{\gamma}{K^G_{ss}/Y_{ss}} \sum_{s=0}^{+\infty} (1-\delta)^s \Phi(L) g^I_{t-1-s},$$

where $\hat{\Theta}_t = \frac{\Theta_t - \Theta_{ss}}{\Theta_{ss}}$ and $g^I_t = \frac{G^I_t - G^I_{ss}}{Y_{ss}}$. Since in reasonable calibrations γ is small and K^G_{ss}/Y_{ss} large the total effect of infrastructure spending on TFP is dampened but persistent. Final output is linear in labor but now includes a TFP term—$Y_t = \Theta_t N_t = \overline{\Theta}(K^G_t)^\gamma N_t$.

The Phillips curve for final goods prices changes in two ways: (i) as firms target a constant markup the relationship between final goods inflation, π_t, and wage inflation, π^w_t, is $\pi_t = \pi^w_t - \left(\hat{\Theta}_t - \hat{\Theta}_{t-1}\right)$ and (ii) the wage New Keynesian Phillips curve includes additional terms capturing the fact that employment and output no longer perfectly comove. Specifically, the extended wage Phillips curve is

$$\pi^w_t = \kappa \left\{ y_t - \frac{\varphi}{\varphi + \sigma \frac{C_{ss}}{Y_{ss}}} (g_t + g^I_t) - \frac{(1+\varphi)\sigma \frac{C_{ss}}{Y_{ss}}}{\varphi + \sigma \frac{C_{ss}}{Y_{ss}}} \hat{\Theta}_t \right\} + \beta \pi^w_{t+1}. \tag{A.35}$$

This expression shows that there are three channels through which infrastructure spending affects inflation dynamics: (i) through the output multiplier via changes in y_t (ii) standard wealth effects mediated by g^I_t and (iii) direct deflationary effects from productivity increases $\hat{\Theta}_t$.

The remaining model is unchanged from the baseline version in the main text.

Calibration. As discussed, we size the infrastructure spending shock as $500 billion and take the time path of infrastructure spending from the narrative reports. We assume that 0.83% of the infrastructure spending was tax financed and the remaining 17% deficit financed. This share equals the realized financing of the Inflation Reduction Act. We use the realized financing share because our narrative information on the financing of infrastructure, contained in Appendix Table B.8, does not contain precise information on financing. We then calibrate the additional model parameters to standard values from Ramey (2021). We report our calibration in Table A.1.

Discussion. Figure A.2 reports the impulse response of output and inflation to the fiscal shock, including infrastructure. In the top panel we study our baseline two agent OLG model. In the bottom panel we study a more quantitatively realistic three agent OLG model, as in Wolf (2021). The three agent model is calibrated as in subsection A.4.3 and otherwise is the same as the baseline model. We find that despite the fact that the expected infrastructure was large, the effect on inflation is considerably smaller. The negligible effects of infrastructure spending on output in the short-run and large effects in the long-run are in line with Boehm (2020) and Ramey (2021). Overall, the small effect of infrastructure spending on inflation is for three reasons. First, the infrastructure program was close to balanced budget (i.e. only 17% deficit financed), and the tax rises dampen the output multiplier. Second, the wealth effects induced by greater infrastructure spending dampen the effects on inflation and output. Third, following Ramey (2021), we incorporate a realistic "time to build" lag, meaning little of the infrastructure is spent in the first three years. This lag further lowers the output multiplier.

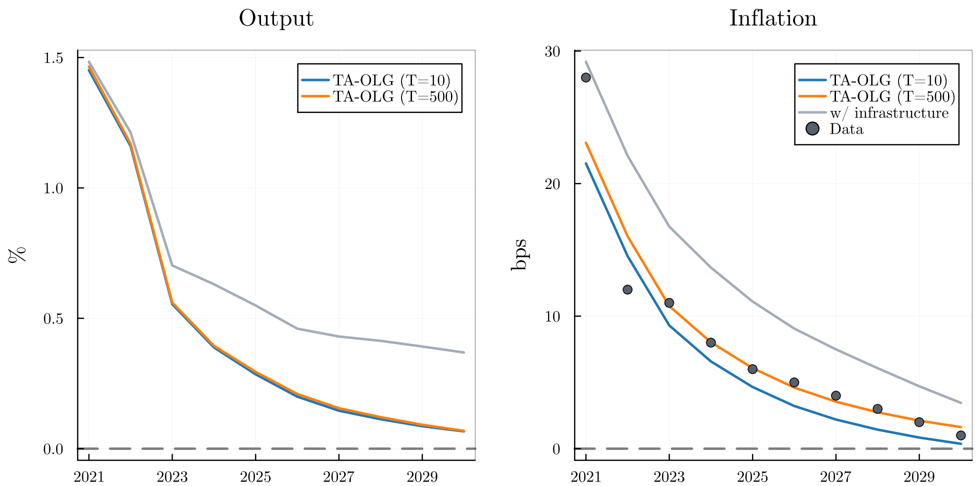
A.4.2 Alternative Financing of Stimulus

In the baseline model we assume that the fiscal authority raises lump sum taxes on OLG households to stabilize debt dynamics during the refinancing phase. In this Section, we consider alternative financing mechanisms. Figure A.3 shows that inflation and output dynamics are largely unaffected if instead the required primary surplus is raised by either (i) distortionary taxes on labor or (ii) lowering government consumption. To isolate the role of the source of financing the new debt target $\overline{B}$ is kept the same across specifications.

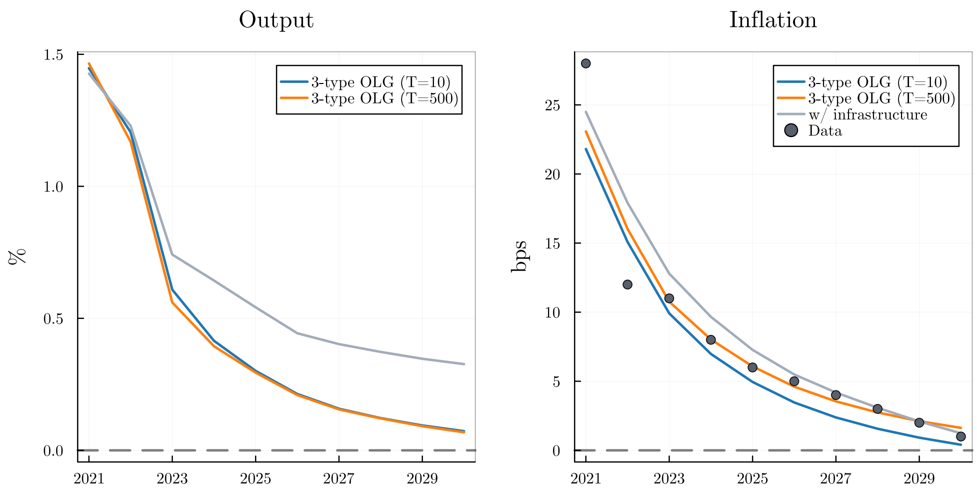
A.4.3 Alternative Consumption Models

We consider the following set of consumption models: (i) two agent OLG (ii) two agent BU and (ii) quantitative three agent OLG. For each model we also consider a modification of sticky

Figure A.2: Impulse response to Georgia shock including infrastructure



(a) Baseline two-agent OLG.



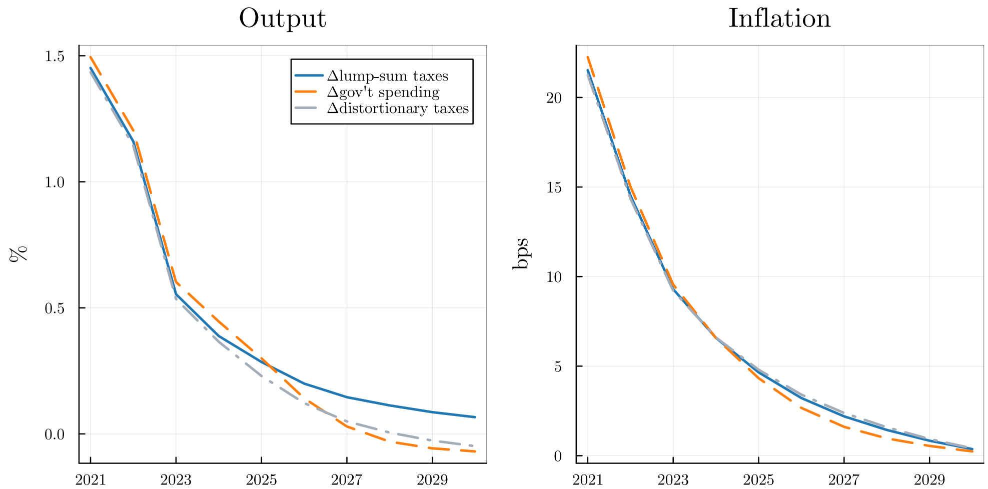
(b) Three-agent OLG.

Notes: the top panel shows the impulse responses to output y_t and inflation π_t in the baseline two-agent OLG model. The bottom panel shows the impulse responses in a three-agent OLG model. All responses are to the Georgia deficit shocks. The blue line adds the news about expected infrastructure spending. The baseline model $T = 10$ assumes that economy returns to steady state after 10 years. Since with infrastructure spending dynamics are considerably more persistent we also consider the alternative terminal condition in which the economy returns to steady state after $T = 500$.

information as in Auclert et al. (2020). For the quantitative three agent OLG model we further calibrate the wealth share of the near permanent income households to be 60% as in Angeletos et al. (2024) and set the IES to $\sigma = 0.5$.

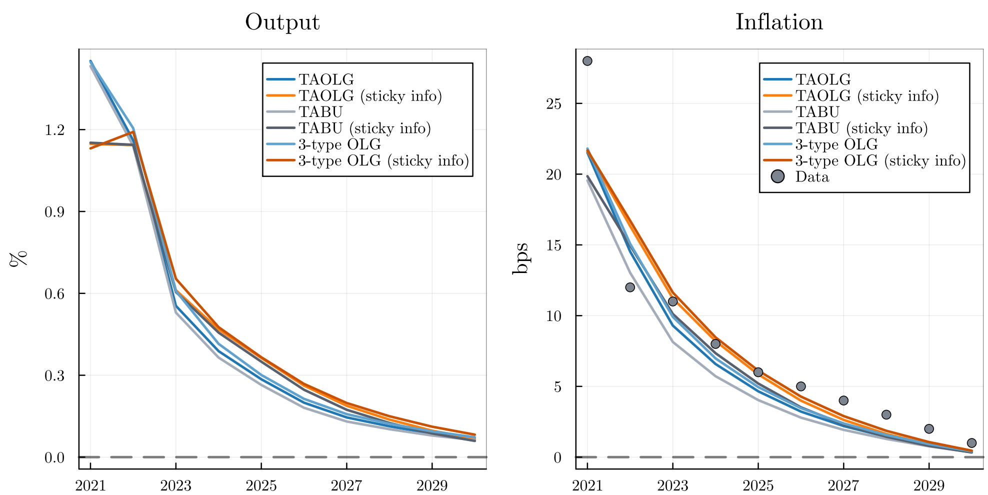
We report the impulse responses of these models in Appendix Figure A.4. Sticky information responses are generally larger and feature more persistent output responses. On the one hand, sticky information lowers the general equilibrium effect through future income increases. On the other hand, households are less attentive to future tax increases and rising real interest rates.

Figure A.3: Impulse responses to Georgia shock under different financing assumptions.



Notes: impulse responses to output y_t and inflation π_t to the Goergia deficit news under three assumptions of paying back the debt: (i) adjusting lump-sum taxes on savers (blue) (ii) adjusting government consumption (orange) and raising primary surpluses through distortionary taxes (gray).

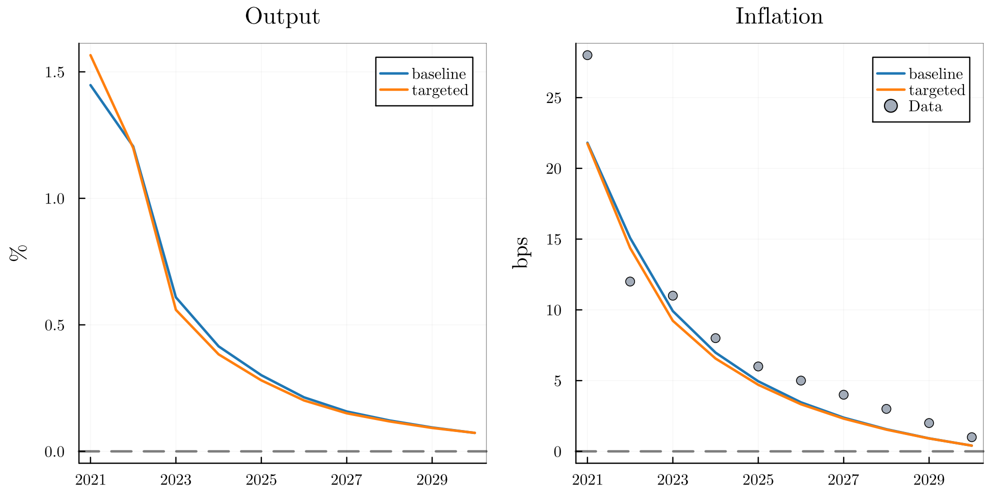
Figure A.4: Impulse responses to Georgia shock under different consumption models.



Notes: impulse responses of output y_t and inflation π_t to Georgia shock for a variety of consumption models. All models are calibrated to the same iMPCs (Fagereng et al. 2021).

In our calibration the latter effect dominates.

Figure A.5: Impulse responses to targeted stimulus.



Notes: impulse responses of output y_t and inflation π_t to Georgia shock under different distributions of transfer payments: (i) equal distribution as in the baseline version (blue) and (ii) targeted spending towards financially vulnerable households as well as targeted spending towards low MPC business owners (orange).

A.4.4 Targeted Stimulus

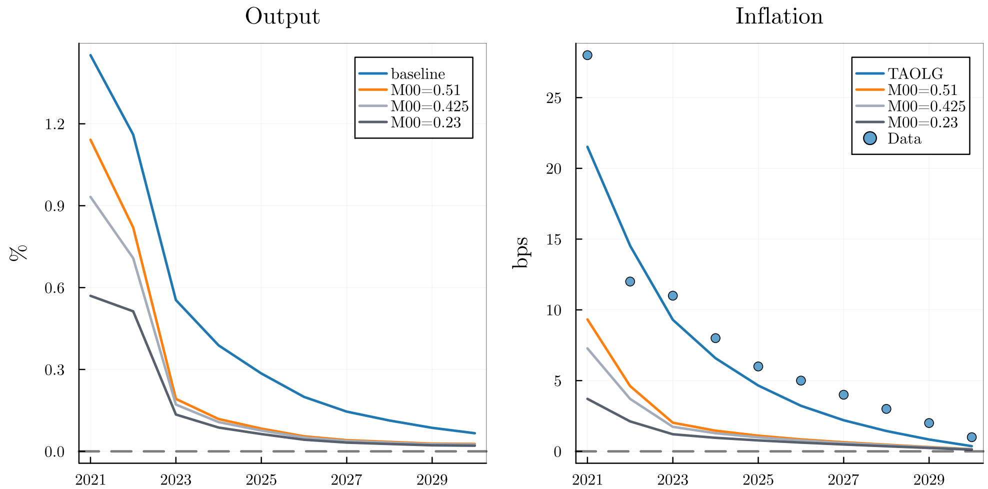
In this Section, we consider an extension of the 3-type OLG model in which fiscal stimulus is targeted as follows. Using the classification of Edelberg & Sheiner (2021), we allocate (i) *direct aid to families* (e.g. stimulus checks) to all households equally (ii) *direct aid to financially vulnerable households* (e.g. UI) to hand-to-mouth households only and (iii) *aid to businesses* to the low MPC OLG households only. Figure A.5 shows that the effects of the stimulus are largely unchanged.

A.4.5 Calibrating to Alternative Intertemporal MPCs

In this Section, we consider a version of the baseline OLG model with lower contemporaneous MPCs, which decay rapidly with the horizon. These estimates of the MPC are in line with several empirical studies (e.g. Orchard et al. 2023; Boehm et al. 2023). We find that calibrated to these MPCs, the model can no longer match the inflation multiplier from the data. However for the model to be consistent with the empirical evidence on interest rates, the intertemporal elasticity of substitution (IES) must be very small.

Why does the model with transitory MPCs need a low IES? In order to fit transitory MPCs, the calibration of the model requires a spender and a permanent income household. This model has an infinite elasticity of savings with respect to the real rate. This is at odds with a change in

Figure A.6: Impulse responses to Georgia shock under different iMPC assumptions.



Notes: impulse responses of output y_t and inflation π_t to Georgia shock under different calibrations of intertemporal marginal propensities to consume. When changing iMPCs the intertemporal elasticity of substitution is re-calibrated – making sense of the empirical observation that long-run interest rates rose after the Georgia shock. M00 is the impact MPC, and each line other than the baseline model refers to a model calibrated to a different impact MPC.

the long-run nominal rate after the fiscal stimulus, as we documented in Section 5. For example, with no change in the calibration of the IES, the observed rise in the interest rate requires an increase in the stock of debt of close to 600%.

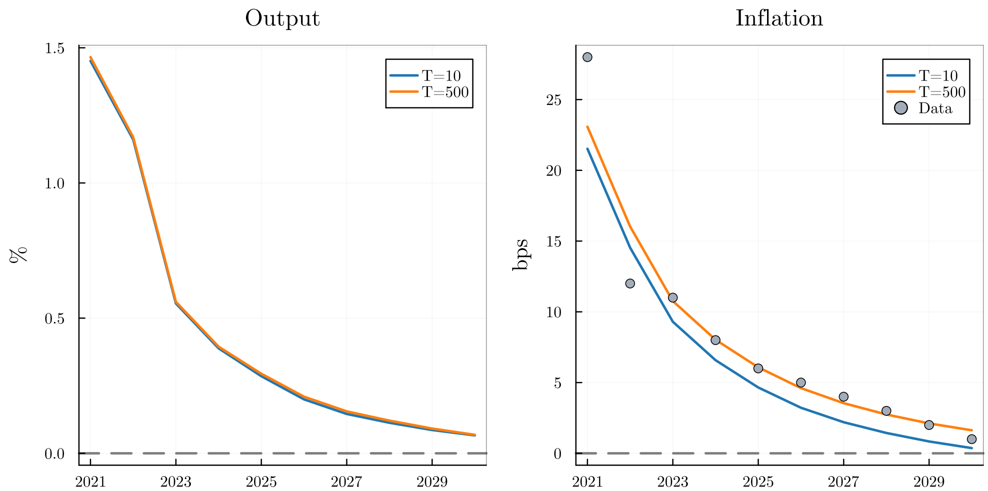
For our calibration to transitory MPCs, we consider the case in which OLG households are essentially permanent income consumers (i.e. $\phi = 0.99$). The share of hand to mouth consumers is then chosen to target the contemporaneous MPC. We use the expression for the elasticity of household savings, equation (A.11), to calibrate the IES to match the new steady state level of debt in the baseline model. The calibrated value for the IES is $\sigma = 0.0012$—much smaller than typical macro estimates.

Figure A.6 plots the effect on output and inflation of the fiscal stimulus, in the models that are calibrated to transitory MPCs. The specifications in the figure all share fast decaying iMPCs in line with the estimates of Boehm et al. (2023). Each targets a different intertemporal MPC, of between $M00 = 0.51$ and $M00 = 0.23$. These specifications can no longer fit the response of inflation, as we see in the right panel; because the output response is now smaller (left panel).

A.4.6 Alternative Monetary Policy at End of Horizon

In the baseline model we assume that after $t = 10$ the monetary authority chooses the sequence of nominal rates that implement steady state output and inflation. In this Section, we consider

Figure A.7: Impulse Responses with Different Assumptions About Terminal Condition



Notes: impulse responses of output y_t and inflation π_t to the Georgia shock under two different assumptions about the terminal condition: (i) impose steady state after ten years ($T = 10$, blue) and (ii) assume monetary authority switches to an active monetary policy after ten years and setting $T = 500$ (orange).

an alternative in which the central bank switches to a standard Taylor rule $i_t = i^* + \phi_\pi \pi_t$ after $t = 10$. Figure A.7 shows that the effects of the stimulus on inflation and output are similar—though the inflation response is minimally larger in the model with the alternative terminal condition. Output is not fully back to steady state after 10 years and since the Phillips curve is a net present value formulation, these future output gaps beyond the 10 year horizon contribute to higher inflation at shorter horizons. As such the choice of the terminal condition in the baseline model can be viewed as a lower bound.

A.4.7 Fiscal Theory of the Price Level

In this Section, we consider whether a simple FTPL model calibrated to the 2021 stimulus can match our estimate for the inflation multiplier. Following Bianchi et al. (2023) we consider an economy with flexible prices, long-term debt that has an average maturity of 6 years, and a monetary authority that follows a Taylor rule with coefficient $\phi = 0.8$. Bianchi et al. (2023) show that this very simple benchmark model is a good approximation for explaining inflation dynamics in richer models with nominal rigidities and fully passive monetary policy, i.e. $\phi = 0$. We now show that this model is capable of matching the inflation multiplier from the data.

First, we present our derivation of the equilibrium equations of the model, which is standard. Outstanding nominal government debt is linked to real primary surpluses S_t by the accounting identity

$$\sum_{j=1}^{+\infty} Q_t^{(t+j)} B_t^{(t+j)} = \sum_{j=0}^{+\infty} Q_t^{(t+j)} B_{t-1}^{(t+j)} - P_t S_t, \tag{A.36}$$

where $Q_t^{(t+1j)}$ denotes the price of a nominal bond with outstanding maturity j and $B_t^{(t+j)}$ nominal bond holdings. Define the real market value of debt relative to trend output, $\overline{Y}_t = (1+g)^t Y_0$, to be

$$V_t = \left(\sum_{j=1}^{+\infty} Q_t^{(t+j)} B_t^{(t+j)}\right) / (P_t \overline{Y}_t).$$

Let real primary surpluses relative to trend output be $\tilde{S}_t$ and assume a geometric maturity structure ω, then

$$V_t = \frac{1+\omega Q_t}{Q_{t-1}} \frac{1}{1+\pi_t} \frac{1}{1+g} V_{t-1} - \tilde{S}_t, \tag{A.37}$$

where $1 + r_t^n := (1+\omega Q_t)/Q_{t-1}$ denotes the ex-post nominal return on the portfolio of government debt. To first order, $d\log(1+r_t^n) = \frac{\omega}{1+i_{ss}} d\log Q_t - d\log Q_{t-1}$ where we have used the fact that $1 + r_{ss}^n = 1 + i_{ss} = \omega + 1/Q_{ss}$. Iterating on the equation and using the fact that by no arbitrage $\mathbb{E}_t d\log(1+r_{t+j}^n) = \mathbb{E}_t \left[d\log(1+r_{t+j}) + d\log(1+\pi_{t+j})\right]$ links the revaluation effect to future inflation and real rates (e.g. Cochrane 2023) as

$$\Delta\mathbb{E}_t d\log(1+r_t^n) = -\sum_{j=1}^{+\infty} \left(\frac{\omega}{1+i_{ss}}\right)^j \Delta\mathbb{E}_t \left[d\log(1+r_{t+j}) + d\log(1+\pi_{t+j})\right], \tag{A.38}$$

where the operator $\Delta\mathbb{E}_t = \mathbb{E}_t - \mathbb{E}_{t-1}$ denotes the expectation surprise in period t.

Linearizing and iterating forward the budget constraint (A.37) we obtain

$$\Delta\mathbb{E}_t d\log(1+\pi_t) - \Delta\mathbb{E}_t d\log(1+r_t^n) = \Delta\mathbb{E}_t \sum_{j\geq 1} \left(\frac{1+g}{1+r_{ss}}\right)^j d\log(1+r_{t+j}) - \Delta\mathbb{E}_t \sum_{j\geq 0} \left(\frac{1+g}{1+r_{ss}}\right)^j \left[\frac{1+g}{1+r_{ss}} \frac{1}{V_{ss}}\right] d\tilde{S}_{t+j}. \tag{A.39}$$

As we consider a flexible price economy the real rate does not change. Next, as Bianchi et al. (2023) explain—with constant real rates—the Taylor coefficient pins down the persistence of inflation via the Fisher equation. That is, $\Delta\mathbb{E}_t d\log(1+\pi_{t+j}) = \phi^j \Delta\mathbb{E}_t d\log(1+\pi_t)$. Combining all these elements together with the expression for the ex-post nominal rate, we can characterize the response of inflation in the simple FTPL model:

1. The response of inflation on *impact* is given by

$$\Delta\mathbb{E}_t d\log(1+\pi_t) = -\left(1 - \frac{\omega\phi}{1+i_{ss}}\right) \sum_{j=0}^{+\infty} \left(\frac{1+g}{1+r_{ss}}\right)^j \left[\frac{1+g}{1+r_{ss}} \frac{1}{V_{ss}}\right] \Delta\mathbb{E}_t d\tilde{S}_{t+j}. \tag{A.40}$$

2. The *persistence* of the inflation response is given by $\Delta\mathbb{E}_t d\log(1+\pi_{t+j}) = \phi^j \Delta\mathbb{E}_t d\log(1+\pi_t)$ for $j \geq 1$.

Quantification. We calibrate to an average maturity of 6 years and therefore set $\frac{\omega}{1+i_{ss}} = 5/6$. Next, we consider the case in which $r_{ss} \approx g$ and take the gross market value of total outstanding debt to GDP from the Federal Reserve Bank of Dallas (FRBD (2024)) to be $V_{ss} = 1.49$.[27] Last, we set the fraction of unfunded transfers to 50%–taken from Bianchi et al. (2023)—which amounts to a total unfunded stimulus surprise of 1.05% of GDP due to the Georgia shock.

Therefore, the initial inflation surprise evaluates to $\Delta\mathbb{E}_t d\log(1+\pi_t) = -\left(1-0.8\times\frac{5}{6}\right)\times\frac{1}{1.49}\times(-1.05)\% = 0.234\%$ which aligns well with our empirical estimate of 0.28%. The geometric persistence at the rate ϕ also qualitatively mimics the persistence of the empirical estimates – though the data features less persistence.

[27] There are several notions of government debt. Arguably, for the FTPL the most natural is the gross market value of debt rather than simply the value of privately held debt.

B Additional Empirics

B.1 Tables

Table B.1: Expected Stimulus with Democratic Senate Majority in Week Before Elections

Date	**Bank**	**Election Results**	**Number, $(billion)**	**Expectation Phrase**	**Exact Phrasing**
04.01.2021	Goldman Sachs	before	600	“we would expect”	“If Democrats manage to win both of the Senate seats in play in Georgia, they would win 50 seats, which would allow Vice President-elect Harris to cast the tie-breaking vote. This would lead to greater fiscal stimulus—**we would expect around $600bn more on top of the recently enacted $900bn—** but would also likely mean tax increases to finance additional spending."
05.01.2021	Barclays	before	2000	“the size of the package could possibly be”	“If the Democrats control the Senate, a larger stimulus package could be more likely, with a sizable portion dedicated to state and local governments. With the focus in Q1 likely to be on the virus, **the size of the package could possibly be $2trn**, and Democrats might expand it to include significant spending for infrastructure, clean energy initiatives, etc. if the political climate is advantageous."
05.01.2021	Bloomberg	before	700	“we think”	“In the event of a Democratic sweep in Georgia, we think additional near-term pandemic relief and **accompanying stimulus could stretch into the $600 billion to $800 billion range**."

Median of Expected Stimulus with Democratic Senate Majority: $700 bn

Notes: The number is taken from the reports of investment banks. The window is restricted to 1st-5th of January 2021. The number on 6th of January 2021 is already considered to be the number after the elections because the information about the results already started to appear. For cases where a range is given, the median of the range is taken.

Table B.2: Expected Stimulus with Republican Senate Majority in Week Before Elections

Date	**Bank**	**Number, $(billion)**	**Expectation Phrase**	**Exact Phrasing**
31.12.2020	Deutsche Bank	0	"do not see"	"As such, unless the Senate switches to Democratic control on the results of the Georgia election, **we do not see much scope for further stimulus**."
04.01.2021	Goldman Sachs	0	"we would not expect"	"If Senate Republicans hold one or both of these Georgia seats, this will leave them with a narrow majority and probably will not have substantially different implications for legislation than in the last Congress when they held 53 seats ... In that environment, **we would not expect much further fiscal stimulus**. President Trump recently proposed $2000/person stimulus payments, but these are unlikely to move forward under a Republican controlled Senate, we believe, as it would cost around $450bn, Republican leaders and many Republican senators don't support it, and there is likely to be less momentum behind it once individuals start receiving the smaller payments that Congress recently passed."
05.01.2021	Moody's Analytics	0	"not penciling"	"Our baseline forecast does not assume that Democrats will pick up both Georgia seats, which would be necessary for that party to retake the Senate from Republicans. As a result, **Moody's Analytics is not penciling in a sixth piece of federal pandemic legislation following the $900 billion economic relief package that was enacted over the holidays**, nor do we expect President-elect Biden to get his tax and spending policy proposals from the campaign through Congress."
05.01.2021	Rabobank	0	"we should not expect"	"In contrast, if the Republicans manage to hold on to at least one of these two Georgia seats, they will keep their majority in the Senate (either 51-49 or 52-48). In this case, the Senate Republicans are likely to shoot down the ambitious spending plans of the Democrats. This means that **we should not expect major fiscal policy measures, at least until the 2022 midterms**."
05.01.2021	Barclays	1000	"remains viable... we think"	"If Republicans keep control of the Senate, moderate virus-related relief and possible infrastructure spending may be the only areas of bipartisan agreement in Congress, in our view. **If the GOP retains control of the Senate and the Biden administration faces a divided Congress, we still a Q1 virus-related stimulus package—potentially around $1trn—remains viable** ... [w]e think moderate virus-related relief and possible infrastructure spending may be the only areas of bipartisan agreement in Congress."
05.01.2021	Bloomberg	225	"we expect"	"If Republicans hold the chamber by retaining at least one of the two seats, **we expect only must-have Covid relief in the vicinity of $150 billion to $300 billion by sometime in 2Q, at most**."

Median of Expected Stimulus with Republican Majority: $0 bn

Notes: The number is taken from the reports of investment banks. The window is restricted to 1st-5th of January 2021. For cases where a range is given, the median of the range is taken.

Table B.3: Probability of Democratic Senate Majority in Week Before Elections

Date	**Bank**	**Prob Democratic Government**	**Exact Phrasing**
04.01.2021	Deutsche Bank	0.5	"The web now has sites suggesting odds are only 52% in favour of the Republicans maintaining control of the Senate - **so a bit of a toss-up**. Same story on the individual races with the Ossoff-Perdue now essentially 50/50 while Warnock-Loeffler is 60/40 in the Democratic candidates favour. All this well within the poll margin of errors, to say the least."
05.01.2021	Barclays	0.5	"Polling in both Georgia Senate run-off elections is well within the margin of error, and we **consider them both toss-ups**."
05.01.2021	Goldman Sachs	0.5	"Polls show Democratic candidates with a very **slim advantage** and early voting appears to have moved slightly in the Democratic direction (vs early voting in November) ... **race remains a toss-up** with a slight Republican lean ... Prediction markets appear to take the same view and imply nearly even odds that Democrats win both seats"
05.01.2021	Moody's Analytics	<0.5	"Our baseline forecast **does not assume that Democrats will pick up both Georgia seats**, which would be necessary for that party to retake the Senate from Republicans."
05.01.2021	Rabobank	0.5	"[A]fter the Georgia bifurcation point we enter one of two regimes that will be very different in political dynamics, fiscal policy outcomes and pressure on the various Fed policies. If we look at recent polls **the probabilities of the two regimes are close to fifty-fifty**, although there appears to be a slight advantage for both Democratic candidates."

Median of Expected Probability of Democratic Senate Majority: 0.5
Notes: the probability is taken from the investment bank reports before the election date. We take the closest probability to election date, for each investment bank, from the window of 1st of January - 5th of January. The window is chosen before 6th of January 2021 because on 6th of January visible information about Democrat win started to appear.

Table B.4: Composition of Stimulus Package

Date	**Bank**	**Initial Number**	**Transfers**	**Government Spending**	**Other Spending**
05.01.2021 (before, case of Dem. win)	Bloomberg	$850bn	UI: - $250bn - 29.4% stimulus checks: - $350bn - 41.2% **Total: $600bn** **Total Share: 70.6%**	state and local fiscal aid: - $250bn - 29.4% **Total: $250bn** **Total Share: 29.4%**	
06.01.2021 (after)	Goldman Sachs	$750bn	UI: - $150bn - 20% stimulus checks: - $300bn - 40% **Total: $450bn** **Total Share: 60%**	state and local fiscal aid: - $200bn - 26.7% **Total: $200bn** **Total Share: 26.7%**	other: - $100bn - 13.3% **Total: $100bn** **Total Share: 13.3%**
06.01.2021 (after)	BNP Paribas	$1000bn	stimulus checks: - $350bn - 35% **Total: $350bn** **Total Share: 35%**	state and local fiscal aid: - $300bn - 30% **Total: $300bn** **Total Share: 30%**	other non-COVID related fiscal support: - $350bn - 35% **Total: $350bn** **Total Share: 35%**

Date	Bank	Initial Number	Transfers	Government Spending	Other Spending
07.01.2021 (after)	JP Morgan Wealth Management	$750bn	stimulus checks: - $250bn - 33.3% UI: - $150bn - 20% paycheck protection program (PPP): - $150bn - 20% **Total: $550bn** **Total Share: 73.3%**	state and local fiscal aid: - $150bn - 20% health/COVID related: - $50bn - 6.7% **Total: $200bn** **Total Share: 26.7%**	
08.01.2021 (after)	Barclays	$1425bn	UI: - $125bn - 8.77% economic impact payments: - $300bn - 21.05% hazard pay for essential workers: - $190bn - 13.33% cover 100% COBRA costs: - $100bn - 7.02% expand emergency medical leave: - $10bn - 0.70% **Total: $725bn** **Total Share: 50.87%**	state and local fiscal aid: - $500bn - 35.09% Federal Medicaid funding: - $50bn - 3.51% Testing, tracing, vaccine distribution: - $100bn - 7.02% **Total: $650bn** **Total Share: 45.62%**	other: - $50bn - 3.51% **Total: $50bn** **Total Share: 3.51%**

Median Share of Transfers: 0.69

Notes: The numbers for composition are taken from the reports of investment banks both before and after elections. When a range is given, the median is taken. The share of transfers is calculated as transfers/(transfers + government spending), which assumes that “other spending” has the same composition of transfers vs. government spending as the rest of the stimulus. We classify certain items (e.g. unemployment insurance and stimulus checks) as transfers and other components (e.g. stage and local fiscal aid or vaccine distribution) as government spending, as in the table.

Table B.5: Stimulus Package Financing

Date	Bank	Fiscal Package	Exact Phrasing
30.12.2020	Financial Times	Deficit Financed	“The Treasury department plans to sharply shift its bond sales towards debt maturing well into the future as the government seeks to fund vast spending programmes."
06.01.2021	DWS North America	Deficit Financed	“**More fiscal support will likely require huge Treasury issuance to fund it**, which is already pushing yields higher, and could increase borrowing costs for companies."
06.01.2021	Bloomberg	At least some deficit financing implied	“While stimulus will be the primary focus, high-earners and corporations could be tasked with helping to pay for it ... tax hikes may be limited and possibly delayed until the economy is on stronger footing."
06.01.2021	BNP Paribas	Deficit Financed	“In order to finance our increased 2021 fiscal deficit projection of USD2.5trn+, we expect US Treasury issuance to remain at elevated levels (averaging USD370bn/month) throughout 2021."
08.01.2021	HSBC	Deficit Financed	“The benchmark 10-year Treasury yield has moved above 1.0 per cent for the first time since March 2020. **This has been driven by expectations that the Senate elections in Georgia will pave the way for even greater fiscal stimulus, which will ultimately have to be financed by more bond issuance.**"
10.01.2021	Moody’s Analytics	Deficit Financed	“Fiscal support from the new Biden administration and Congress is expected to include an additional $750 billion to help the economy through to the end of the pandemic. **This will be entirely deficit-financed**, passed into law in February, and largely take effect in March."
14.01.2021	Goldman Sachs	Deficit Financed	“The new stimulus programs should also translate into higher deficits and larger net issuance."
14.01.2021	Barclays	At least some deficit financing implied	“Taken together, we estimate that the FY21 fiscal deficit increases by about $1trn relative to our prior forecast, to $3.1trn (14.0% of GDP), and the FY22 fiscal deficit increases to $1.9trn (8.0% of GDP) vs. 6.0% of GDP previously."

Notes: discussion about financing of stimulus is taken from the reports of investment banks both before and after elections.

Table B.6: Infrastructure Discussion Before Elections

Date	Bank	Infrastructure Number	Exact Phrasing
30.12.2020	Moody's Analytics	**Rep. win:** sizeable infrastructure is possible once the pandemic winds down	"A divided government will prevent additional fiscal stimulus from being passed next year. However, **there are reasonable odds that once the pandemic winds down, Biden will be able to get Congress to agree to a sizable infrastructure package, though likely not in 2021.**"
31.12.2020	Deutsche Bank	**Dem win:** possible infrastructure package	"However, if Democrats take both seats, another large fiscal stimulus package would be likely, possibly including some of the more structural priorities of the new Administration such as infrastructure."
04.01.2021	Goldman Sachs	**Dem win:** meaningful infrastructure package; **Rep win:** some infrastructure package	"Infrastructure, for example, continues to be an area where some bipartisan support appears possible...Democratic control of the Senate would increase the odds of a meaningful infrastructure package becoming law, though this is more of an indirect effect as such legislation would still require bipartisan support to pass."
05.01.2021	Rabobank	**Dem win:** more expansive fiscal policy; **Rep win:** 0	"**Biden's ambitious plans to boost the economy through expansive fiscal policy will be shot down in the Senate if the Republicans keep a majority.** ... So we can forget about all those plans to spend on education, public R&D, green infrastructure, health care, unemployment benefits and social programs. The same is true for tax hikes for corporations and high income and high wealth individuals. **If the Democrats win both run-off elections in Georgia this would open the door to a large fiscal stimulus package and more expansive fiscal policy in the coming years.** Part of this will likely be financed by higher taxes somewhere down the road."
05.01.2021	Barclays	**Dem win:** possible significant spending on infrastructure; **Rep win:** possible moderate infrastructure spending	"If the Democrats control the Senate, their first priority would likely be a stimulus package, with a sizable portion dedicated to state and local governments, and it might even get expanded to include significant spending for infrastructure and clean energy initiatives ... **If Republicans keep control of the Senate, moderate virus-related relief and possible infrastructure spending may be the only areas of bipartisan agreement in Congress**, in our view."

Notes: The discussion of infrastructure is taken from the reports of investment banks before the Georgia Senate election.

Table B.7: Expected Infrastructure Package After Elections

Date	**Bank**	**Infrastructure, $(billion)**	**Type**	**Exact Phrasing**
06.01.2021	Cornerstone Research	1000	infrastructure	"Infrastruct. Larger deal **($1 trillion) via budget recon**; surface infrastr + schools/housing"
06.01.2021	BNP Paribas	600	infrastructure and industrial policy	"We also see a strengthened likelihood of a bipartisan passage of President-elect Biden's **infrastructure and industrial policy plans** (≈**USD600bn) roughly evenly spread across 2021 and 2022.**"
06.01.2021	Capital Economics	0	infrastructure	"Biden's major legislative priorities, including a large Green New Deal-style infrastructure package partly funded by higher taxes on high-income individuals and corporations are still unlikely to become a reality, so we are not minded to change our (above-consensus) forecasts for 2021 or 2022."
07.01.2021	Deutsche Bank	1000	infrastructure	"While at this point the size and scope of these policies are highly uncertain, we have in mind an **infrastructure package of about $1tn and tax reform raising revenues of about half that much.**"
10.01.2021	Moody's Analytics	1150	net fiscal support	"We also expect an additional $1.15 trillion in net fiscal support to be signed into law later this year with government spending and tax increases in the spirit of the "Build Back Better" policy agenda that Biden proposed during the campaign."
11.01.2021	Saxo	3500	green infrastructure	"With Harris to break the 50/50 potential Tie in the Senate, about $7 trillion in Green Infrastructure that Biden and Harris campaigned on has risen several magnitudes in not just probability but scope ... We are not saying the full $7 trillion will come into fruition, it could actually be more – but even if it's "only" $3.5 trillion the ripples are huge."
11.01.2021	Goldman Sachs	550	infrastructure and green stimulus	"Our US economists see ... an **ongoing 0.25% of GDP in new annual spending financed by tax increases, which helps fund infrastructure and green initiatives.**"
11.01.2021	Bank of America Corp	3000	infrastructure	"A Blue Wave increases the likelihood of an immediate $1 trillion Covid stimulus and **$2 trillion to $4 trillion infrastructure spending package later in 2021**"

Median of Expected Infrastructure Package: $1000 bn

Notes: The number is taken from the reports of investment banks after elections. For cases where the range is given, the median of the range is taken. In Goldman Sachs report 0.25% of GDP for 10 years would equal approximately $550bn.

Table B.8: Infrastructure Package Financing

Date	Bank	Infrastructure	Exact Phrasing
06.01.2021	Morgan Stanley	Partially by taxes	“US public policy strategist Michael Zezas ... sees ... a lighter touch on taxes, used as a partial offset to infrastructure and/or healthcare spending initiatives later in 2021."
06.01.2021	Capital Economics	Partly funded by higher taxes on high-income individuals and corporations (but unlikely)	“But Biden’s major legislative priorities, including a large Green New Deal-style infrastructure package partly funded by higher taxes on high-income individuals and corporations are still unlikely to become a reality, so we are not minded to change our (above-consensus) forecasts for 2021 or 2022.”
07.01.2021	Deutsche Bank	Half by tax	“While at this point the size and scope of these policies are highly uncertain, we have in mind an infrastructure package of about $1tn and tax reform raising revenues of about half that much."
08.01.2021	UBS	Partially financed by taxes	“Our Dem sweep scenario also assumed that there would be a multi-year fiscal package that included infrastructure spending along with other measures. We had penciled in an annual flow rate of about $275bn, but not starting until the second half of 2021. In addition, we had assumed that there would be a set of tax increases, including higher business taxes, that would be used to partially pay for the extra spending."
10.01.2021	Moody’s Analytics	Financed by taxes	“We also expect an additional $1.15 trillion in net fiscal support to be signed into law later this year with government spending and tax increases in the spirit of the "Build Back Better" policy agenda that Biden proposed during the campaign."
11.01.2021	Goldman Sachs	Fully tax financed	“Congress is likely to spend whatever tax revenue it raises on infrastructure and social benefit spending. At the moment, infrastructure appears to be the top priority."
14.01.2021	Barclays	Financed by taxes	“[I]nfrastructure spending advanced under budget reconciliation would likely include revenue increases since it must score deficit neutral outside of the 10-year budget window. This would put the focus on Democrats agreeing on pay-fors, such as an increase in the corporate tax rate and/or changes to the taxation of capital gains.

Notes: discussion about financing of infrastructure is taken from the reports of investment banks both before and after elections.

Table B.9: Types of Tax Change for Infrastructure Financing

Date	**Bank**	**Taxes**
22.10.2020	UBS	Personal tax: - Dem win: increase to 0.396 - Rep win: taxes remain unchanged Capital gains taxes: - Dem win: capital gains taxed at higher rates at higher income levels - Rep win: taxes remain unchanged Corporate tax: - Dem win: increase to 0.28 - Rep win: taxes remain unchanged Alternative min tax on book income: - Dem win: increase to 0.15 - Rep win: taxes remain unchanged
06.01.2021	Cornerstone Research	Personal tax: - Increase to 0.396 Capital gains taxes: - Increase to 0.265 Corporate tax: - Increase to 0.25 Social Security Tax and Payroll Tax: - no change Dividend rates: - Increase to 0.265 Deductions and restorations: - no TCJA extensions - possible partial SALT deduction restoration

Date	Bank	Taxes
10.01.2021	Moody's Analytics	Capital gains taxes: - Increase to 0.28
11.01.2021	Goldman Sachs	Personal tax: - no net increase in personal taxes - increase in marginal rate on top earners: 0.396 Capital gains taxes: - increase to 0.28 - $160bn Corporate tax: - increase to 0.25 - $400bn Social Security Tax and Payroll Tax: - no change Deductions and restorations: - increase to 0.28 - $225bn - itemized deductions

Notes: This table shows the changes in various tax categories as predicted by different banks and research institutions.

Table B.10: Policy Outcomes After Democratic Victory—Example from Barclays

Date	**Bank**	**Outcome**	**Probability**	**Exact Phrasing**
06.01.2021	Barclays	aggressive progressive policy agenda	unlikely	We believe ... the probability of an 'aggressive progressive policy agenda' is unlikely even if the Democrats win both seats in Georgia ... [w]e generally agree with Maneesh that near-term corporate tax hikes are unlikely given policy priorities during the pandemic.
06.01.2021	Barclays	stimulus	likely	the outcome of the two Georgia elections, which are likely to give control of Congress to Democrats, will raise expectations for further COVID-related fiscal support and, potentially, spending on infrastructure
06.01.2021	Barclays	infrastructure	moderately likely	the outcome of the two Georgia elections, which are likely to give control of Congress to Democrats, will raise expectations for further COVID-related fiscal support and, potentially, spending on infrastructure
07.01.2021	Barclays	lower trade risks	likely	With a Democratic Congress, we expect the Biden administration likely will pursue additional stimulus, revert to a more active regulatory agenda, and lower trade risks.
07.01.2021	Barclays	tax change	moderately unlikely	While infrastructure remains a distinct possibility, we assign a lower probability to significant tax changes or a public option.
07.01.2021	Barclays	public option	moderately unlikely	While infrastructure remains a distinct possibility, we assign a lower probability to significant tax changes or a public option.
08.01.2021	Barclays	confirm Biden administration nominees	likely	With full control of Congress, we expect Democrats are more likely to confirm all of the Biden administration's nominees
08.01.2021	Barclays	broader agenda setting powers	likely	With full control of Congress, we expect Democrats are more likely to confirm all of the Biden administration's nominees, control the Congressional policy agenda with the power to call hearings
08.01.2021	Barclays	overturn some of the Trump administration's de-regulatory efforts	likely	With full control of Congress, we expect Democrats are more likely to confirm all of the Biden administration's nominees, control the Congressional policy agenda with the power to call hearings, and overturn some of the Trump administration's de-regulatory efforts
08.01.2021	Barclays	filibuster elimination	unlikely	Issues such as eliminating the legislative filibuster or expanding the Supreme Court are very unlikely to gain traction
08.01.2021	Barclays	Supreme Court expansion	unlikely	Issues such as eliminating the legislative filibuster or expanding the Supreme Court are very unlikely to gain traction
14.01.2021	Barclays	severe gas and oil regulatory policy changes	unlikely	Regulatory risk. Even with the Georgia Senate results, our view is that near-term policy changes are likely to be less punitive to oil & gas than initially feared

Notes: this table an illustrative example for one of the banks, Barclays. Here, we show how we use the text of Barclays reports to discuss what policy outcomes are associated with the Democratic victory, and what is their likelihood. In the main text, Figure 3 uses information of this kind for all banks, not just Barclays, in order to create the word cloud.

Table B.11: Accuracy of Inflation Forecasts from Swaps

	CPI Inflation	CPI Core Inflation	Δ CPI Inflation	Δ CPI Core Inflation
	(1)	(2)	(3)	(4)
Year 1 Swaps	1.237	1.034		
	(0.524)	(0.284)		
Δ Year 1 Swaps			1.168	0.828
			(0.547)	(0.334)
Observations	51	51	39	39
R^2	0.426	0.653	0.336	0.521

Notes: The outcome variable in columns (1) and (2) is CPI inflation or CPI Core Inflation, measured between month $t+9$ and month $t-3$. The timing accords with the 12 month inflation swap over the same period, which is the independent variable (monthly mean of end of day information). In columns (3) and (4) we take the difference over 12 months of both variables. Newey-West standard errors with three lags are in parentheses. The sample period is from the start of 2019 to the start of 2024.

Table B.12: Conditional Forecast Table

Source	Date	Real GDP Increase	Real GDP Phrasing
Goldman Sachs	06.01.2021	0.8% increase over 2 years	"We have revised our forecasts to reflect the results of the Georgia elections. With control of the Senate by a narrow margin, Democrats are likely to pass further fiscal stimulus. We now forecast ... 2021 GDP growth of +6.4% on a full-year basis (vs. +5.9% previously and +3.9% consensus) and +6.6% on a Q4/Q4 basis (vs. +5.6% previously and +3.3% consensus)... Our 2022 GDP growth forecast is now +4% on a full-year basis (vs. +3.7% previously) and +2.4% on a Q4/Q4 basis (vs. +2.7% previously)."
BNP Paribas	06.01.2021	1.4% increase over 2 years	"Both Democratic candidates are projected to win their Georgia run-off races...[w]e revise our annual average 2021 and 2022 GDP forecasts up by 0.5pp and 0.9pp, respectively, with growth expected to register 4.2% and 4.1%."
Moody's Analytics	10.01.2021	1.5% increase over 2 years	"The additional fiscal support will quickly boost the economy, pushing real GDP growth to ... more than 5% for all of 2021. This is a percentage point more growth than we expected in last month's forecast, which was based on the incorrect assumption the Senate would remain in Republican control. Real GDP should post another 5% gain in 2022, about 0.5 percentage point more than previously forecast."
Deutsche Bank	07.01.2021	1.8% increase over 2 years	"The first priority of the Biden administration and Democratic Congress is likely to be another tranche of Covid-related fiscal support. ... In response, we have lifted our growth forecast for 2021 by about 2 percentage points to 6.3% (Q4/Q4) ... Beyond this year, we have modestly downgraded 2022 growth expectations given a pull forward of activity into the next few quarters."
JP Morgan	07.01.2021	1.9% increase over 2 years	"Democrats are now set to control the White House and to hold slim majorities in both chambers of Congress. This could set the stage for a dramatic increase in federal spending and fiscal transfers to households ... If realized this would boost GDP growth this year by about 1.5%-points to 5.3% (Q4/Q4), and 0.5%-point next year to 2.6%."
Barclays	14.01.2021	2.3% increase after 2 years	"With Democratic control of Congress, we expect another virus- related relief package of about $1.4trn ...[w]e now expect Q4/Q4 real GDP growth of 7.0% in 2021 (up 3.2pp) and 1.5% in 2022 (down 0.9pp). On a calendar-year basis, these revisions boost real GDP growth to 6.3% y/y in 2021 and 3.9% y/y in 2022."
Bloomberg	06.01.2021	2.3% increase after 2 years	"In the event of a Democratic sweep in Georgia, we think additional near-term pandemic relief and accompanying stimulus could stretch into the $600 billion to $800 billion range. The high end could be sufficient to lift growth by roughly 1.7 percentage points in 2021, to 5.2% year-over-year, with a faster pace continuing into 2022 (above 3%), compared to our current baseline of 2.4%."

Median of the real GDP increase is 1.8%.

Notes: This table shows the change in forecasts of real GDP growth in the week after the Georgia election, by various investment banks. For Deutschebank the new "downgraded" number for 2022 is given in the table in the report.

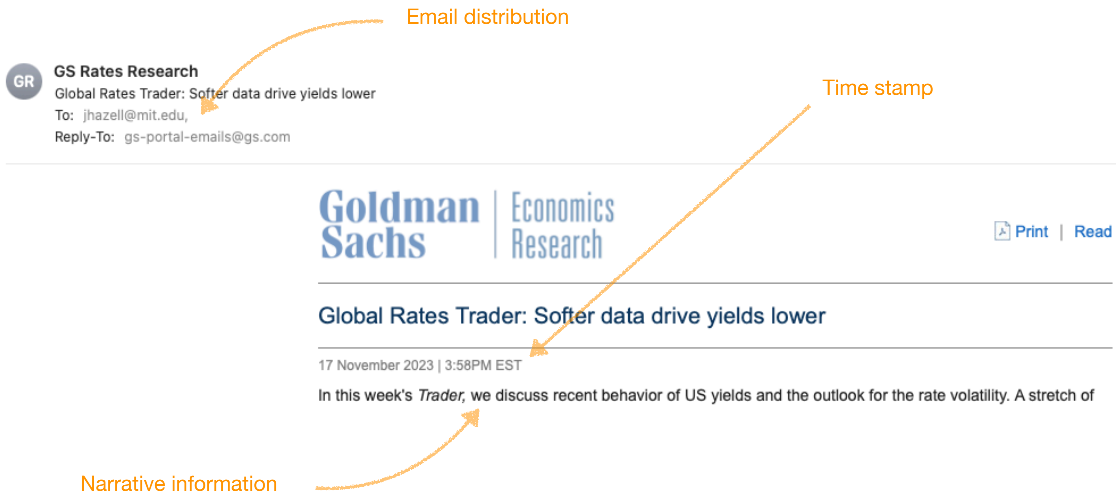
Table B.13: Changing of Probability of Democratic Senate Majority over Time (Barclays)

Date	Source of Probability	Probability of Democratic Majority	Exact Phrasing
06.11.2020	Barclays	< 0.5	“With a split Congress highly likely, prospects for another large fiscal package seem remote, putting pressure on the Fed to boost monetary policy support. Although many votes remain to be counted, **the likelihood of a divided government outcome is high.**"
04.12.2020	Prediction Markets	0.2	“On November 3 (or shortly thereafter), we thought that we would have all the answers, but with the Senate’s fate still in limbo, the muni market faces a lot of uncertainty. **Prediction markets assign a nearly 80% probability of Republicans winning at least one of the Georgia Senate seats in the January run-off.**"
11.12.2020	Barclays	unlikely (< 0.5)	“Looking ahead, as discussed in our 2021 municipal outlook, **although it appears somewhat unlikely, if Democrats win both Senate seats in Georgia,** Treasuries and tax-exempt yields might sell off sooner and to a larger degree."
18.12.2020	Prediction Markets	0.35	“Regardless, the main focus of muni investors going into 2021 will be on the Georgia Senate elections, with a possibility of a large stimulus bill, with a sizable portion dedicated to municipalities, implemented **if Democrats win both races (although prediction markets assign less than a 35% probability to this outcome).**"
05.01.2021	Barclays	0.5	“Polling in both Georgia Senate run-off elections is well within the margin of error, and **we consider them both toss-ups.** ’

Notes: The probabilities are taken for Barclays as an illustrative example of change of assumed probabilities over time. They are taken from after the presidential election up to the date of the Georgia senate runoff.

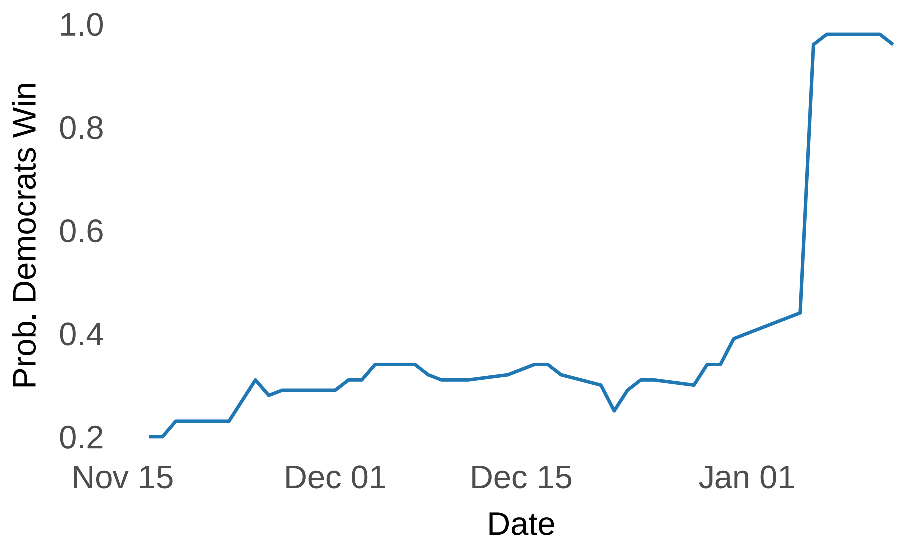
B.2 Figures

Figure B.1: Example of Report from Goldman Sachs



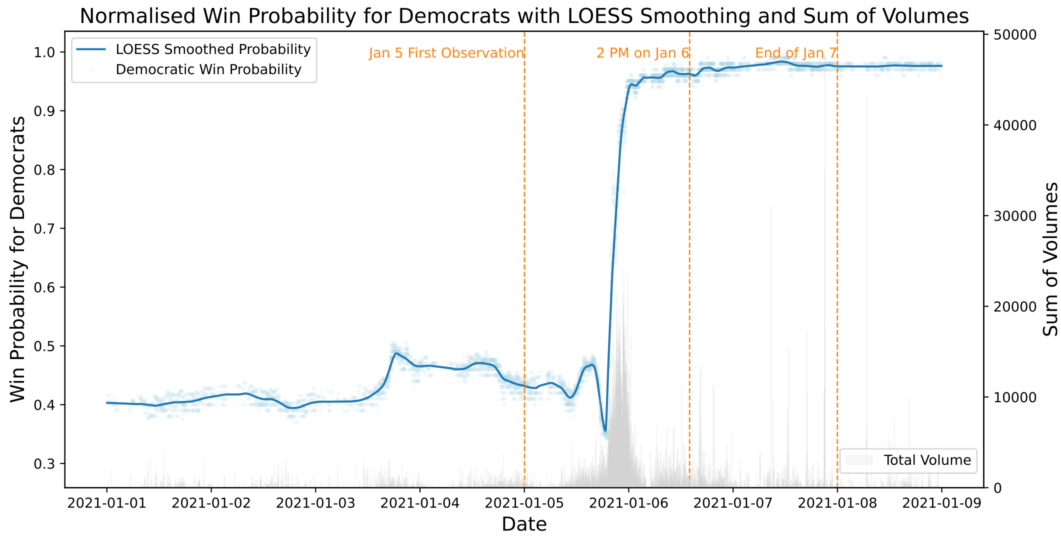
Notes: this figure contains a snapshot of a representative report from Goldman Sachs.

Figure B.2: Daily Probability of Democrat Majority in Senate



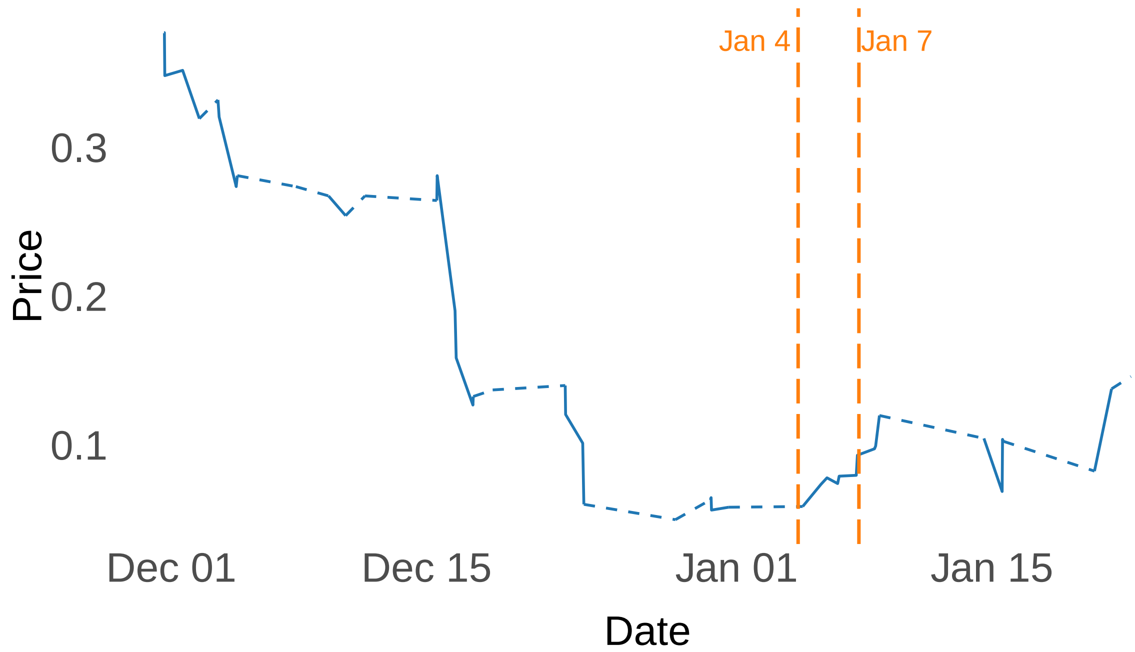
Notes: this graph plots the daily probability that Democrats would win both Georgia Senate seats and hence take a majority in the Senate, using end-of-day probabilities from PredictIt.

Figure B.3: High Frequency Betting Data around Georgia Runoff



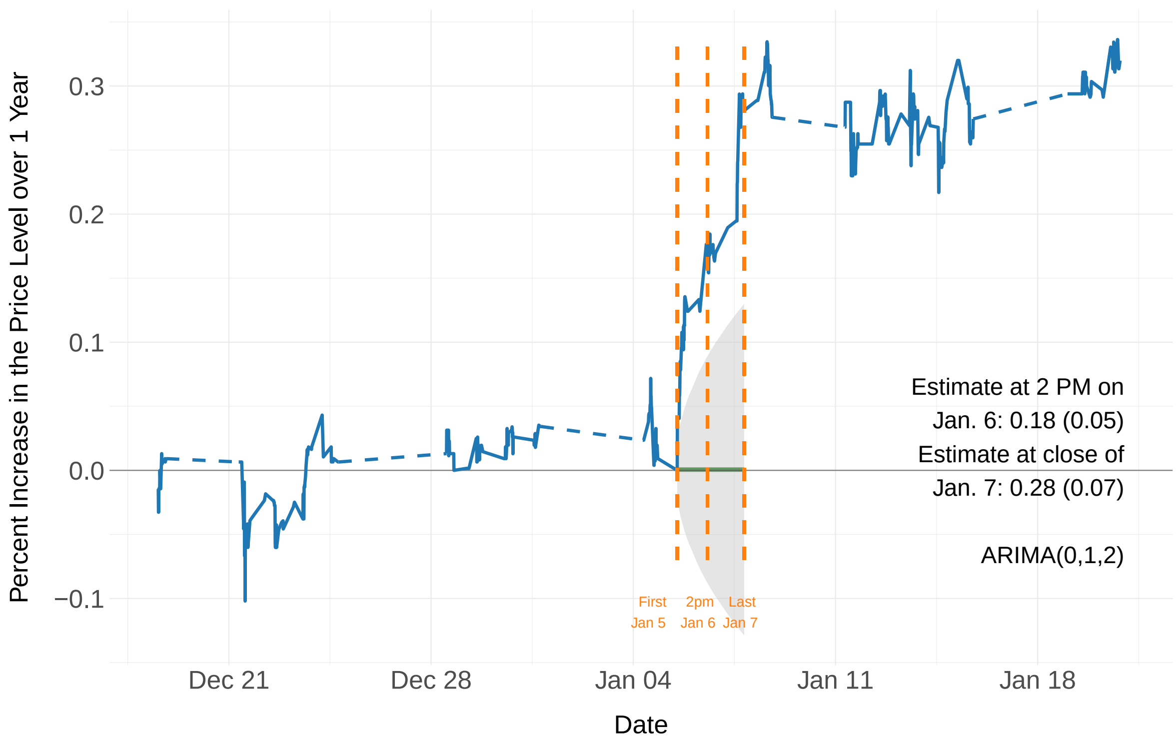
Notes: this figure contains tick by tick data on the probability that Democrats would control the 2020 Senate, based on trades from PredictIt. We add a LOESS smoothed line to the figure. In shaded gray is the total trade volume at a given point in time.

Figure B.4: Bloomberg Surprise Index Around Georgia Runoff



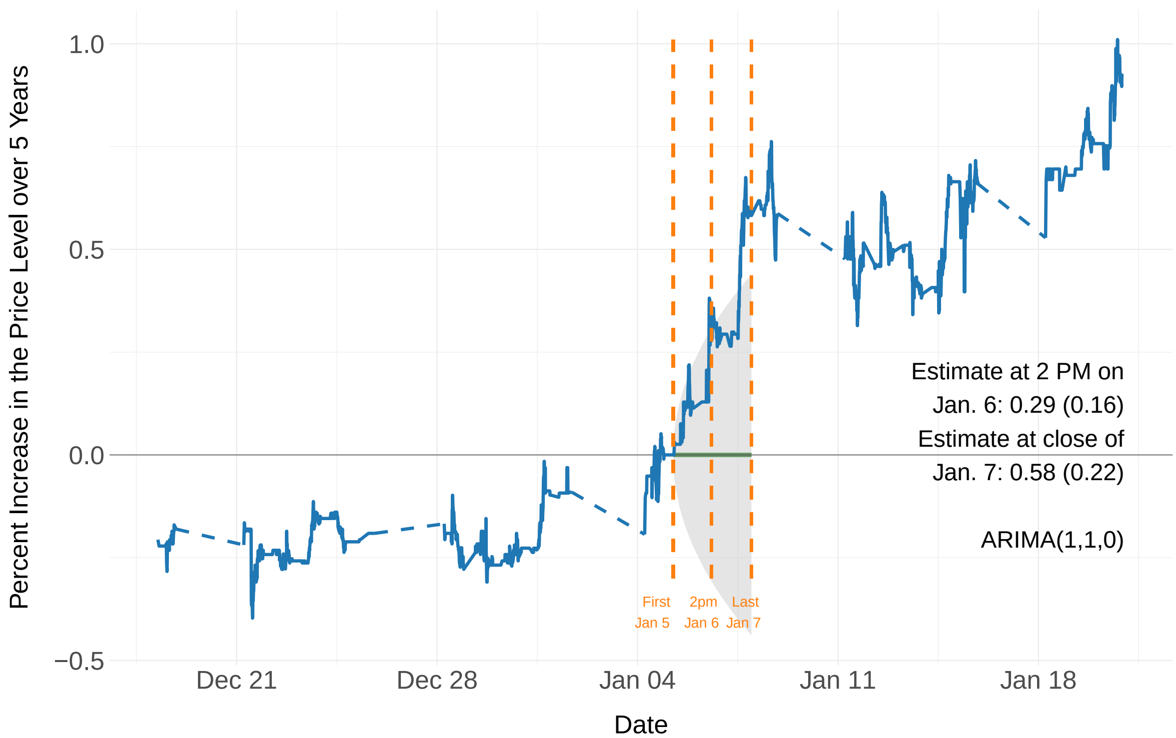
Notes: this figure contains the square of Bloomberg's intradaily "Surprise Index", which measures the surprise from data releases.

Figure B.5: Expected Percent Increase in the Price Level Over 1 Year



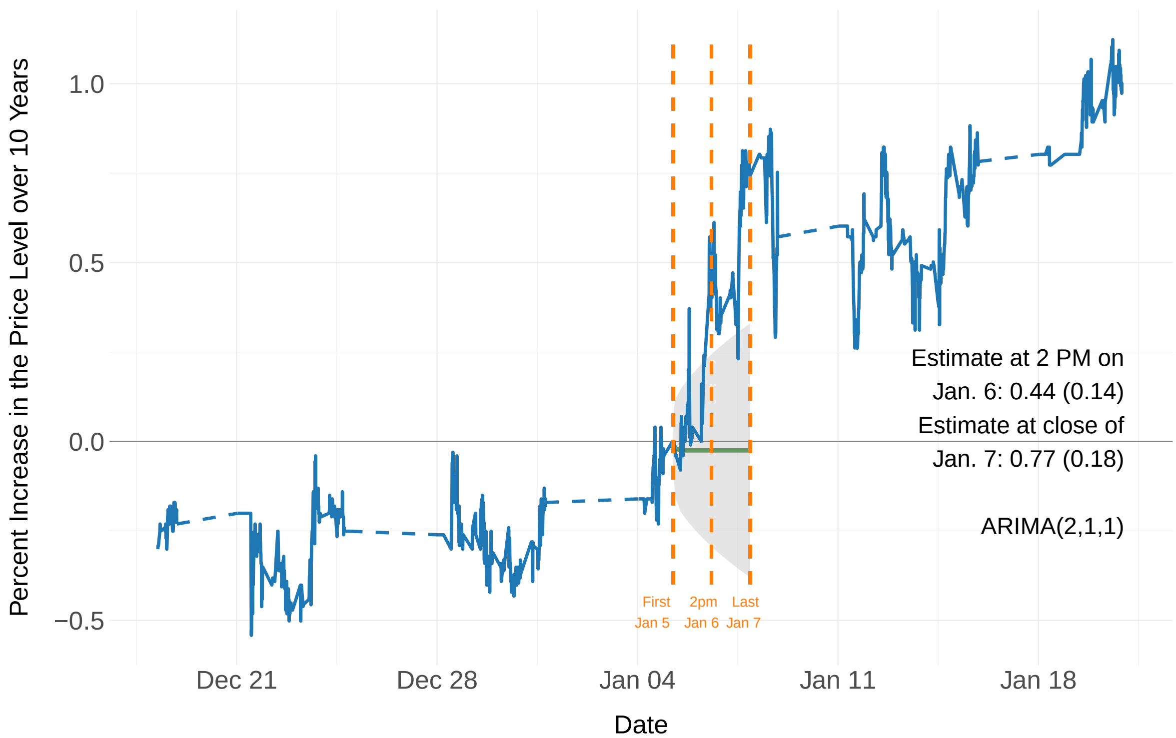
Notes: this graph plots the intraday percent increase in the price level 1 year ahead, implied by the 1 year inflation swap, subtracting the first value on January 5th. Dashed lines are missing data from holidays and weekends. The green line is the forecast if the policy had not taken place, the gray shade is the 95% confidence interval.

Figure B.6: Expected Percent Increase in the Price Level Over 5 Years



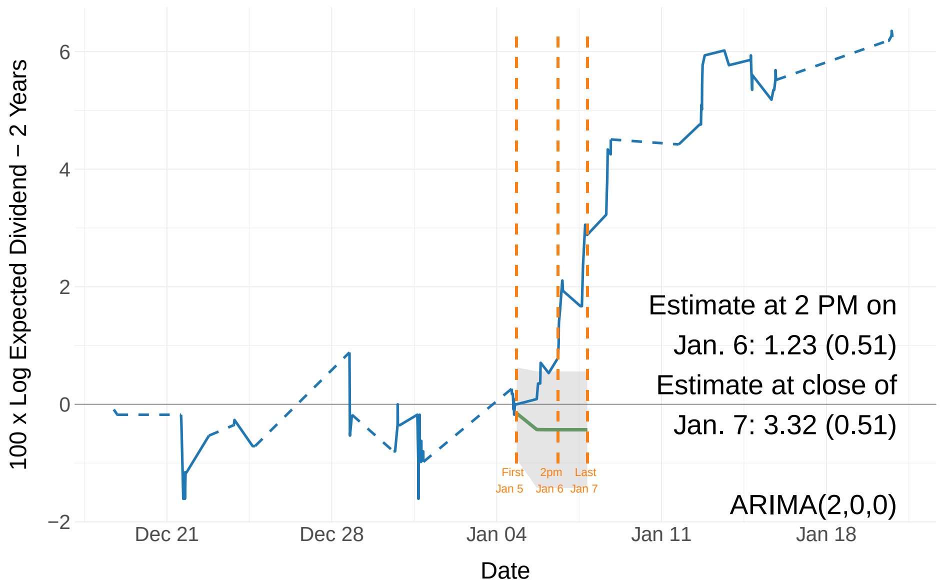
Notes: this graph plots the intraday percent increase in the price level 5 years ahead, implied by the 5 year inflation swap, subtracting the first value on January 5th. Dashed lines are missing data from holidays and weekends. The green line is the forecast if the policy had not taken place, the gray shade is the 95% confidence interval.

Figure B.7: Expected Percent Increase in the Price Level Over 10 Years



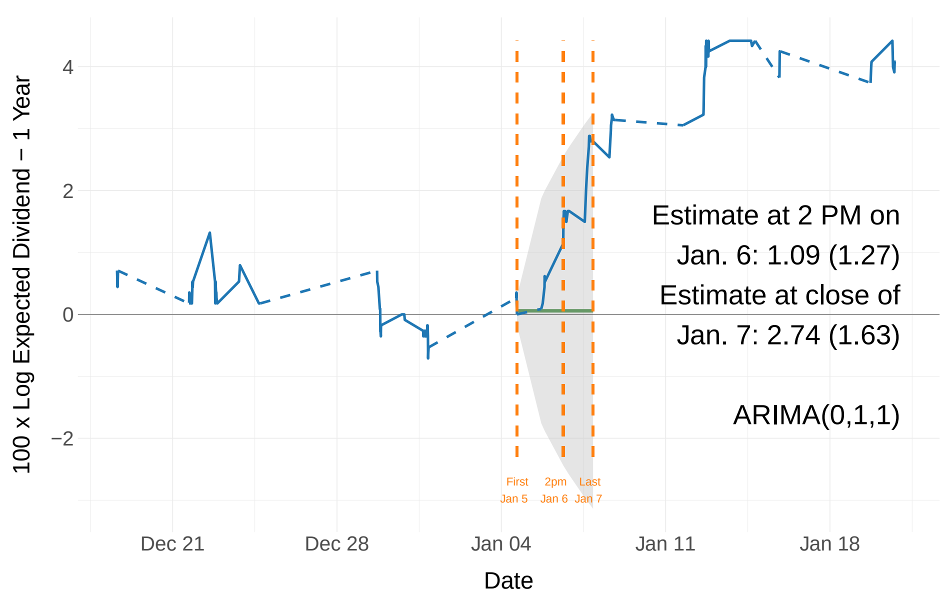
Notes: this graph plots the intraday percent increase in the price level 10 years ahead, implied by the 10 year inflation swap, subtracting the first value on January 5th. Dashed lines are missing data from holidays and weekends. The green line is the forecast if the policy had not taken place, the gray shade is the 95% confidence interval.

Figure B.8: Single Event Study—2022 Dividend Futures



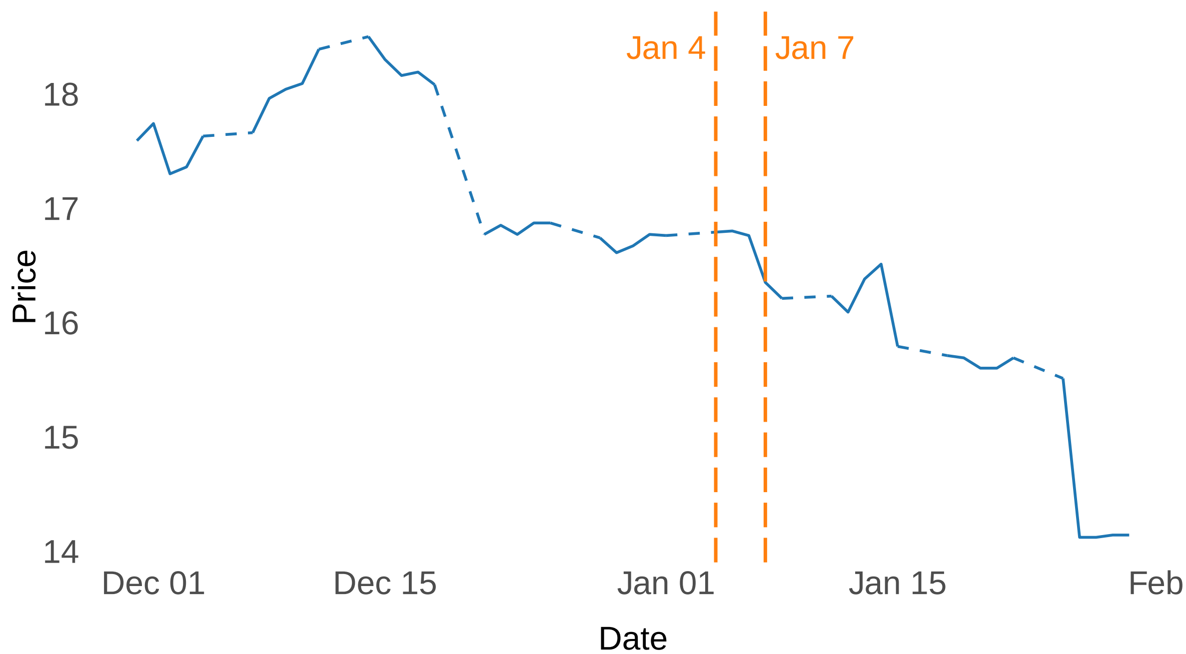
Notes: this graph plots the intraday percent increase in dividends 2 years ahead, implied by the 2 year S&P 500 dividend future, subtracting the last value on January 4th. Dashed lines are missing data from holidays and weekends. The green line is the forecast if the policy had not taken place, the gray shade is the 95% confidence interval.

Figure B.9: Single Event Study—2021 Dividend Futures



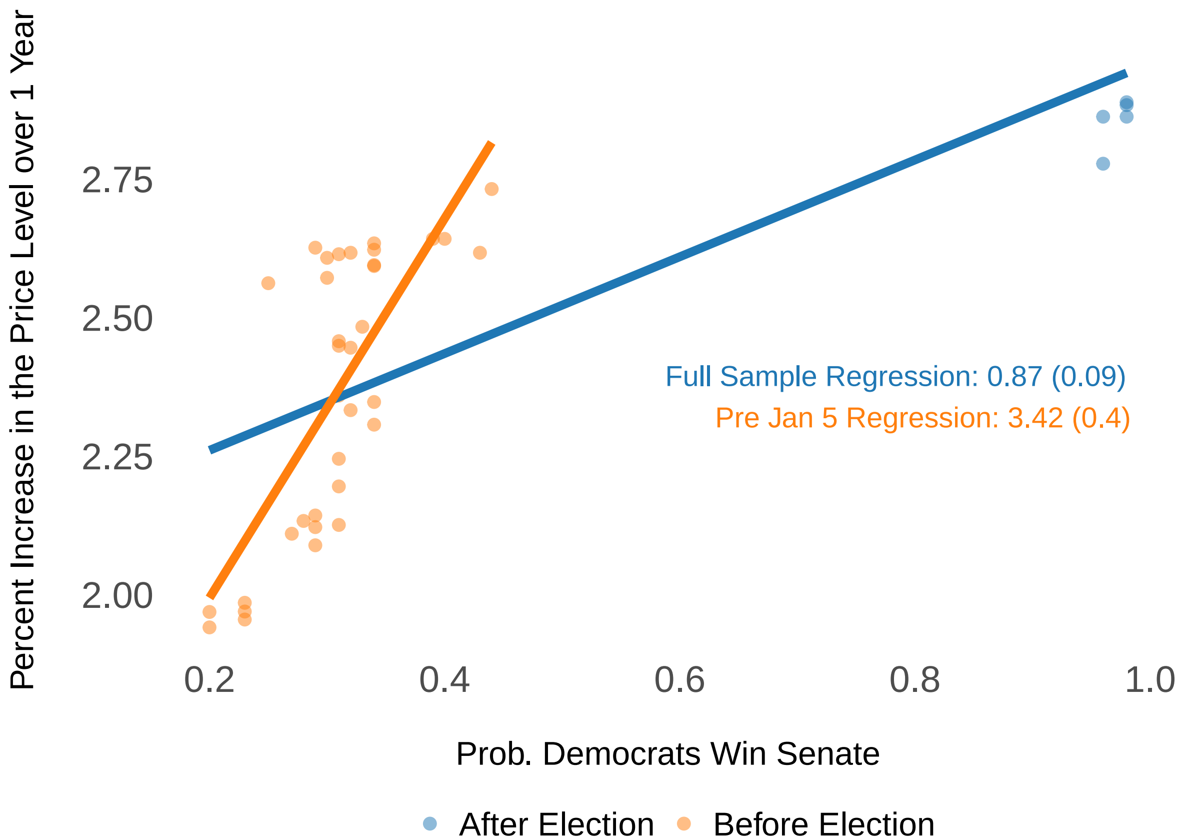
Notes: this graph plots the intraday percent increase in dividends 1 year ahead, implied by the 1 year S&P 500 dividend future, subtracting the last value on January 4th. Dashed lines are missing data from holidays and weekends. The green line is the forecast if the policy had not taken place, the gray shade is the 95% confidence interval.

Figure B.10: Credit Default Swaps around Georgia Runoff



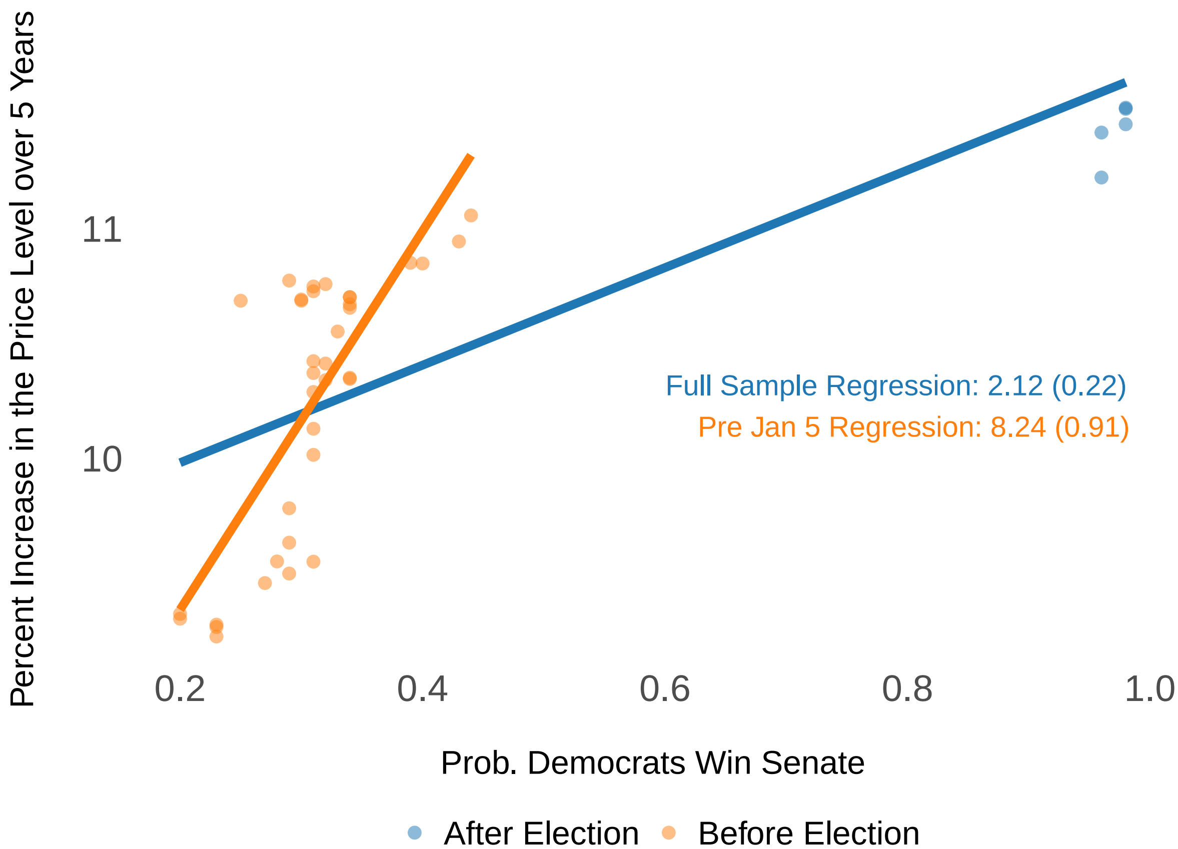
Notes: this figure plots end-of-day Credit Default Swaps Prices on 5 year US government debt in a month interval around the Georgia Senate Runoff.

Figure B.11: Instrumental Variables—1 Year Swaps



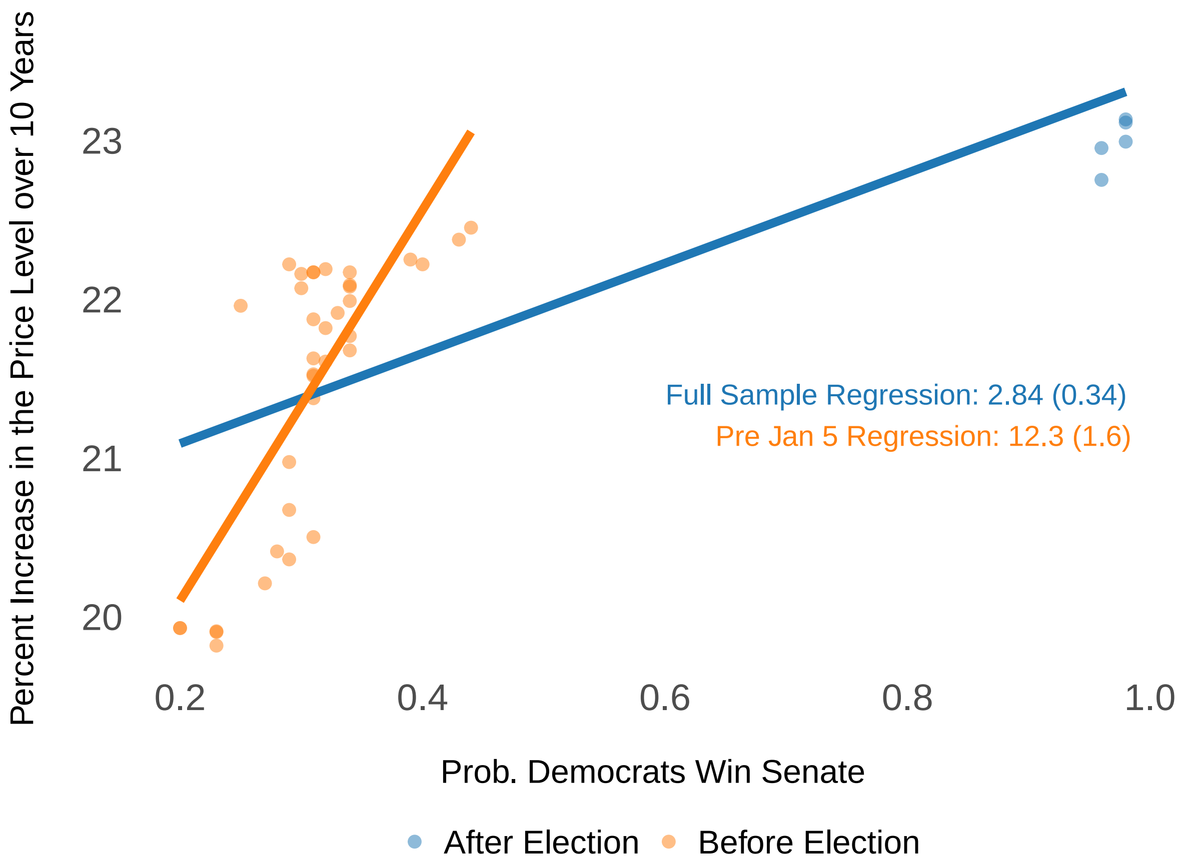
Notes: this graph plots the end-of-day expected percent increase in prices over 1 years, implied by the 1 year inflation swap, against end of day probability of Democrat victory from PredictIt. The regressions use Newey-West standard errors with 3 lags.

Figure B.12: Instrumental Variables—5 Year Swaps



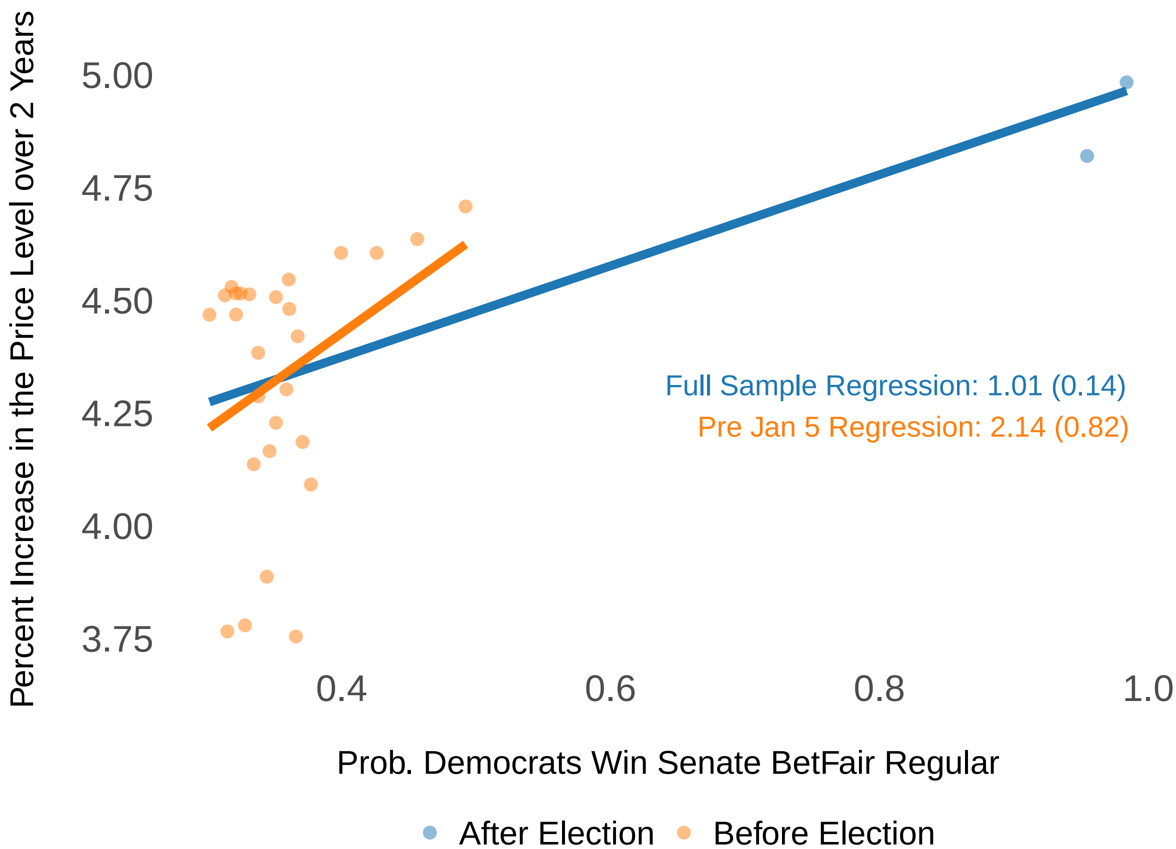
Notes: this graph plots the end-of-day expected percent increase in prices over 5 years, implied by the 5 year inflation swap, against end of day probability of Democrat victory from PredictIt. The regressions use Newey-West standard errors with 3 lags.

Figure B.13: Instrumental Variables—10 Year Swaps



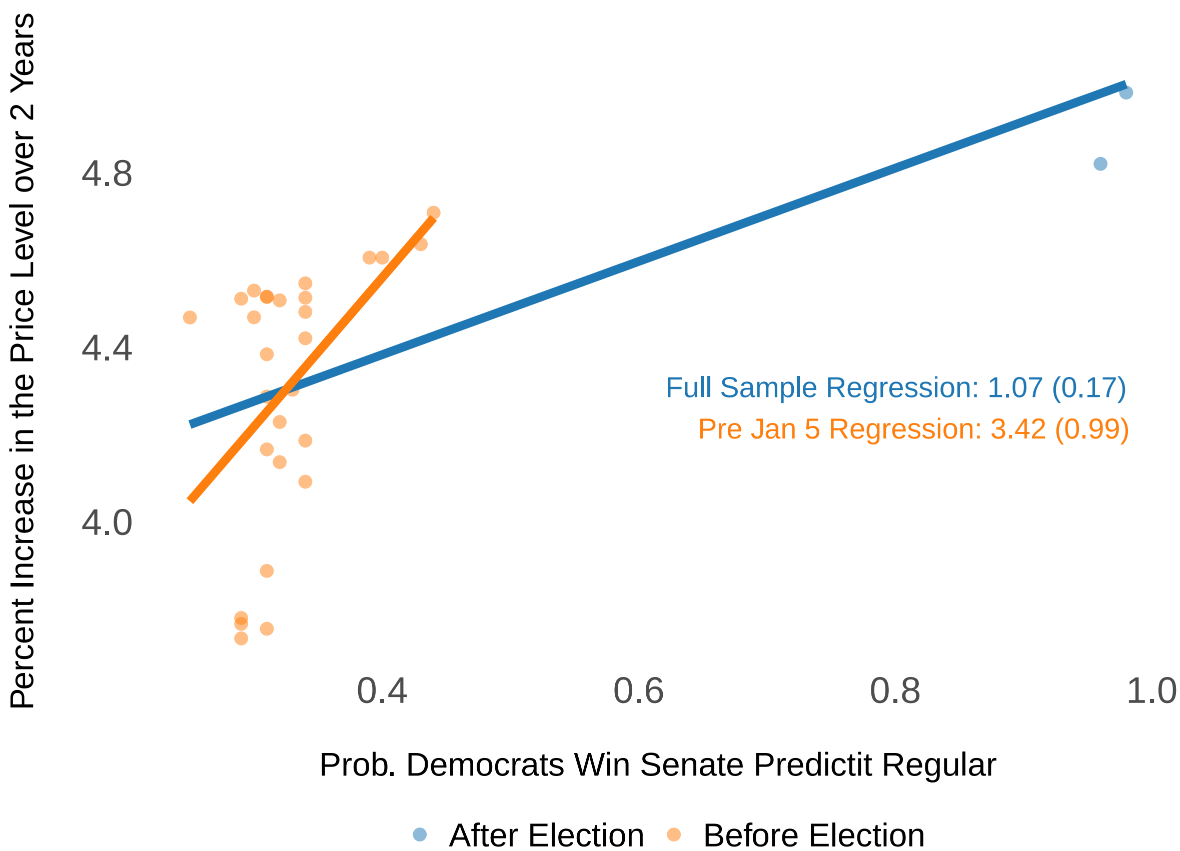
Notes: this graph plots the end-of-day expected percent increase in prices over 10 years, implied by the 10 year inflation swap, against end of day probability of Democrat victory from PredictIt. The regressions use Newey-West standard errors with 3 lags.

Figure B.14: Instrumental Variables—BetFair, Ossoff Election, 2 Year Swaps



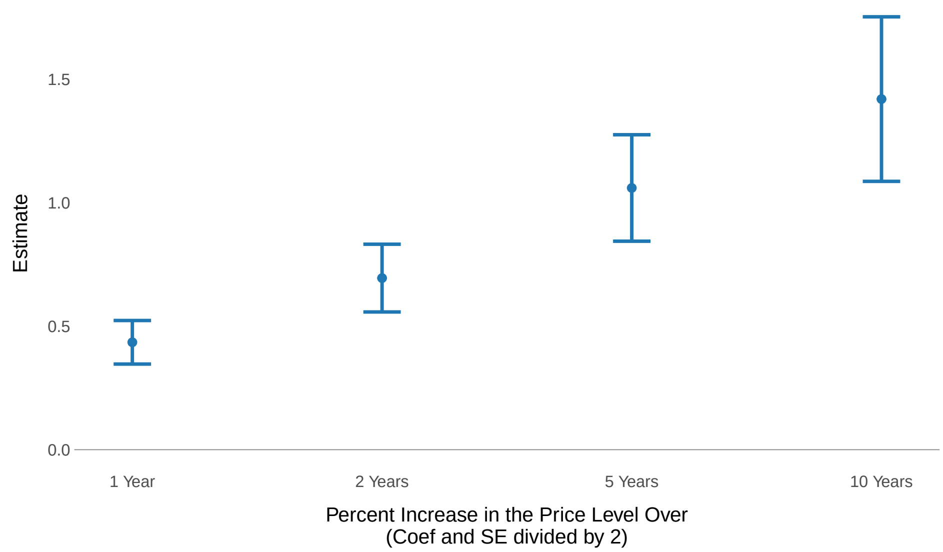
Notes: this graph plots the end-of-day expected percent increase in prices over 2 years, implied by the 2 year inflation swap, against end of day probability of Jon Ossof's victory in the regular Senate Election, from Betfair. The regressions use Newey-West standard errors with 3 lags.

Figure B.15: Instrumental Variables—PredictIt, 2 Year Swaps (same sample as BetFair)



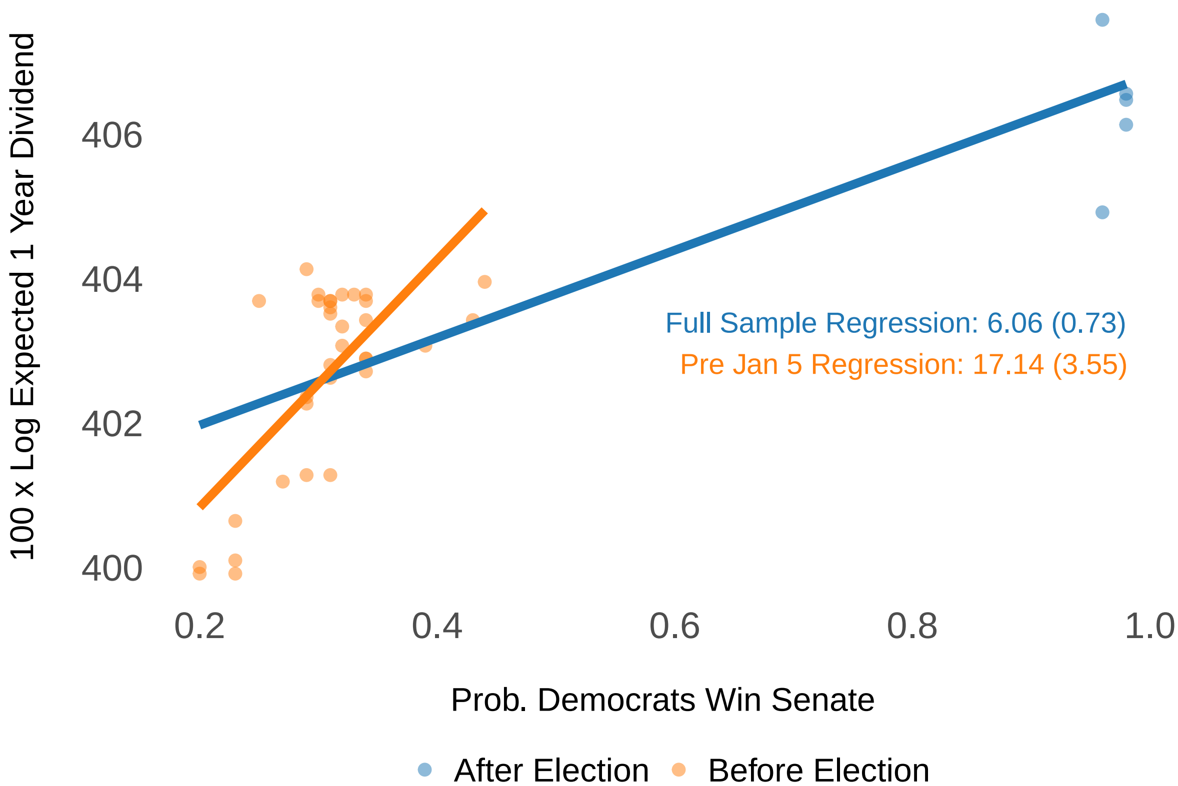
Notes: this graph plots the end-of-day expected percent increase in prices over 2 years, implied by the 2 year inflation swap, against end of day probability of Democrat victory from PredictIt, on the sample for which BetFair data are available. The regressions use Newey-West standard errors with 3 lags.

Figure B.16: Instrumental Variables—Expected Impulse Response of Inflation



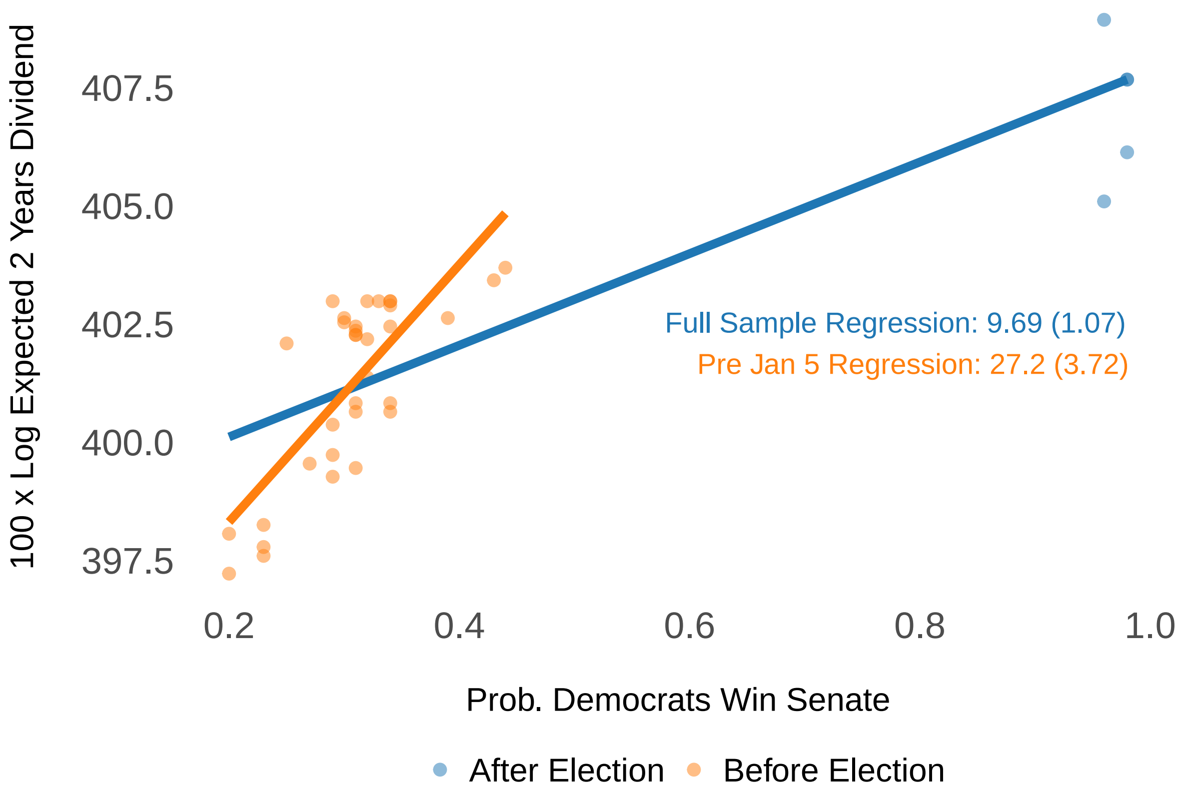
Notes: this graph collects the instrumental variables estimates of the effect of changing Democrat probability on expected price level growth over 1, 2, 5 and 10 years. We divided the baseline regression coefficient by 2, so that graph depicts how expected price level growth responds to a change in probability of 0.5. The bars correspond to 95% confidence intervals of the point estimates.

Figure B.17: Instrumental Variables—2021 Dividends



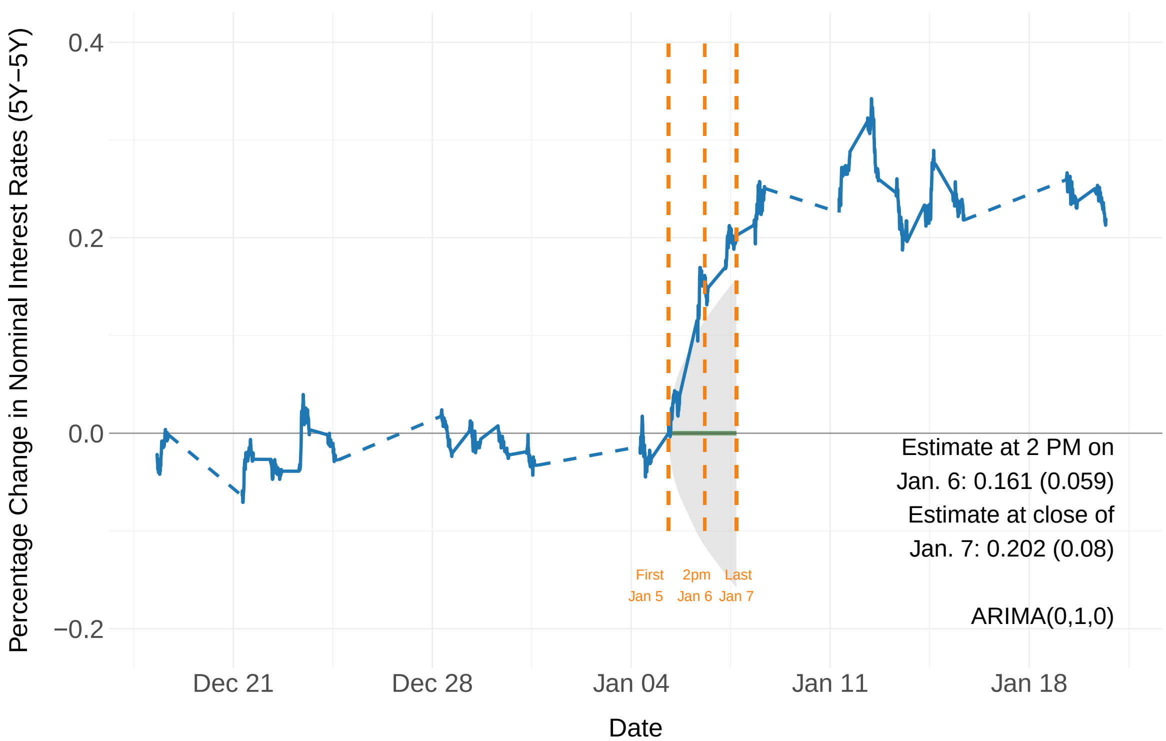
Notes: this graph plots the end-of-day log dividend future for the S&P500 1 year ahead, against end of day probability of Democrat victory from PredictIt. The regressions use Newey-West standard errors with 3 lags.

Figure B.18: Instrumental Variables—2022 Dividends



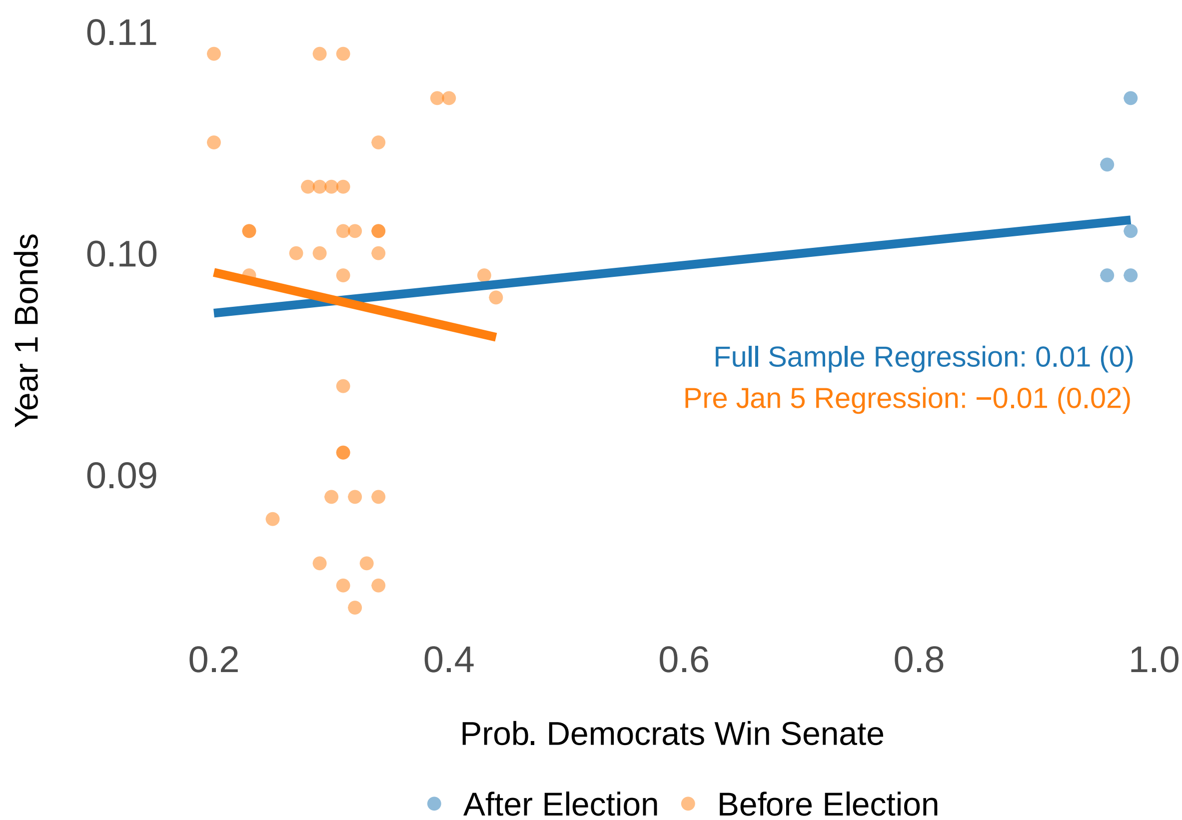
Notes: this graph plots the end-of-day log dividend future for the S&P500 2 years ahead, against end of day probability of Democrat victory from PredictIt. The regressions use Newey-West standard errors with 3 lags.

Figure B.19: 5 Year Nominal Interest Rate After 5 Years



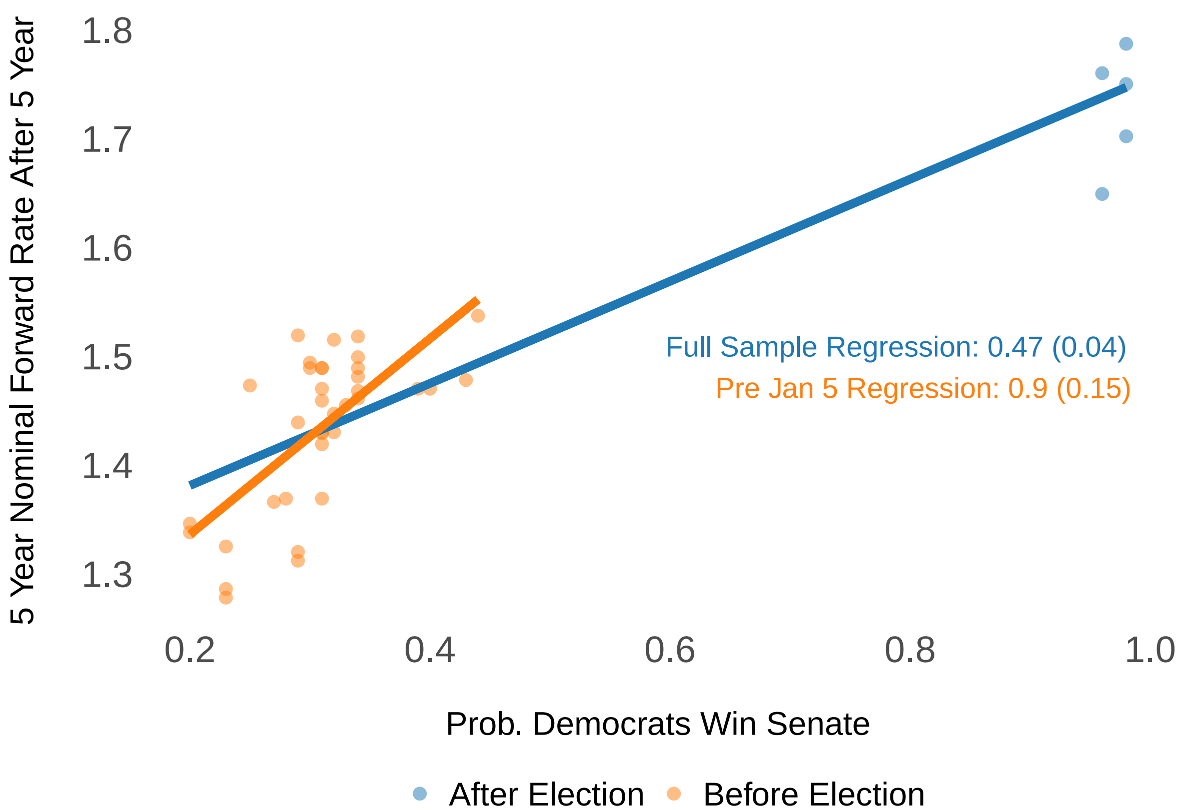
Notes: This plot shows the 5 year-5 year forward interest rate. Dashed lines indicate missing data from holidays and weekends. The green line is the forecast if the policy had not taken place, and the gray shade is the 95% confidence interval. The dashed orange lines mark the first observation on January 5th, 2 PM on January 6th, and the final observation on January 7th.

Figure B.20: Instrumental Variables—Year 1 Bonds



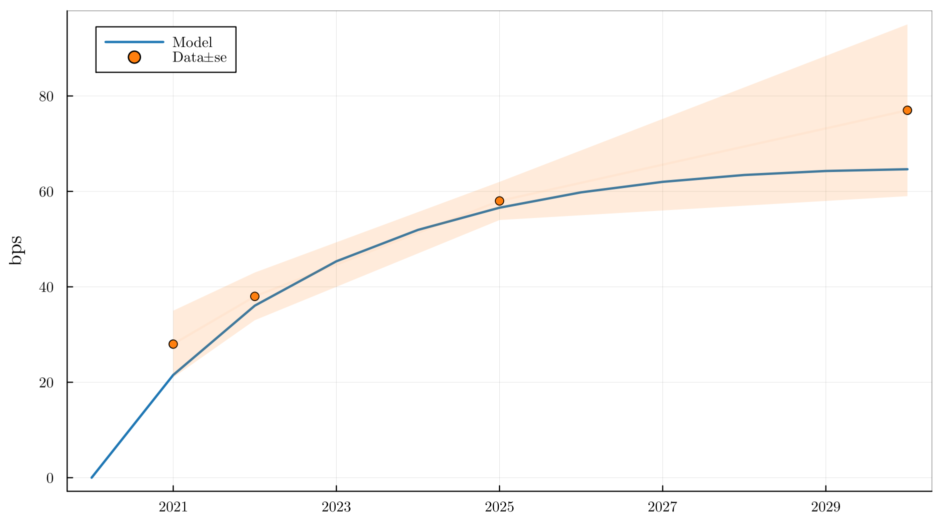
Notes: this graph plots the end-of-day 1 year nominal interest rate on government bonds, in percentage points; against end of day probability of Democrat victory from PredictIt. The regressions use Newey-West standard errors with 3 lags.

Figure B.21: Instrumental Variables—5 Year Nominal Forward Rater After 5 Years



Notes: this graph plots the end-of-day 5 year nominal interest rate on government bonds expected after 5 years, in percentage points; against end of day probability of Democrat victory from PredictIt. The regressions use Newey-West standard errors with 3 lags.

Figure B.22: Impulse response for price level



Notes: this graph plots impulse responses of the price level. All responses are to the shocks shown in Figure 9. Price level estimates from the data are shown with bands of one standard error.