Great Expectations: Electoral Accountability After Economic Shocks*

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Abstract

This paper examines how exogenous economic shocks shape electoral accountability in local elections. We develop a theoretical framework in which a sudden increase in household income temporarily boosts support for incumbents, even when the shock is unrelated to their actions. As voters gradually update their expectations, however, the incumbent's advantage fades. We test the model's predictions using Brazil's 2003 legalization of genetically engineered soybean seeds, a policy that triggered uneven productivity gains across municipalities due to variation in climate and soil. Leveraging this quasi-natural experiment over the 2000–2020 period, we show that incumbent mayors were more likely to be reelected in municipalities with larger gains in soy productivity — but this advantage was short-lived. Our findings highlight how misattribution and voter learning jointly shape the political consequences of economic change in developing countries, where structural reliance on commodity exports increases vulnerability to external shocks.

Keywords: exogenous shocks, economic voting, electoral accountability, local politics
JEL Codes: D72; O13; O17; O54

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1 Introduction

Economic voting is a core instrument of democratic accountability: citizens reward or punish incumbents based on perceived economic performance (Duch & Stevenson, 2008). For instance, between 1980 and 2003, presidential elections in 13 Latin American countries indicate that a one percentage point decrease in per capita gross domestic product (GDP) is associated with a 1.7 percentage point decline in the vote share of the incumbent party (Benton, 2005). Yet, economic voting depends crucially on clarity of responsibility — voters' ability to discern whether governments are genuinely responsible for economic outcomes — a condition often unmet in practice (Achen & Bartels, 2017). External events such as wars, pandemics, natural disasters, global inflationary pressures, and commodity price shocks can significantly alter economic conditions independently of domestic policy, blurring lines of accountability and distorting voter perceptions.[1] This challenge is especially acute in developing countries, whose economies often rely heavily on commodity exports like oil, soybeans, coffee, sugar, and iron ore, making them particularly susceptible to exogenous economic shocks (Campello & Zucco, 2016) — and where still-consolidating institutions may amplify the political consequences of attribution errors by limiting voters' ability to verify government responsibility.

Much of the existing literature on economic voting and clarity of responsibility focuses on national-level outcomes, examining how voters attribute macroeconomic performance to presidents, prime ministers, or ruling parties (e.g. Campello & Zucco, 2020; Lewis-Beck & Stegmaier, 2000; Lewis-Beck et al., 2008; Nadeau et al., 2013; Remmer, 2014). Yet, lower levels of government — especially local administrations in developing countries — play a crucial role in shaping citizens' everyday economic conditions. Despite this, we know relatively little about how voters evaluate local incumbents when economic change originates from outside the political sphere. Recent work by Novaes and Schiumerini (2022) and Gélineau et al. (2025) suggests that exogenous shocks can meaningfully influence subnational elections, even when local officials have little control over economic fundamentals. Building on this insight, we ask: how do exogenous shocks affect electoral accountability at the local level, and how persistent are their political consequences?

We begin by developing a theoretical-formal framework that links income shocks to voter behavior through adaptive expectations. Voters use changes in their own income to

[1] Even seemingly irrelevant occurrences, such as local college football games (Healy et al., 2010) or shark attacks (Achen & Bartels, 2017), have been claimed to influence voting behavior, although recent analyses cast doubt on these findings (Fowler & Hall, 2018; Fowler & Montagnes, 2015).

infer incumbent performance, but they update their reference points only gradually. This mechanism generates a temporary incumbency advantage: following a positive shock, voters initially misattribute the resulting gains to local policymakers, but as expectations adjust, the political payoff fades — even if prosperity endures. We test this mechanism in the context of Brazil's 2003 legalization of genetically engineered (GE) soybean seeds, a nationwide reform that triggered spatially uneven productivity gains due to local variation in soil and climate conditions. This technological shift — well documented to have boosted productivity, reduced labor intensity, and spurred manufacturing employment in affected areas (Bustos et al., 2016, 2020) — was largely exogenous to local politics. Combining this quasi-natural experiment with two decades of mayoral election data (2000–2020), we implement a difference-in-differences design that leverages both the timing of the policy and cross-municipality variation in agronomic suitability. In contrast to prior studies that rely on commodity price shocks or identification strategies limited to close elections, our setting allows us to estimate causal average treatment effects across a broad and heterogeneous set of municipalities.

We find that incumbents in high-productivity-gain municipalities were significantly more likely to win reelection in the years following the shock, consistent with misattribution of economic performance. However, this advantage was short-lived: it peaked in 2008 — when the economic impacts of GE soy adoption became most salient — and disappeared in subsequent cycles as voters updated their expectations. These findings contribute to the literature in two key ways. First, we explicitly formalize and empirically document voter misattribution as a temporary phenomenon rather than a persistent bias. Second, we extend previous analyses by demonstrating how accountability mechanisms operate differently at the local level, particularly in commodity-dependent developing economies, where external shocks routinely complicate voters' ability to evaluate incumbents' economic performance.

The remainder of the paper proceeds as follows. First, we review the extensive literature on electoral accountability, focusing on commodity-exporting developing countries, where accountability challenges are more widespread. Second, we develop a theoretical-formal framework to examine how exogenous economic shocks impact the fortunes of incumbents in local elections, deriving testable propositions. Third, we present the case of Brazil, using agricultural data to show how municipalities varied in their exposure to the exogenous shock and public opinion data to illustrate how this variation shaped voters' economic perceptions. Finally, we test our propositions using a difference-in-differences design and find support for our expectations. Beyond demonstrating the potential for misattribution in new democracies like Brazil, our findings underscore the temporal dynamics of voter learning: rather than rewarding static levels of economic performance, voters respond to perceived changes and adjust their evaluations over time. These insights have broader relevance for resource-dependent developing economies, where economic shocks are frequent, democratic institutions are still consolidating, and voters often struggle to distinguish policy-driven growth from externally induced booms.

2 Electoral Accountability and Commodity Dependence

Political sophistication and trust in government help voters better perceive and evaluate economic performance, making them more likely to vote based on the incumbent's economic record (Duch, 2001; Gomez & Wilson, 2001). Timing also matters. Early in a term, during the honeymoon phase, optimistic voters might rely on prospective expectations of the incumbent's economic success. As the incumbent amasses a performance record, voters "learn" about the economic vote and increasingly hold the incumbent accountable through retrospective evaluations (Singer & Carlin, 2013). In the absence of a crisis, however, growth, inflation, and related economic outcomes tend to fade in salience, as voters shift their attention to other issues (Singer, 2011, 2013).

Still, economic voting and electoral accountability hinge on voters' ability to correctly connect outcomes to the actions of those in power, something voter characteristics and temporal orientations alone are not enough to guarantee. Even in times of crisis and well past the honeymoon phase, well-informed voters with high trust in political institutions might struggle to connect economic outcomes to their true causes (Campello & Zucco, 2020; Lewis-Beck & Stegmaier, 2000; Nadeau et al., 2013; Valdini & Lewis-Beck, 2018). Without reliable information, individuals may mistakenly credit incumbents for economic upturns and provide undue political support or punish incumbents for circumstances outside the control of domestic leadership.

Institutional features condition how clearly voters can assign responsibility. Where policies are designed nationally but implemented locally, voters struggle to identify which level of government is responsible for particular outcomes. Conditional cash transfers in Mexico (De La O, 2013), Uruguay (Manacorda et al., 2011), and the Philippines (Labonne, 2013) illustrate this challenge: although these programs are designed and managed by the central government, local politicians often receive electoral credit for their implementation.

In presidential systems, united governments (where the executive and the legislative come from the same party) and concurrent elections (when presidential and legislative elections are held on the same day) enhance clarity (Samuels, 2004), with voters responding to sustained — not just momentary — economic performance (Johnson & Schwindt-Bayer, 2009). Complex coalitions, in contrast, reduce clarity (Duch & Stevenson, 2008), as do term limits, which limit incentives for good performance during an incumbent's final term (Klašnja & Titiunik, 2017). In Brazil, Colombia, Mexico, and elsewhere, weak parties with inconsistent platforms rarely discipline their members, amplifying this problem (Klašnja & Titiunik, 2017). Parties that barely win local elections are more likely to lose in the following cycle, a phenomenon known as the "incumbency curse." However, since incumbents can easily switch parties or continue their careers elsewhere, this rarely translates into improved governance. Voters sanction parties, not individuals, further weakening the link between performance and accountability. This "incumbency curse" — like its counterpart, the "incumbency blessing" — is particularly prevalent in rural areas, which Novaes and Schiumerini (2022) attribute to commodity dependence.

Indeed, commodity dependence can distort accountability by amplifying existing institutional features as well as exerting a distorting effect of its own. In the United States, voters in oil-producing states like Alaska, Wyoming, or Texas are more likely to reelect the incumbent governor when oil prices are high, something the incumbent has no control over (Wolfers, 2007). In Brazil, oil windfalls translate into increased revenue and, consequently, increased reported spending on public goods and services, yet concrete benefits — like educational and health inputs, infrastructure, and household income — increase far less than one would expect, due to corruption and patronage (Caselli & Michaels, 2013). In São Tomé and Príncipe, there is similar evidence that oil discovery announcements increase perceived corruption (Vicente, 2010). Driven by excessive optimism, the electorate might exaggerate the likely revenues (Collier, 2017) and not only reward the wrong political actor, but also do so based on perceived gains that fail to materialize.

This challenge is particularly acute in developing countries, where economic performance depends on factors largely beyond government control: commodity prices, exchange rates, international trade policies, and United States interest rates (Campello & Zucco, 2016). This can work in the incumbent's favor, as voters might shift the blame to foreign actors like the International Monetary Fund or the World Trade Organization (Alcañiz & Hellwig, 2011; Hellwig & Samuels, 2007), but it also constrains the incumbent's ability to respond to voter demands through policy (Ezrow & Hellwig, 2014). While industrialized nations are susceptible to global economic shocks, they tend to have diversified economies, easy access to financial markets, and more robust welfare systems that help them weather difficult times (Wibbels, 2006). In contrast, most developing countries have undiversified economies: they rely on exporting a few commodities, like oil, natural gas, soybeans, sugar, coffee, wheat, and cotton, all of which have volatile prices. When commodity prices are high, incumbents might prioritize short-term policies that bring immediate electoral gains, hoping to receive credit for economic success. Conversely, in times of downturn, even the most qualified and effective leaders might be unfairly blamed and voted out of office.

In sum, divided governments, non-concurrent elections, complex coalitions, term limits, and weak parties cloud citizens' ability to hold leaders responsible for economic performance. External shocks in general and commodity dependence, in particular, exacerbate this challenge: by distorting the link between government action and economic performance, they fuel political volatility and frequent turnover that can weaken democratic institutions. This dynamic is particularly destabilizing in contexts where democratic institutions are already fragile.

3 The Argument

To examine how commodity shocks could drive voting behavior, we consider a dynamic electoral environment in which municipalities r hold local elections at discrete dates $t \in \{-1, 0, 1, 2, \ldots\}$. Each municipality contains a unit continuum of risk-neutral voters indexed by $i \in [0, 1]$. Politicians are *ex-ante* identical, so elections function solely as a mechanism for retrospective accountability rather than for selecting among heterogeneous types (Ashworth, 2012).

At $t = 0$, municipality r receives an exogenous, positive income windfall $\Delta A_r > 0$ that we treat as permanent for analytical convenience, though, in reality, it may simply be long-lasting. Such a shock might result from the adoption of new extraction technologies, an expansion of arable land, the introduction of high-yield crop varieties, or the discovery of natural resources. The windfall is realized before the $t = 0$ election, so voters' income at this period already includes the shock.

3.1 Income, Exposure, and Expectations

Voters do not directly observe policy effort or quality. Instead, following the logic of retrospective voting (Fearon, 1999; Wolfers, 2007), they use their own material outcomes —

particularly income — as a proxy for performance. Two dimensions of household-level heterogeneity shape how income responds to shocks.

First, individuals differ in their exposure to the regional windfall. Let $\theta_{i,r} \in [\eta, 1]$ denote the exposure of voter i in municipality r, where $0 < \eta < 1$ is the lowest spillover any resident receives. Individuals more directly connected to the sectors positively affected by the shock — whether through employment, investment, or supply chain linkages — obtain the full benefit, $\theta_{i,r} = 1$; all others receive only the baseline spillover, potentially capturing general equilibrium impacts, $\theta_{i,r} = \eta$. This general formulation allows for the possibility that the main beneficiaries of a commodity boom may lie outside the directly impacted sector, consistent with labor-saving technological change, structural transformation, or downstream diffusion. Exposure is taken as exogenous and time-invariant, with the cumulative distribution $F_r(\theta)$ as common knowledge. Thus, we have that:

$$\theta_{i,r} = \begin{cases} 1, & \text{if } i \text{ is linked to sectors positively affected by the shock in region } r, \\ \eta, & \text{otherwise} \end{cases}$$

Second, voters differ in their baseline income levels. Let $\mu_{i,r}$ denote the pre-shock income of individual i in municipality r, capturing heterogeneity unrelated to the commodity windfall. Each period, income is further affected by an idiosyncratic zero-mean shock $\varepsilon_{i,r,t} \sim \mathcal{N}(0, \sigma_\varepsilon^2)$, which we assume is independent across individuals, municipalities, and time. The variables $\mu_{i,r}$, $\theta_{i,r}$, and $\varepsilon_{i,r,t}$ are mutually independent; $\theta_{i,r}$ is drawn once — prior to $t = -1$ — and remains fixed thereafter. Consequently, the observed income of voter i in municipality r at date t is given by:

$$y_{i,r,t} = \mu_{i,r} + \theta_{i,r} \mathbb{I}_{\{t \geq 0\}} \Delta A_r + \varepsilon_{i,r,t} \tag{1}$$

where $\mathbb{I}_{\{t \geq 0\}}$ is an indicator function that equals 1 from $t = 0$ onward and 0 beforehand.

Following the adaptive-expectations tradition, voters compare their current income with a moving reference point that adjusts gradually. Let $\lambda \in (0, 1)$ denote the speed of adaptation. The reference income evolves according to:

$$\bar{y}_{i,r,t} = (1 - \lambda)\, \bar{y}_{i,r,t-1} + \lambda\, y_{i,r,t-1}, \qquad \bar{y}_{i,r,-1} = \mu_{i,r} \tag{2}$$

From Equation (2), voters are therefore initially surprised by the windfall, but as new income realizations arrive, their benchmark converges toward the post-shock level.

Substituting (1) into (2) and iterating forward yields the closed-form path of the reference income:

$$\bar{y}_{i,r,t} = \mu_{i,r} + \left[1 - (1-\lambda)^{t+1}\right]\theta_{i,r}\, \mathbb{I}_{\{t\geq 0\}}\Delta A_r + \sum_{s=-1}^{t-1} (1-\lambda)^{t-1-s}\, \varepsilon_{i,r,s} \tag{3}$$

where the first term is the pre-shock baseline, the second captures the gradually internalized income windfall, and the third is a geometrically weighted history of idiosyncratic shocks. Note that $\lim_{t\to\infty} \bar{y}_{i,r,t} = \mu_{i,r} + \theta_{i,r}\Delta A_r$; i.e., the reference point converges to the post-shock steady state.

3.2 Sanctioning Behavior and Support for the Incumbent

Voters sanction the incumbent by comparing their *current* income with the *reference* income formed in the previous period. The resulting satisfaction gap for voter i in municipality r at election t is defined as:

$$G_{i,r,t} \equiv y_{i,r,t} - \bar{y}_{i,r,t} \tag{4}$$

Using (1) and (3), and focusing on the post-shock years $t \geq 0$, we obtain

$$G_{i,r,t} = \theta_{i,r}\Delta A_r \gamma(t) + \varepsilon_{i,r,t} - \sum_{s=-1}^{t-1} (1-\lambda)^{t-1-s}\varepsilon_{i,r,s} \tag{5}$$

where the decay factor $\gamma(t) = (1-\lambda)^{t+1}$ captures the diminishing surprise from the income windfall as voters' expectations adjust.

Importantly, heterogeneity in baseline income $\mu_{i,r}$ does not affect the satisfaction gap, implying that voting behavior is governed solely by a voter's exposure to the regional windfall and the history of idiosyncratic shocks.

We assume a voter retains the incumbent if, and only if, her satisfaction gap is non-negative. From Equation (5) we know that $G_{i,r,t}$ is the sum of independent normal shocks; conditional on exposure $\theta_{i,r}$, the satisfaction gap is therefore normally distributed with mean $\theta_{i,r}\, \Delta A_r\, \gamma(t)$ and variance σ_ε^2. Hence the probability that voter i supports the incumbent at date t is given by:

$$\Pr\left[G_{i,r,t} \geq 0 \mid \theta_{i,r}\right] \;=\; \Phi\!\left(\frac{\theta_{i,r}\, \Delta A_r\, \gamma(t)}{\sigma_\varepsilon}\right) \tag{6}$$

where $\Phi(\cdot)$ denotes the cumulative distribution function of the standard normal.

Aggregating over the continuum of voters with exposure distribution $F_r(\theta)$ yields the share of municipality r's electorate that backs the incumbent in election t:

$$S_r(t) \;=\; \int_{\eta}^{1} \Phi\!\left(\frac{\theta\,\Delta A_r\,\gamma(t)}{\sigma_\varepsilon}\right)\, dF_r(\theta) \tag{7}$$

A particularly transparent case arises when within-region individual shock exposure takes only two values. Suppose a fraction $p \in (0,1)$ of the electorate is fully exposed ($\theta = 1$), while the remaining $1-p$ receive only the baseline spillover ($\theta = \eta$). Equation (7) then reduces to:

$$S_r(t) \;=\; p\,\Phi\!\left(\frac{\Delta A_r\,\gamma(t)}{\sigma_\varepsilon}\right) \;+\; (1-p)\,\Phi\!\left(\frac{\eta\,\Delta A_r\,\gamma(t)}{\sigma_\varepsilon}\right) \tag{8}$$

a weighted average of the approval probabilities of the two voter groups. We adopt this two-type specification for the remainder of the paper.

Elections are decided by simple majority rule,[2] so the incumbent is reelected in period t if and only if $S_r(t) > \frac{1}{2}$.

3.3 Income Windfall and Incumbency

Let $V_r(t) = \Pr\left(S_r(t) > \frac{1}{2}\right)$ denote the likelihood of reelection for the incumbent in region r at election t, as governed by model parameters. Our simple formal theoretical framework model yields three transparent comparative-static results.

Proposition 1 (Windfall Effect on Reelection)**.** *For every post-shock electoral period, the probability of reelection is strictly increasing in the magnitude of the regional income windfall.*

Proof. Differentiating Equation (7) with respect to ΔA_r gives

$$\frac{\partial S_r(t)}{\partial \Delta A_r} \;=\; \int_{\eta}^{1} \phi\!\left(\tfrac{\theta\,\Delta A_r\,\gamma(t)}{\sigma_\varepsilon}\right) \frac{\theta\,\gamma(t)}{\sigma_\varepsilon}\, dF_r(\theta) \;>\; 0$$

because the standard-normal density $\phi(\cdot)$ is strictly positive and all other factors are non-negative. Under simple-majority rule the incumbent wins whenever $S_r(t) > \frac{1}{2}$; thus $V_r(t) \equiv \Pr[S_r(t) > \frac{1}{2}]$ is a non-decreasing transformation of $S_r(t)$ that is strictly increasing on the interior of $(0,1)$. Consequently

$$\frac{\partial V_r(t)}{\partial \Delta A_r} \;>\; 0, \qquad \forall\, t \geq 0 \qquad \square$$

[2] Following Alesina and Rodrik (1994), we impose simple majority to focus on aggregate support rather than vote margins or strategic turnout.

Proposition 2 (Decay of Windfall Advantage)**.** *The marginal electoral benefit of the regional income windfall diminishes over time.*

Proof. For any $t \geq 0$, the windfall enters each voter's satisfaction gap through the term $\theta_{i,r}\, \Delta A_r\, \gamma(t)$, with $\gamma(t) = (1-\lambda)^{t+1}$ and $\gamma'(t) < 0$. From Proposition 1 we have:

$$\frac{\partial S_r(t)}{\partial \Delta A_r} \;=\; \int_{\eta}^{1} \phi\Big(\tfrac{\theta\, \Delta A_r\, \gamma(t)}{\sigma_\varepsilon}\Big) \frac{\theta\, \gamma(t)}{\sigma_\varepsilon}\, dF_r(\theta) \;>\; 0.$$

Differentiating this expression with respect to t multiplies the integrand by $\gamma'(t) < 0$, yielding:

$$\frac{\partial^2 S_r(t)}{\partial \Delta A_r\, \partial t} \;<\; 0$$

Because the reelection probability $V_r(t) = \Pr[S_r(t) > \frac{1}{2}]$ is monotonically increasing in $S_r(t)$, the same sign carries over:

$$\frac{\partial^2 V_r(t)}{\partial \Delta A_r\, \partial t} \;<\; 0$$

□

Proposition 3 (Exposure and Spillover)**.** *In the two-type case, the probability of reelection is strictly increasing in both the fraction of fully exposed individuals and the magnitude of spillovers given an exposure level.*

Proof. With two exposure types, aggregate support is given by:

$$S_r(t) \;=\; p\, \Phi\big(k\big) + (1-p)\, \Phi\big(\eta\, k\big)$$

with $k \;\equiv\; \frac{\Delta A_r\, \gamma(t)}{\sigma_\varepsilon} \;>\; 0$. Because $S_r(t)$ is linear in p, it follows that:

$$\frac{\partial S_r(t)}{\partial p} \;=\; \Phi\big(k\big) - \Phi\big(\eta\, k\big)$$

Since $0 < \eta < 1$ and the standard-normal c.d.f. Φ is strictly increasing, the difference is positive. That is, $\frac{\partial S_r(t)}{\partial p} > 0$. Again, as the reelection probability is monotonically increasing in $S_r(t)$, we have:

$$\frac{\partial V_r(t)}{\partial p} > 0$$

Furthermore, only the second term of the $S_r(t)$ depends on η, so we have:

$$\frac{\partial S_r(t)}{\partial \eta} \;=\; (1-p)\, \phi\big(\eta\, k\big)\, k$$

Because $k > 0,\ 1 - p > 0$, and $\phi(\cdot) > 0$, the derivative is strictly positive. Thus:

$$\frac{\partial V_r(t)}{\partial \eta} > 0$$

□

3.4 Discussion

This theoretical framework builds on prior work suggesting that voters shift from prospective to retrospective evaluations over an incumbent's term (Singer & Carlin, 2013). We formalize a fully retrospective mechanism through which long-lasting, exogenous income shocks — such as those associated with commodity-based windfalls — translate into potentially short-lived electoral rewards for incumbents. In the immediate aftermath of the shock, household income rises abruptly while expectations, shaped by past experiences, remain anchored in pre-shock conditions. This divergence creates a transitory satisfaction gap that increases the likelihood of incumbent support.

Over time, voters gradually revise their benchmarks through a simple adaptive process, allowing reference income to catch up to the new income level. As a result, the perceived benefit of the shock diminishes, although income remains permanently higher. The incumbent's electoral advantage decays geometrically, at a rate determined by the speed of expectation adjustment, captured by λ. This is consistent with public opinion evidence that in times of economic stability, voting decisions are driven less by economic performance and more by issues like corruption, crime, or foreign policy (Singer, 2013).

To reiterate, the mechanism is fully retrospective: voters do not evaluate incumbents based on policy quality or effort, but infer performance from personal economic outcomes. Political returns to a windfall, therefore, reflect the psychology of adaptation rather than actual competence.

A key implication of the framework (buttressed by simulations in Appendix A.1) is that it isolates the role of exposure in shaping electoral responses. Baseline income heterogeneity, $\mu_{i,r}$, is absorbed by the adaptive benchmark and does not enter the satisfaction gap. Instead, what drives incumbent support is the interaction of individual exposure, $\theta_{i,r}$, and the size of the regional windfall, ΔA_r. This combination generates a temporary surge in support that peaks in the first post-shock election and fades over time, even though income remains permanently higher.

Together, these dynamics yield a clear empirical prediction: exogenous income shocks should produce a temporary rise in incumbent support, concentrated in the first post-shock election. In the next section, we test this prediction using data on a large-scale agricultural transformation that generated uneven windfalls across municipalities in a commodity-dependent economy.

4 Agricultural Transformation in Brazil

4.1 Case Selection

Brazil is a good case to test the relationship of interest due to its global economic integration and local-level variation in commodity dependence. In June 2003, the government of Brazil authorized the cultivation and sale of genetically engineered (GE) soy seeds for the 2003/2004 harvest season.[3] Six months later, the temporary authorization was extended to the 2004/2005 season.[4] In March 2005, the government established a lasting regulatory framework, creating a National Technical Commission on Biosafety and authorizing genetically modified organisms on a lasting basis.[5] The decision was a win for biotech companies like Monsanto, but also for farmers who were already smuggling GE seeds from neighboring Argentina since 2001. The appeal of GE soy seeds is evident: they are much more resistant to herbicides than their traditional counterparts. Instead of extensively preparing the soil to weed out unwanted plants, GE seeds allow farmers to use herbicides that eliminate weeds while safeguarding the soy plants. This requires less labor to yield the same output, allowing for an expansion of soy production into areas where traditional seeds would not be viable.

As Figure 1 shows, there was a pronounced increase in the area devoted to soy production — and, as a consequence, in total production — after 2003, coinciding with the legalization of GE seeds (as the dotted vertical lines indicate). By both metrics, Brazil is the world's largest soy producer as of 2023 (FAOSTAT).

As Figure 1 indicates, GE seeds coincided with a surge in productivity that translated into higher revenues, job creation, and improved infrastructure. This change increased savings and available credit, driving capital investment in soy-linked municipalities (Bustos et al., 2020). Although mayors were not directly responsible for these gains, many claimed credit for the economic boom. As a result, the legalization of GE soy seeds likely had political consequences, enhancing the reelection prospects of incumbent mayors.

4.2 Productivity Shock

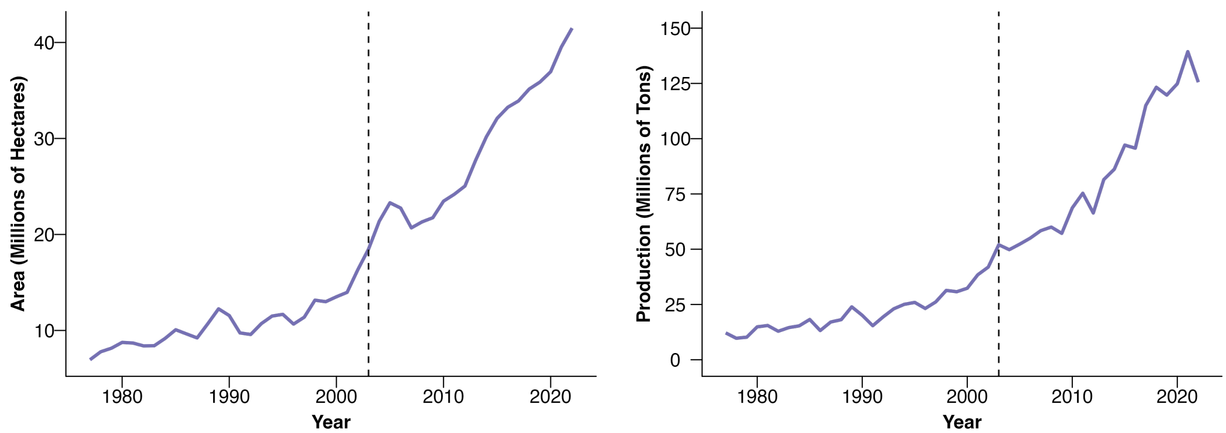
Following Bustos et al. (2016) and Bustos et al. (2020), we leverage the legalization of GE soy seeds as a source of temporal variation and the differential impact of this technology

[3] Lei 10688, https://www.planalto.gov.br/ccivil_03/leis/2003/l10.688.htm

[4] Lei 10814, https://www.planalto.gov.br/ccivil_03/leis/2003/l10.814.htm

[5] Lei 11105, https://www.planalto.gov.br/ccivil_03/_ato2004-2006/2005/lei/l11105.htm

Figure 1: Soybean Productivity: 1976-2022



(a) Area Planted

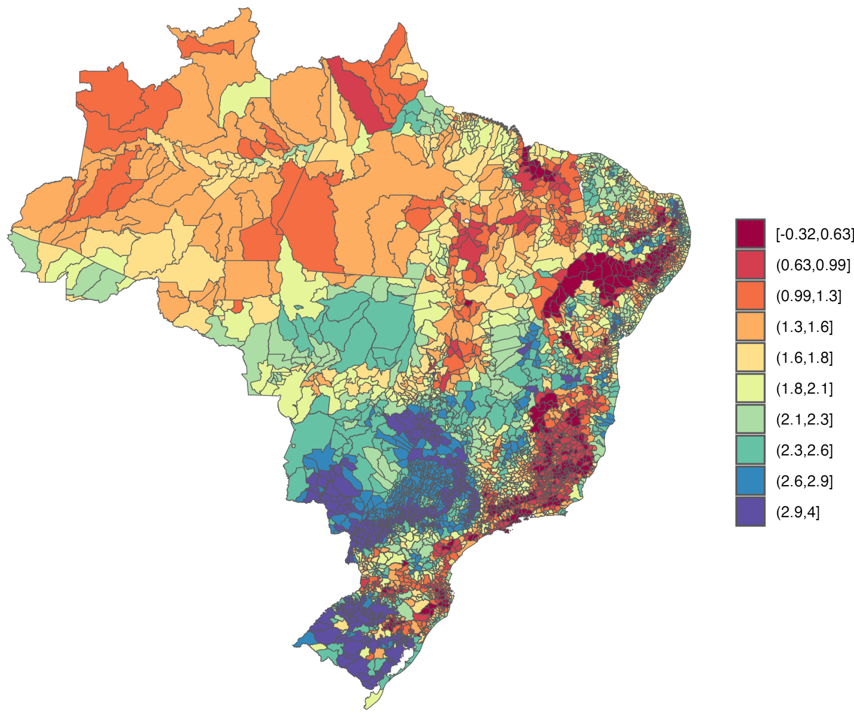
(b) Total Production

This figure shows Brazil's soybean productivity, in area planted (millions of hectares, left) and output (millions of tons, right). The dotted vertical line indicates the legalization of GE soybean seeds in 2003. Source: Brazilian Ministry of Agriculture, computed by *Companhia Nacional de Abastecimento* (CONAB). Adapted from Bustos et al. (2016).

across regions as a source of cross-sectional variation. This methodology allows us to disentangle the effects of soybean technological change from other confounding factors that might affect the likelihood of reelection. The legalization of GE soy seeds is not itself exogenous: it may be correlated with specific factors of Brazilian municipalities, individual characteristics of decision-makers, or pressure from farmers following the 1996 approval of such seeds in the US. Yet a municipality's potential yield is arguably exogenous: it is a function of weather and soil characteristics, not actual yields (Bustos et al., 2016).

Data from the Food and Agriculture Organization's Global Agro-Ecological Zones project (FAO-GAEZ) indicate that productivity gains from GE seed adoption were unevenly distributed across municipalities. FAO-GAEZ estimates agro-climatic potential yields by combining historical climate data (1961–2010), local soil characteristics, and terrain constraints with crop-specific growth models. For each crop, the model reports potential yields under alternative management regimes that differ in input intensity. Low-input conditions reflect traditional practices with minimal mechanization and no chemical inputs, while high-input conditions incorporate improved seed varieties, fertilizers, pest and weed control, and full mechanization. The contrast between these input regimes helps identify how suitable different areas are for adopting productivity-enhancing technologies such as

Figure 2: Difference in Potential Soy Yield at the Municipality Level, in Tons Per Hectare (Deciles)



This figure shows each municipality's potential soy yield under the high technology minus its potential soy yield under low technology. Source: FAO-GAEZ. Adapted from Bustos et al. (2016).

GE seeds.

We use these data to construct a measure of local exposure to productivity gains from adopting GE soy seeds in municipality r as ΔA_r^{soy}, the municipal-level *difference* in potential yield in the high- and low-input scenarios. This difference captures the effect of moving from traditional to modern agriculture. Figure 2 illustrates the resulting measure of technical change in soy production across Brazilian municipalities,[6] aggregated into deciles. Even for the very productive regions *ex ante*, the potential yield (in tons of soy per hectare) with the new technology is 3 to 5 times larger. To the extent that GE soy seeds improved mayoral fortunes, they likely did so in municipalities with higher changes in

[6]Since municipality borders change over time, this measure is reported in Áreas Mínimas Comparáveis (AMC), or "smallest comparable areas," as defined by the Brazilian Institute of Geography and Statistics (IBGE). In Figure 2 and subsequent empirical tests, we convert this unit of analysis to municipalities.

potential yields, where voters were more exposed to the income windfall and experienced a greater satisfaction gap.

4.3 Economic Outcomes and Voter Perceptions

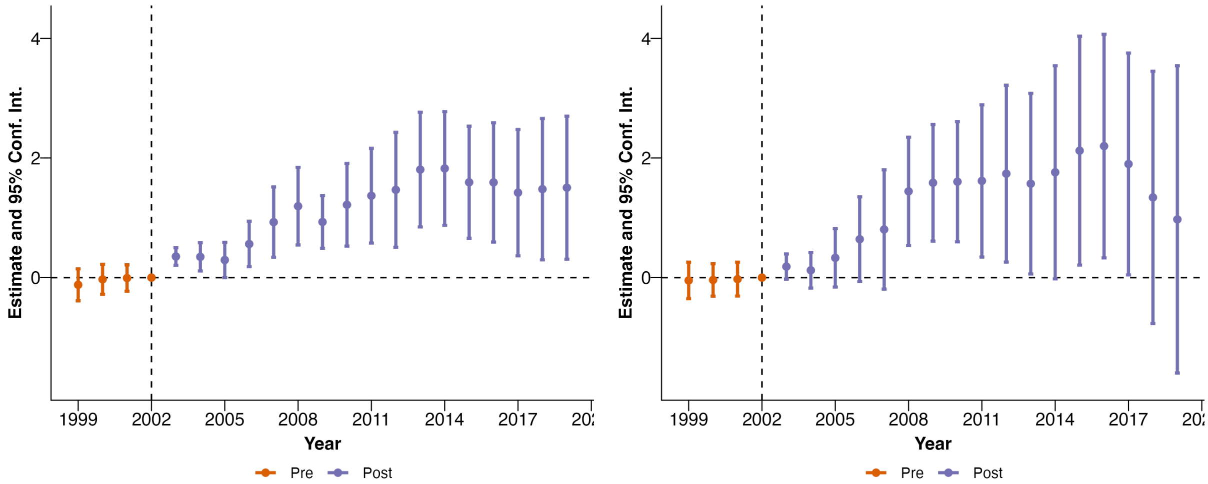
Before turning to the political consequences of the productivity shock, we first establish that it generated substantial regional heterogeneity in economic outcomes. Specifically, the shock produced uneven gains in household income across municipalities — a central mechanism in our argument that increased support for incumbents was concentrated in areas with a larger increase in soy production. To capture these localized economic effects, we use annual municipal GDP per capita data (in current Brazilian reais) from the Brazilian Institute of Geography and Statistics (IBGE) to estimate an event-study specification that interacts the change in potential soy yield, ΔA_r^{soy}, with year indicators, using the reference year 2002 — the year immediately preceding GE soy legalization.[7] To address spatial and temporal correlation in residuals, we cluster standard errors at the microregion level (geographically contiguous groups of municipalities defined by IBGE).

Figure 3 presents the estimated dynamic effects, showing that the introduction of GE soy seeds was associated with significant changes to the local economy. Panel (a) reports the unweighted specification, while Panel (b) applies population weights to account for the relative size of each municipality. The results indicate that municipalities more exposed to the shock — those with greater increases in soy potential yield — experienced persistent and statistically significant gains in income per capita relative to less exposed areas. These gains emerge gradually, becoming pronounced years after legalization, consistent with delays related to technology adoption, planting cycles, and harvest timing.

Of course, not every change to the local economy affects voting behavior. Voters have limited attention spans and do not always care about economic issues (Singer, 2011, 2013). For local context to matter, it must be salient in the minds of citizens, in what Larsen et al. (2019) call "context priming." The sharp increase in soy production (Figure 1) and associated rise in household income (Figure 3) already suggest a shock large enough to affect individuals' lived experience. To confirm that this transformation registered in public attitudes (and that perceptions varied with individual exposure to the productivity shock), we turn to public opinion data from Latinobarómetro, focusing on a question

[7]The Online Appendix presents complementary long-difference estimates under varying model specifications. The results consistently show that municipalities with greater gains in potential soy yield experienced significantly faster growth in both the level and rate of GDP per capita between 2000 and 2010.

Figure 3: Dynamic Effects of the Soy Shock on Municipality Income per Capita



(a) Unweighted Estimates (b) Population-Weighted Estimates

This figure shows the dynamic effects of ΔA_r^{soy} on GDP per capita. Vertical bars represent 95% confidence intervals. The dotted vertical line indicates 2002, the year preceding the legalization of GE soybean seeds. The specification includes municipality and year fixed effects, microregion–year interactions, and standard errors clustered at the microregion level (555 clusters). Panel (a) presents unweighted estimates, whereas Panel (b) applies population weights.

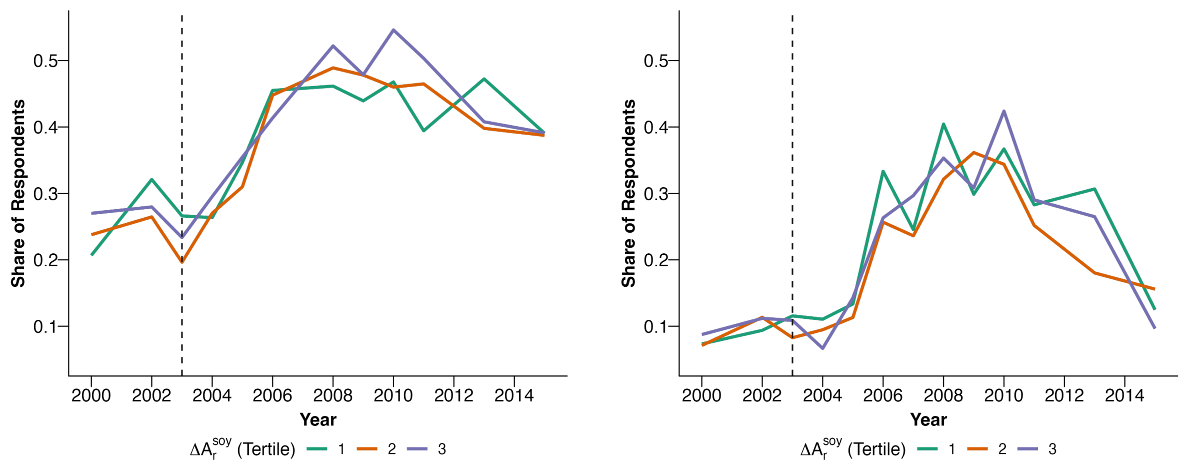
about personal economic well-being: "In general, how would you describe your present economic situation and that of your family? Would you say that it is very good, good, about average, bad, or very bad?"[8]

In Figure 4, Panel (a) plots the share of respondents who answered "very good" or "good," disaggregated by tertiles of ΔA_r^{soy}, the municipal-level change in potential soy yield. While *all* respondents expressed greater optimism about their economic situation in the 2004-2010 period (reflecting a general improvement in living conditions among Brazilians), those in areas most affected by the productivity shock (3rd tertile) were more likely to report favorable personal economic evaluations. While the limited sample size (around 1,000 Brazilians per wave) constrains statistical inference, a one-way ANOVA comparing the mean share of respondents who answered "very good" or "good" reveals a statistically significant difference across tertiles ($p < 0.001$), and post-hoc Tukey tests

[8]We exclude waves that did not ask this question (2007, 2016, 2017, 2018, 2020) or did not provide municipality identifiers (1996, 1997, 2001). Latinobarómetro conducted no waves in 1999, 2012, 2014, and 2019.

confirm that this difference is driven by respondents in the highest tertile. Households with more exposure to the productivity shock not only *experienced* improved economic conditions but also *perceived* such improvement.[9]

Figure 4: Share of Latinobarómetro Respondents Who Report Favorable Economic Evaluations, by Potential Soy Yield



(a) Personal Economic Evaluation (b) National Economic Evaluation

For every Latinobarómetro wave, Panel (a) shows the share of respondents who answered the question "In general, how would you describe your present economic situation and that of your family?" with "very good" or "good," disaggregated by tertiles of ΔA_r^{soy}, the municipal-level difference in potential soy yield. Panel (b) does the same for respondents who answered the question "In general, how would you describe the present economic situation of the country?" with "very good" or "good." The dotted vertical line indicates the legalization of GE soybean seeds in 2003. The 3rd tertile indicates municipalities most affected by the productivity shock.

Importantly, this relationship holds for *individual*, not *national* economic evaluations. Latinobarómetro also asks respondents: "In general, how would you describe the present economic situation of the country? Would you say that it is very good, good, about average, bad, or very bad?"[10] In Figure 4, Panel (b) shows the relationship between soy productivity

[9]Ideally, we would use surveys of vote intention or mayoral approval to capture political consequences more directly. However, such data are rarely available for small municipalities across an extended period, hence our indirect measure of personal economic situation, which often shapes electoral behavior.

[10]While this question (unlike the previous one) was asked in the 2016, 2017, 2018, and 2020 waves, these years are not included to render both panels in Figure 4 comparable.

and national economic evaluations. While a one-way ANOVA indicates significant differences around tertiles ($p < 0.001$), post-hoc Tukey tests reveal that respondents in the 3rd tertile are significantly *less* optimistic than those in the 1st tertile. Although not a smoking gun, this pattern is consistent with our expectation of local attribution and context priming: voters directly exposed to the productivity shock perceive the resulting economic gains as *localized*. This sets the stage for a political response: voters should reward local — rather than national — incumbents, at least in the short term.

5 The Political Consequences of a Productivity Shock

5.1 Electoral Context

Brazil elects national and state leaders every four years and municipal leaders in midterm elections.[11] Since 1997, mayors, governors, and the president can serve up to two consecutive four-year terms. Most municipalities elect mayors through a simple majority, except for those with over 200,000 registered voters, where a runoff election is held if no candidate secures an absolute majority in the first round. All municipalities follow a mayor-council form of government and have significant autonomy to manage their own budgets or provide key public services, such as education, health care, and sanitation. This means that Brazilian mayors are powerful figures; their elections are politically consequential and have been widely studied (e.g. Brollo & Nannicini, 2012; Bueno, 2018; De Magalhães, 2015; Johannessen, 2020; Novaes & Schiumerini, 2022).

Following De Magalhães (2015), our unit of analysis is the individual candidate, and our main outcome of interest is a candidate's unconditional *Probability of Winning* (not conditional on the incumbent's probability of rerunning). We retrieve this information, along with each candidate's *Incumbency* status (that is, whether the candidate won the previous mayoral election), from the Superior Electoral Court (*Tribunal Superior Eleitoral*, or TSE) for the 1996, 2000, 2004, 2008, 2012, 2016, and 2020 municipal elections. Because *Incumbency* refers to the previous election, $t - 1$, we use 1996 data to construct the lagged independent variable, but restrict our analysis to elections beginning in 2000.

[11] The following discussion does not apply to Brasília and Fernando de Noronha, the only two of Brazil's 5,570 municipalities not to hold municipal elections.

5.2 Empirical Strategy

As previously discussed, the productivity impacts of GE soy technology varied significantly across municipalities due to heterogeneous local soil and climatic conditions. We quantify this variation using the measure ΔA_r^{soy}, the difference in potential soy yields between high-technology (GE) and low-technology scenarios, and employ a difference-in-differences (DiD) framework across multiple electoral cycles. The first election included in our analysis, 2000, provides a pre-treatment baseline preceding both the legalization of GE soy seeds in 2003 and the initial smuggling of such seeds from Argentina since 2001 (see Section 4), two factors that could otherwise pose a risk to clear identification and exogeneity.[12] The 2004 election — the first after GE soy was legalized — serves as our baseline treatment year. Our identification approach leverages this nationwide legislative change combined with geographical variation in productivity gains, circumventing common pitfalls associated with staggered DiD designs highlighted in recent methodological literature (De Chaisemartin & d'Haultfoeuille, 2020; Goodman-Bacon, 2021; Roth et al., 2023).

To test the first proposition that productivity shocks causally increase the incumbency advantage, our DiD model is given by:

$$\begin{aligned} V_{j,r,t} = {} & \beta_1 \, \text{Incumbency}_{j,r,t-1} + \beta_2 \left(\text{Incumbency}_{j,r,t-1} \times \mathrm{D}_{r,t}\right) + \beta_3 \left(\text{Incumbency}_{j,r,t-1} \times \Delta A_r^{soy}\right) \\ & + \beta_4 \left(\mathrm{D}_{r,t} \times \Delta A_r^{soy}\right) + \beta_5 \left(\text{Incumbency}_{j,r,t-1} \times \mathrm{D}_{r,t} \times \Delta A_r^{soy}\right) + \rho X_{j,r,t} \\ & + \mu_r + \gamma_t + \delta_{s,t} + \varepsilon_{j,r,t} \end{aligned} \tag{9}$$

where $V_{j,r,t}$ denotes the probability of electoral victory for candidate j in municipality r during election year t. Here, $\Delta A_r{}^{soy}$ captures the productivity shock, and $D_{r,t}$ is an indicator set to 1 for elections from 2004 onward (post-shock) and 0 otherwise. The terms μ_r and γ_t represent municipality and election-year fixed effects, respectively, while $\delta_{s,t}$ captures region-by-election-year fixed effects, addressing potential regional temporal heterogeneity. These fixed effects control for systematic variations due to policy changes or broader socioeconomic shifts across regions. The triple interaction term β_5 is central to our analysis, as it identifies differential incumbency advantages in municipalities most exposed to productivity gains following GE soy legalization. To adjust for observable differences, additional specifications incorporate candidate-level covariates ($X_{j,r,t}$): gender, age, education, and party affiliation, all retrieved from TSE. As before, we cluster standard errors at the microregion level.

[12] We only have one pre-treatment period because mayors could not run for reelection before 1997.

Even when the underlying economic transformation is persistent, its political consequences — particularly the incumbency advantage — may dissipate over time as voters update their beliefs or as initial gains become normalized and less politically salient. To assess this second proposition and further validate our identification assumptions, particularly the parallel pre-trends condition, we conduct an event-study analysis that explicitly evaluates whether electoral outcomes followed similar trajectories in high- and low-exposure municipalities before the policy intervention. The event-study model is:

$$V_{j,r,t} = \sum_{t \neq 2004}^{t} \mathbb{I}\left\{\tau = t\right\} \left[\alpha_t Incumbency_{j,r,t-1} + \beta_t \left(Incumbency_{j,r,t-1} \times \Delta A_r{}^{soy}\right)\right] + \rho X_{j,r,t} + \mu_r + \gamma_t + \delta_{s,t} + \varepsilon_{j,r,t} \quad (10)$$

This specification introduces a flexible set of year-specific interaction coefficients β_t, allowing us to assess the evolution of incumbency advantages relative to the productivity shock over time. Under the parallel trends assumption, the coefficient for 2000 (pre-treatment) should not differ significantly from zero.

Finally, we evaluate the third proposition: the political return to an income shock should be larger where a greater share of the population is either directly exposed to the gains or benefits from broader local spillovers. Testing this prediction is challenging, as it requires identifying variation in exposure within municipalities. Bustos et al. (2016) provide key empirical guidance, showing that municipalities with higher potential soy yields saw a decline in agricultural employment and an increase (both relative and absolute) in manufacturing employment between 2000 and 2010. These changes, which reflect the labor-saving nature of GE soy adoption, suggest that the income gains primarily benefited those employed in non-agricultural sectors, particularly manufacturing.

Building on this insight, we construct two employment-based proxies for local exposure using data from the 2000 Census (the first year included in our analysis), disaggregated based on the Brazilian National Classification of Economic Activities (CNAE) and following a crosswalk based on Costa et al. (2016) and Cícero (2025). The first measure indicates the share of municipal employment in soy-related activities (soy cultivation, agricultural services, and vegetable oil processing), capturing the most immediate points of contact with the technological change — though not necessarily its primary beneficiaries. The second measure indicates the share of employment in manufacturing, a proxy for the sectors most positively affected by the shock. This latter measure also captures broader economic spillovers, as manufacturing-intensive municipalities tend to have more diversified and structurally responsive local economies. For each measure, we estimate:

$$
\begin{aligned}
V_{j,r,t} = \beta_1 \,\text{Incumbency}_{j,r,t-1} + \beta_2 \left(\text{Incumbency}_{j,r,t-1} \times \text{D}_{r,t}\right) + \beta_3 \left(\text{Incumbency}_{j,r,t-1} \times \Delta A_r^{soy}\right) \\
+ \beta_4 \left(\text{D}_{r,t} \times \Delta A_r^{soy}\right) + \beta_5 \left(\text{Incumbency}_{j,r,t-1} \times \text{D}_{r,t} \times \Delta A_r^{soy}\right) \\
+ \beta_6 \left(\text{Incumbency}_{j,r,t-1} \times \text{D}_{r,t} \times \Delta A_r^{soy} \times \text{Employment}_r\right) + \gamma X_{j,r,t} \\
+ \mu_r + \gamma_t + \delta_{s,t} + \varepsilon_{j,r,t} \quad (11)
\end{aligned}
$$

This approach allows us to assess whether the political impact of the shock varies systematically with local labor market composition, holding overall exposure constant.

5.3 Results

Table 1 reports the results from estimating Equation (9), progressively saturating the model with additional fixed effects and covariates to address potential confounders. Column (1) presents the most parsimonious specification, including only municipality and election-year fixed effects. Columns (2) and (3) introduce increasingly granular region-year fixed effects, at the state and then microregion levels, to account for regional electoral dynamics and unobserved time-varying shocks. Column (4) adds party-year fixed effects to absorb national partisan dynamics, such as the influence of gubernatorial or presidential coattails. Column (5) presents our preferred specification, which includes additional candidate-level controls to account for individual heterogeneity in electoral appeal (with a modest reduction in sample size due to missing data).

All models identify a sizable incumbency advantage: holding other factors constant, incumbents are approximately 30 percentage points more likely to win reelection. Consistent with the first proposition of our formal framework, the interaction between incumbency and exposure to potential soy yield is statistically significant *after the legalization of GE soy* (post-shock). This interaction indicates that incumbents in municipalities with greater agronomic suitability for the new technology — measured by potential yield gains — experienced a disproportionate electoral benefit after 2003.

Quantitatively, the estimated effect is modest but politically meaningful. In our preferred specification, a one standard deviation increase in ΔA_r^{soy} is associated with a 2.7 percentage point increase in the probability of reelection ($\approx 0.85 \times 0.032$). Alternatively, moving a municipality from the 25th to the 75th percentile of the distribution of soy potential yield corresponds to a 4.15 percentage point increase in reelection probability ($\approx (2.46 - 1.16) \times 0.032$). These magnitudes are similar to those reported by Novaes and

Table 1: Potential Soy Yield and Electoral Victory DiD

Dependent variable:	**Prob. Victory**				
	(1)	(2)	(3)	(4)	(5)
Incumbency	0.2981***	0.2991***	0.3019***	0.2617***	0.2601***
	(0.0306)	(0.0307)	(0.0313)	(0.0317)	(0.0317)
Incumbency × Post-shock	-0.0386	-0.0401	-0.0405	0.0318	-0.0304
	(0.0309)	(0.0309)	(0.0315)	(0.0317)	(0.0317)
Incumbency × ΔA_r^{soy}	-0.0221	-0.0226	-0.0232	-0.0244	-0.0236
	(0.0155)	(0.0155)	(0.0158)	(0.0160)	(0.0160)
Post-shock × ΔA_r^{soy}	-0.0043	-0.0067	-0.0024	-0.0024	0.0024
	(0.0044)	(0.0044)	(0.0055)	(0.0052)	(0.0053)
Incumbency × Post-shock × ΔA_r^{soy}	0.0331**	0.0338**	0.0344**	0.0328**	0.0319**
	(0.0158)	(0.0158)	(0.0161)	(0.0163)	(0.0162)
Municipality fixed effects	✓	✓	✓	✓	✓
Year fixed effects	✓	✓	✓	✓	✓
State-Year fixed effects		✓	✓	✓	✓
Microregion-Year fixed effects			✓	✓	✓
Party-Year fixed effects				✓	✓
Controls					✓
Observations	90,926	90,926	90,926	90,926	90,334
R^2	0.087	0.088	0.092	0.122	0.125

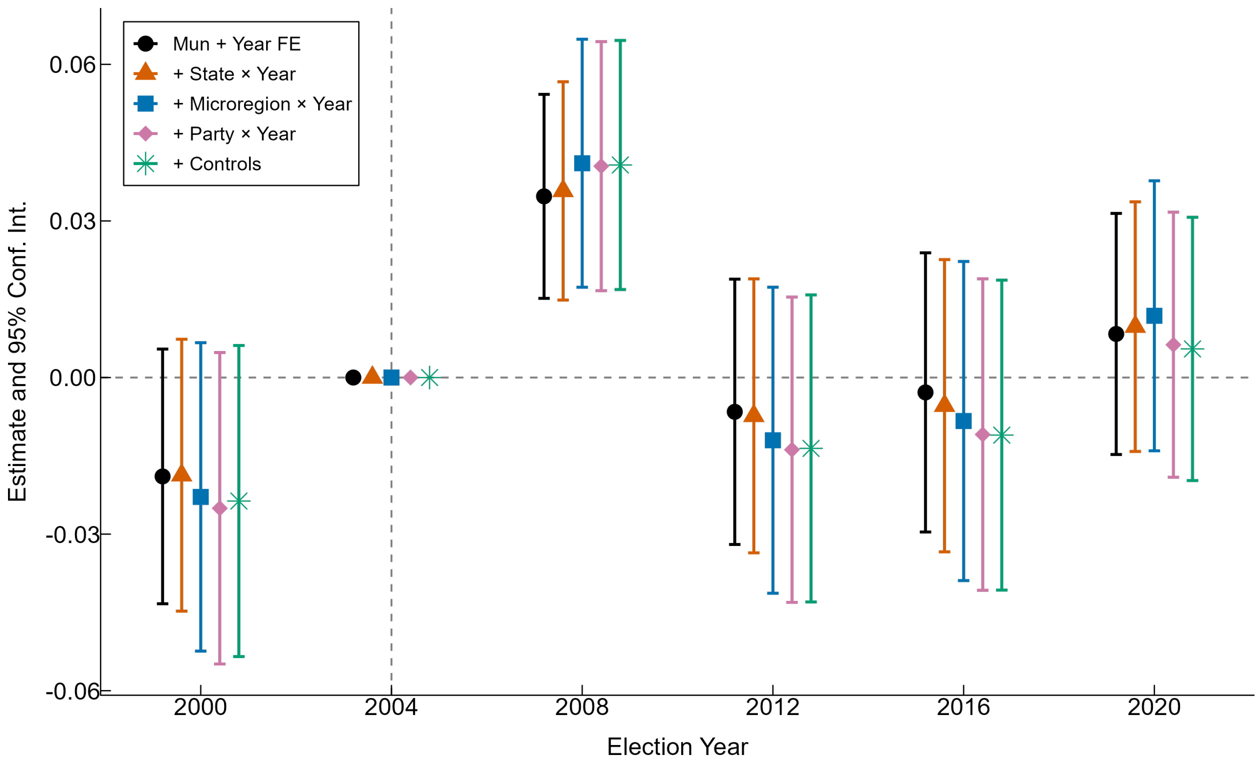
Notes: Unit of analysis is a candidate j in municipality r and election t. Standard errors (in parentheses) are adjusted for 555 microregion clusters. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Schiumerini (2022), who find a 3–5 percentage point incumbency boost in response to one standard deviation commodity price shocks in Brazil. While their identification relies on a regression discontinuity design in close elections — capturing effects at the electoral margin — our strategy exploits geographic variation in agronomic suitability following the diffusion of GE soy, allowing us to estimate average treatment effects across the full distribution of municipalities. This distinction enhances external validity and highlights a complementary mechanism: rather than conditioning on tight races and international price variation, we examine how a widespread technological shock with spatially heterogeneous gains shaped voter behavior. More broadly, our results align with evidence from other

Latin American contexts showing that local economic fluctuations — whether positive or negative — can meaningfully influence incumbent support (Murillo & Visconti, 2017).

To assess the second proposition of our theoretical framework and evaluate the plausibility of the parallel trends assumption underlying our identification strategy, we estimate Equation (10) and report the dynamic treatment effects in Figure 5. These event study specifications follow the structure of Table 1, with progressively saturated models incorporating various combinations of fixed effects and covariates.

Figure 5: Dynamic Effects of Potential Soy Yield



In this figure, each point represents a regression coefficient ($\hat{\beta}$) from estimating Equation (10). The dependent variable is the probability of victory of candidate j in municipality r in each election $t = 2000, \ldots, 2020$. All regressions include municipality and year fixed effects. Standard errors are clustered at the microregion level (555 clusters).

The results offer two key insights. First, the coefficients for the baseline pre-treatment period (the 2000 election) are uniformly close to zero and statistically insignificant across all specifications. This supports the validity of the parallel trends assumption: absent the GE soy shock, municipalities with differing exposure to productivity gains would have followed comparable electoral trajectories.

Second, the dynamic effects exhibit a pronounced temporal concentration. Across all specifications, we observe a statistically significant increase in the incumbency advantage in 2008 — the first election cycle in which the GE soy shock could plausibly have translated into visible economic improvements at the local level. Quantitatively, a one standard deviation increase in ΔA_r^{soy} raised the probability of reelection by roughly 3.5 percentage points in that year. This electoral gain, however, does not persist into subsequent cycles: in 2012, 2016, and 2020, the estimated effects are small and statistically indistinguishable from zero. This transience is consistent with the mechanism emphasized in our theoretical framework: as voters experience sustained income gains, they adjust their expectations, diminishing the salience of earlier improvements. What initially registers as an economic windfall is soon internalized as the new norm, eroding the incumbent's perceived credit over time.

Finally, we test whether incumbency effects were stronger in municipalities with greater direct exposure or higher spillover potential (proposition 3) by extending our preferred specification and interacting the core triple-difference term with each employment share, following Equation 11. Table 2 presents the results.

Column (1) presents the baseline result without additional interactions to establish a reference point, equivalent to column (5) in Table 1. Column (2) tests whether the incumbency effect varies with the share of employment in soy-related sectors. The interaction term is statistically insignificant, suggesting that incumbents did not benefit more in municipalities where these activities were relatively more prevalent. Consistent with Bustos et al. (2016), we interpret this result as a consequence of the labor-saving nature of GE soy technology: although these sectors were closely tied to the shock, they did not transmit substantial income gains to local workers.

By contrast, column (3) shows that the post-shock incumbency advantage was significantly stronger in municipalities with higher preexisting manufacturing employment shares. This finding supports the model's third proposition: the political return to the income shock was amplified in regions where a larger portion of the population benefited from downstream gains or where the local economy was better positioned to absorb and diffuse the shock. In short, incumbents were more likely to be rewarded in municipalities where the economic transformation reached a broader base of the electorate.

We further assess the robustness of our findings in the Online Appendix. First, we re-estimate our models using weights based on the number of valid municipal votes to account for heteroskedasticity arising from population disparities. Second, we report

Table 2: Potential Soy Yield and Electoral Victory DiD — Employment Shares

Dependent variable:	**Prob. Victory**		
	(1)	(2)	(3)
Incumbency	0.2601***	0.2601***	0.2602***
	(0.0317)	(0.0317)	(0.0317)
Incumbency × Post-shock	-0.0304	-0.0307	-0.0243
	(0.0317)	(0.0317)	(0.0319)
Incumbency × ΔA_r^{soy}	-0.0236	-0.0236	-0.0236
	(0.0160)	(0.0160)	(0.0160)
Post -shock × ΔA_r^{soy}	0.0000	0.0000	0.0002
	(0.0053)	(0.0053)	(0.0053)
Incumbency × Post-shock × ΔA_r^{soy}	0.0319**	0.0344**	0.0128
	(0.0162)	(0.0163)	(0.0172)
Incumbency × Post-shock × ΔA_r^{soy} × Share of Soy		-0.0241	
		(0.0292)	
Incumbency × Post-shock × ΔA_r^{soy} × Share of Manufacture			0.1484***
			(0.0294)
Municipality fixed effects	✓	✓	✓
Year fixed effects	✓	✓	✓
State-Year fixed effects	✓	✓	✓
Microregion-Year fixed effects	✓	✓	✓
Party-Year fixed effects	✓	✓	✓
Controls	✓	✓	✓
Observations	90,334	90,334	90,334
R^2	0.125	0.125	0.126

Notes: Unit of analysis is a candidate j in municipality r and election t. Standard errors (in parentheses) are adjusted for 555 microregion clusters. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

fully disaggregated cross-sectional analyses by election year (2000–2020), using both linear probability and Probit models. Third, we follow Novaes and Schiumerini (2022) and address concerns about selective reelection eligibility by excluding municipalities where incumbents were term-limited at $t+1$. In all cases, the main results are highly stable in both magnitude and statistical significance. Finally, we evaluate the existence of a *party* incumbency advantage (that is, whether another candidate *of the same party* won an election at $t - 1$). Consistent with previous research (De Magalhães, 2015), we find a disconnect between individual and party estimates, reflecting a system with weak parties and widespread party switching (Desposato, 2006). Put together, these results show that individual candidates (not parties) benefited from the GE soy shock.

6 Conclusion

When local economic conditions improve due to exogenous shocks, incumbents are more likely to receive credit for prosperity — even when the gains are unrelated to their actions. Our formal model explains how this misattribution arises: voters anchor their expectations in pre-shock conditions and update them gradually, creating a temporary satisfaction gap that inflates support for the incumbent. As expectations adjust to new income levels, the political advantage dissipates, even if the underlying prosperity persists. We test these predictions by examining how an agricultural productivity shock shaped mayoral reelection outcomes in Brazil between 2000 and 2020. Exploiting the timing of GE soy legalization and geographic variation in agronomic potential, we show that incumbents were significantly more likely to win reelection in municipalities with larger gains in soy productivity. A one-standard-deviation increase in soy potential yield was associated with a 2.7 percentage point increase in the probability of reelection on average — but the effect peaked at 3.5 percentage points in 2008 and declined to null in subsequent elections. This pattern highlights the political salience of recent gains and the transience of attribution errors.

While our empirical analysis focuses on Brazil, the dynamics we document are common to many low- and middle-income democracies. Undiversified economies, weak institutions, and high exposure to global markets make them especially vulnerable to misattribution. When external shocks blur the line between competence and coincidence, electoral accountability suffers. Future research could explore *who benefits* from such exogenous shocks. For example, male and conservative candidates may be better positioned to claim credit for an agricultural boom, thus deriving a greater electoral benefit. Also, not all voters are equally susceptible to misattribution: political knowledge, media exposure, and social networks might influence the degree to which citizens credit incumbents for exogenous economic gains. Understanding these heterogeneities is important to design interventions that improve electoral accountability.

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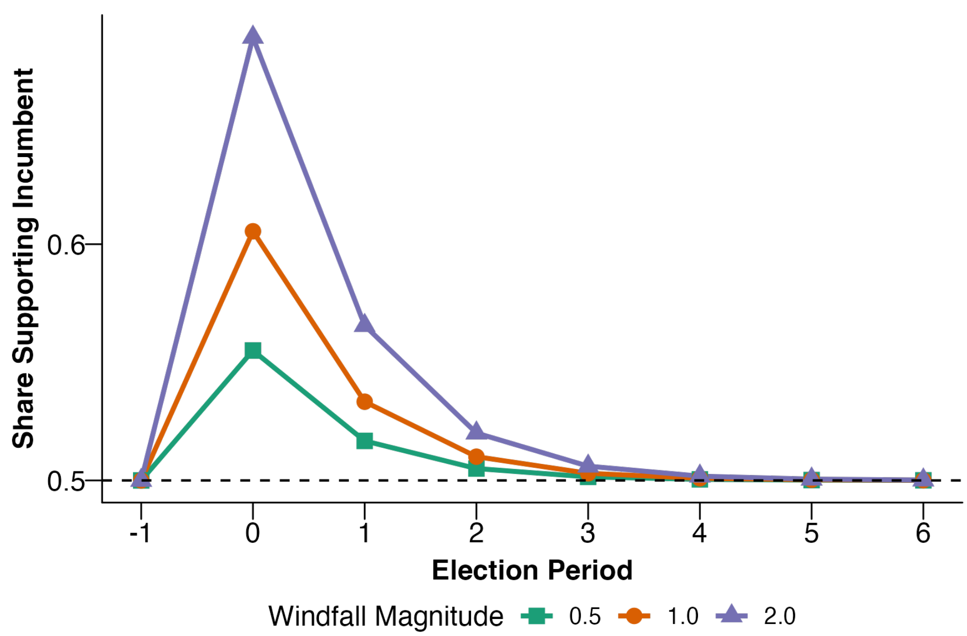
A Online Appendix

A.1 Simulations

To visualize the dynamic logic of the theoretical-formal framework presented in Section 3, we simulate the aggregate support function $S_r(t)$ under varying parameter configurations. Each exercise isolates a key mechanism: (i) the magnitude of the windfall ΔA_r, (ii) the speed of expectation adjustment λ, and (iii) the structure of exposure — namely, the share of voters fully exposed to the shock p and the intensity of spillovers η.

We begin by illustrating the result in Proposition 1. Holding the speed of adjustment fixed at $\lambda = 0.7$, we assume that 10% of voters are fully exposed to the income windfall, while the remaining 90% receive a spillover of 20%. Figure A.1 plots support dynamics across different windfall magnitudes. As expected, larger shocks generate sharper initial gains in support, reflecting a greater satisfaction gap. However, these gains diminish over time as expectations adjust, even though incomes remain permanently higher.[13]

Figure A.1: Windfall Effects on Share Supporting the Incumbent

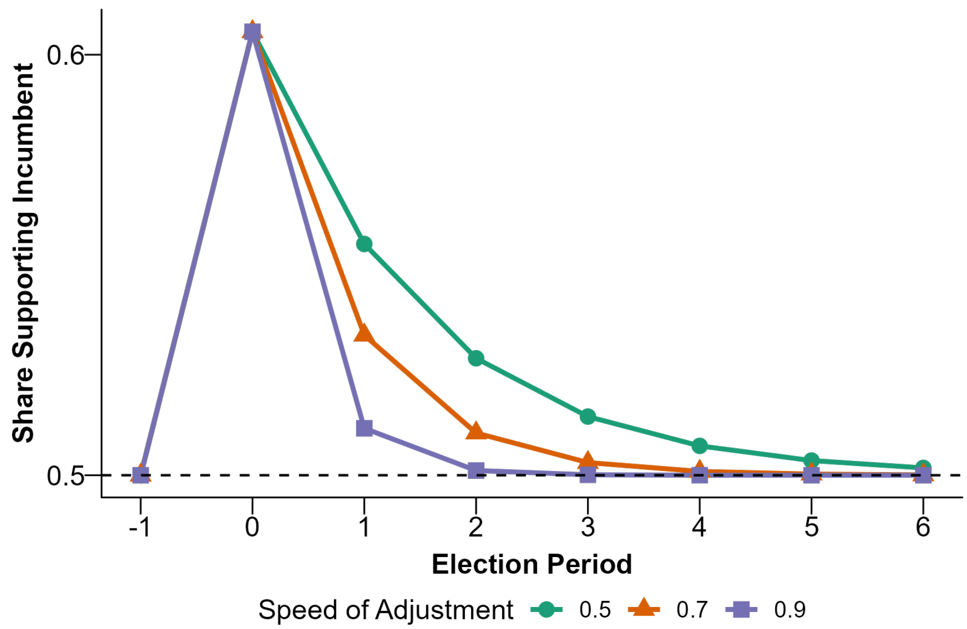


Next, we turn to the role of expectation adjustment, following Proposition 2. Using the same exposure structure and an intermediate windfall level, Figure A.2 shows how

[13]While the model focuses on positive shocks, the logic plausibly holds for negative income shocks that incumbents might be punished for (Murillo & Visconti, 2017).

the speed of learning affects the persistence of political gains. When adaptation is slower ($\lambda = 0.5$), the satisfaction gap — and thus support — remains elevated for longer. Faster adaptation compresses this window, causing support to revert more quickly toward baseline levels.

Figure A.2: Adjustment Speed and the Persistence of Support



We then explore the role of exposure heterogeneity, in line with Proposition 3. Figure A.3 examines how aggregate support varies with the share of voters fully exposed to the shock. Holding other parameters constant, a larger value of p strengthens and extends the boost in support, while a lower value (i.e., more indirect exposure) dampens the aggregate response due to weaker income gains.

Finally, Figure A.4 highlights the role of spillover intensity η, again holding other parameters fixed. When indirect exposure is low, the benefits — and thus support — are narrowly concentrated among the directly exposed minority. As η increases, the windfall reaches a broader segment of the population, amplifying and prolonging political support.

Figure A.3: Share of Fully Exposed Population and Incumbent Support

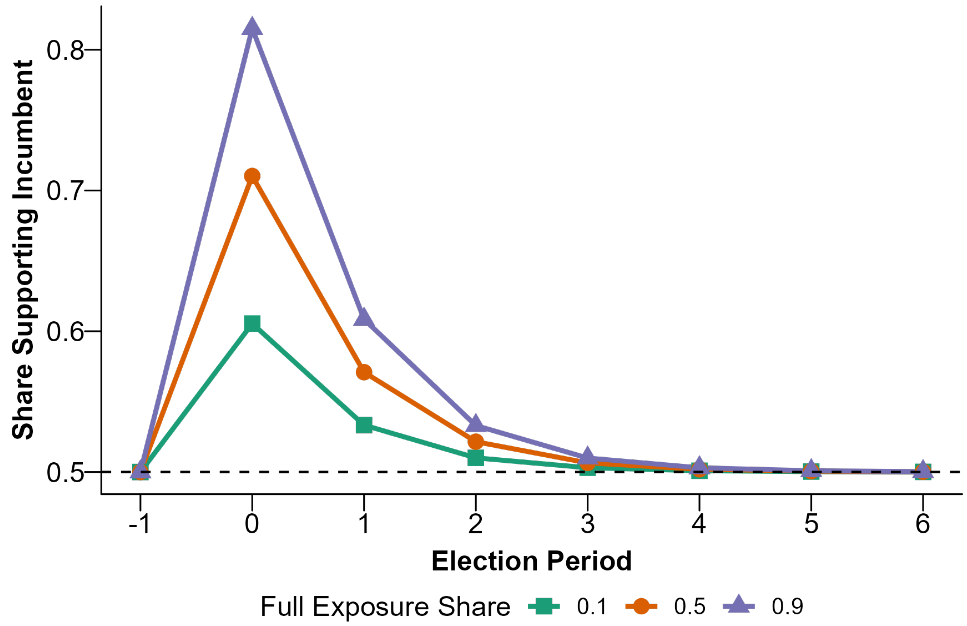
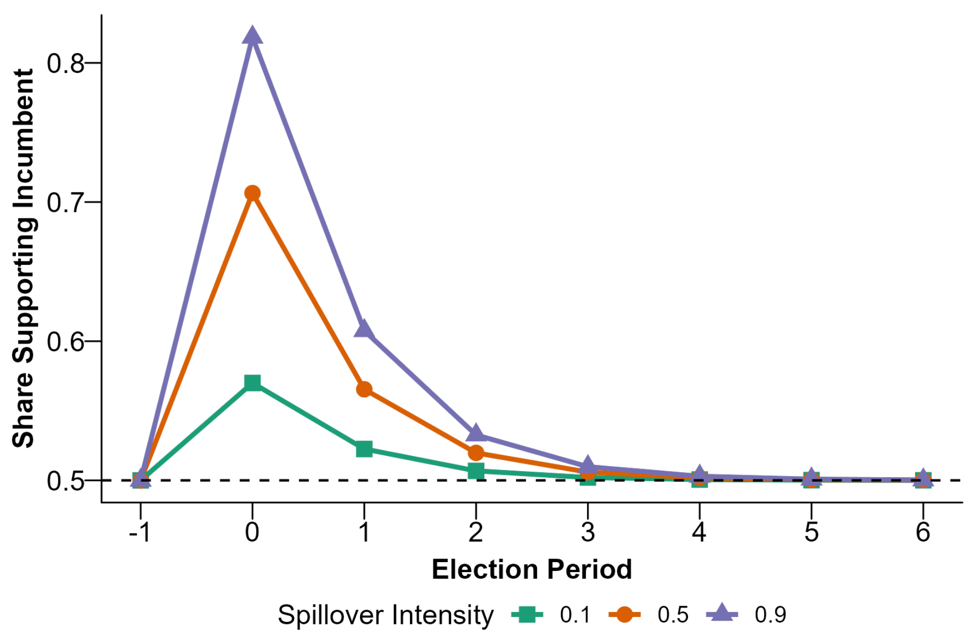


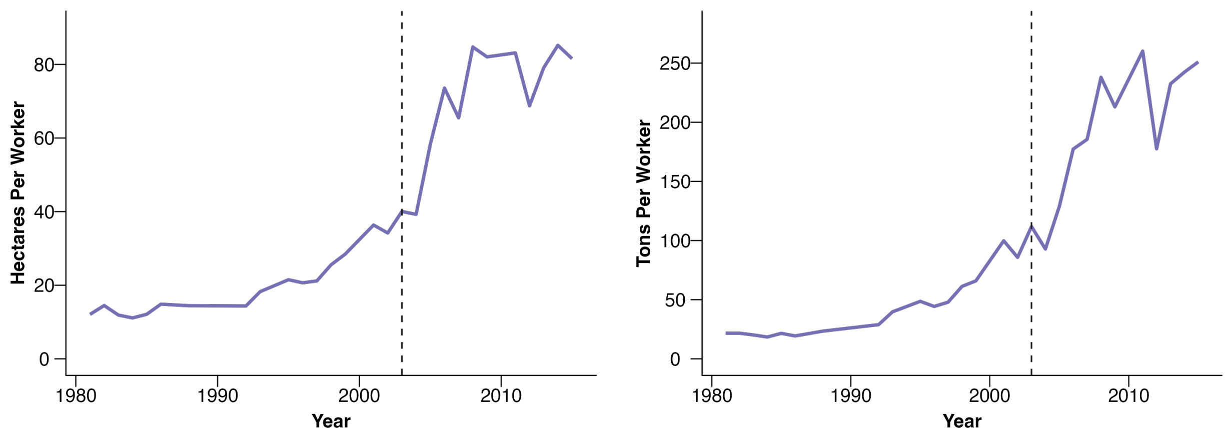
Figure A.4: Spillover Intensity and the Breadth of Political Gains



A.2 Agricultural Transformation in Brazil: Additional Descriptive Information

Figure A.5 shows the area planted per worker and output per worker (or labor productivity). While these metrics have increased consistently since the 1990s, their slope and level increased noticeably after 2003.

Figure A.5: Soybean Productivity Per Worker: 1980-2015



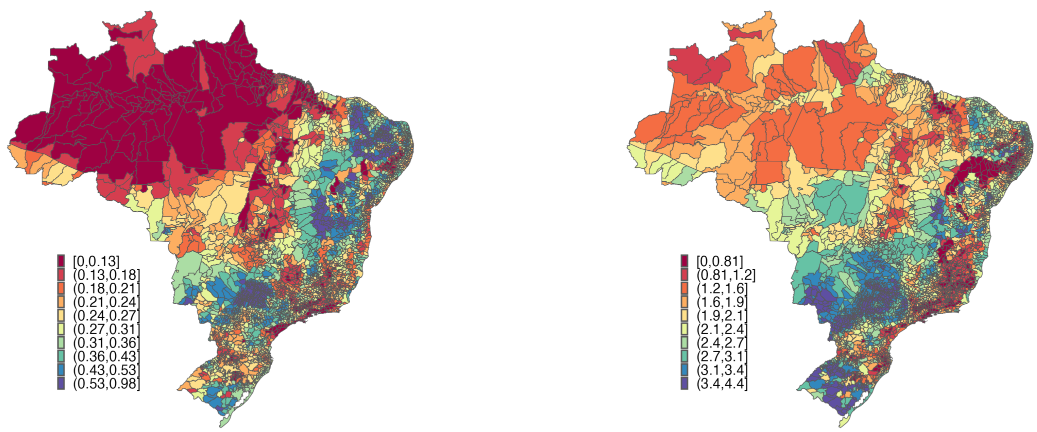
(a) Area Planted Per Worker

(b) Output Per Worker

This figure shows the soybean productivity per worker, in area planted (hectares per worker, left) and output (tons per worker, right). The dotted vertical line indicates the adoption of GE soybean seeds in 2003. Source: Brazilian Ministry of Agriculture, computed by *Companhia Nacional de Abastecimento* (CONAB); *Pesquisa Nacional por Amostra de Domicílios* (PNAD), implemented by the Brazilian Institute of Geography and Statistics. Adapted from Bustos et al. (2016).

Figure A.6 presents our measure of the potential yield of soy production, in terms of tons per hectare, under the low and high agricultural technology at the municipality level in Brazil, aggregated into deciles. There is a large variation in production capacity for the municipalities in the top deciles of the distribution.

Figure A.6: Potential Soy Yield Under Low and High Agricultural Technology at the Municipality Level, in Tons Per Hectare (Deciles)



(a) Low (b) High

This figure shows each municipality's potential soy yield, in tons per hectare, using low and high agricultural technology. Source: FAO-GAEZ.

A.3 Additional Income Regression

For clarity, the results shown in Figure 3 come from estimating the following dynamic event-study specification:

$$GDPpc_{r,t} = \sum_{t \neq 2002}^{t} \mathbb{I}\left\{\tau = t\right\} \beta_t \Delta A_r^{soy} + \mu_r + \gamma_t + \delta_{s,t} + \varepsilon_{r,t} \tag{12}$$

Complementing these dynamic estimates, Table A.1 presents long-difference models that summarize income growth between 2000 and 2010. Consistent with the event-study results, municipalities experiencing larger productivity gains also saw significantly greater income increases. Formally, we estimate:

$$\Delta GDPpc_{r,2010-2000} = \beta \Delta A_r^{soy} + \mu_r + \delta_{s,t} + \varepsilon_{r,t} \tag{13}$$

Table A.1: Soy and Income Per Capita

Dependent variable:	Δ GDPpc				Δ log(GDPpc)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ΔA_r^{soy}	1.069***	0.9278***	0.3287	1.093**	0.2405***	0.2417***	0.1130***	0.1694**
	(0.1668)	(0.2719)	(0.3510)	(0.4953)	(0.0235)	(0.0335)	(0.0359)	(0.0825)
Weighted		✓	✓	✓		✓	✓	✓
State-year fixed effects			✓	✓			✓	✓
Microregion-year fixed effects				✓				✓
Observations	4,255	4,255	4,255	4,255	4,150	4,150	4,150	4,150
R^2	0.013	0.009	0.098	0.386	0.063	0.051	0.267	0.553

Notes: Unit of analysis r is a municipality. Standard errors (in parentheses) are adjusted for 555 microregion clusters. In columns 2 and 5, observations are weighted by the population; columns 3 and 5 adds state-year fixed effects; and columns 4 and 6 adds microregion-year fixed effects. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

A.4 Cross-Sectional Analysis

Below, we present a cross-sectional analysis, evaluating incumbency advantages across municipalities with varying exposure levels to the soy productivity shock. Specifically, we estimate the following regression separately for each election cycle t from 2000 to 2020:

$$V_{j,r,t} = \alpha Incumbency_{j,r,t-1} + \beta \left(Incumbency_{j,r,t-1} \times \Delta {A_r}^{soy} \right) + \delta_{r,t} + \varepsilon_{j,r,t} \qquad (14)$$

where $V_{j,r,t}$ is the probability of electoral victory for candidate j in municipality r at election year $t \in \{2000, 2004, 2008, 2012, 2016, 2020\}$, $\Delta {A_r}^{soy}$ captures the productivity shock, measured by the potential yield of soy under the high technology minus the potential yield of soy under low technology, $\delta_{r,t}$ are municipality-election fixed effects and $\varepsilon_{j,r,t}$ is an idiosyncratic error term. To ensure robustness, we estimate Equation (14) using both ordinary least squares (OLS, linear probability model in Table A.2) and a Probit specification (Table A.3). To address potential heteroskedasticity arising from population disparities, Tables A.4 and A.5 weight these results by valid municipal votes.

Table A.2: Potential Soy Yield and Electoral Victory — OLS, Cross-Sectional Analysis

Dependent variable:	Prob. Victory					
Election Year	2000	2004	2008	2012	2016	2020
	(1)	(2)	(3)	(4)	(5)	(6)
Incumbency	0.3249***	0.2675***	0.3505***	0.2740***	0.1642***	0.4220***
	(0.0385)	(0.0401)	(0.0320)	(0.0415)	(0.0448)	(0.0341)
Incumbency $\times$ ΔA_r^{soy}	-0.0260	0.0168	0.0510***	-0.0202	-0.0192	0.0136
	(0.0197)	(0.0205)	(0.0165)	(0.0213)	(0.0218)	(0.0173)
Municipality-year fixed effects	✓	✓	✓	✓	✓	✓
Observations	14,316	15,268	14,387	14,714	14,964	17,277
R^2	0.119	0.106	0.182	0.094	0.095	0.200

Notes: Unit of analysis is a candidate j in municipality r and election t. Standard errors (in parentheses) are adjusted for 555 microregion clusters. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A.3: Potential Soy Yield and Electoral Victory — Cross-Sectional Analysis, Probit

Dependent variable:	Prob. Victory					
Election Year	2000	2004	2008	2012	2016	2020
	(1)	(2)	(3)	(4)	(5)	(6)
Incumbency	0.8762***	0.7299***	0.9470***	0.7397***	0.4475***	1.197***
	(0.1069)	(0.1107)	(0.0944)	(0.1131)	(0.1208)	(0.1044)
Incumbency $\times$ ΔA_r^{soy}	-0.0682	0.0495	0.1536***	-0.0531	-0.0502	0.0457
	(0.0545)	(0.0571)	(0.0503)	(0.0580)	(0.0587)	(0.0534)
Municipality-year fixed effects	✓	✓	✓	✓	✓	✓
Observations	14,182	15,151	14,145	14,604	14,773	17,109
Pseudo R^2	0.082	0.074	0.125	0.064	0.058	0.150

Notes: Unit of analysis is a candidate j in municipality r and election t. Standard errors (in parentheses) are adjusted for 555 microregion clusters. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A.4: Potential Soy Yield and Electoral Victory — Cross-Sectional Analysis, OLS (Weighted)

Dependent variable:	Prob. Victory					
Election Year	2000	2004	2008	2012	2016	2020
	(1)	(2)	(3)	(4)	(5)	(6)
Incumbency	0.3985***	0.4647***	0.4085***	0.4229***	0.1721*	0.4997***
	(0.0741)	(0.1177)	(0.0600)	(0.1142)	(0.0964)	(0.0634)
	(0.0385)	(0.0401)	(0.0320)	(0.0415)	(0.0448)	(0.0341)
Incumbency × ΔA_r^{soy}	-0.0124	0.0101	0.1008***	0.0141	0.0163	0.0565**
	(0.0362)	(0.0393)	(0.0324)	(0.0410)	(0.0498)	(0.0282)
Municipality-year fixed effects	✓	✓	✓	✓	✓	✓
Observations	14,316	15,268	14,387	14,714	14,964	17,277
R^2	0.152	0.178	0.283	0.163	0.118	0.298

Notes: Unit of analysis is a candidate j in municipality r and election t. Standard errors (in parentheses) are adjusted for 555 microregion clusters and observations are weighted by valid votes. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A.5: Potential Soy Yield and Electoral Victory — Cross-Sectional Analysis, Probit (Weighted)

Dependent variable:	Prob. Victory					
Election Year	2000	2004	2008	2012	2016	2020
	(1)	(2)	(3)	(4)	(5)	(6)
Incumbency	1.119***	1.415***	1.097***	1.242***	0.4475***	1.519***
	(0.2278)	(0.4280)	(0.2122)	(0.3856)	(0.1208)	(0.2372)
Incumbency × ΔA_r^{soy}	-0.0248	0.0278	0.3817***	0.0484	-0.0502	0.2233**
	(0.1103)	(0.1336)	(0.1278)	(0.1307)	(0.0587)	(0.1117)
Municipality-year fixed effects	✓	✓	✓	✓	✓	✓
Observations	14,182	15,151	14,145	14,604	14,773	17,109
Pseudo R^2	0.121	0.156	0.235	0.138	0.058	0.265

Notes: Unit of analysis is a candidate j in municipality r and election t. Standard errors (in parentheses) are adjusted for 555 microregion clusters. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

A.5 Canonical DiD Robustness

To probe the robustness of Table 1, we re-estimate these models in several ways. First, in Table A.6, we weight them by valid municipal votes, addressing potential heteroskedasticity arising from population disparities. Second, in Table A.7, we replace the linear DiD with a Probit specification. Finally, in Table A.8, we do both: we present the results of Probit specifications weighted by valid municipal votes. Our results are largely robust to these changes.

Table A.6: Potential Soy Yield and Electoral Victory DiD (Weighted)

Dependent variable:	**Prob. Victory**				
	(1)	(2)	(3)	(4)	(5)
Incumbency	0.3712***	0.3722***	0.3749***	0.3169***	0.3097***
	(0.0643)	(0.0642)	(0.0657)	(0.0661)	(0.0668)
Incumbency × Post-shock	-0.0217	-0.0230	-0.0216	-0.0238	-0.0183
	(0.0608)	(0.0609)	(0.0630)	(0.0634)	(0.0642)
Incumbency × ΔA_r^{soy}	-0.0134	-0.0133	-0.0110	-0.0059	-0.0040
	(0.0311)	(0.0311)	(0.0318)	(0.0326)	(0.0328)
Post-shock × ΔA_r^{soy}	-0.0034	-0.0061	0.0008	0.0090	0.0017
	(0.0081)	(0.0076)	(0.0098)	(0.0102)	(0.0103)
Incumbency × Post-shock × ΔA_r^{soy}	0.0533*	0.0536*	0.0530*	0.0427	0.0413
	(0.0300)	(0.0300)	(0.0311)	(0.0315)	(0.0315)
Municipality fixed effects	✓	✓	✓	✓	✓
Year fixed effects	✓	✓	✓	✓	✓
State-Year fixed effects		✓	✓	✓	✓
Microregion-Year fixed effects			✓	✓	✓
Party-Year fixed effects				✓	✓
Controls					✓
Observations	90,926	90,926	90,926	90,926	90,334
R^2	0.162	0.163	0.169	0.229	0.232

Notes: Unit of analysis is a candidate j in municipality r and election t. Standard errors (in parentheses) are adjusted for 555 microregion clusters. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A.7: Potential Soy Yield and Electoral Victory DiD — Probit

Dependent variable:	**Prob. Victory**				
	(1)	(2)	(3)	(4)	(5)
Incumbency	0.7867***	0.7895***	0.7997***	0.6947***	0.6966***
	(0.0832)	(0.0837)	(0.0858)	(0.0879)	(0.0881)
Incumbency × Post-shock	-0.0996	-0.1031	-0.1045	-0.0830	-0.0708
	(0.0839)	(0.0841)	(0.0860)	(0.0880)	(0.0881)
Incumbency × ΔA_r^{soy}	-0.0582	-0.0593	-0.0613	-0.0646	-0.0615
	(0.0421)	(0.0422)	(0.0433)	(0.0445)	(0.0444)
Post-shock × ΔA_r^{soy}	-0.0122	-0.0183	-0.0083	0.0050	0.0007
	(0.0128)	(0.0129)	(0.0157)	(0.0154)	(0.0161)
Incumbency × Post-shock × ΔA_r^{soy}	0.0886**	0.0900**	0.0924**	0.0879*	0.0846*
	(0.0428)	(0.0429)	(0.0439)	(0.0451)	(0.0449)
Municipality fixed effects	✓	✓	✓	✓	✓
Year fixed effects	✓	✓	✓	✓	✓
State-Year fixed effects		✓	✓	✓	✓
Microregion-Year fixed effects			✓	✓	✓
Party-Year fixed effects				✓	✓
Controls					✓
Observations	90,926	90,926	90,926	90,242	89,655
Pseudo R^2	0.068	0.068	0.072	0.099	0.103

Notes: Unit of analysis is a candidate j in municipality r and election t. Standard errors (in parentheses) are adjusted for 555 microregion clusters and observations are weighted by valid votes. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A.8: Potential Soy Yield and Electoral Victory DiD — Probit (Weighted)

Dependent variable:	**Prob. Victory**				
	(1)	(2)	(3)	(4)	(5)
Incumbency	1.018***	1.021***	1.035***	0.8578***	0.8394***
	(0.1911)	(0.1922)	(0.1992)	(0.2005)	(0.2039)
Incumbency × Post-shock	-0.0284	-0.0289	-0.0208	-0.0394	-0.0221
	(0.1787)	(0.1792)	(0.1886)	(0.1879)	(0.1907)
Incumbency × ΔA_r^{soy}	-0.0379	-0.0369	-0.0269	-0.0085	-0.0025
	(0.0907)	(0.0913)	(0.0943)	(0.0989)	(0.0995)
Post-shock × ΔA_r^{soy}	-0.0145	-0.0226	-0.0077	0.0239	-0.0027
	(0.0289)	(0.0268)	(0.0341)	(0.0358)	(0.0365)
Incumbency × Post-shock × ΔA_r^{soy}	0.1624*	0.1621*	0.1604*	0.1258	0.1221
	(0.0894)	(0.0901)	(0.0950)	(0.0977)	(0.0977)
Municipality fixed effects	✓	✓	✓	✓	✓
Year fixed effects	✓	✓	✓	✓	✓
State-Year fixed effects		✓	✓	✓	✓
Microregion-Year fixed effects			✓	✓	✓
Party-Year fixed effects				✓	✓
Controls					✓
Observations	90,926	90,926	90,926	90,242	89,655
Pseudo R^2	0.139	0.140	0.146	0.204	0.207

Notes: Unit of analysis is a candidate j in municipality r and election t. Standard errors (in parentheses) are adjusted for 555 microregion clusters and observations are weighted by valid votes. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

A.6 Term Limits

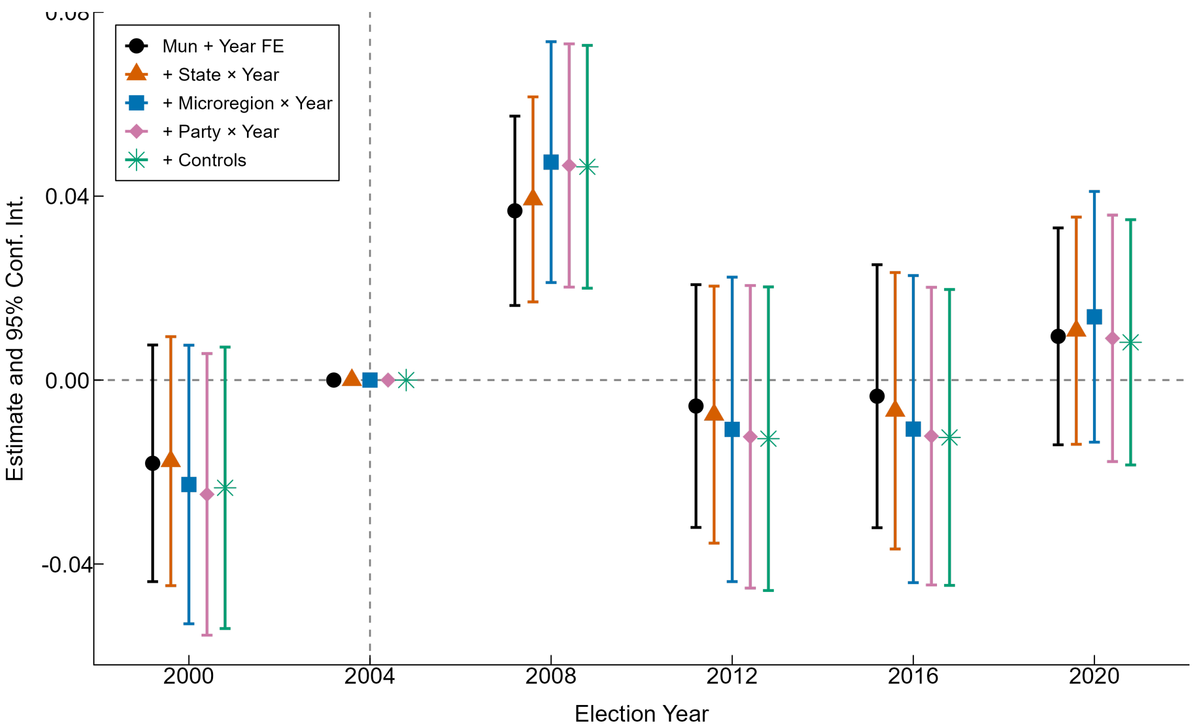
Following Novaes and Schiumerini (2022), Table A.9 excludes municipalities where incumbents cannot run in $t+1$ due to term limits. The results are nearly identical in terms of magnitude and statistical significance. Figure A.7 presents the corresponding dynamic effects. In Table A.10, we present similar results estimating a Probit model.

Table A.9: Potential Soy Yield and Electoral Victory DiD — Excluding Municipalities With Term-Limited Incumbents

Dependent variable:	**Prob. Victory**				
	(1)	(2)	(3)	(4)	(5)
Incumbency	0.3030***	0.3034***	0.3060***	0.2648***	0.2624***
	(0.0311)	(0.0312)	(0.0319)	(0.0322)	(0.0322)
Incumbency × Post-shock	-0.0138	-0.0149	-0.0158	-0.0064	-0.0045
	(0.0313)	(0.0314)	(0.0321)	(0.0323)	(0.0323)
Incumbency × ΔA_r^{soy}	-0.0221	-0.0225	-0.0232	-0.0243	-0.0233
	(0.0158)	(0.0158)	(0.0162)	(0.0163)	(0.0163)
Post-shock × ΔA_r^{soy}	-0.0051	-0.0082*	-0.0031	0.0018	-0.0002
	(0.0044)	(0.0045)	(0.0057)	(0.0054)	(0.0055)
Incumbency × Post-shock × ΔA_r^{soy}	0.0336**	0.0343**	0.0350**	0.0336**	0.0321*
	(0.0160)	(0.0161)	(0.0164)	(0.0166)	(0.0165)
Municipality fixed effects	✓	✓	✓	✓	✓
Year fixed effects	✓	✓	✓	✓	✓
State-Year fixed effects		✓	✓	✓	✓
Microregion-Year fixed effects			✓	✓	✓
Party-Year fixed effects				✓	✓
Controls					✓
Observations	68,832	68,832	68,832	68,832	68,361
R^2	0.110	0.111	0.116	0.142	0.146

Notes: Unit of analysis is a candidate j in municipality r and election t. Standard errors (in parentheses) are adjusted for 555 microregion clusters. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Figure A.7: Dynamic Effects of Soy Potential Yield — Excluding Municipalities With Term-Limited Incumbents



Notes: Each point represents a regression coefficient ($\hat{\beta}$) from estimating Equation (10). The dependent variables are the probability of victory of candidate j in municipality r in each election $t = 2000, \ldots, 2020$. All regressions include municipality and year fixed effects. Standard errors are clustered at the microregion level (555 clusters).

Table A.10: Potential Soy Yield and Electoral Victory DiD — Probit, Excluding Municipalities With Term-Limited Incumbents

Dependent variable:	Prob. Victory				
	(1)	(2)	(3)	(4)	(5)
Incumbency	0.8001***	0.8016***	0.8124***	0.7046***	0.7057***
	(0.0848)	(0.0853)	(0.0876)	(0.0898)	(0.0899)
Incumbency × Post-shock	-0.0265	-0.0302	-0.0324	-0.0127	-0.0015
	(0.0853)	(0.0858)	(0.0881)	(0.0901)	(0.0902)
Incumbency × ΔA_r^{soy}	-0.0578	-0.0587	-0.0611	-0.0643	-0.0611
	(0.0430)	(0.0432)	(0.0443)	(0.0456)	(0.0455)
Post-shock × ΔA_r^{soy}	-0.0154	-0.0239*	-0.0132	0.0013	-0.0020
	(0.0130)	(0.0133)	(0.0164)	(0.0162)	(0.0168)
Incumbency × Post-shock × ΔA_r^{soy}	0.0906**	0.0924**	0.0954**	0.0914**	0.0870*
	(0.0436)	(0.0437)	(0.0449)	(0.0463)	(0.0461)
Municipality fixed effects	✓	✓	✓	✓	✓
Year fixed effects	✓	✓	✓	✓	✓
State-Year fixed effects		✓	✓	✓	✓
Microregion-Year fixed effects			✓	✓	✓
Party-Year fixed effects				✓	✓
Controls					✓
Observations	68,829	68,829	68,826	68,193	67,719
Pseudo R^2	0.086	0.086	0.090	0.114	0.119

Notes: Unit of analysis is a candidate j in municipality r and election t. Standard errors (in parentheses) are adjusted for 555 microregion clusters and observations are weighted by valid votes. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

A.7 Party Incumbency

In Table A.11, we evaluate the existence of a *party* incumbency advantage (that is, whether another candidate *of the same party* won an election at $t-1$). As De Magalhães (2015) shows, this measure is not directly comparable to our original (individual) incumbency measure, at least not in a country with weak parties and widespread party switching like Brazil. Unsurprisingly, our results are not robust to the use of this measure, indicating that only individual candidates — not their parties — benefit from the incumbency advantage conferred by the productivity shock.

Table A.11: Potential Soy Yield and Electoral Victory DiD — Party Incumbency

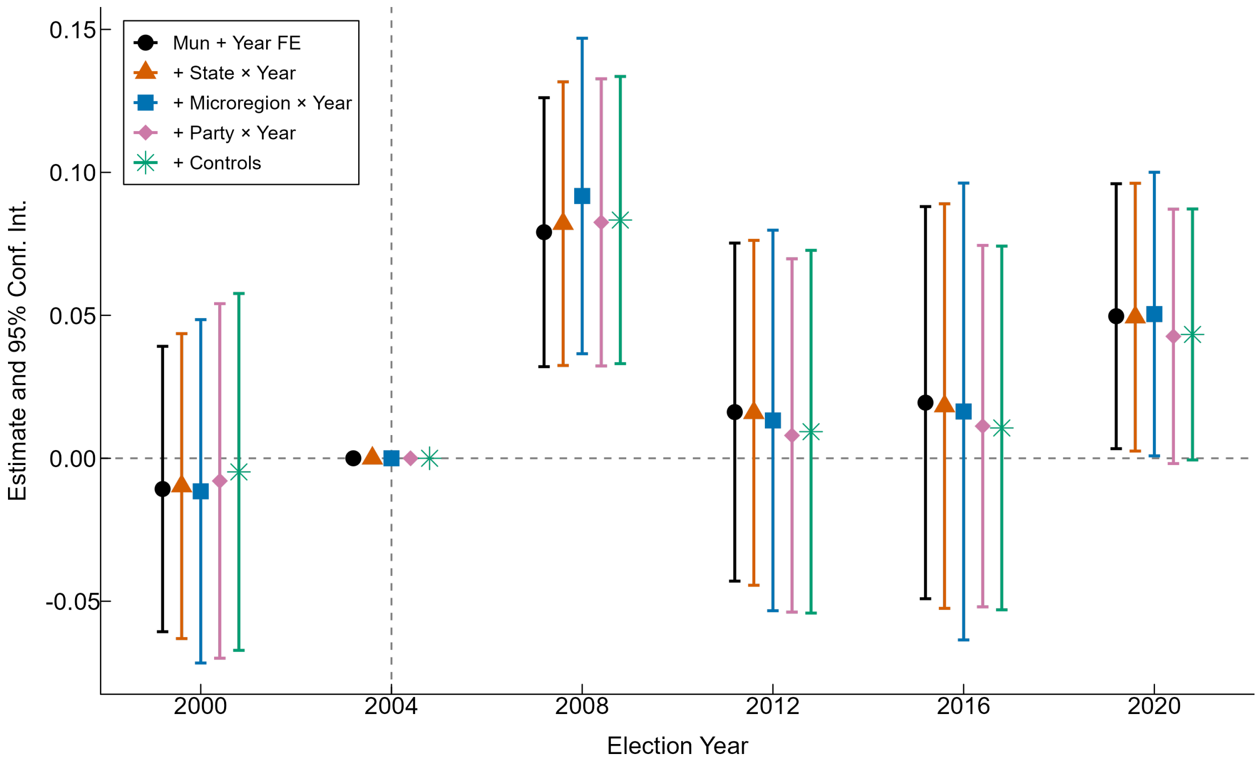
Dependent variable:	**Prob. Victory**				
	(1)	(2)	(3)	(4)	(5)
Party Incumbency	0.2117***	0.2141***	0.2167***	0.1730***	0.1729***
	(0.0285)	(0.0287)	(0.0294)	(0.0299)	(0.0302)
Party Incumbency × Post-shock	-0.0268	-0.0291	-0.0305	-0.0162	-0.0185
	(0.0294)	(0.0296)	(0.0303)	(0.0306)	(0.0307)
Party Incumbency × ΔA_r^{soy}	-0.0037	-0.0035	-0.0039	-0.0047	-0.0052
	(0.0150)	(0.0150)	(0.0154)	(0.0156)	(0.0156)
Post-shock × ΔA_r^{soy}	0.0007	-0.0003	0.0012	0.0062	0.0037
	(0.0045)	(0.0045)	(0.0057)	(0.0055)	(0.0056)
Party Incumbency × Post-shock × ΔA_r^{soy}	0.0108	0.0104	0.0106	0.0107	0.0117
	(0.0157)	(0.0157)	(0.0161)	(0.0163)	(0.0162)
Municipality fixed effects	✓	✓	✓	✓	✓
Year fixed effects	✓	✓	✓	✓	✓
State-Year fixed effects		✓	✓	✓	✓
Microregion-Year fixed effects			✓	✓	✓
Party-Year fixed effects				✓	✓
Controls					✓
Observations	90,926	90,926	90,926	90,926	90,334
R^2	0.065	0.06	0.069	0.103	0.107

Notes: Unit of analysis is a candidate j in municipality r and election t. Standard errors (in parentheses) are adjusted for 555 microregion clusters. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

A.8 Weighted Event-Study

Figure A.8 re-estimates the original event-study results of Figure 5, weighting them by valid votes.

Figure A.8: Dynamic Effects of Soy Potential Yield (Weighted)



Notes: Each point represents a regression coefficient ($\hat{\beta}$) from estimating Equation (10). The dependent variables are the probability of victory of candidate j in municipality r in each election $t = 2000, \ldots, 2020$. All regressions include municipality and year fixed effects. Standard errors are clustered at the microregion level (555 clusters) and observations are weighted by valid votes.