EXAMINING POLICY-RELATED ISSUES AND THEIR EFFECT ON LABOR DYNAMICS AND THE SUPPLY CHAIN

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A DISSERTATION

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

Business Administration – Logistics – Doctor of Philosophy

2025

ABSTRACT

This dissertation explores labor as an essential component of supply chain operations. Collectively, these three essays contribute to the domains of labor economics, supply chain management, and public policy, demonstrating that employment structures, labor market responses, and inter-industry dynamics are sensitive to regulatory environments and institutional constraints. Methodologically, this dissertation leverages robust causal identification strategies, including synthetic controls, natural experiments, and difference-in-differences, to establish strong causal inference. Theoretically, it extends economic property rights frameworks and supply chain spillover models to account for legal frictions and institutional change. For scholars, it offers integrative frameworks to study firm boundary decisions and policy-induced labor effects. For policymakers, the results highlight the heterogeneous and sometimes unintended consequences of regulatory interventions. For supply chain practitioners, the research provides insight into labor availability, governance structures, and compliance challenges that influence strategic sourcing and workforce management.

The first essay (see Chapter 2) examines the consequences of California's Assembly Bill 5 (AB5), a landmark law addressing employee misclassification. Using a synthetic control method to identify causal impacts on employment dynamics in the trucking industry, I find a sharp decline in independent contractors (IC) and the shift toward vertically integrated employment models. This transformation is framed through Barzel and Allen's (2023) lens of property rights theory, whereby I explore how legal property rights cascade to impact economic property rights. The findings reveal that AB5 triggered significant firm-level adjustments, particularly among larger carriers and intermodal drayage operators. The study contributes to organizational theory

by offering a unique temporal setting for institutionalization and firm boundary decisions and advancing a unified theoretical framework for organizational structures.

The second essay (see Chapter 3) examines the local labor market effects of large multinational plants, termed "Million Dollar Plants" (MDPs), on employment in ancillary sectors, specifically transportation and warehousing. Leveraging a difference-in-differences design, the study compares "winning" counties that secure MDPs with "runner-up" counties, controlling for unobservable factors. This work highlights a surprising cannibalizing effect on local labor, underscoring the complex interplay between labor market dynamics and supply chain operations. Contrary to expectations, average spillover effects on local logistics employment are muted or negative, but were found to be moderated by plant size. For larger MDPs, the higher-paying opportunities in transportation or manufacturing industries likely draw labor away from warehousing. This study contributes by identifying boundary conditions to contextualize the direction of labor spillovers for transportation and warehousing industries through an additional perspective, county-level employment. These findings challenge conventional assumptions about regional economic development and underscore the nuanced dynamics of labor across industries.

The third essay examines the labor market consequences of the early termination of enhanced federal unemployment insurance (UI) benefits during the COVID-19 recovery. Using border discontinuities between states that ended benefits early and those that did not, I conduct a county-level analysis. The results are heterogeneous across temporal and regional dimensions, concentrated in goods-producing sectors with energy fracking activity. While the policy had limited immediate impact, it highlights the broader context of mechanisms in play during economic recovery. This essay contributes to conflicting empirical findings in pandemic recovery and debates on optimal unemployment policy and macro-labor responsiveness.

ACKNOWLEDGEMENTS

I am deeply grateful for the many people who have supported and guided me throughout my doctoral journey. First and foremost, I owe my sincere thanks to my advisor and dissertation chair, Dr. Jason Miller. His steady guidance, insightful feedback, and patience were instrumental in shaping my research and academic growth. I am incredibly fortunate to have had the opportunity to learn from him and to count him as a mentor, role model, and friend. Thank you also to Dr. Alex Scott, who was always available and a constant source of support. I would also like to express my gratitude to my dissertation committee members, Dr. Alex Scott, Dr. Sriram Narayanan, Dr. Jordan Barker, and Dr. Anne Dohmen, for their thoughtful critiques, encouragement, and support, which helped me refine my work and grow as a scholar. I am truly grateful for their time and investment in my development.

I extend heartfelt thanks to the entire faculty in the Department of Supply Chain Management at Michigan State University. Each contributed to my education in meaningful ways, and I am thankful for the opportunity to learn from such a talented group of scholars. To my fellow Ph.D. students, thank you for your camaraderie, collaboration, and friendship. Thank you for sharing this journey with me as such a supportive and inspiring cohort.

I also want to thank my mentors at Miami University who first encouraged me to pursue this path. Their belief in my potential and early guidance was pivotal in my decision to enter a Ph.D. program.

Finally, and most importantly, I am profoundly grateful to my family and friends. To my wife, thank you for your love, sacrifices, and unwavering belief in me. Your encouragement and support gave me the strength to persist through challenges, and I share this accomplishment with you.

Above all, I give glory to God for the opportunity, strength, and grace that sustained me through this journey.

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CHAPTER 1 – INTRODUCTION & MOTIVATION

The intersection of public policy, labor economics, and supply chain management has gained increased scholarly and practical relevance in recent years. This relevance has been increased by a series of macroeconomic and institutional shifts: rapid growth in alternative work arrangements (Katz & Krueger, 2019), rising tensions in global supply chains (Flynn et al., 2021), a surge in U.S. industrial policy (Handley, 2023), and the profound disruptions of the COVID-19 pandemic (Moosavi et al., 2022). These forces have redefined the relationship between firms, workers, and institutions, making it critical to understand how policy shapes organizational behavior and labor dynamics.

This dissertation addresses these pressing issues by examining how distinct policy interventions influence employment structures, labor allocation, and firm-level decision-making. Specifically, I analyze how state-level labor classification laws, large-scale capital investments, and enhanced federal unemployment insurance affect labor market outcomes and organizational structures within supply chain-relevant sectors. These include transportation, warehousing, and manufacturing sectors that form the backbone of logistics networks.

Each essay in this dissertation leverages a quasi-experimental design to establish causal identification: synthetic controls, natural experiments using runner-up counties, and border discontinuities across states. These empirical strategies allow for robust inference about how policy interventions affect firms and workers. Theoretically, the research extends economic property rights theory (Barzel & Allen, 2023), agglomeration economics (Ellison et al., 2010; Marshall, 1980), and institutional theory (W. R. Scott, 2014; Williamson, 2000). To further understand how policy shapes labor markets and firm boundaries, these essays address issues that are central to contemporary logistics and operations management research (Helper et al., 2021; Richey & Davis-Sramek, 2022).

The fissuring of the workplace, a term coined by Weil (2014), describes a shift in employment relationships where firms rely increasingly on subcontracting, outsourcing, and contingent labor to reduce costs and liabilities. While this has afforded firms flexibility, it has also generated negative externalities: lower job quality, weaker enforcement of labor standards, and increased legal ambiguity (Collier et al., 2017; Goldschmidt & Schmieder, 2017). In response, state and federal governments have proposed, and in some cases enacted, legislation to redefine employment classifications. At the same time, supply chain complexity and globalization have led firms to rethink their operational footprints, including where and how they source labor.

However, research in supply chain management has not kept pace with these institutional developments. Much of the literature focuses on firm-level optimization, risk mitigation, or process innovation, focusing less on how policies shape the workforce structures that underpin logistics operations (Carpenter, Van Sandt, et al., 2022; Miller et al., 2024). This dissertation is motivated by the need to fill that gap, bringing institutional and labor considerations into core supply chain research, using robust empirical methods and theoretically grounded frameworks.

From a managerial perspective, the outcomes of policy changes are not trivial. They influence hiring strategies, vertical integration decisions, the geographic location of operations, and compliance costs. For policymakers, understanding the downstream effects of legislation, especially unintended spillovers, is critical to crafting effective and equitable interventions. This dissertation, therefore, contributes by providing rigorous, policy-relevant insights into how policy and regulation reshape labor markets and supply chain operations.

To investigate the interface between labor dynamics, policy, and supply chains, this dissertation addresses three research questions: (1) What impact did California's Assembly Bill 5

misclassification legislation have on independent contractors and drayage truck drivers' employment dynamics? (2) What are the local labor market spillover effects of million-dollar plants on transportation and warehousing? (3) Did the early termination of the Federal Unemployment Benefits by State policy affect goods-producing (e.g., manufacturing, mining, construction) and service-providing employment? Each chapter corresponds to one of these questions, emphasizing labor dynamics, empirical rigor, and relevance.

The first essay examines California's Assembly Bill 5 (AB5), which redefined the legal criteria for classifying workers as independent contractors. The trucking industry, heavily reliant on independent contractors, was uniquely impacted by this law. Using a synthetic control method and drawing from the property rights literature (Barzel & Allen, 2023; Grossman & Hart, 1986) demonstrate that AB5 significantly reduced the number of independent contractors and triggered a shift toward vertical integration. This essay contributes to organizational theory by advancing a unified framework that distinguishes between legal and economic property rights, particularly in contexts of legal uncertainty (Lawrence et al., 2001).

The second essay investigates whether and how new industrial investments affect local labor markets in complementary logistics sectors. Using a difference-in-differences research design with runner-up counties as controls (Bloom et al., 2019; Greenstone et al., 2010), I assess whether million-dollar plant openings generate employment spillovers into trucking and warehousing. Surprisingly, the average effects are modest or negative but moderated by plant size. Larger plants decrease warehousing employment, suggesting a competitive labor market dynamic rather than uniform spillovers.

The third essay explores the labor market impact of early termination of federal unemployment insurance (UI) benefits during the COVID-19 recovery. Using border

discontinuities between states that ended benefits and those that did not, I estimate the employment effects across counties, focusing on goods-producing and service sectors. Results suggest limited but delayed impacts, with some employment growth concentrated in areas of higher industrial activity. This essay informs debates on labor incentives, macro policy timing, and the resilience of sectoral labor pools.

Each essay engages with and extends a distinct theoretical stream. Property rights theory (Barzel & Allen, 2023; Grossman & Hart, 1986) is extended as the legal property rights cascade to impact the economic property rights, particularly in cases of regulatory uncertainty. Agglomeration theory and input-sharing spillovers (Ellison et al., 2010; Marshall, 1980) are tested using county-level labor outcomes in logistics sectors. Institutional and organizational theory (W. R. Scott, 2014; Williamson, 2000) is applied to analyze how firms respond asymmetrically to policy changes based on size, asset ownership, and regulatory exposure. The combination of these perspectives offers a more complete account of how policy shapes labor dynamics and organizational behavior in modern supply chains.

For practitioners, this dissertation provides actionable insights. Transportation and logistics firms can better anticipate the effects of employee classification laws on labor supply and cost structures. Regional economic development officials can temper expectations about indirect job creation from industrial investments. Policymakers can also use empirical evidence to refine the design and timing of social insurance rollbacks.

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CHAPTER 2 – A PROPERTY RIGHTS PERSPECTIVE FOR ORGANIZATIONAL STRUCTURE IN THE TRUCKING INDUSTRY

2.1 INTRODUCTION

Independent contractors (ICs) are an essential and rapidly growing segment of the U.S. workforce, with over 10 million workers classified as such by the U.S. Bureau of Labor Statistics (2018). The prevalence of ICs has increased significantly in recent years (Katz & Krueger, 2019). This growth trend has been particularly pronounced in industries such as construction, professional services, healthcare, and transportation (Cantor et al., 2013; Doloi, 2009; Huckman & Pisano, 2006; McKeown & Pichault, 2021). Firms often integrate both employees and ICs in a mixed workforce (Mayer & Nickerson, 2005; Rothaermel et al., 2006).

Firms rely on ICs for flexibility and competitive advantages. ICs allow businesses to meet fluctuating demand and balance vertical integration with strategic outsourcing (Harrigan, 1984; Lobel et al., 2024; Rothaermel et al., 2006). ICs require less training and onboarding (particularly in the case of experienced ICs), provide their own equipment or other assets (Castillo et al., 2018), and can allow employers to be more responsive to changing demand conditions because they are easier to engage and disengage with, relative to employees. The IC arrangement also benefits the worker. ICs often enjoy greater flexibility in their work schedules, the potential for higher earnings, and the ability to work for multiple clients (Bernhardt & Thomason, 2017). Some workers, particularly those with specialized skills or a desire for autonomy, actively seek out IC status.

In 2019, California passed a law[1] (known as Assembly Bill 5, or simply "AB5"). This landmark legislation dramatically altered the landscape of organizational structure in California, making it more difficult to be classified as an IC (Moore, 2023). This impacted how firms and

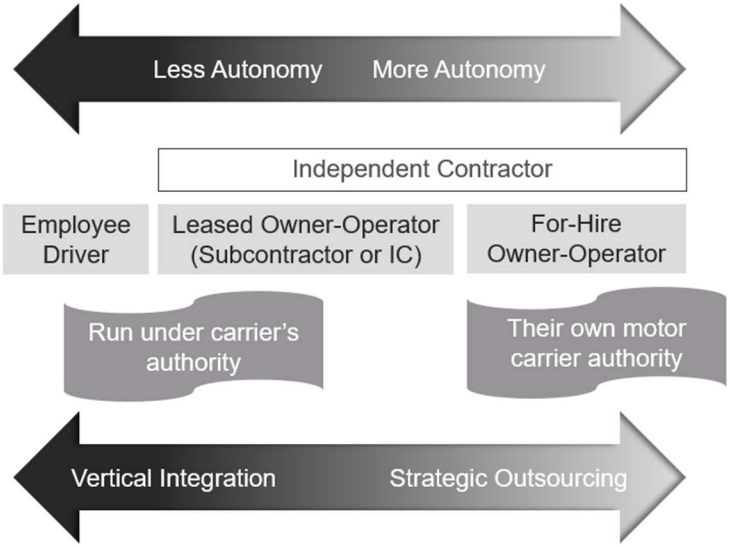
[1] CA Labor Code § 2750.3 (2019)

workers interact, particularly in the trucking industry (Reibstein, 2020). There were approximately 70,000 IC truck drivers in California affected by this legislation (Saraiva & Yeung, 2022). By establishing strict guidelines, AB5 effectively eliminated the existing use of ICs in California's trucking industry, which is the status quo in the rest of the country, with few exceptions (Leonard & Cosgrove, 2019; Reibstein, 2020).

The for-hire trucking industry provides an ideal setting for exploring the legislation's impact, due to its prevalent use of ICs and various organizational structures (Baker & Hubbard, 2004). The trucking industry has three dominant organizational structures for employment relationships (Han et al., 2008). This landscape of organizational structure in the truck transportation industry is illustrated in Figure 2.1. Many drivers are employed directly by a motor carrier, as employee drivers (i.e., vertical integration). Others are commonly grouped together as independent contractors, of two types. One type is known as a leased owner-operator, or subcontractor. A leased owner-operator drives "under the authority" of a carrier's Department of Transportation (DOT) number as a subcontractor in a leased-subcontractor model, from now on referred to as an IC. The use of ICs is often in conjunction with a mix of employee drivers. The other type is an independent owner-operator with their own operating authority[2] and is considered a small business owner[3] (i.e., strategic outsourcing via freight brokerage).

[2] Operating Authority from the Federal Motor Carrier Safety Administration (FMCSA) https://www.fmcsa.dot.gov/registration/get-mc-number-authority-operate
[3] Employer ID Number (EIN) www.irs.gov/businesses/small-businesses-self-employed

Figure 2.1 Landscape of Organizational Structure in the Truck Transportation Industry



This distinction is important, as AB5 decidedly influenced the trucking industry for ICs by limiting ICs as an available organizational structure, the leased-subcontractor model, which has been the status quo in employment dynamics for the past several decades (Leonard & Cosgrove, 2019). AB5 is the first significant regulatory change to the transportation industry impacting a specific organizational structure since deregulation in 1980 for interstate operations. Firms will consider their comparative positions in response to the regulation (Argyres et al., 2019). This study examines AB5's regulatory change, which offers a unique natural experiment to study the impact of firms in the trucking industry adjusting their employment dynamics and organizational structure.

While research has examined the economic implications of the increased prevalence of IC classification (Weil, 2014), there is a gap in our understanding of how regulatory changes addressing worker classification impact a firm's organizational structure. To examine this issue, we turn to property rights theory, which offers a valuable framework for understanding organizational structures and economic relationships. Particularly in the trucking industry, the

AB5 legislation restricted the flexibility of truck drivers over the control of their assets, i.e., the truck, thus impacting their property rights. I extend property rights theory (Grossman & Hart, 1986; Holmstrom & Milgrom, 1994) by distinguishing between legal property rights and economic property rights (Barzel & Allen, 2023; Holzhacker et al., 2024). This distinction is particularly relevant in the context of AB5, as the legislation fundamentally alters the legal rights of workers and firms in ways that may have cascading effects on their economic property rights. Through this theoretical lens, this study provides a unified framework for understanding organizational structure decisions in truck transportation, also reconciling previous theoretical perspectives, such as agency theory and transaction cost economics.

To analyze the impact of AB5, I adopt a synthetic control methodology (Abadie et al., 2010; Abadie & Gardeazabal, 2003). This approach constructs a suitable counterfactual for California and provides a clean identification of the causal relationship between the legislation and changes in organizational structure within the trucking industry. I use data from the Federal Motor Carrier Safety Administration (FMCSA) on the composition of trucking establishments to track changes in organizational structure before and after the implementation of AB5. My findings reveal a significant decrease in the number of ICs in California compared to the synthetic control group, representing the legislation's exogenous impact on employment dynamics. Interestingly, I observe a shift from ICs towards a carrier model, particularly among larger carriers. This shift represents a new distribution of economic property rights as firms consider the adjustment costs of repositioning following the change in legal property rights imposed by AB5 (Argyres et al., 2019). I find that as ICs transition to employee status, they further cede some of their property rights to employers rather than capturing full control of their assets as independent owner-operators (De Soto, 2000).

This study makes several key contributions to transportation and organizational economics literature by providing empirical evidence within a novel legislative environment. First, it provides a unified theoretical framework for understanding organizational structure in the for-hire trucking industry, addressing critiques of property rights theory's ability to explain intermediary relationships such as subcontracting (J. Kim & Mahoney, 2005). In doing so, this study also answers a call for more frameworks in transportation research for policy and regulation (Helper et al., 2021; Richey & Davis-Sramek, 2022). Second, it explores the impact of a unique policy intervention without enforcement by the state, challenging the canonical legal property rights perspective and introducing the concept of legal uncertainty in the process of institutionalization (Lawrence et al., 2001) and driving firm boundaries (Makadok et al., 2018; Williamson, 2000). Finally, from a practical standpoint, our findings offer insights for policymakers, shippers, and carriers on the potential impacts of similar legislation in other states.

The remainder of this paper is structured as follows: Section 2 reviews the relevant literature on organizational structure in the trucking industry, independent contracting, and property rights theory. Section 3 describes the institutional setting and develops our hypotheses. Section 4 outlines our data and methodology. Section 5 presents our results and analysis. Finally, Section 6 discusses the implications of our findings, addresses limitations, and suggests avenues for future research.

2.2 LITERATURE REVIEW

2.2.1 Organizational Structure in the Trucking Industry

Scholarly research has found valuable insights into the factors influencing the organizational structure within the trucking industry. Following the Motor Carrier Act of 1980 (MCA), the trucking industry experienced reduced barriers to entry and increased competition. These

changes increased the prevalence of independent owner-operators post-deregulation (Corsi & Grimm, 1987; Peoples & Peteraf, 1999). Deregulation increased the productivity of independent owner-operators, providing the independent owner-operator "with a broader range of options in the post-MCA environment" (Corsi & Grimm, 1987, p. 4). Deregulation increased their control over their assets, allowing them to capture more of their economic property rights as independent owner-operators. Other findings on deregulation found the MCA to "increase the utility of [independent] owner-operators and to expand the range of their competitive opportunities" (Peoples & Peteraf, 1995, p. 39).

Research has also identified a decrease in ICs amongst the largest truckload carriers, termed advanced truckload firms (ATLFs) in the academic literature at that time, because the ATLFs focused on high levels of asset utilization and service (Corsi & Grimm, 1989; Corsi & Stowers, 1991). This strategy requires coordination and control (e.g., dispatching, load matching, and lane density) to synchronize close operations integration (Lee, 1987). This is facilitated by using employee drivers, as the carrier owns the asset and has stronger property rights when it uses employee drivers versus ICs (Miller et al., 2018). Related to the routes driven, Nickerson and Silverman (2003) found that externalities across hauls preclude higher independent owner-operator utilization due to the higher required coordination efforts or when service failure impacts reputation investments. Consistent with this argument, Han et al. (2008) identified specialized equipment assets and the less-than-truckload (LTL) sector to strongly favor employee drivers over independent owner-operators. The availability of tracking technologies (i.e., onboard computers) improved behavior monitoring and also led carriers to leverage employee drivers (Baker & Hubbard, 2004).

Multiple theoretical lenses have been applied to examine the varied organizational structure decisions in the trucking industry. These theoretical lenses range from transaction cost economics (Edelman & Geradin, 2015; Han et al., 2008; Klein et al., 1978; Nickerson & Silverman, 2003), to agency theory (Alchian & Demsetz, 1972; Baker & Hubbard, 2004; Belzer & Swan, 2011; Milgrom & Roberts, 1992), to property rights theory (Baker & Hubbard, 2003; Windsperger & Jell, 2004). Other research found that neither the focus on relationship-specific investments from transaction cost economics nor the emphasis on incentive alignment from agency theory adequately explains the diverse organizational setups observed within the trucking industry (He & Nickerson, 2006; Lafontaine & Masten, 2002). Research over the last several decades has been episodic and has not provided a single comprehensive theoretical perspective. Through the lens of Barzel and Allen's (2023) economic property rights, the range of organizational structures can be dynamically addressed to account for the dissonance in prior research. In doing so, this study presents a single unified framework to be used going forward for interpreting organizational structure decisions in the trucking industry.

Several factors impact a driver's decision to be an employee driver, IC, or independent owner-operator. For independent owner-operators, access to capital and experience have been found to influence a driver's ability to invest in large assets, such as the tractor-trailer (Lafontaine & Masten, 2002). Viscelli (2016) described new drivers without experience or an independent source of capital as being too often forced into 'debt peonage' with a carrier to finance their initial training. This aligns with Cantor et al. (2013), highlighting the limited financial resources of many independent owner-operators. Another important externality is that independent owner-operators have been found to have worse safety performance (Cantor et al., 2013; Miller et al., 2018), increasing the cost of insurance. Taken together, the financial burden

of training and assets required for small business owners can be significant within the trucking industry (Kingston, 2022).

2.2.2 Independent Contracting

Independent contracting represents a departure from traditional employment arrangements. Literature on this work arrangement has identified an increased prevalence in recent decades (Goldschmidt & Schmieder, 2017; Katz & Krueger, 2019) as it provides flexibility and autonomy for workers. However, the asymmetric power dynamics inherent in independent contracting relationships often result in adverse outcomes for contractors (Connolly & Ruckelshaus, 2017; Weil, 2014) and have been associated with rising wage inequality (Song et al., 2019). Independent contracting redistributes responsibility for worker protection away from the firm and creates an arms-length relationship (Weil, 2014).

Firms may opportunistically exploit non-priced attributes of contracted labor and create incentives to cut corners; the workers may lack access to benefits, correct and on-time payment, or limited upward mobility (Kennedy, 2005; Weil, 2017). These practices can produce negative externalities for the worker, such as abuse, decreased job security, diminished labor rights, and reduced workers' bargaining power (Dube & Kaplan, 2010; Goldschmidt & Schmieder, 2017). Legislation plays a role in mitigating negative externalities inherent in independent contracting relationships (Alchian, 1965; Barzel & Allen, 2023). Some examples of regulatory action in transportation have addressed negative externalities, such as congestion (Paget-Seekins et al., 2015) and unsafe driving (Cantor et al., 2009; Edelman & Geradin, 2015). However, meaningful legislation has not addressed the negative externalities associated with the burgeoning organizational structure of independent contracting (Collier et al., 2017; Reibstein, 2020).

California's AB5 fills this void by addressing employee misclassification, where a worker who should be classified as an employee is instead categorized as an IC.

2.2.3 Property Rights Theory

Independent contracting, vertical integration, and strategic outsourcing are common forms of organizational structure. Evaluating firm boundaries and vertical integration of employment draws on theoretical perspectives from property rights theory (Grossman & Hart, 1986; Hart & Moore, 1990). In determining vertical integration, the modern perspective of property rights theory emphasizes legal asset ownership that grants a set of property rights and, with it, extends control over the workers who use them (Foss & Foss, 2005; J. Kim & Mahoney, 2005). For example, an independent owner-operator is a driver who owns the truck and has all the rights to control the asset, including who drives the vehicle. The control and capture of property rights are costly, e.g., the cost of contracting with shippers, moral hazard, or ex-post negotiating (Barzel, 1997; Foss & Foss, 2005). Asset ownership matters only when the establishment and enforcement of property rights incur costs (Barzel, 1997). But when transaction costs are present, it becomes meaningful to distinguish between the legal and economic property rights to an asset (Alchian, 1965; Barzel, 1997), such that legal property rights are expressed by law, whereas economic property rights are an individual's ability to exercise choice over an asset (Barzel & Allen, 2023). AB5 represents a change in the legal property rights that impacts the economic property rights of the IC.

Similar but distinct from the modern definition of property rights, which emphasizes the legal definition (Foss & Foss, 2015; J. Kim & Mahoney, 2005), Barzel and Allen's (2023, p. 15) economic definition of property rights stress "the individual's ability (in expected terms) to exercise a choice with respect to a commodity or some other thing." In the context of trucking,

an independent owner-operator's capacity or bundle of economic property rights (Foss & Foss, 2015) as it relates to their primary asset (the truck) can be conceptualized as a set of decisions. The strength of the economic property rights are with respect to the driver's ability to create, capture, and appropriate value from the use of their asset, e.g., the truck. This bundle includes the right to operate, earn income, and contract with a range of business partners, transfer or modify the asset, and make operational decisions such as route selection, scheduling, or vehicle maintenance. The emphasis of legal property rights is focused on whether they will be enforced by the state, i.e., imperfect enforcement. Consider uncertainty, for example, in how adequate police efforts are to stop shoplifting or local judges' reluctance to incarcerate shoplifters, both affecting retailers. The enforcement of the legal property rights by the state protects the economic property rights.

In contrast, in the context of AB5, uncertainty stems from whether the law will be enacted due to court action, i.e., uncertain enforcement. This is a distinct type of uncertainty with pending legal action that will remove economic property rights of ICs. Moreover, many truck drivers, if not most, affected did not wish to alter their organizational structure (Moore, 2023). Considering a general perspective of property rights and delineating the source of uncertainty in legal property rights, this study broadens the theory's ability to explain more empirical findings (Lipton, 2004).

2.3 INSTITUTIONAL SETTING AND HYPOTHESES

2.3.1 California's Assembly Bill 5 (AB5)

The history of legislation shaping today's employment law for ICs dates to the early 20th century, with the creation of the 1099 Tax Form for ICs in 1918 and the Fair Labor Standards Act (FLSA) in 1938. California's Assembly Bill 5 (AB5) joins this legislation as "the most

meaningful law enacted in the past ten years involving independent contractors" (Reibstein, 2020, para. 8). California State Governor Newsom signed AB5 in September of 2019[4], and several industries, including the trucking industry, immediately challenged the law[5], citing interference with interstate commerce and that AB5 conflicted with existing federal regulations (Moore, 2023). Considering the numerous legal refutes to the legislature aimed at preventing it from taking effect, there was a great deal of legal uncertainty in the law's survival, and if it did, AB5 would drastically change how the trucking industry would function (Leonard & Cosgrove, 2019).

During this period of uncertainty, other industries successfully fought legal action against AB5. For example, an exemption eventually passed for app-based transportation and delivery companies[6], such as Uber and Lyft drivers. The exemption allowed gig companies to continue classifying their drivers as ICs, whereas no such exemption materialized for the trucking industry. The long delay and piecemeal approach to exemptions created an environment of uncertainty around both the timing and potential legitimacy of the law.

The long period of legal uncertainty, taken together with the cost of compliance, barred the industry from significant anticipatory behavior. In June 2022, the Supreme Court did not hear the case, i.e., denied certiorari, therefore ending the two-and-a-half-year injunction. The law then went into immediate effect with a new three-pronged test (the ABC test) to establish if a worker was an IC. This test requires a worker to satisfy each of the following[7]:

> *(A) The person is free from the control and direction of the hiring entity in connection with the performance of the work, both under the contract for the performance of the work and in fact.*

[4] Add Section § 2750.3 to California's Labor Code.
[5] California Trucking Association (CTA) and Owner-Operators Independent Drivers Association (OOIDA)
[6] CA Bus. & Prof. Code § 7448-7467, as added by Prop. 22 titled, "Protect App-Based Drivers and Services Act."
[7] CA Labor Code § 2750.3 (2019)

(B) The person performs work that is outside the usual course of the hiring entity's business.
(C) The person is customarily engaged in an independently established trade, occupation, or business of the same nature as that involved in the work performed.

Unique to the ABC test passed in California is the stringent nature of the B-prong. The B-prong of this test is problematic for the trucking industry to distinguish who is hired related to "the usual course of the hiring entity's business." Other states that have adopted the ABC test have included language such as "*or* [emphasis added] the work is performed outside of all the places of business." [8] This additional language makes it easier for IC status to be established.

With California's ABC test, a trucking company designating truck drivers as ICs is problematic if they also have employee truck drivers. However, a broker who strictly tenders to truck drivers as independent owner-operators would meet this new criterion[9]. A trucking company would, therefore, have to (1) hire (or terminate) existing IC drivers and shift to a full carrier employee model, (2) fundamentally change operations by splitting the existing business to employ company drivers and establish a brokerage to tender to truck drivers as for-hire independent owner-operators with their own authority[10], or (3) leave or cease to do business in California.

The legislation eliminates a governance structure that has existed for decades and continues to exist in the rest of the country within the trucking industry (Pino, 2022). The implementation of AB5 in California serves as a "quasi-experiment" to evaluate the implications of the policy

[8] AK Stat. § 23.20.525(a)(8)(A-C); CT Gen. Stat. § 31-222(a)(1)(B)(ii); NJ Unemployment Compensation Act, N.J.S.A. § 43:21-19(i)(6)(A)-(C).
[9] Freight brokerage falls within NAICS 488510: Freight Transportation Arrangement. In contrast, trucking activity can fall into one of six 5- or 6-digiit NAICS codes (i) NAICS 484110: General Freight Trucking, Local; (ii) NAICS 484121: General Freight Trucking, Long-Distance, Truckload; (iii) NAICS 484122: General Freight Trucking, Long-Distance, Less-than-Truckload; (iv) NAICS 484210 Used Household and Office Goods Moving; (v) NAICS 484220: Specialized Freight Trucking, Local; or (vi) NAICS 484230: Specialized Freight Trucking, Long-Distance.
[10] Or a business-to-business exemption (Lockridge, 2022).

addressing the misclassification, the effect of which provides exogenous variation at the state level.

2.3.2 Hypotheses

This study's framework analyzes the implications of firm boundaries and vertical integration strategies. The AB5 legislation forces the governance structure of employment dynamics in California's trucking industry to shift dramatically (Leonard & Cosgrove, 2019). Drawing on the interaction of legal property rights and economic property rights, the legislation cascades to affect the distribution of economic property rights by reducing the control, thereby weakening an IC's decision-making ability regarding their asset (Barzel & Allen, 2023). The legislation does not remove asset ownership but limits an IC's ability to choose whether to cede some of their autonomy to a carrier and drive as a subcontractor while retaining asset ownership.

AB5 made the mixed-use of the leased-subcontractor model in conjunction with the employee model illegal for ICs in the trucking industry in California. The AB5 legislation reshaped the institutional environment of California's trucking industry, leading to a transformation in the governance structure that regulates employment dynamics (Williamson, 2000). Due to the considerable attention the legislation garnered, it is reasonable to expect carriers and ICs to be aware of the law and the fact it went into effect. This is consistent with awareness in the industry of other looming legislation (Miller et al., 2020). Drawing from these insights, when AB5 is implemented, the managers and owners will adjust the organizational structure away from ICs in California due to concerns about sanctioning and avoid further usage of ICs. Leveraging secondary data, my first hypothesis checks the theoretical alignment and maps the prediction to the operationalization within the data (Ketokivi et al., 2021; Miller & Kulpa, 2022).

H_1: The total number of ICs as truck drivers in California will decrease following the implementation of AB5.

Building upon the first hypothesis, I explore predictions for the new organizational structure for ICs in the trucking industry. The change in legal property rights from the AB5 legislation alters the economic property rights, constraining the ICs' ability to exercise control over their assets. Activities involving uncertainty or coordination are likely to result in vertical integration, which is consistent with empirical evidence suggesting coordination and control favor an employee model in certain segments of the trucking industry, such as less-than-truckload (LTL) (Han et al., 2008; Langlois, 2003). Intermodal shares similar characteristics in requiring coordination and synchronization of various operations.

California represents a unique combination of the second most heavy tractor-trailer truck drivers[11] and the most intermodal truck drivers of any state in the country (FMCSA, 2023b). Intermodal drayage truck drivers service seaports and railyards, moving cargo short distances (defined as less than 250 miles) to a nearby facility. The San Pedro Bay Port Complex (Port of Los Angeles and Port of Long Beach) was responsible for 29% of the United States containerized market share (import and export) in 2022 (Facts and Figures, 2022), indicating the significance of the intermodal drayage. A key group targeted by AB5 was the drayage sector and the intermodal drivers supporting the California ports (Kingston, 2022). The recent port congestion (CBS Interactive, 2021) in southern California highlights the uncertainty and the backlog that impacts drayage drivers' ability to pick up and deliver loads efficiently. With most intermodal drayage drivers being local (and less likely to leave the state), the AB5 legislation

[11] 53-3032 Heavy and Tractor-Trailer Truck Drivers operate a tractor-trailer combination or a truck with a capacity of at least 26,001 pounds Gross Vehicle Weight (GVW). "53-3032 Heavy and tractor-trailer truck drivers," Occupational Employment Statistics (U.S. Bureau of Labor Statistics), https://www.bls.gov/oes/current/oes533032.htm

options for IC as truck drivers are either to become a carrier employee (vertically integrate) or establish their own DOT authority and remain independent owner-operators. The higher (relative) uncertainty for drayage drivers related to port operations impacts the efficiency of their daily work and is outside of their control.

In California, 70% of ICs work within the intermodal industry, such as drayage drivers supporting the ports (Pino, 2022). Some empirical evidence suggests that 82% of the drivers in the intermodal sector are misclassified (Smith et al., 2014). However, as Peoples and Peteraf (1995) note, independent owner-operators have a strong desire for independence. Joni Casey, president of the Intermodal Association of North America (IANA), stated, "Although employee-driver positions are readily available, these [independent] owner-operator drivers explicitly chose the freedom, flexibility, and independence that comes with small business ownership," further stressing autonomy (Lockridge, 2022, para. 16). ICs will decide between surrendering autonomy to a carrier or capturing the full economic property rights available to an independent owner-operator.

The change in legal property rights from the AB5 legislation has diminished the economic property rights of ICs in terms of controlling their assets. Removing the leased-subcontractor model requires existing ICs to make a decision within their opportunity set of property rights (Foss & Foss, 2022). When a worker's ability to exercise specific ownership rights is constrained, an employment model is preferred if the employee can substitute behavior to capture margins elsewhere (Demsetz, 1998). Foss and Foss (2022) describe this as an adaptability advantage for workers to find utility in unspecified margins in the employment contract. The decision to surrender control of the asset to the carrier also submits other asset attributes, including the right to refuse tendered loads or work their choice of hours (Baker &

Hubbard, 2004; Viscelli, 2016). However, in the employee model, the worker leverages the carrier's economies of scope to create efficiencies in coordinating the loads and is relieved of the financial liability to maintain the asset. The alternative has the worker setting up their own business as an independent owner-operator, in doing so, absorbing the transaction costs to capture more economic property rights. In the context of intermodal, this is a weaker opportunity set for independent owner-operators than the highly profitable spot market afforded standard over-the-road drivers (Solomon, 2023), as most loads start/end at the port, limiting flexibility in potential trade partners. Barzel and Allen (2023) argue that property rights are assigned to the partner that exerts the most control over the income flow from these rights to maximize their new opportunity set, which I posit to be the drayage carrier.

Given the constraints imposed by the AB5 legislation on independent contracting arrangements, it is expected that intermodal truck drivers in California will be more likely to transition towards an employee model rather than becoming independent owner-operators. Both paths to compliance for AB5 are associated with significant transaction costs. For example, employers hiring ICs as employee drivers will cost an estimated additional 30% to cover payroll, benefits, etc. (Canon, 2019). For a truck driver to get their own DOT authority, insurance, etc., it has been conservatively estimated to cost an additional $20,000 (Kingston, 2022). This hypothesis aligns with the broader theoretical framework of property rights theory, which suggests that firms will adjust their organizational structure and vertical integration strategies in response to changes in the institutional environment and the associated transaction costs.

> **H_2:** Intermodal truck drivers in California will shift towards an employee model rather than become independent owner-operators following the implementation of AB5.

Larger firms have been identified to be more likely to adopt change in part due to their increased legal and regulatory exposure (Miller, 2020). California's AB5 legislation impacts nearly 40% of the state's truck drivers and carries tremendous regulatory exposure. When considering compliance forces, the emphasis is on institutions (such as the State of California) having the power to enforce versus the normative or cultural/social pressures (W. R. Scott, 2014). For the firms impacted within California, the carriers' size increases their exposure to regulatory enforcement (Miller, 2017).

Carriers will also need financial means to comply with the new regulation. Cantor et al. (2016) propose that larger carriers benefit from greater access to human and physical capital, easier access to financial resources, the ability to leverage economies of scale, and broader knowledge diversity. These factors collectively afford larger carriers a strategic advantage when adapting to new regulations. Prior research supports larger carriers to be more responsive in their regulatory compliance (Balthrop et al., 2023; Miller et al., 2020). The larger carriers, being less financially constrained, are positioned to invest in the necessary physical assets, human capital, and technology. Further, Miller (2020) highlights that larger carriers experience fewer economic restraints and possess a better understanding of regulatory requirements, often facilitated by dedicated back-office staff. Barzel and Allen's (2023) economic property rights perspective falls largely silent on how responding to changes in the regulatory environment relates to firm size; however, larger firms benefit from their resource endowment, allowing them to adapt more effectively to changes in the legal environment. The superior economic flexibility and access to a knowledge base may enable larger carriers to navigate the complexities of new regulations more efficiently than their smaller counterparts,

Larger carriers, given their access to financial resources, legal exposure, and greater understanding of regulatory requirements, are more likely to become compliant with new legislation. I hypothesize that the compliance with AB5 for individual firms will be greater for larger firms than for smaller firms, influencing their proportion of ICs post-implementation. Building on these arguments, I conjecture that:

> **H_3:** Larger carriers in California will be more likely to decrease their proportion of ICs following the implementation of AB5.

Next, I construct a series of synthetic control models to evaluate the hypotheses. Considering the AB5 legislation as an exogenous event mandated by the state, my aim within the model formulation (Chatfield, 1991) is to map the theoretical hypotheses to the estimated parameters (Miller & Kulpa, 2022).

2.4 METHODS

2.4.1 Synthetic Control Method

Comparative case studies are limited in social sciences by the identification of the control group. Finding a suitable control and avoiding bias in selecting the comparison units presents challenges. The Synthetic Control Method (Abadie et al., 2010; Abadie & Gardeazabal, 2003) is a data-driven methodology that alleviates these challenges and enhances the inferential techniques. The synthetic control method builds upon the framework of Rubin's causal model of potential outcomes (Rubin, 1974). Within the context of a potential outcomes framework, causality is conceptualized as a comparison between two hypothetical scenarios: one where individuals have received a particular treatment and another where they have not. This approach places significant emphasis on the effective imputation of missing potential outcomes, i.e., the

counterfactual. This methodological perspective serves as a foundational framework motivating the development of the synthetic control method.

To test the hypotheses, I use a synthetic control estimator to estimate the impact of AB5 legislation on California's truck driver employment dynamics. The synthetic control approach has been called the "most important innovation in the policy evaluation literature in the last 15 years" (Athey & Imbens, 2017, p. 9). After gaining popularity in the economics domain over the last decade, its use within the OM field remains largely nascent (e.g., Chen et al., 2023; Ferreira & Mower, 2023) but offers promising advantages over existing matching methods (Yılmaz et al., 2024). The synthetic control methodology combines features from both matching and difference-in-difference (DiD) (Abadie & Gardeazabal, 2003; Yılmaz et al., 2024). This approach extends classic DiD analysis, which requires the control group to satisfy the parallel trends assumption (Angrist & Pischke, 2009). The synthetic control method relaxes this assumption and relies on the ability to construct a quality synthetic control that minimizes the difference between the treated unit and the associated synthetic control group. In doing so, the weighted combination of the synthetic control provides a better comparison against the treated unit than any single control unit. The synthetic control is evaluated on the ability to mirror the treated unit pre-intervention using both observable covariates and the outcome variable over the length of the pretreatment period.

After establishing the synthetic control in the pretreatment period, the synthetic control method next compares the post-treatment outcome of the treated unit, i.e., California, with the counterfactual synthetic control group. The counterfactual outcome of the treated unit can be imputed using a linear combination of weighted synthetic control units, i.e., synthetic California. Synthetic California is composed of the weighted average of states selected from the "donor

pool" previously. The weights are derived from pre-policy similarities in trucking labor trends before the implementation of the AB5 legislation. I constructed the synthetic control group using a data-driven process composed of the outcome variables from 49 states and the District of Columbia. The match of 'fit' is established on the comparison of pre-treatment trends for California and Synthetic California. Instead of matching individual units, the estimator matches California's pre-treatment observation with a weighted average of observations. Lastly, I use a synthetic control estimator to estimate the causal effect of AB5 legislation on California's truck driver employment dynamics. In the next section, I sketch out the model specification, followed by the results and inference testing for the synthetic control.

2.4.2 Data and Variables

The primary data sample is sourced from the Federal Motor Carrier Safety Administration (FMCSA). The FMCSA is an agency in the Department of Transportation (DOT) that is tasked with monitoring and developing safety standards for commercial motor carriers. The FMCSA maintains records, such as annual census files, using the Motor Carrier Management Information System (MCMIS) to collect comprehensive records (e.g., carrier headquarters, cargo classification, hazardous materials, owned and leased equipment, industries served, etc.). Each annual census file contains over one million records for active interstate carriers and hazardous material shippers (FMCSA, 2023b). Data was collected from census files on carriers from 2016-2023 across all 50 states and the District of Columbia, with the treatment occurring on June 30, 2022. Each census record can uniquely identify an individual carrier via the DOT number (A. Scott & Nyaga, 2019). Within the cargo classification data, drayage drivers can be identified by transporting intermodal cargo. Prior empirical research has been conducted using this data to

identify carrier assets and driver count details (A. Scott et al., 2023). I leverage the census file records and filter the data on active for-hire status carriers.

For the outcome variable of interest for testing H_1, I examine the absolute number of IC drivers. I totaled the count of term leased tractors (TRMTRACT) in the census files for both pre-treatment and post-treatment periods. This identifies the equipment an IC leases to a carrier, i.e., term leased by the entity (MCMIS, 2015). To determine the change in employment dynamics for the ICs related to H_2, I totaled and identified intermodal drivers as either = 1 (independent owner-operators) or > 1 for when employee drivers are hired by a carrier. For H_3, the size cohorts for the carriers are determined based on the total power units (i.e., the number of trucks or tractors) constructed using the owned plus leased tractor counts per carrier. The size cohorts are defined as (1) 1 truck, (2) 2–6 trucks, (3) 7–20 trucks, (4) 21–100 trucks, (5) 101–1,000 trucks, (6) 1,001+ trucks. These size cohorts are consistent with DOT (FMCSA, 2023a) and prior empirical research (A. Scott et al., 2021). To avoid biases from single annual measurements, I use the recommended average size (i.e., years t - 1 and t) to construct the size cohorts for studying economic size-growth relationships (Haltiwanger et al., 2013). I averaged the data in the 2018 and 2019 census files to create and classify steady cohorts and retain the carriers in the subsequent years of analysis. The collected samples of outcome variables were used in the next section to construct a synthetic counterfactual to mirror the California data in the pre-intervention period.

2.4.3 Model Specification

I am interested in evaluating the impact of California's AB5 policy on the treated unit (California) compared to a counterfactual potential outcome in which the policy intervention did not take place. Following the notation from Abadie (2021) , the data consists of $J + 1$ number of

units, where j = 1 is the treated unit, i.e., California, and j = 2, 3, …, $J + 1$ represents the "donor pool" of states for potential comparison. For time T, I assume the T_0 periods are pre-intervention and become treated at $T_0 + 1$. Given j = 1 and $t > T_0$, the observed outcome is $Y_{1,t}$. The estimate for the treatment effect, i.e., the difference between potential outcomes, is defined {j, t} in equation (2.1). Therefore, to evaluate the policy, I need to find the estimate for $\hat{Y}_{1t}^{N}$ when $t > T_0$, the counterfactual potential outcome without intervention. In the absence of an observable outcome without intervention for j = 1, I need to construct the counterfactual for California had there been no policy intervention, $\hat{Y}_{1t}^{N}$.

$$\hat{\tau}_{1,t} = Y_{1,t} - \hat{Y}_{1t}^{N} \tag{2.1}$$

The counterfactual for California is created first with observable data from the pre-intervention period. To find a suitable comparison for the potential outcome of the treated unit, a weighted combination of control units from the "donor pool" is approximated. A data-driven process produces the weights for each control unit (see Table 2.1). This elicits a substantially better fit for the treated unit than any single unaffected unit and avoids subjective researcher bias in constructing the control group (Abadie et al., 2010; Abadie & Gardeazabal, 2003). The vector of weights (i.e., w_j) for the available control units are restricted to both sum to 1 and be nonnegative, these two restrictions are emphasized by Abadie et al. (2010) to avoid extrapolation bias. The nonnegative synthetic control weights are, therefore, a convex combination of the "donor pool" units not affected by the intervention (see equation 2.2). That is, the outcome variable of the treated unit (California) is found within the values of the "donor pool" through interpolation, avoiding extrapolating. The nonnegative weights improve the interpretability and transparency of the counterfactual as a weighted average of control units.

$$\hat{Y}_{1,t}^{N} = \sum_{j=2}^{J+1} w_j Y_{j,t} \tag{2.2}$$

Table 2.1 State Weights in Synthetic California for Term Leased Tractors

State	Weight	State	Weight
Michigan	0.595	Wisconsin	0.049
Missouri	0.135	Florida	0.025
Texas	0.113	Indiana	0.002
Minnesota	0.081		

Notes . The synthetic weight represents the weight assigned by the data-generating process of the synthetic control estimator for each state in the donor pool.

The weights are derived from pre-treatment data independent from the post-treatment outcome. The selected predictors are used to construct the synthetic control in the pre-treatment period. The resulting pre-treatment period of weighted control units best resembles the treated unit on the outcome variable. The predictor means for the synthetic control compared to the treated unit are presented in Table 2.2. The synthetic control is determined by minimizing the root mean squared prediction error (RMSPE) with respect to the treated unit in the pre-intervention period (Abadie et al., 2010). Further, the synthetic control is then estimated into the post-treatment period, i.e., t > 0, representing the treated unit had the treatment not taken place. Therefore, the estimated treatment effect for the synthetic control estimator is written as equation 2.3.

$$\hat{\tau}_{1,t} = Y_{1,t} - \sum_{j=2}^{J+1} w_j Y_{j,t} \tag{2.3}$$

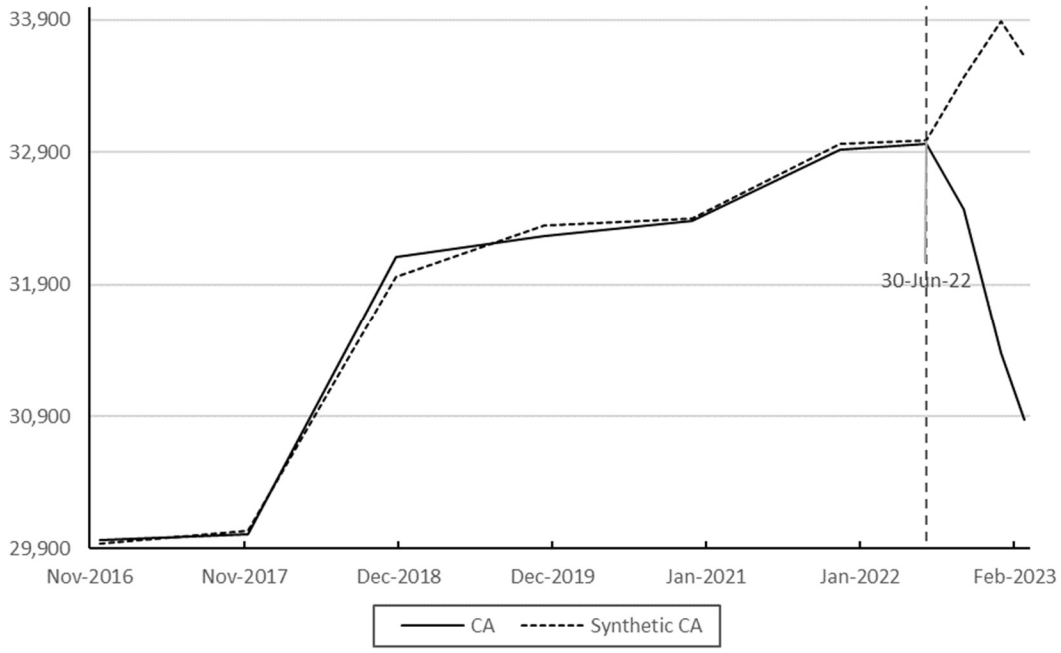
Table 2.2 Term Leased Tractor Predictor Means

	Californa	Synthetic California
Total Term Leased Tractors 2017	30,012	30,035
Total Term Leased Tractors 2019	32,269	32,350
Total Term Leased Tractors 2021	32,920	32,961

Notes . The pre-treatment values of the total term leased tractors for each state in the donor pool are averaged for the 2016-2022 period.

In this study, a negative (positive) treatment effect, i.e., - $\hat{\tau}_{1,t}$, indicates a decrease (increase) in the number of term leased tractors in California compared to synthetic California. To support the validity of the synthetic control, the pre-treatment period trends are assessed for trajectory fit (Abadie, 2021). Matching on a larger number of pre-treatment periods "allow us to control for the heterogeneous responses to multiple unobserved factors" (Cunningham, 2021, p. 518) and avoid overfitting (Yılmaz et al., 2024). As presented in Figure 2.2, the 2016-2022 pre-treatment trends for total term leased tractors in California are very similar to those of synthetic California. As illustrated in the figure, the generally positive trend continues for synthetic California but decreases sharply for California following the policy intervention. The abrupt change in both magnitude and direction is with respect to the policy intervention. The synthetic control steps outlined here are repeated for each scenario to test each hypothesis.

Figure 2.2 Trends in Term Leased Tractors: California vs. Synthetic California

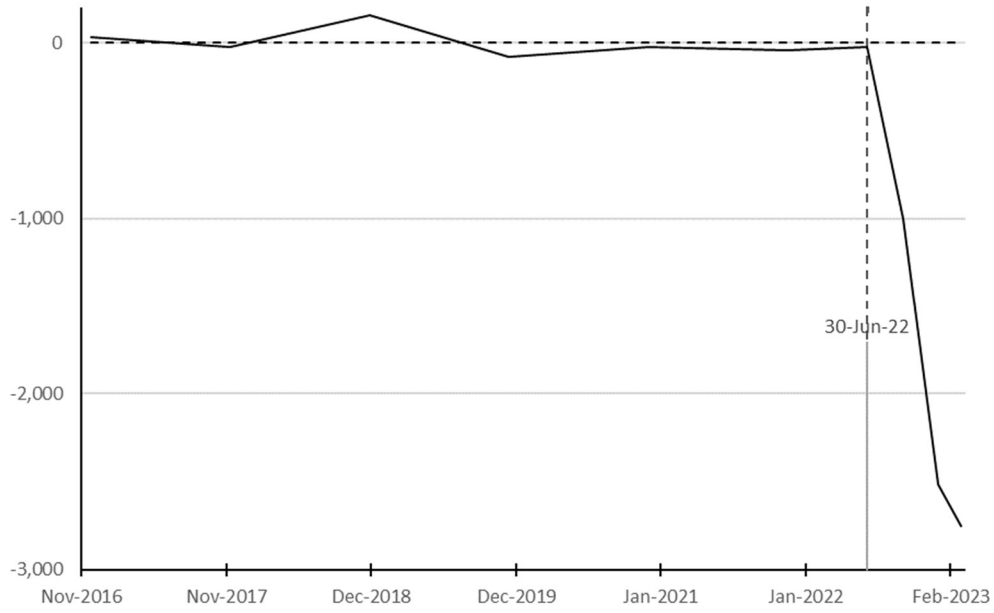


2.5 ANALYSIS & RESULTS

The presentation of the study's findings on the impact of employment on trucking dynamics in California requires several pieces of evidence. First, as presented previously in Tables 2.1 and 2.2, the constructed synthetic control weights and the comparison of predictor means support goodness of fit metrics between the treatment and control group. The visualization of the synthetic control against California's pre-treatment trend is very similar before the policy intervention, see Figure 2.2. Next, we measure the post-treatment effect, i.e., the average treatment effect, or the gap in the two trend lines post-treatment, which is further illustrated in Figure 2.3. The total count of term leased tractors in California, 9 months after the policy intervention, is 2,753 (8.9%) less than synthetic California. This result is understated, given that the data collection of the MCMIS survey for carriers to update their demographic changes can be delayed (Ryley & Belzer, 2023). Although partial adaptation, the findings provide evidence to

support H_1 with a decrease in term leased tractors for California immediately following the treatment implementation.

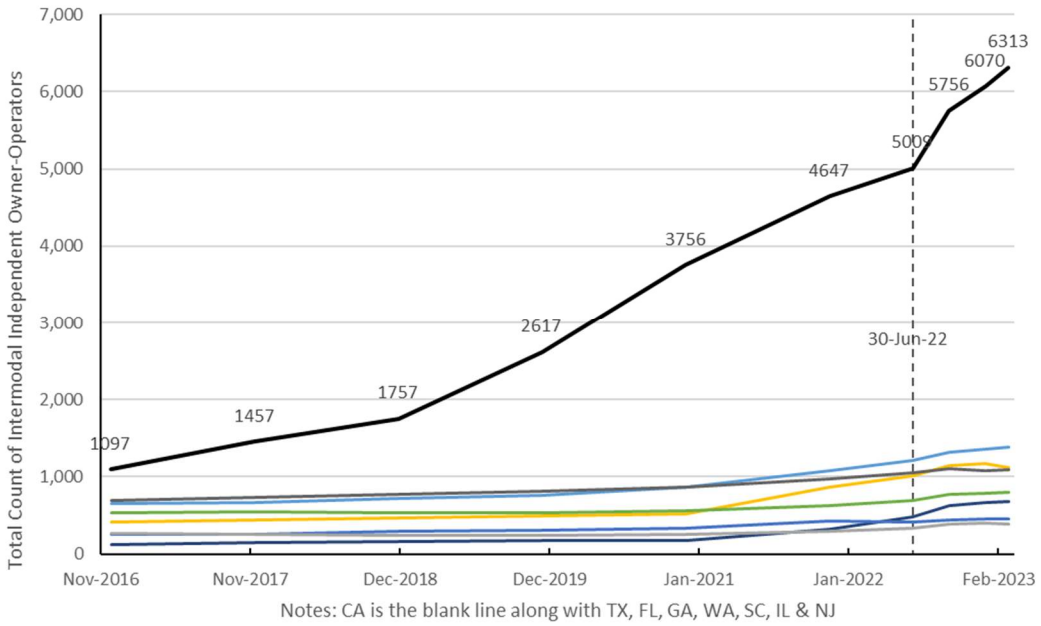
Figure 2.3 Total Term Leased Tractor Gap Between California and Synthetic California



This study further predicted the direction of shifting employment dynamics because of the policy intervention in the intermodal industry. To assess the direction of the employment shift, I look at the intermodal employment trend for both drivers who are carrier employees and those who are independent owner-operators. First, I measure carriers with a single driver, representing the intermodal independent owner-operator. In Figure 2.4, the trend from 2016-2023 for intermodal independent owner-operators (i.e., DOT carriers with total drivers = 1) has steadily increased, with little evidence of a change due to the policy intervention in June 2022. The next 7 largest states (i.e., Texas, Florida, Georgia, Washington, South Carolina, Illinois, and New Jersey) are not close to the total count or trend for intermodal independent owner-operators in California. Therefore, I cannot produce a synthetic control without excessive extrapolation. But, leveraging the model-free evidence (Davis-Sramek et al., 2023) illustrated in Figure 2.4, the policy implementation appears to have had little impact on the trajectory of California's trend for

intermodal independent owner-operators, neither attenuating nor muting the pre-trend trajectory into the post-implementation period.

Figure 2.4 Trend in Total Intermodal Independent Owner-Operators



To assess the alternative, i.e., a shift towards an employee driver model, I check for an increase in the intermodal carrier driver count. The synthetic control estimator was executed for intermodal carriers with more than one driver (i.e., DOT carriers with total drivers > 1). The state-level counts of drivers for intermodal carriers will serve as the "donor pool." The synthetic control weights for the intermodal employed carrier driver counterfactual are presented in Table 2.3. The predictor means for the synthetic control, and that of California, can be found in Table 2.4. The comparison between the treated group and the control group values in this table demonstrates that the weights assigned produce similar means (i.e., fit) in the predictor variable.

Table 2.3 State Weights in Synthetic California for Employed Intermodal Drivers

State	Weight	State	Weight
Florida	0.564	Georgia	0.035
Tennessee	0.281	Wisconsin	0.026
Nebraska	0.072	Iowa	0.022

Notes. The synthetic weight represents the weight assigned by the data-generating process of the synthetic control estimator for each state in the donor pool.

Table 2.4 Intermodal Employed Driver Predictor Means

	Californa	Synthetic California
Total Intermodal Employed Drivers 2017	20,512	20,745
Total Intermodal Employed Drivers 2019	24,808	24,783
Total Intermodal Employed Drivers 2021	23,859	23,864

Notes. The pre-treatment values of the employed drayage drivers for each state in the donor pool are averaged for the 2016-2022 period.

As done previously, Figure 2.5 plots the pre-and post-intervention trend lines of California and synthetic California. The pre-intervention trends mirror closely, representing good fit, before the two trends diverge following the policy implementation. The total gap between the driver count for California and synthetic California is quantified visually in Figure 2.6. Both figures 2.5 and 2.6 support H_2, illustrating a shift in carrier employment for intermodal drivers post-policy implementation. This shift coincides with a continued positive trend in the count of intermodal independent owner-operators as well. Taken together, the driver count continued to increase for independent owner-operators, as it had before the policy, and a four-year flat trend in the employee carrier driver count became sharply positive after the policy.

Figure 2.5 Trends in Total Employed Intermodal Drivers: California vs. Synthetic California

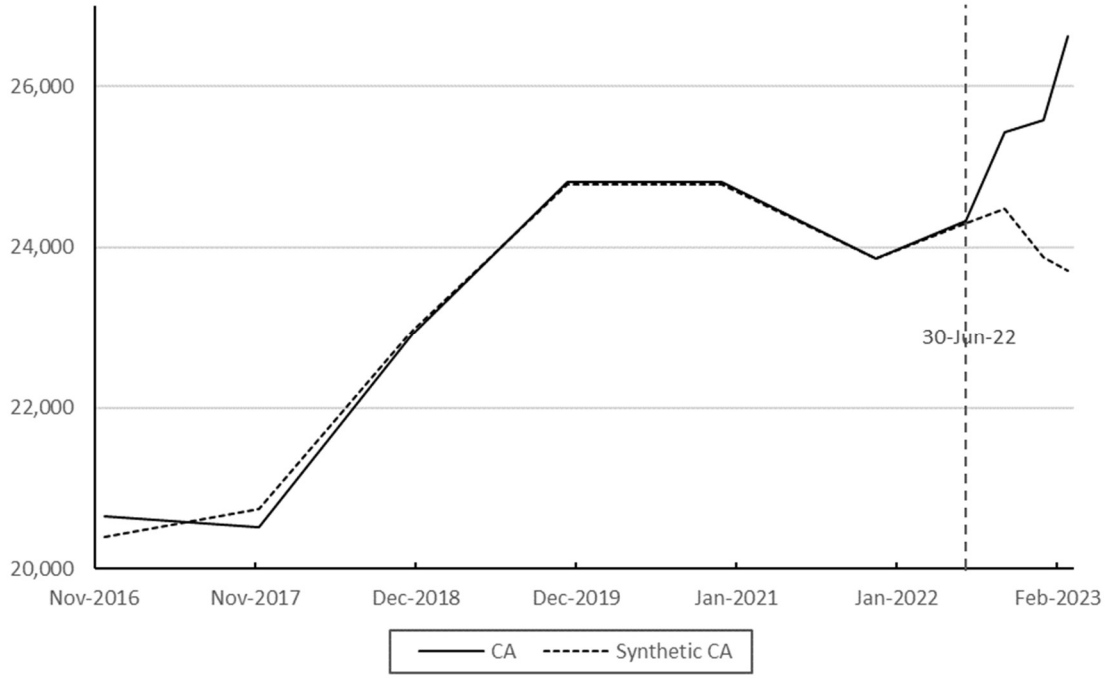
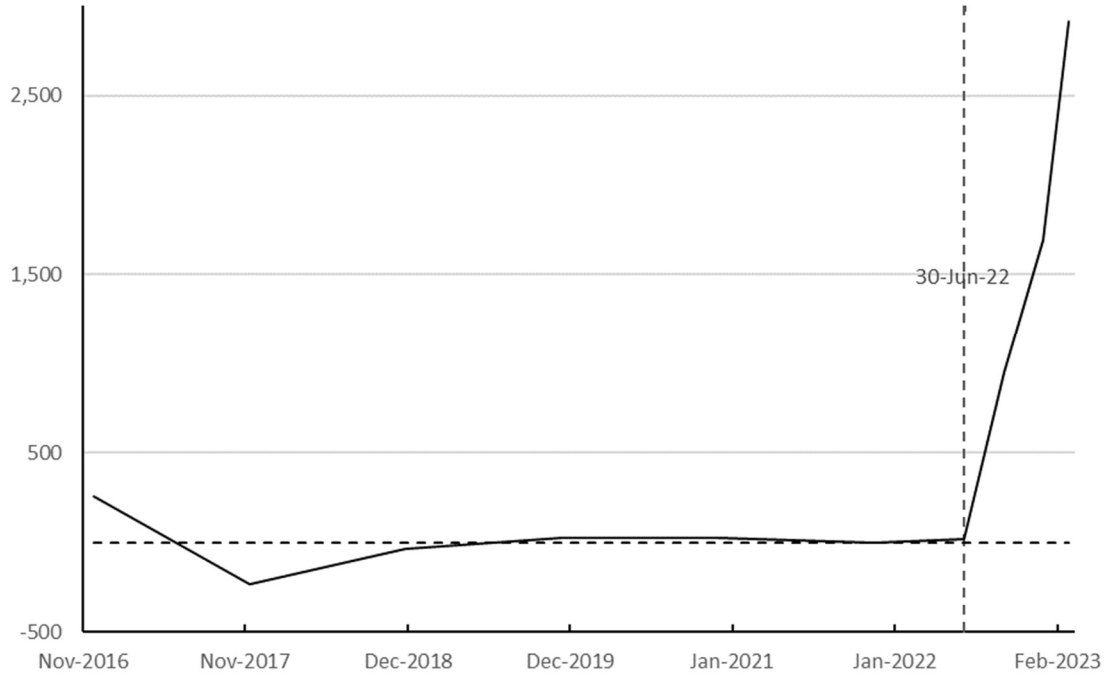


Figure 2.6 Total Employed Intermodal Drivers Gap Between California and Synthetic California



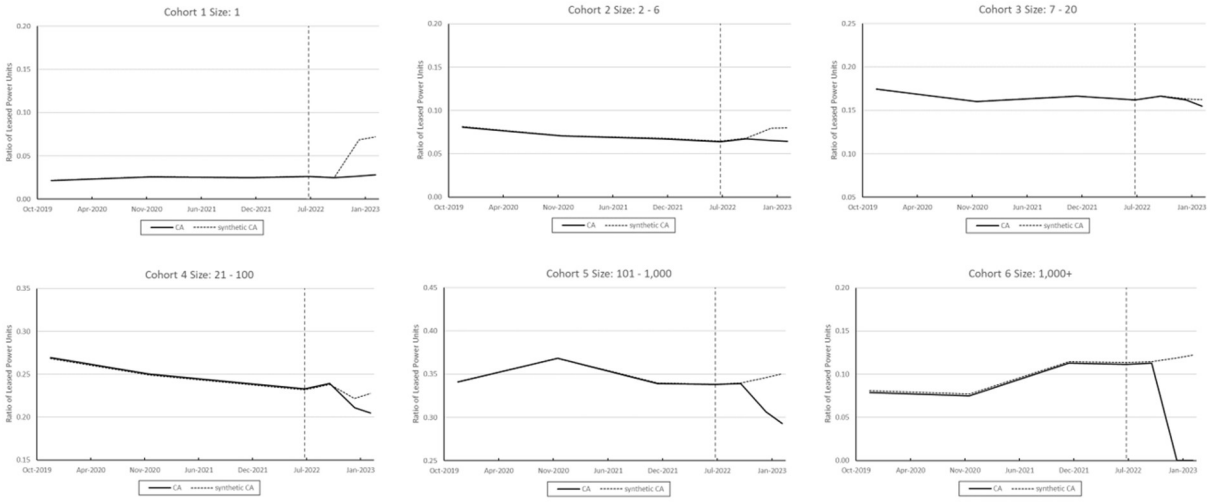
To test the third hypothesis, synthetic controls were created separately for each of the six size cohorts constructed. The weights for each synthetic California are presented together in Table 2.5. The trends pre-intervention for California and each synthetic California match closely. However, post-AB5, the trends for the proportion of ICs in California do not substantially deviate for the smaller cohorts, as illustrated in Figure 2.7. The three largest cohorts suggest larger decreases in the proportion of ICs compared to the synthetic California until Cohort 6 reaches full compliance. This finding supports hypothesis 3, which had expected more adaptability in the larger firms.

Table 2.5 State Weights in Synthetic California for Size Cohorts (measured by proportion of ICs)

State	1 Truck	2-6 Trucks	7-20 Trucks	21-100 Trucks	101-1,000 Trucks	1,001+ Trucks
West Virginia	37.6%	43.3%	1.5%			
Tennessee						34.9%
Massachusetts			2.1%	33.7%		
Delaware	33.3%					
New Mexico	17.1%	19.6%	22.6%	2.0%		
Idaho				20.4%	2.3%	
Alaska			18.3%	2.1%		
Minnesota					1.4%	18.2%
Nebraska			12.5%		1.8%	
New Hampshire			5.4%		11.3%	
Arizona			10.7%	1.1%	1.6%	
Hawaii				9.9%		
District of Columbia		9.8%				
Vermont		6.6%		7.4%		
Montana			1.6%		6.5%	
Washington				1.3%	6.2%	
Alabama					2.5%	5.8%
Georgia					1.4%	5.8%
South Carolina					1.4%	5.8%
Oklahoma					1.4%	5.8%
Louisiana					5.1%	
Kansas					4.7%	1.1%
Wyoming	4.6%		1.5%	2.5%	4.4%	
Maine		4.6%	1.1%		3.6%	
Mississippi					1.6%	2.9%
Wisconsin					2.1%	2.7%
North Carolina					2.6%	
Colorado					2.4%	
New York					1.8%	2.2%
North Dakota				2.1%	2.1%	
Virginia					2.1%	1.4%
Iowa					2.1%	
Utah			1.9%		1.7%	
South Dakota			1.3%		1.9%	
Maryland					1.3%	1.8%
Nevada					1.7%	
Kentucky					1.6%	
Texas					1.6%	
Oregon			1.4%		1.5%	
Connecticut			1.2%		1.5%	
Arkansas					1.5%	
Missouri					1.4%	
Michigan					1.3%	1.2%
Florida					1.3%	
Pennsylvania					1.3%	
New Jersey					1.2%	
Rhode Island		1.1%			1.1%	
Indiana					1.1%	

Notes . The synthetic weight represents the weight assigned by the data-generating process of the synthetic control estimator for each state in the donor pool > .01.

Figure 2.7 Trends in Each Size Cohort (by proportion of ICs): California vs. Synthetic California



1 Each output is scaled to a range of .20

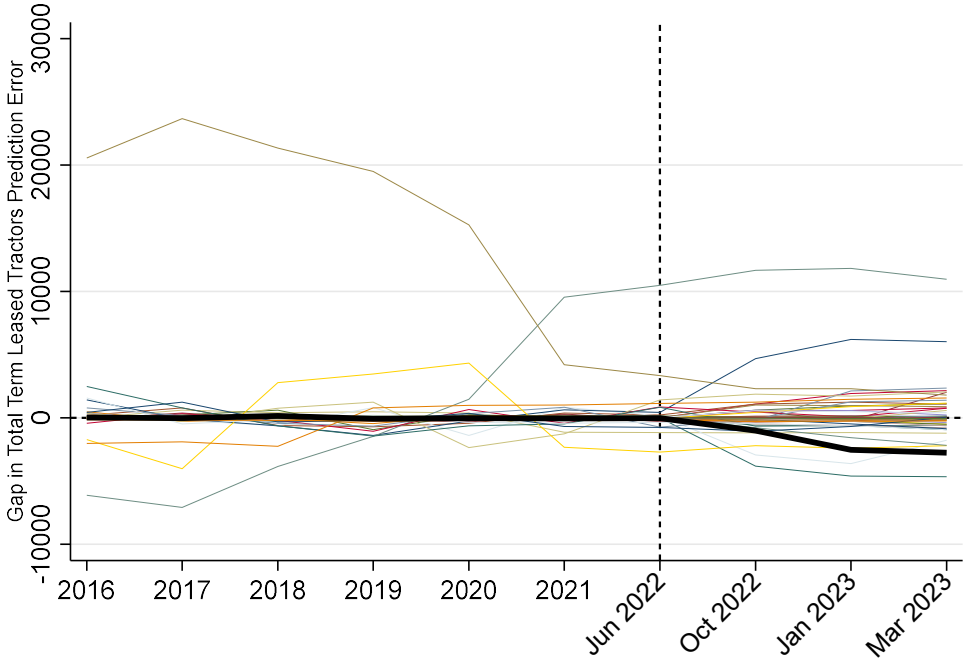
2.5.1 Inference and Placebo Tests

To further evaluate the findings presented above, several steps were taken to test whether the effects observed are spurious. One challenge to the findings is whether there was anticipatory behavior leading up to the Supreme Court's decision not to review the appeal. The nature of the legislation required a significant change to the existing status quo in organizational structure. Both options for ICs carried material adjustment costs to reposition for either the new employer or for a driver becoming established as an independent owner-operator. Coupled with a two-and-a-half-year legal injunction, there was little incentive for any drastic changes prior to the policy becoming law, establishing exogenous variation for the policy intervention. The lack of anticipatory behavior is evident in the data illustrated in Figure 2.2, where the trend is positive for several years before turning in the opposite (negative) direction at the time of the legislation.

Further, placebo tests are conducted to assess the significance of the findings using permutation methods. A synthetic control for each state is taken iteratively to assess the estimated effect of AB5 on the term leased tractor counts. Each iteration replaces California into

the “donor pool” and considers if the implementation of AB5 had taken place for a different state. The process will produce a synthetic control for each state and measure the Root Mean Squared Predictor Error (RMSPE) gap for both pre- and post-implementation, as recommended by Abadie et al. (2010). By comparing the rank of the treatment effect to each placebo effect, a p-value can be derived for a traditional statistical assessment (Yılmaz et al., 2024). Figure 2.8 displays each run, and California is superimposed as the dark line. The RMSPE for each state represents the average of the root squared discrepancies in the term lease tractor counts for a given state and its respective synthetic control, that is, the gap between each line and zero.

Figure 2.8 Total Term Leased Tractors in California and Placebo Gaps in all Control States (full sample)

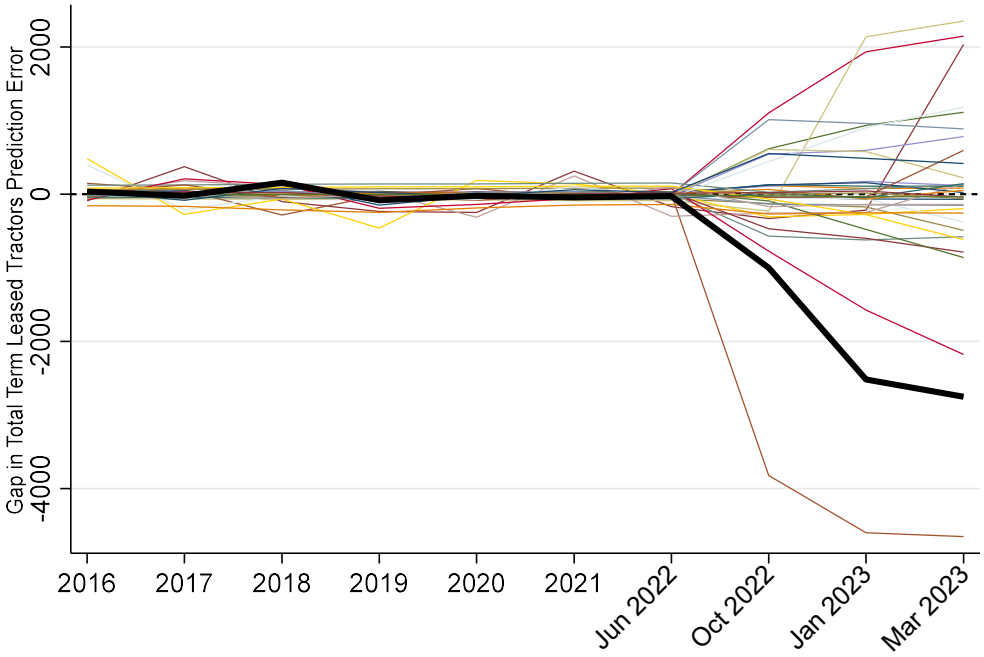


Notes: CA black line. Control states other lines.

The states with very poor fitting synthetic control groups in the pre-AB5 period have larger gaps in the pre-AB5 period. As Figure 2.8 indicates, the pre-AB5 period does not produce a close fit for all states with a convex combination of the term leased tractor counts from the other states in the “donor pool.” The lack of a good pre-implementation synthetic control, i.e., small

RMSPE, prevents an accurate counterfactual from being produced in the post-AB5 period. Given a large pre-AB5 RMSPE, any gap in post-AB5 between a state and related synthetic control would be spurious, given the lack of fit between the two. Limiting the pre-AB5 RMSPE level allows for comparing states with similarly fit synthetic controls (Abadie, 2021). Abadie et al. (2010) advise several iterations, dropping various multiples of poor fit. I then excluded states with 5 times the pre-AB5 RSMPSE of California; see Figure 2.9.

Figure 2.9 Total Term Leased Tractors in California and Placebo Gaps in 34 Control States (discards states with pre-AB5 RMSPE 5x higher than California's)



Notes: CA black line. Control states other lines.

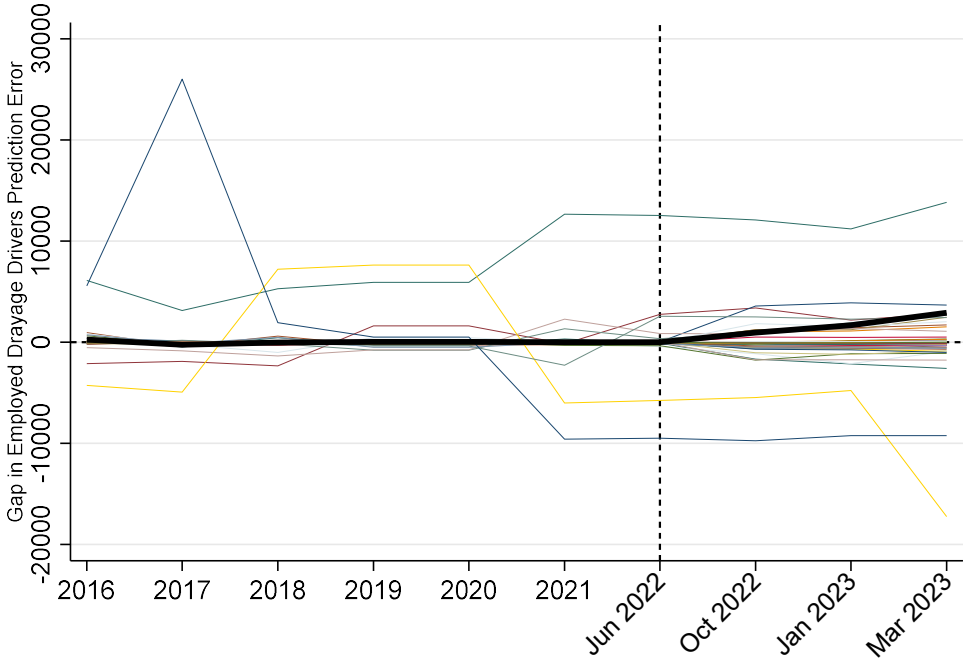
Figure 2.9 has removed states with poor pre-AB5 fit and retains California with 34 control states. As seen in the figure, California has a very unusual distribution post-AB5. The single state with a larger decrease post-AB5 trend is North Carolina. However, a single carrier moved their domicile from the state because of a merger[12] days after AB5, accounting for 94.3% of the

[12] XPO Logistics sold their intermodal business to STG (O'Neal, 2022).

decrease in the total term leased tractor count in the post-AB5 period. In comparison, the negative trend in California, however, because of AB5, is attributed to hundreds of carriers updating their Census files. Considering the remaining 33 control states, the probability of California having the gap found in the data through a randomly generative process is 0.03 (p-value < 0.05).

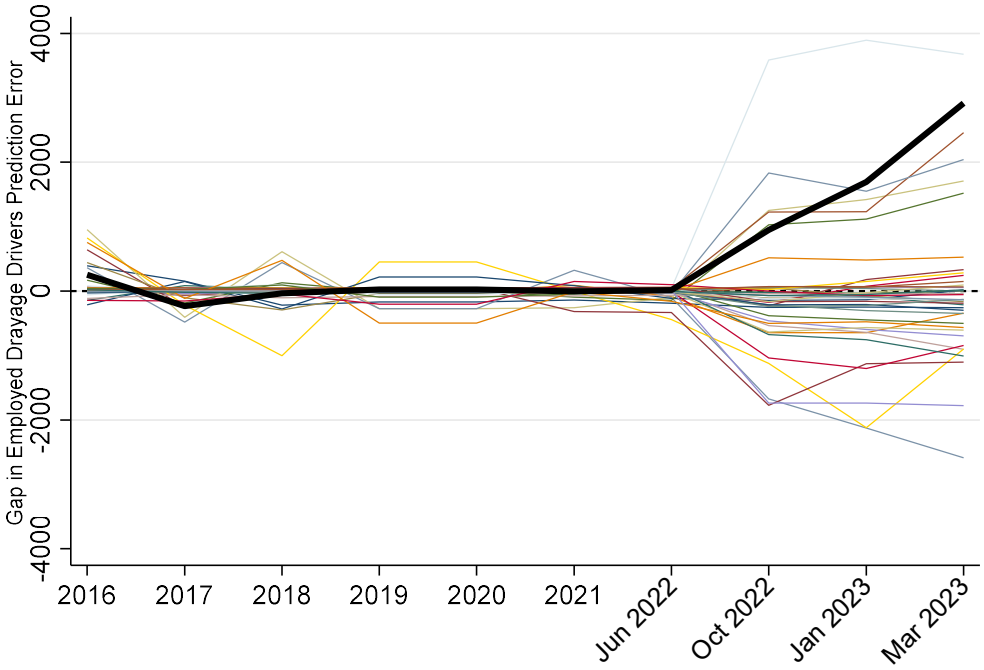
The placebo run of permutations for my second hypothesis mapped the synthetic controls for each state's total intermodal employed driver count. Figure 2.10 displays each run, and California is superimposed as the dark line. To assess states with similar pre-AB5 RMSPE, I again drop states with more than 5 times the RMPSE of California. Illustrated in Figure 2.11, California has a distinct positive distribution post-AB5. Again, a single state with a larger increase post-AB5 trend is Ohio, the other end of the aforementioned merger. With 42 remaining control states, the probability that California has the largest positive gap found in the data is 0.02 ($p < 0.05$).

Figure 2.10 Total Intermodal Employed Drivers in California and Placebo Gaps in all Control States (full sample)



Notes: CA blackline. Control states other lines.

Figure 2.11 Total Intermodal Employed Drivers in California and Placebo Gaps in 42 Control States (discards states with pre-AB5 RMSPE 5x higher than California's)



Notes: CA black line. Control states other lines.

2.6 DISCUSSION

This paper explores how changes in legal property rights affect the distribution of economic property rights, leveraging California's AB5 legislation which effectively removed ICs within the trucking industry. I used a synthetic control method to estimate the treatment effect, comparing the actual outcome in California post-intervention to the counterfactual potential outcome of the synthetic control. In doing so, I identified a causal relationship between the employment legislation and the determinate organizational structure of the trucking industry.

Given the long period of legal uncertainty leading up to the intervention, I found a clear change in the direction and magnitude of the trend in California's employment dynamics. The findings illustrate decreased ICs and a clear shift towards a carrier employment model for intermodal truck drivers in California. There was evidence for size effects only when approaching the largest size cohorts. The identification strategy did not include new entrants after 2018; therefore, the findings are only indicative of established firms that had remained active in the data for the years 2018 to 2023. Collectively, the findings offer direct evidence of the impact of the employee classification policy on the employment dynamics within truck transportation. This paper provides an initial evaluation of the California legislature on the misclassification of independent contractors and offers details on the implications for the distribution of economic property rights.

2.6.1 Theoretical Contributions

In terms of theoretical contributions, this study advances a single theoretical framework that incorporates previous perspectives based on Barzel and Allen's (2023) economic property rights programmatic theory (Cronin et al., 2021). Consolidating prior perspectives advances unit theory through empirical support and scope (Wagner & Berger, 1985). This is accomplished across

multiple theoretical virtues, such as the extension of the explanatory ability (Thagard, 1978), addressing concerns to existing theory (Wagner & Berger, 1985), and unification (Keas, 2018). In addition, this study explores how changes to legal property rights, from legislation, cascade to affect the distribution of economic property rights, which are the individual's ability to exercise choice over an asset (Barzel & Allen, 2023). The findings have the potential to provide valuable insights into the factors driving firm boundaries (Makadok et al., 2018) and vertical integration (Williamson, 2000). Third, I extend Barzel and Allen's (2023) perspective on economic property rights, leveraging a novel context to explore legislation that may not become implemented, introducing a form of legal uncertainty to economic property rights as AB5's future remained uncertain for over two years before becoming enforceable in California (Kingston, 2022). This research contributes to understanding the intricate interplay between legal and economic property rights in shaping the range of organizational structures and the allocation of decision-making authority within firms.

This framework, considering the bundle of economic property rights (Foss & Foss, 2015) and decision-making ability regarding their asset (Barzel & Allen, 2023), can be applied to reconcile prior assorted empirical findings, see Table 2.6. For example, Baker and Hubbard (2004) found that monitoring technology incentivized the carrier model. Carriers installed monitors on the company-owned assets, i.e., trucks, thereby reducing the economic property rights of drivers in order to control and impact the behavior of truck drivers. The increased hours of service (HOS) violations by independent owner-operators during periods of high spot prices, identified by Scott and Nyaga (2019), illustrate an individual's behavior to maximize their economic profit by exercising their opportunity set of economic property rights (Foss & Foss, 2022). Further results of Miller et al. (2022) exhibit IC behavior prioritizing economic profit over non-contractible

actions. In this scenario, with the control of the asset within the IC's bundle of economic property rights, a carrier does not have the operating authority over the asset or its maintenance. An independent owner-operator's capacity or bundle of economic property rights (Foss & Foss, 2015) includes such activities as soliciting freight from a range of business partners and operational decisions such as vehicle speed, route selection, defensive driving, vehicle maintenance, etc. This theorizing at the individual level allows for variation in how each bundle of economic property rights is exercised and valued, which increases the theory's ability to explain varied empirical findings (Thagard, 1978).

Table 2.6 Reconciling Organizational Structure Theories in Truck Transportation

Study	Existing Theory	Economic Property Rights
Lafontaine and Masten (2002)	Price Determination	Governance structure is a function of the ability to capture additional attributes of economic property rights due to endowments of wealth or human capital.
Nickerson and Silverman (2003)	TCE	To account for externalities across hauls, vertical integration facilitates carrier control, thereby reducing the economic property rights bundle of the driver.
Baker and Hubbard (2004)	Agency Theory	Carriers installed monitors on company-owned assets, such as trucks, thereby reducing drivers' economic property rights to control and impact their behavior.
Windsperger and Jell (2005)	PRTF	Critical intangible assets increase residual surplus, suggesting drivers should capture more economic property rights as their variable fraction of total income increases.
Han et al. (2008)	TCE	Requiring high levels of coordination removes an attribute of operational decision-making for drivers, thereby reducing the economic property rights to coordinate assets and routes.
Belzer and Swan (2011)	Agency Theory	Reducing supply chain security threats, carriers vertically integrate to increase their control, effectively reducing the economic property rights of drivers.
Edelman and Geradin (2015)	TCE	Technology, such as software platforms, increases the utility of the existing bundle of economic property rights by improving information efficiency and resource allocation.
Miller et al. (2018)	Rational Choice	Safety behaviors (e.g., HOS violations and unsafe in-cab operations) are actionable attributes for an owner-operator's given opportunity set.
Scott and Nyaga (2019)	Rational Choice	Maximizing their economic profit is an individual's behavior to exercise their opportunity set of economic property rights.
Miller et al. (2022)	PRTF	Independent contractors prioritize economic profit over non-contractible actions (e.g., vehicle maintenance).

2.6.2 Managerial Implications

Lastly, there are contributions to the managerial implications for evaluating the impact of California's AB5. To date, the elimination of the subcontracted IC model in the trucking industry has been held up in court. The state judiciary has responded that the law does not impact the

"rate, routes, or services" argued in the injunction filed by the California Transportation Association (CTA) (Kingston, 2023, para. 22). The findings in this study align with California's judiciary in that the decline in term leased tractors roughly mirrored the increase in employed carrier drivers in magnitude. This indicates a shift in employment dynamics toward a carrier employee model and not the catastrophic decline predicted in California's overall trucking capacity (Swaim, 2023). Following similar legislation in other states, managers should anticipate ICs being absorbed into their operation and the costs associated with adding drivers. The results can also inform policymakers by noting that larger firms are more likely to comply, and more controls or resources may need to be shifted to motivate smaller firms and curb carrier agency.

The results of this study provide evidence of outcomes from classification legislation, should similar regulations be adopted in other states. Several state legislators have noted they are waiting to learn from California's experience addressing misclassification (Prince, 2022) or are currently being challenged in court (such as Wisconsin [([Kingston, 2024b])]). A benefit to federalism is that it allows states to implement their solutions via state legislation. Other states can apply parts of California's legislation, how they were adopted or enforced, and perhaps approved upon. For example, California's AB5 (and eventually AB2257) included 109 exemptions (Micheli, 2020), as it was broadly written and received wide-ranging pushback from various industries.

Operations in other states have already been impacted by AB5, as California's laws affect drivers hauling interstate loads originating in California. Although AB5 aimed to improve labor conditions and protect drivers' rights, it had broad implications for the industry. Further research needs to be conducted on the potentially destabilizing impact of this legislation on truck driver labor in California amid an ongoing driver shortage (Phares & Balthrop, 2022). A reduction in

available labor would further aggravate company efforts to move freight, for example, from the ports to the rest of the country (Whitaker, 2021). Truck drivers leaving the state impact the overall capacity, and within California, there are further complications due to pending environmental legislation (i.e., the Zero-Emission Vehicle program) targeting cleaner emissions for heavy trucks in California. Future research should consider the capacity, rates, and productivity for the long-term impact of this legislation. For example, as carriers absorb ICs into their operations, a group found to have poor safety records (Cantor et al., 2013; Miller et al., 2018), additional liabilities should be considered. Further research can explore whether the reduced barriers to coordination vis-à-vis vertical integration reduce externalities and improve safety metrics for firms in California's trucking industry.

The shift to a carrier employment model for truck drivers affects the economic property rights, such as flexibility and autonomy, the truck drivers previously enjoyed as ICs (Barzel & Allen, 2023). Truck drivers value control over their work hours, loads, and routes (Castillo et al., 2022). The transition to stricter schedules and increased oversight may impact productivity and job satisfaction despite the access to employer-provided benefits.

2.6.3 Conclusion

In conclusion, the fissuring of the workplace has created a gap between evolving employment dynamics and legal workplace protections (Weil, 2014). The AB5 legislation represents an early mover measure by California to define the parameters of employment relationships. AB5 considerably impacted truck drivers in California, disrupting the governance structure that had existed for decades as a business model, i.e., subcontracted ICs in the trucking industry (Leonard & Cosgrove, 2019). The new employment dynamics pose significant challenges for trucking companies and truck drivers navigating the complexities of the new

legislation as the pathways to compliance come with significant transaction costs amid legal uncertainty. This study's theoretical and empirical findings provide insight to other industries and policymakers on how this and other classification legislation impacts employee dynamics.

Drawing from Barzel and Allen's (2023) framework, regulatory interventions can be designed to curb opportunistic behavior by contracting entities and promote fair and transparent exchanges. The results of AB5 to date are mixed, as it has yet to be enforced, leaving firms that absorbed the costs of compliance at a cost disadvantage to those operating under the prior model (Hawes, 2024; Kingston, 2024a). In conclusion, independent contracting presents both opportunities and challenges in contemporary labor markets. However, the prevalence of negative externalities underscores the importance of regulatory interventions to safeguard workers' rights and mitigate exploitation. Building on insights from scholars such as Katz and Krueger (2019) or David Weil (2014), regulatory frameworks must evolve to address the unique industry dynamics identified in the transportation industry.

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CHAPTER 3 – LOCAL LABOR MARKET EFFECTS FROM MILLION DOLLAR PLANTS (MDPs)

3.1 INTRODUCTION

Global dynamics have undergone significant changes in recent years. This is partly due to increased disruptions to supply chains (Flynn et al., 2021). Whether the disruptions are a pandemic (Moosavi et al., 2022), geopolitical conflict (Sodhi & Tang, 2021), trade wars (Roscoe et al., 2020), or terrorist activity (Deng, 2024), the shift has resulted in a resurgence of U.S. manufacturing initiatives (Handley, 2023). To further support this trend, the Biden administration prioritized domestic manufacturing with bills, such as the Infrastructure Investment and Jobs Act of 2021, CHIPS and Science Act of 2022, and the Inflation Reduction Act of 2022, to strengthen domestic supply chains (The White House, 2022).

As firms reevaluate their supply chain strategies, the opening of large plants, primarily by multinational corporations, becomes a focal point in this change (Keilman, 2023; Rabouin, 2022). While the direct employment impact of these plants has been widely studied (Decker et al., 2022; Dunne et al., 1989), there remains a critical gap in understanding the spillover effects to local labor markets in complementary industries like transportation and warehousing. Practically, obtaining sufficient labor for the new plant alone has been difficult to secure (Obando, 2023). Beyond hiring workers at the new facilities, it's critical that local labor markets have the capacity to staff ancillary operations to support large plants, such as warehouses that provide manufacturing support (Keilman, 2023). Staffing for warehouse positions has also struggled amid the rapid growth in employment numbers, which have tripled since 2010 (U.S. Bureau of Labor Statistics, 2024a). Thus, the opening of large facilities comes with significant concerns of labor shortfalls (Guilford, 2022) to keep up with the increasing economic activity. Policymakers have a vested interest in understanding such effects because they often provide

large incentives for building new plants. Thus, this study explores labor spillover effects associated with large plant openings and analyzes cascading employment to local labor markets in the supply chain. By examining these effects, the study explores how shifts in demand affect labor supply dynamics, such as trucking capacity and other critical logistics operations (Miller et al., 2024).

The interaction between industry activity and the logistics workforce has not been sufficiently explored (Carpenter, Dudensing, et al., 2022) despite the theoretical and practical importance of these linkages. The interaction is sizeable, considering domestic manufacturing accounts for 59.3% of for-hire trucking ton-miles, and warehousing plays a crucial role in facilitating the flow of goods within a supply chain (Miller et al., 2024; U.S. Census Bureau, 2017b). Many establishments that are not involved in manufacturing are also engaged in secondary activities as major shippers (U.S. Census Bureau, 2022). Given the economic significance of logistics sectors, opening a new plant may create additional demand and labor increases in the warehousing and truck transportation sectors. However, warehouse workers may be attracted to jobs at the new manufacturing plant as these jobs generally offer higher pay relative to warehouses (U.S. Bureau of Labor Statistics, 2024c, 2024d). Likewise, plants may poach employees from for-hire trucking firms to work for their private trucking fleets, which tend to offer better pay and more time home (Farris & Pohlen, 2008; A. Scott et al., 2024). Consequently, it is theoretically unclear whether there are employment spillovers from plant openings to trucking and warehousing payrolls at local businesses.

The opening of large plants by multinational corporations serves as the event through which I examine the spillover effect on local labor markets, extending beyond the immediate boundaries of the facilities themselves. To examine the labor spillovers, I leverage a dataset initiated by

Greenstone et al. (2010) using “Million Dollar Plants” (MDPs). Their identification strategy leverages the site selection announcements of both the winning county chosen for the new industrial facility and the runner-up county that had advanced through an extensive vetting process but was not selected (Bloom et al., 2019). The runner-up county provides a counterfactual, having economic trends and characteristics similar to those of the winning county prior to the plant opening (H. Kim, 2020). By comparing outcomes between the counties before and after the plant opening, this quasi-experimental research design allows for causal identification of the plant's local labor market impacts, overcoming issues of endogenous selection on unobservable county characteristics (Atanasov & Black, 2016).

Through a difference in difference analysis, the results show counterintuitive evidence of spillover effects from MDPs on the local labor market. The effects differ for the transportation and warehousing industries and are moderated by the size of the MDP. Neither transportation nor warehousing experienced positive labor spillovers from the MDP on average. However, the relationship between the county with the MDP on transportation employment was moderated by the size of the MDP, such that the increase in transportation employment is statistically significant with increases in plant size.

This research contributes to our understanding of how million-dollar plant openings cascade through the local labor market, influencing employment patterns, employment patterns, and skill demands in the transportation and warehousing industries. This study makes several contributions to theory and practice. It extends the business dynamics literature by (i) establishing boundary conditions to contextualize the direction of labor spillovers to logistics and supply chain management (L&SCM) industries and (ii) changing the unit of analysis to the county level (Makadok et al., 2018), where prior studies have been aggregated at the state or

national level (Allen, 1977). The rigorous empirical identification gives greater confidence in the veracity of the estimated effects, which, when coupled with the predictions being grounded in existing theory, gives confidence in both empirical and theoretical identification. Our results provide nuanced insight into the local labor dynamic impacts from both small and large MDPs on their incumbent establishments for managers and policymakers. The local labor market dynamics extend beyond the MDP facility itself and differ by the size of the MDP for both the warehousing and trucking industries. Understanding these labor dynamics is critical for incumbent L&SCM managers and policymakers to anticipate workforce challenges and mitigate supply chain disruptions related to the MDP. This additional labor demand on local logistics industries would intensify the existing struggle warehouses and trucking companies are experiencing in finding labor (Keilman, 2023; Obando, 2023).

The essay is organized in the following manner. In the next section, I review relevant streams of literature. Then, I formulate the theoretical perspective for developing hypotheses. Third, I describe the research design, including the variable construction and econometric approach for testing the hypotheses. Then, I present the results and post-hoc analysis. Lastly, I present theoretical and managerial contributions, concluding with limitations and directions for future research.

3.2 LITERATURE REVIEW: SPILLOVER RESEARCH

3.2.1 Spillovers in Economic Literature

The term ‘spillover’ has been used broadly in the academic literature. In economic terms, a spillover refers to an event from one entity or economy impacting another (Dupor, 2023). A spillover can be positive or negative and occur at varying levels. The literature on labor spillovers from economic activity touches on various aspects, whether from labor earnings,

structure, or employment. For example, organizational factors, such as limited promotion opportunities, have been found to influence labor market career spillovers (Bianchi et al., 2023). Due to information frictions (e.g., lack of transparency or communication) and structural challenges, labor spillover effects have been discussed related to minimum wage, unionization, and wage inequality (Card, 2022; Derenoncourt et al., 2021; Fortin et al., 2021; Nanos, 2023). Greenstone et al. (2010) studied increases in total factor productivity through agglomeration spillovers. However, there has been limited research within the supply chain context. A few examples are knowledge spillovers within buyer-supplier relationships in high-tech sectors (Isaksson et al., 2016), vertical spillovers on firm-level productivity (Serpa & Krishnan, 2018), financial spillovers to customers or suppliers (Hofmann & Sertori, 2020), legitimacy spillovers from supplier sustainability incidents (Mateska et al., 2023), and spillovers through a supply network from natural disasters (Carvalho et al., 2021; Wiedmer et al., 2021).

A rich body of economic literature has explored spillovers from foreign direct investment (FDI). FDI has been an attractive manner for improving performance and acquiring knowledge (i.e., innovation) through spillovers to domestic firms (Arora et al., 2018; Murata et al., 2014). Multinational corporations play a significant role in driving productivity spillovers, particularly through the mobility of workers who transfer knowledge and skills between firms(Balsvik, 2011; Görg & Strobl, 2005). In developing countries, this process often operates through a demonstration effect, where local firms and workers adopt improved practices and technologies by observing and interacting with international firms. This mechanism has been especially crucial in facilitating the transfer of technology and fostering local innovation (See Teece, 1977). Productivity spillovers have been found to be positive from FDI upstream to suppliers (Javorcik, 2004). Through a meta-analysis, Havranek and Irsova (2011) found vertical spillover effects to

be larger upstream to suppliers than downstream to buyers. Spillovers are not isolated solely within international relationships, as Bloom et al. (2019) identified learning spillovers through management practices from large U.S. plants. The proximity of these establishments allows for exchanges in tacit skills through spillovers in labor flows and knowledge, both of which facilitate learning through imitation. This study builds on this work by examining spillover effects from investment in MDPs to local labor employment in supporting industries.

3.2.2 Spillovers in Logistics Literature

There remains a dearth of literature on local employment propagation spillovers from firm growth (Brown et al., 2017). One study found no impact on local employment from high-growth establishments (Crown et al., 2021). Little evidence is available on the impact on other parts of the economy from successfully attracting a new firm (Moretti, 2010). This represents an opportunity to understand the broader local economic ripple effects of new business investment and applies to policymakers and managers.

There have been studies of labor flows on productivity (Wu et al., 2018) and labor flows between industries (Phares et al., 2025; Phares & Balthrop, 2022), but the specific consequences of supporting industries like transportation and warehousing remain underexplored (Miller et al., 2024). The logistics industry has experienced restructuring in the past decades, with facilities relocating geographically, i.e., moving from concentrated city centers to becoming more decentralized (Kang, 2020). This is related to accessing newer transportation infrastructure, the need for space, and lower taxes (Cidell, 2010). Notably, the location for distribution facilities has moved toward urban outskirts, leveraging lower land costs with larger footprints through economies of scale, which can outweigh the increased transportation costs (Hesse, 2002; McKinnon, 2009).

The agglomeration of firms into regional hubs has positively impacted entrepreneurship via new establishments (Delgado et al., 2016). Agglomeration economics is evident in regional hubs creating a competitive advantage (Porter, 2000) vis-à-vis lower transportation costs (Cidell, 2010) and labor pooling (Sheffi, 2020). This suggests that the location choices of large plants could have spillover effects on transportation and warehousing employment locally, though the relationship remains unclear. Studies highlight that recurring economic activity manifests into supply chain clusters or hubs (Bolumole et al., 2015; Sheffi, 2012). The supply chain clusters represent an industry concentration, whereas the vertical interaction of location determinants between supply chain partners remains an understudied area (Carpenter, Dudensing, et al., 2022). This distinction is important, considering there are few empirical studies on logistics facility location decisions (Kang, 2020). Whereas that literature focuses on why many logistics operations seem to come together geographically, this paper focuses on the derived demand nature of activity from MDPs by identifying localized employment spillovers into transportation and warehousing industries. In doing so, I will contribute to the understanding of labor market dynamics surrounding domestic investment and the interconnected nature of localized supply chains.

3.3 THEORY & HYPOTHESIS DEVELOPMENT

The hypothesis development builds on a rich history in economic literature stemming from agglomeration theories[13]. The concentration of economic activity increases productivity (Bolter & Robey, 2020), whether by creating a competitive advantage (Porter, 2000), lowering the costs of transporting goods (Cidell, 2010), or the availability of labor (Sheffi, 2012). The seminal work of Marshall (1980) defined three mechanisms as the foundation of agglomeration theory: labor

[13] See Glaeser & Gottlieb (2009) and Moretti (2010) for a thorough review of this literature.

market pooling, shared inputs, and knowledge spillovers. Across the three mechanisms, empirical evidence found input sharing to be the most important in determining if companies in two industries co-locate (Ellison et al., 2010). Input sharing has also been described in the literature as a customer-supplier relationship or supplier linkage. Vertical spillovers have been identified in supply chains moving upstream from customers to suppliers (Serpa & Krishnan, 2018). This is consistent with local industry growth propagation originating downstream and flowing upstream (Forni & Paba, 2002), and aligns with the principle of derived demand in logistics, where growth in production activities leads to higher demand for warehousing and transportation services to handle and distribute the resulting increase in activity.

Refining Marshall's agglomeration predictions, the economic returns depend on the stage within the industry life cycle (Potter & Watts, 2011). Positive returns are not found in the later waning stages but exist through the early growth stages. For this study, the MDPs are a large investment and indicative of growth for the focal firm. Further, the opening or expansion of the MDPs translates to increased demand and growth in related freight services and transportation (Carlsson et al., 2021). However, empirical results for agglomeration effects for warehousing remain unclear (Kang, 2020). Although upstream proximity for warehouse locations is necessary for short lead times (Jakubicek & Woudsma, 2011), the empirical evidence is largely undeveloped (Carpenter, Dudensing, et al., 2022). However, some evidence of warehouse growth near manufacturing points to minimize the distance that exists in this supplier linkage (Herbert, 2023). To better serve shippers, transportation providers also adapt their network, leveraging the advantages of localized operations (Marchington et al., 2003; Sornn-Friese, 2005). The opposite has also been found to be true, as logistics providers close facilities when losing business (Carvalho et al., 2021; Solomon, 2023; Stroh, 2024). Taking both perspectives together,

new business activity driven by the MDPs is suggested to support complementary growth in both the warehousing and transportation industries.

Combining these perspectives, I leverage the shared input agglomeration mechanism for industries in supply chain relationships and posit that the forthcoming MDP will have a positive spillover effect on employment in the transportation and warehousing industries.

> **H_{1a}**: The county selected for a million-dollar plant will see an increase in transportation employment.
>
> **H_{1b}**: The county selected for a million-dollar plant will see an increase in warehousing employment.

Building upon the first hypothesis, I further explore the input-sharing mechanism from agglomeration theory with growth in transportation and warehousing employment. Considering that plant size will share some level of correlation to the diversity or variety of required inputs for the MDP, the derived demand from larger plants will be greater than smaller MDPs. This is supported by recent literature linking job gains in trucking (Miller et al., 2024) due to increased demand for freight services (Carlsson et al., 2021). Similarly, larger operations and an increase in the variety of supporting activities and inventory require an increase in warehousing labor (Swink et al., 2020). Therefore, new business activity driven by the MDPs is suggested to support complementary growth in both L&SCM industries.

Studies on the spillover impacts on the local economy from a new establishment are scarce (Moretti, 2010). There remains a gap in understanding the boundary conditions and factors that moderate the presence and magnitude of these spillovers. Examining potential moderators will support developing a more nuanced theory around the contingencies of local economic impact. The size of the plant is a potential moderator, given that spillovers from large firms exist (Keller

& Yeaple, 2009). Considering the fixed costs involved in opening establishments, a larger plant (and hence higher demand) may help justify these fixed costs (Decker et al., 2022). Large plants influence local industry concentration (Holmes & Stevens, 2002), and larger industries are associated with larger employment multipliers (Bivens, 2019; Moretti, 2010). The size of the plant, measured in projected employment, may moderate the impact on transportation and warehousing industries. Larger plants often require more extensive supply chains, frequent shipments, and higher volumes of goods, necessitating more logistical and storage support.

Drawing on these patterns, I hypothesize that the spillover effect of MDPs on local transportation and warehousing employment will be positively moderated by MDP size. Such that larger MDPs generate greater positive spillovers into these industries.

H_{2a}: The size of the MDP positively moderates the relationship between the MDP and the county's transportation employment.

H_{2b}: The size of the MDP positively moderates the relationship between the MDP and the county's warehousing employment.

3.4 RESEARCH DESIGN

3.4.1 Methodological Approach and Causal Identification

This paper uses a difference-in-differences (DiD) approach to facilitate causal identification. To examine the spillover effects of county-level labor, the research design leverages the announcement of MDPs from the corporate real estate journal *Site Selection*[14]. Each published issue of MDP announcements identifies the county where the establishment will be located and details for the runner-up county. However, county-level characteristics can introduce unobserved heterogeneity, impacting the growth outcomes of existing facilities and plant openings. This can

[14] https://siteselection.com/

lead to biased estimated effects in regression models due to omitted predictors. To resolve this identification issue, we have leveraged the rankings reported by profit-driven firms regarding location choices, which help establish a credible counterfactual for assessing what would have happened in the winning counties if the plant opening had not occurred (Greenstone et al., 2010). These counties are not randomly selected but have survived a long vetting process by the firms. This approach builds on the identification strategy used in prior studies (Bloom et al., 2019; Greenstone et al., 2010; H. Kim, 2020; O'Keefe, 2004; Patrick, 2016) to build a county-level counterfactual.

In this manner, I identified the winning site (treatment group) and the runner-up site (control group). The runner-up site provides an appropriate counterfactual[15] to the winning county in the absence of the new establishment opening when conditioning on county-level observables and unobservables through fixed effects for county pair, the time within each pair, and calendar year. The average treatment effect is the change in the outcome of interest before and after the MDP announcement compared to the difference between the winning and runner-up sites (A. Scott et al., 2021).

3.4.2 Timeline

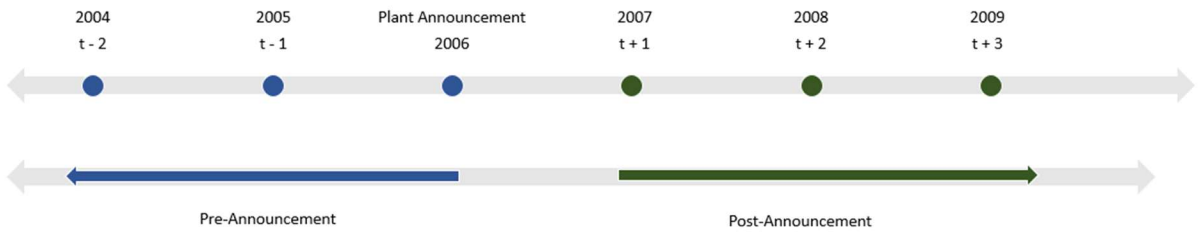
For the given DiD design, I need to establish the timeline for the study to test my hypothesis regarding spillover effects from MDP announcements. I leverage the plant announcement data from the published MDP *Site Selection* articles. Data is collected 2 years prior and 3 years after the year the announcement is published. For the treatment (i.e., selected MDP county), the plant announcement is lagged one year to allow for the construction or expansion . of the facility and hiring to take place (Bruns, 2009). The pre-announcement period includes the two years prior

[15] Greenstone & Moretti (2004) find this methodological approach to demonstrate a valid counterfactual.

and the year the announcement is published. To avoid contaminating the samples, the counties in the control group cannot exist concurrently or within 3 years after the treatment county announcement and were dropped from the sample. That is, the same county cannot be the treatment for one MDP pair and the control for another. Further details are provided in the following sample section.

With the pre- and post-announcement periods discussed above, the timeline for each MDP pair is illustrated in Figure 3.1. I identify the pre-treatment periods as the 2 years prior to the announcement and the year of the announcement itself, a total of 3 years. The post-treatment period consists of the 3 years post-MDP announcement. For the example illustrated in Figure 3.1, the MDP announcement is 2006, with 2007-2009 representing the post-treatment period. The winning and losing counties will each have a pre- and post-announcement period. Thus, the DiD design will produce evidence for a causal estimate of the change in the outcome of interest by differencing the difference between the pre-and post-treatment for each pair of winning and runner-up counties.

Figure 3.1 Study Timeline Example



3.4.3 Data Sources

For this study, I leveraged the U.S. Census Bureau's County Business Patterns[16] (CBP) program datasets, an annual series for subnational economic data. The Business Register for the U.S. Census Bureau tracks establishments with paid employees in the United States. The data track employment, payroll, and the number of establishments for businesses by industry and county[17]. The payroll and employment counts are sourced from administrative records and are not subject to sampling error (U.S. Census Bureau, 2023b). The series is useful for studying economic changes over time for geographic areas and has been used in prior studies on labor markets (Xu, 2023) and supply chains (Thilmany et al., 2021).

3.4.4 Sample

Modifying an existing dataset (Bloom et al., 2019; H. Kim, 2020) of paired MDP counties, sourced from *Site Selection* magazine and web searching, I selected those MDP sets with complete county information (e.g., FIPS codes[18]). After review, an initial list of 104 MDP pairs representing 278 counties was identified. In some situations, multiple sites were selected, or multiple alternatives were identified in a given MDP pairing. The MDP pairs range from announcements made in 2000 to 2017. As the data extended two years before the first MDP announcement and 3 years after the last, the sample extended 24 years from 1997 to 2020. Due to economic activity recurring in geographic clusters or hubs (Bolumole et al., 2015; Sheffi, 2012) within the sample timeframe, care was taken to identify overlapping or conflicting counties across pairs. For example, a control group county cannot exist concurrently or within 3 years after the treatment county year announcement (i.e., post-period) of another pair to avoid

[16] https://www.census.gov/programs-surveys/cbp.html
[17] Counties with fewer than 3 establishments are suppressed to protect the identity of individual firms.
[18] FIPS codes are numbers that uniquely identify geographic areas. www2.census.gov/geo/pdfs/maps-data/data/tiger/tiger2006se/app_a03.pdf

coinciding with the treatment. Using the timeline example from Figure 3.1, a control group for another pair cannot overlap with the years 2007-2009, as this is within the treatment period for the sample pair. After removing conflicting pairs of counties, the sample reduced to 85 pairs representing 222 counties.

The labor spillovers of interest from the MDPs are within the logistics industries of truck transportation and warehousing. Employment data for the 3-digit industry codes sourced from the CBP for truck transportation (NAICS 484) and warehousing and storage (NAICS 493) are collected for each county identified as a MDP pair across 6 years, as described previously. The Census Bureau suppresses counties with fewer than three establishments to protect the identity of individual firms. Removing missing data results in a final dataset of 77 pairs with 189 counties for truck transportation and 41 pairs with 97 counties for the warehousing and storage industry[19]. The industrial composition of the MDPs and the year of each announcement can be found in Tables 3.1 and 3.2. The summary statistics for the counties awarded a MDP and the runner-up counties are balanced on observables (H. Kim, 2020), providing further evidence as an informal test for the validity of the counterfactual strategy (Greenstone & Gayer, 2009).

[19] Cidell (2010) notes that the employment data for the warehousing and storage sector is not reliably available at the county level thus reducing the sample.

Table 3.1 Industry Composition of MDP Pairs

Truck Transportation (484)	Warehousing and Storage (493)	3-digit NAICS	Industry Description
3	1	221	Utilities Industries
2	1	311	Food Manufacturing Industries
2	-	312	Beverage and Tobacco Product Manufacturing
1	-	322	Paper Manufacturing
1	-	323	Printing and Related Support Activities Sector
4	2	325	Chemical Manufacturing
3	-	326	Plastics and Rubber Products Manufacturing
1	-	327	Nonmetallic Mineral Product Manufacturing
2	1	331	Primary Metal Manufacturing
2	-	332	Fabricated Metal Product Manufacturing
1	-	333	Machinery Manufacturing
3	1	334	Computer and Electronic Product Manufacturing
18	12	336	Transportation Equipment Manufacturing
1	-	337	Furniture and Related Product Manufacturing
1	1	339	Durable Goods Manufacturing
1	1	488	Support Activities for Transportation
4	-	493	Warehousing and Storage
4	2	522	Credit Intermediation and Related Activities
1	1	523	Securities, Commodity Contracts, and Other Financial Investments and Related Activities
1	1	524	Insurance Carriers and Related Activities
6	4	541	Professional, Scientific, and Technical Services
11	10	551	Management of Companies and Enterprises[20]
4	3	561	Administrative and Support Services
77	41		

Table 3.2 MDP Announcement Year for Sample

Year	Count	Year	Count
2000	4	2009	5
2001	3	2010	8
2002	4	2011	2
2003	5	2012	4
2004	8	2013	5
2005	6	2014	4
2006	3	2015	5
2007	7	2016	1
2008	3	2017	3

[20] Many establishments within NAICS 551 are also engaged in secondary activities as major shippers (U.S. Census Bureau, 2022).

3.4.5 Variables

3.4.5.1 Dependent Variables

The outcome of interest in this study is the county-level employment of either truck transportation (NAICS 484) or warehousing and storage (NAICS 493) industry. The employment data is transformed with the natural logarithm, $LnEmployment_{ijt}$, to increase the interpretability of the coefficient as a semi-elasticity (Törnqvist et al., 1985; Wooldridge, 2015). The formulated notation includes *i* to index each unique county x pair combination, *j* to index the time relative within each pair, and *t* to index the calendar year.

3.4.5.2 Independent Variables

The model includes two predictor variables. The first is a binary indicator of the county selected for the MDP, $PostSelection_{ijt}$. The counties assigned a value of 1 are identified as the winning sites selected for the MDP in the post-announcement period, representing the treatment. The assignment of treatment is lagged by 1 year to allow for the facility construction or expansion to occur before hiring activities, see Figure 3.1. For the runner-up counties and the winning counties in the pre-announcement period, the value of 0 is otherwise assigned. The second predictor variable is the moderator, represented by the interaction of the treated counties in the post-period and the plant size, $PostSelection_{ijt} \times Ln(PlantSize)_i$. The MDP plant size is measured as the estimated increase in employment for the MDP. The employee count for each plant is transformed using the natural logarithm, $Ln(PlantSize)_i$. After the transformation, the variable $Ln(PlantSize)_i$ is centered prior to computing the interaction term to reduce nonessential multicollinearity (Cohen et al., 2003).

$$PostSelection_{ijt} = \begin{cases} 1, winning\ site\ post-announcement\ period \\ 0, runner-up\ site\ and\ pre-announcement\ period \end{cases}$$

3.4.5.3 Control Variables

Several fixed effects are included in the model. First, I include county-level fixed effects to account for the time-invariant characteristics of the counties in each pair, γ_i, that could affect employment. Fixed effects for the time within each pair (i.e., years collected 1-6), denoted as τ_j, and calendar year fixed effects, λ_t, are included to account for average effects across all observations in a given year, e.g., the Great Recession. The county identification strategy addresses further potential unobserved heterogeneity in characteristics that may affect the growth by relying on the selection process. To account for differences in the economic or industrial composition that may contribute to local employment in the paired counties, several controls are included, χ_{it}. I control for factors impacting employment vis-à-vis the availability of labor, such as the county unemployment rate and the total Nonfarm employment of the county. The employment count for each county is transformed using the natural logarithm. In addition, I control for the local industry composition of the county, e.g., the proportion of manufacturing employment to total nonfarm employment, which has been suggested to influence spillover effects (Rosenthal & Strange, 2004). The descriptive statistics for the variables are displayed in Table 3.3.

Table 3.3 Operationalization of Variables and Descriptive Statistics

Variables	Description of operationalization	Operationalization	Mean	SD	Min	Max	Count
Ln(Employment)	Natural logarithm of county employment.	Continuous	7.17	1.43	2.89	10.55	1,140
- Trucking			6.58	1.47	2.20	9.77	588
- Warehousing & Storage							
$PostSelection_{ijt}$	Indicates whether the county received the treatment, i.e., the post-announcement period for the winning site selection.	Binary dummy (1, winning site post-announcement period, 0,runner-up site "+" pre-announcement period)	0.20	0.40	0	1	1,158
$LnPlantSize_i$	Plant Size is mean-centered on the natural logarithm of employees.	Continuous	6.74	1.03	3.40	9.62	1,158
Unemployment Rate	Divide the unemployed people by the total number of people in the labor force.†	Rate	6.23	2.43	1.50	15.90	1,158
Share of Manufacturing Employment	County manufacturing employment over total nonfarm employment.	Share	0.12	0.08	0.00	0.48	1,158
Ln(Total NonFarm Employment)	Natural logarithm of county employment.	Continuous	11.72	1.43	7.58	15.18	1,158

† The official concept of unemployment (as measured in the CPS U-3) includes all jobless persons who are available to take a job and have actively sought work in the past four weeks https://www.bls.gov/lau/stalt.htm

3.4.6 DiD Assumptions

The DiD research design carries an assumption to qualify the causal identification. The parallel trends assumption is that absent the treatment, the employment trends would have continued with similar slopes in both the treated and control group counties (Angrist & Pischke, 2009). This also requires selecting a suitable control group for comparison as a valid counterfactual. Graphically displaying two lines for the means, as illustrated in Figures 3.2 &

3.3, the slopes in the pre-announcement period (i.e., 1-3) are similar for both the treatment and control in both industries, providing model-free evidence (Davis-Sramek et al., 2023) to support the research design. Further statistical testing was conducted by interacting time with the treatment in a linear-trends model to test the null hypothesis that there is no significant difference in the pre-treatment trends. The results were not significant, further supporting the underlying assumption. The graphical and statistical evidence provided support for parallel trends.

Figure 3.2 Parallel Trends for Truck Transportation Industry Employment

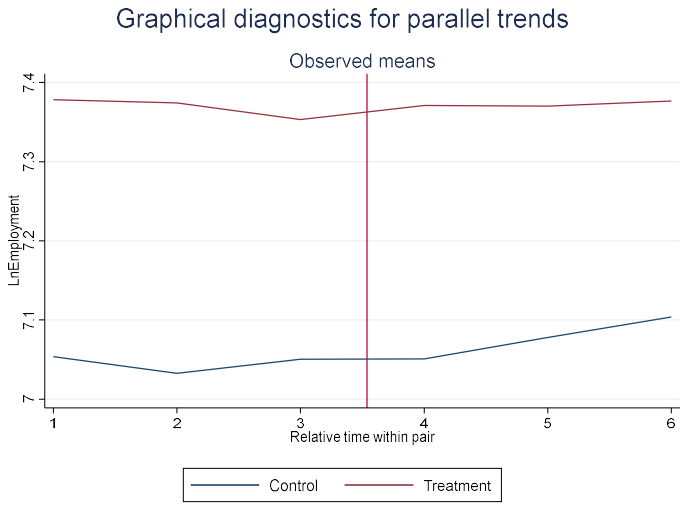
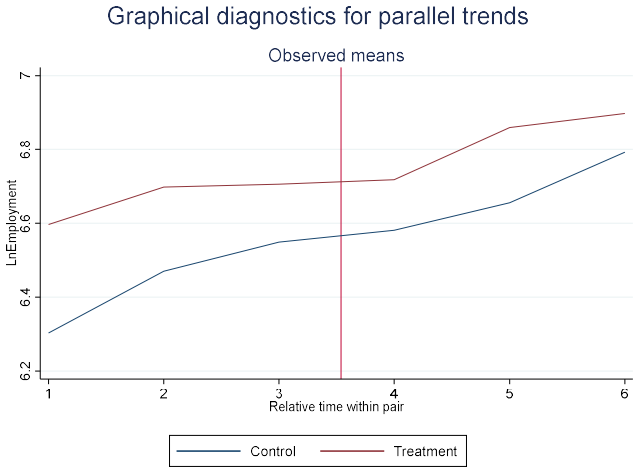


Figure 3.3 Parallel Trends for Warehouse and Storage Industry Employment



3.5 ANALYSIS & RESULTS

3.5.1 DiD Model

I use a Difference-in-Difference model to test my hypotheses. The following mathematical formulation (equation 3.1) is used for the assessment, including the average effect ω in my first model, before adding the interaction ρ coefficients of interest in model 2. The fixed effects and controls are as described previously, along with the residual term ε_{ijt} for the outcome variable of interest, $LnEmployment_{ijt}$. $H1_a$ and $H1_b$ predict that the coefficient ω is positive and significant as the average effect in model 1. $H2_a$ and $H2_b$ predict that the interaction term ρ is positive and significant, representing the indirect moderation effect.

$$LnEmployment_{ijt} = \alpha + \gamma_i + \tau_j + \lambda_t + \boldsymbol{\beta}\chi_{it} + \omega PostSelection_{ijt} + \rho PostSelection_{ijt} \times LnPlantSize_i + \varepsilon_{ijt} \quad (3.1)$$

3.5.2 Main Results

The results from the main analysis are presented in Table 3.4. The model specifications were executed on repeated cross-sectional data, including a series of fixed effects in Stata 17.0 with robust standard errors. Equation 3.1 is used to test the hypotheses, first the average effect without the interaction in Model 1. The average effect for Winning Site Selection on the log of truck transportation employment is neither positive nor statistically significant (β = -0.020, n.s.), contrary to expectation, and does not support $H1_a$. The average effect of the MDP on the log of warehousing employment is negative and marginally statistically significant (β = -0.097104, $p \leq 0.05$), the opposite of the prediction for $H1_b$. This may be evidence of differing labor flows for these industries, considering the average nonsupervisory hourly wage for warehousing is less than that of manufacturing or truck transportation (U.S. Bureau of Labor Statistics, 2023). Model

2 tests H2, the coefficient for the interaction of the treatment with $LnPlantSize_i$. For truck transportation, this moderator was statistically significant ($\beta = 0.027$, $p < 0.05$) and positive, providing evidence supporting $H2_a$. As the operationalization of Plant Size is mean-centered for the logged value, the conditional effect on truck transportation was not statistically significant ($\beta = -0.019$, n.s.) at the mean of Plant Size, but the relationship is positively moderated for larger plants. Each percent increase in the Plant Size above the mean, corresponds to a 2.7% increase in county employment for the truck transportation industry. $H2_a$ is supported for the truck transportation industry, as there is evidence of a moderation effect for Plant Size on the labor spillover from MDPs. The interaction with Plant Size for warehousing employment is not statistically significant ($\beta = -0.020$, n.s.) and does not support $H2_b$.

Table 3.4 Main Results for Spillover Effects from MDPs

Industry:	Truck Transportation		Warehousing & Storage	
	Model 1	**Model 2**	**Model 1**	**Model 2**
Dependent Variable:	*LnEmployment*	*LnEmployment*	*LnEmployment*	*LnEmployment*
Predictor Variables				
Winning Site Selection	-0.020 (0.019)	-0.019 (0.019)	-0.097 (0.050)	-0.093 (0.051)
Interaction with Plant Size		0.027* (0.014)		-0.020 (0.046)
Controls				
County Unemployment Rate	0.016* (0.008)	0.015 (0.008)	-0.034 (0.023)	-0.033 (0.023)
Proportion of Mfg Employment	-0.117 (0.315)	-0.115 (0.315)	1.119 (2.073)	1.131 (2.075)
Log of County Nonfarm Employment	0.952*** (0.123)	0.925*** (0.123)	0.977* (0.406)	1.024* (0.420)
County Event Fixed Effects	Included	Included	Included	Included
Calendar Year Fixed Effects	Included	Included	Included	Included
Time Fixed Effects	Included	Included	Included	Included
Observations	1,140	1,140	588	588
R^2	.990	.990	.968	.968

Notes. Includes data from 1998 through 2020. Robust standard errors are reported in parentheses. Plant Size for the interaction is mean centered on the natural logarithm of employees. * p<0.05, ** p<0.01, *** p<0.001.

3.5.3 Post hoc analysis

Next, I probe the data by MDP sector and on various levels of the moderator, i.e., Plant Size. First, I survey the MDPs by 3-digit NAICS (see Table 3.1) and highlight findings that the

moderating effect of Plant Size is stronger for MDPs in the manufacturing sector on the log of transportation employment ($\beta = 0.050$, $p < 0.05$), see Table 3.5. This is not a surprise, as manufacturing has an established economic multiplicative effect on upstream propagation (Bivens, 2019; Fujii, 2016), and higher levels of both inbound and outbound material flows (U.S. Census Bureau, 2017a).

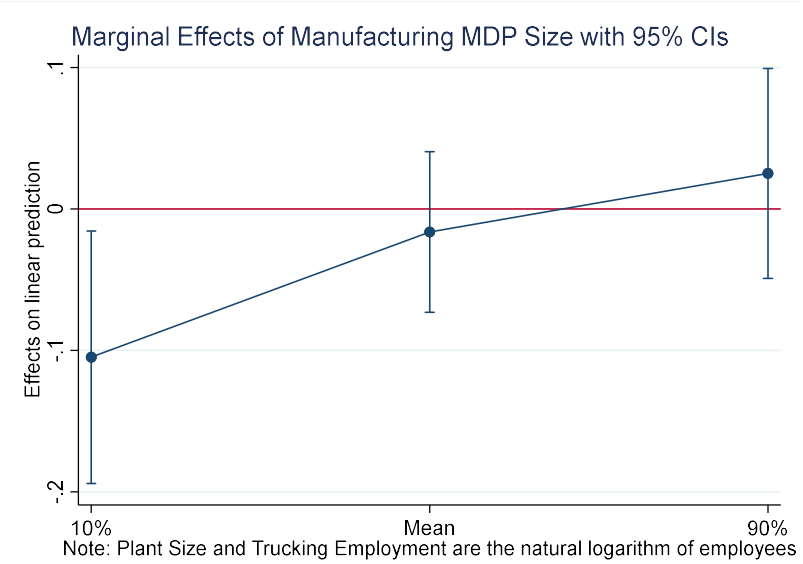
Table 3.5 Spillover Effects for Manufacturing Sector MDPs

Industry:	Truck Transportation		Warehousing & Storage	
	Model 3	**Model 4**	**Model 3**	**Model 4**
Dependent Variable:	*LnEmployment*	*LnEmployment*	*LnEmployment*	*LnEmployment*
Predictor Variables				
Winning Site Selection	-0.028 (0.028)	-0.018 (0.029)	0.015 (0.072)	0.016 (0.073)
Interaction with Plant Size		0.050* (0.023)		-0.006 (0.076)
Controls				
County Unemployment Rate	0.022 (0.012)	0.020 (0.012)	-0.023 (0.034)	-0.022 (0.035)
Proportion of Mfg Employment	-0.398 (0.386)	-0.388 (0.385)	1.336 (2.509)	1.352 (2.524)
Ln(County Nonfarm Employment)	0.857*** (0.218)	0.816*** (0.218)	1.390 (0.788)	1.405 (0.813)
County Event Fixed Effects	Included	Included	Included	Included
Calendar Year Fixed Effects	Included	Included	Included	Included
Time Fixed Effects	Included	Included	Included	Included
Observations	588	588	264	264
R^2	.988	.988	.973	.973

Notes. Includes data from 1998 through 2020. Robust standard errors are reported in parentheses. Plant Size for the interaction is mean centered on the natural logarithm of employees. * p<0.05, ** p<0.01, *** p<0.001.

To further explore the statistical margins, I plot the marginal effect of MDPs with the moderator, Plant Size. I fix the moderator at low, mean, and high levels, as illustrated in Figure 3.4. The average marginal effect on the log of transportation employment from manufacturing sector MDPs varies at different levels of the moderator, Plant Size. At low levels of the moderator, the labor spillover effect is negative and statistically significant. As the moderator increases, the labor spillover effect becomes muted at the mean and at higher levels (larger MDPs).

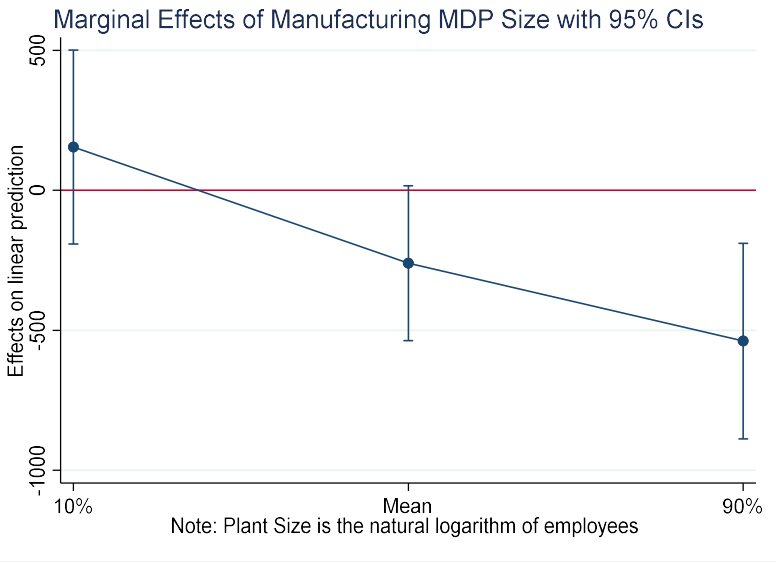
Figure 3.4 Transportation Labor Spillover from Manufacturing Sector MDPs



While the regression results indicate that the interaction between the county selected for a MDP and Plant Size is not statistically significant (β = -0.006, n.s.) on the log of warehousing employment, further exploration of this interaction is warranted. As highlighted by Mize (2019), focusing solely on the statistical significance of the product term can be misleading when examining interaction effects in models with nonlinear relationships, such as the employment elasticity employed in this analysis. Both Berry et al. (2010) and Rönkkö et al. (2022) advocate for examining marginal effects for a more accurate and nuanced understanding of interaction effects and visualizing the interaction through plots. To do so, Rönkkö et al. (2022) and Mize (2019) emphasize interpreting interactions in terms of the natural metric of the dependent variable, which in this case is warehouse employment. I explore this relationship between manufacturing MDPs and warehousing employment in Figure 3.5, illustrating the average marginal effect at different levels of the moderator, Plant Size. At low levels of the moderator and at the mean, the labor spillover effect is not statistically different from zero. For higher levels

of the moderator, the labor spillover effect becomes negative and statistically significant. That is, for large MDPs, the labor spillover effect decreases local county-level warehouse employment.

Figure 3.5 Warehouse Labor Spillover from Manufacturing Sector MDPs



3.6 DISCUSSION

3.6.1 Theoretical Contributions

Through my empirical analyses, this research contributes to understanding how million-dollar plant openings cascade through the local labor market, influencing employment patterns, wage structures, and skill demands. This study makes several contributions to both theory and practice. It extends the business dynamics literature by contributing boundary conditions to contextualize the direction of labor spillovers for transportation and warehousing industries (Makadok et al., 2018). The robust empirical identification enhances the confidence in the accuracy of the estimated effects. When combined with our predictions, which are rooted in theory, this provides strong support for both empirical and theoretical identification. Managers and policymakers gain nuanced insight into the local labor dynamic impacts from both small and large MDPs on their incumbent establishments.

This study contributes to the labor spillover literature in several ways. First, this research adds an additional perspective to labor spillover effects by using county-level employment for the unit of analysis, where other studies have aggregated at higher levels when studying growth, e.g., metro areas, state, regional, or national (Allen, 1977). As has been highlighted, aggregation to various levels may have varied results and may miss the underlying mechanism (Carpenter, Van Sandt, et al., 2022). Applying a different level of analysis extends theory (Makadok et al., 2018) and contributes to our theoretical understanding of labor spillovers.

Second, I find contrasting results between the two L&SCM industries when probing the moderating effect of plant size on the spillover to local labor markets. This boundary condition (Busse et al., 2017; Okhuysen & Waller, 2002; Whetten, 1989) extends our knowledge by contextualizing specific managerially relevant implications of the MDP phenomena (Ketokivi & Jokinen, 2006; Merton, 1968) for the transportation and warehousing industries. Small MDPs were found to cannibalize local transportation employment and muted for plants of average or large size. Comparing this to the warehousing industry, small and average-size MDPs had no statistical significance as a moderator, but large MDPs had a negative spillover effect on local employment. The transportation and manufacturing industries have similar but distinctly higher average hourly wages than warehousing and storage (U.S. Bureau of Labor Statistics, 2023). For large MDPs, the direction of the labor flows between industries suggests that the similar higher average hourly wages in transportation may dissuade job hopping but this variance does draw employees from the warehousing and storage labor pool to manufacturing. These nuanced results enhance our understanding of an understudied topic where previous empirical results were unclear (Carpenter, Dudensing, et al., 2022; Kang, 2020). Specifically to transportation employment, this study contributes to our understanding of derived demand by contrasting prior

findings (Miller et al., 2024) with evidence of reduced transportation employment within the same county as increased manufacturing employment. This study extends the literature stream by establishing causal identification and focusing on labor spillovers from million-dollar plants, which are important given the resurgence of industrial activities due in part to the likelihood of future global disruptions (Flynn et al., 2021).

3.6.2 Managerial Implications

This study has several practical implications relevant to managers for both the focal MDP firm and the incumbent establishments. For managers responsible for hiring or staffing operations, the announcement of an MDP to their county has nuanced labor-related implications. First, the results found no evidence of a positive direct effect on local employment in the county awarded the MDP, which was unexpected. However, when probing the various levels of plant size, the findings are interesting and surprising for MDPs in the manufacturing sector. These implications differ for both transportation and warehousing industries and by the size of the forthcoming or expanding MDP. The cannibalizing effect identified on transportation employment from small MDPs should concern incumbent supply chain managers. The anticipated increase in business, because of the MDP, materialized as a reduction in local labor instead of augmenting employment. This could be evidence of the new or expanding facility absorbing local workers from the existing firms and hiring these resources in-house. However, very large MDPs do spill over and impact local transportation employment positively, in addition to any in-house employment gains. Supply Chain managers planning for a large MDP need to be aware of this competition across occupations and industries. The increase in staffing required for the large MDP and the transportation industry is compounded as they often compete for the same labor pool (Miller et al., 2024; Phares & Balthrop, 2022; Schollmeier & Scott, 2024).

Next, looking at the spillover effect on the warehousing industry, there is evidence for a negative average spillover effect, thereby reducing local warehousing employment. Probing the moderator, I find the relationship exists for large manufacturing MDPs, not small or average-sized MDPs. For the large manufacturing MDPs, there was a negative impact on local employment, resulting in a decrease in the warehouse industry in the same county. Perhaps this is evidence of the MDP drawing workers from across industries. L&SCM managers will be keen to anticipate the varied spillover effects from the MDPs on their establishment's existing labor and competition for future demand from the same labor pool.

For local or state governments, there are implications for soliciting businesses to attract their investment into your jurisdiction. The findings in this study provide nuanced insights for policymakers negotiating with potential companies and answers the call for more L&SCM research to inform policy (Richey & Davis-Sramek, 2022). The consequences of successfully bidding for the forthcoming plant can have both positive and negative spillover effects on logistics employment. The decisions need to be weighed carefully, considering the tax breaks, bonds, funds, and other infrastructure investments that may be included as costs to the taxpayer.

This study provides a more granular level of detail compared to the established aggregated input/output multipliers available (Bivens, 2019). The findings, which varied between two core logistics industries (transportation and warehousing), add to the pragmatic application to inform managers and policymakers (Fawcett & Waller, 2011). Considering the concerns over labor shortages and increased manufacturing activity (Sodhi & Tang, 2021; U.S. Census Bureau, 2023a), this study is both relevant and opportune for managers in today's ecosystem. Specifically, the selective reconfigurations to shorten global supply chains and reduce exposure to disruption have firms looking to return to or reinvest in domestic operations (Moser, 2022).

This strategic realignment is not simply a response to recent disruptions but represents an intentional, nuanced effort against the backdrop of evolving geopolitical and economic uncertainties (Trump et al., 2021).

3.6.3 Limitations & Future Research

Due to the sample size, there are limitations in the ability to assess labor spillover effects by specific industries. There was some evidence for labor spillover effects from MDPs in the manufacturing sector, but further breakdown is unavailable within the given detail of the collected sample. Further research can pursue the nuanced local labor market effects from isolating industries and their unique needs for inbound or outbound coordination from transportation or warehousing entities. Also, the spillover effect from MDPs could propagate to other industries that were not considered in this study. For instance, employment impacts have been identified in the service sector from manufacturing growth (Moretti, 2010). These horizontal spillovers are worth studying as other industries are impacted via respending[21] effects from workers' expenditure.

The unit of analysis, i.e., the identified county, in this study lends itself to capturing the local impact of MDPs narrowly. The county within which an MDP is built could have an impact extending beyond the county's boundaries. For this reason, the findings presented are believed to be an understatement of the full spillover effect from MDPs. The average commute for those not working from home is 26.4 minutes in 2022 (Burrows & Burd, 2024), suggesting there may be labor spillovers into adjacent counties. Future research should explore the effects of labor spillover at other levels of analysis, whether that be by commuter zones or metropolitan areas. Specifically for the transportation and warehousing sector, the labor pool may have different

[21] Respending effects are the impacts that job creation or destruction in an industry has on those sectors where workers spend their paychecks.

commuting limitations or preferences, creating interesting findings within the L&SCM domain to extend our understanding. Extending the research in this way would be an interesting extension, lending itself to spatial economic models.

The findings in this study might not generalize to all counties in the U.S. courting large business investment. Constituents in rural areas might be more sensitive to cannibalizing incumbent employment than in metro areas. Retainment of existing jobs in areas with smaller populations may be valued over job creation. The dominant industry of small counties may also play into the dynamics of which industries are pursued.

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CHAPTER 4 – THE EFFECT OF EARLY TERMINATION OF BENEFITS BY STATE POLICY ON LOCAL EMPLOYMENT

4.1 INTRODUCTION

The COVID-19 pandemic triggered unprecedented economic turmoil, culminating in a 14.8% unemployment rate and a labor force participation rate of just 60.2% in April 2020, the worst in decades (Falk et al., 2021). In response, the U.S. government passed the CARES Act, a federally funded relief package that increased the generosity and expanded the eligibility of unemployment insurance (UI) benefits, providing financial support to millions of unemployed workers. While these enhanced federal UI benefits aimed to mitigate economic hardship, they also sparked contentious debate as the economy began to recover. Critics argued that the enhanced federal UI benefits created disincentives for job-seeking, prompting 26 state governors to terminate these programs early, seeking to accelerate their state's labor market recovery (Robenalt & Dudek, 2021). The early withdrawal of these benefits by some states during the post-pandemic recovery offers a quasi-experiment to evaluate their impact on employment outcomes during periods of economic distress.

Despite extensive research on unemployment insurance (UI) and labor market dynamics, the evidence remains indecisive. On one hand, increased UI generosity has been shown to extend unemployment durations by reducing the urgency to find work (Holzer et al., 2024; Lalive et al., 2006; Mortensen, 1970). On the other hand, some studies find no significant disincentive effects, even with more generous benefits (Altonji et al., 2020). Beyond these short-term impacts, UI may also serve a constructive role by enabling more thorough job searches, potentially leading to better matches and long-term stability (Albert et al., 2022; Mortensen, 1970). However, a recent study observed no meaningful improvement in job quality associated with extended UI benefits (D'Ambrosio & Scrutinio, 2022). This underscores the nuanced relationship and tension between

UI's social welfare function and the potential disincentive posed by moral hazard in job-seeking behavior.

This study seeks to address the conflicting findings and examine the impact of withdrawing enhanced federal UI benefits during the post-pandemic recovery period. The unique context of the post-pandemic recovery period, where many unemployed workers received benefits exceeding their previous earnings (Ganong et al., 2020), provides an opportunity to explore the dynamics of UI responsiveness during economic recovery (Card et al., 2015). The withdrawal of enhanced federal UI benefits, driven by some states choosing to withdraw enhanced federal UI benefits in mid-2021 while others retained them, was designed to mitigate hiring struggles in the recovering economy. As employment levels serve as a reasonable indicator for evaluating the states' policy impact, this study leverages county-level data from the Quarterly Census of Employment and Wages (QCEW), specifically counties located along the state border where UI policy differed across the boundary. By comparing labor market outcomes in neighboring counties subject to different policies but otherwise similar, this research isolates the effect of policy withdrawal and offers a unique geographic identification strategy. This quasi-experimental research design allows for causal identification of the impact of the state-level policy.

The county-level employment and unemployment rates for those states that withdrew early from the enhanced federal UI benefits, were not found to have significant differences between the groups. However, in an event study analysis, a positive lagged post-treatment effect for county employment was found. This effect was clearer in the Texas and West Virginia border regions, two areas with heavy industry concentration of mining, quarrying, and oil and gas extraction. This study contributes to the broader discourse on how government assistance

interacts with labor market recovery during economic distress by identifying temporal and regional heterogeneity in labor market responses.

4.2 LITERATURE REVIEW

UI plays a critical role in stabilizing labor markets, particularly during economic downturns. Understanding its influence on job search behavior is essential for policymakers striving to balance social welfare and economic efficiency. A significant body of research exists examining the relationship between unemployment insurance (UI) and job search behavior. The theoretical foundation for this research lies in job search theory (Mortensen, 1970). This theory suggests that unemployed individuals weigh the costs and benefits of searching for work, considering factors such as the level of unemployment benefits (i.e., generosity), search costs, labor market conditions, and potential gains in employment. Higher unemployment benefits reduce the financial pressure to find work, potentially leading to less intensive job searches and longer unemployment durations (Marinescu, 2017).

Economic models expand upon job search theory, offering additional insights into the labor market impacts of UI benefits. According to the standard labor market model, unemployment benefits can create disincentives for individuals to seek employment by reducing the opportunity cost of remaining out of work (Pissaridēs, 2000). As such, cutting unemployment benefits is expected to shorten the duration of unemployment and incentivize job seekers to re-enter the labor market (Chetty, 2008; Rothstein, 2011). While theoretical perspectives provide a framework for understanding UI's potential effects, empirical studies highlight the nuance of these policies. An early study by Meyer (1990) found that more generous UI benefits led to a longer unemployment period. Similarly, Farber and Valletta (2015) found that the

unemployment duration was longer given the extended UI benefits, but this did not affect the broader labor market, only the unemployed.

While prior research has established the relationship between UI generosity and unemployment duration in typical economic conditions, further research is needed to study this relationship in times of economic distress (Card et al., 2015). The unprecedented challenges posed by the COVID-19 pandemic necessitate further evaluation of this relationship. Research on pandemic-era UI benefits has yielded mixed results, further underscoring the complexity of this issue. Some studies have found that expansions and withdrawals of UI benefits had relatively small effects on job-finding rates and employment. Albert et al. (2022) found that the removal of enhanced UI benefits was associated with a modest increase in job gains but no significant difference in the unemployment rate. Similarly, Petrosky-Nadeau and Valletta (2024) found that both the expansion and withdrawal of UI benefits during the pandemic had a small effect. These findings align with other studies like Coombs et al. (2022), which suggest that the effect of UI benefits on job search behavior may be muted during periods of significant economic distress

There are contrasting results in the literature with varying effects of UI benefits on labor market outcomes, see Table 4.1. Holzer et al. (2024) found a significant increase in job-finding rates in states that withdrew from expanded UI programs early, suggesting a notable effect on relative unemployment rates. Findings from this study indicate that UI benefits maintained their influence on job search behavior during the pandemic. Similarly, Arbogast and Dupor (2022) found a more pronounced effect from benefit termination. Using an instrumental variable analysis of state-level data, they estimated that ending expanded benefits led to an increase of 27 employed individuals for every 100 people who lost benefits, suggesting a potentially significant

impact on employment levels. These estimates contrast with the other findings, where estimates had a smaller employment impact from the early benefit withdrawals.

Table 4.1 COVID-era Pandemic Recovery UI Literature

Study	Sample	Outcome Variable	Results
Albert et al. (2022)	U.S. state-level withdrawal of UI benefits; Bureau of Labor Statistics (BLS) Job Openings and Labor Turnover Survey (JOLTS)	Employment changes post-UI withdrawal; Hiring rates; Job opening rates	Employment gains following UI withdrawal (n.s.), suggesting UI benefits did not significantly effect job search; Unemployment rates (n.s.); Job opening rates (n.s.)
Arbogast & Dupor (2022)	U.S. state-level withdrawal of UI benefits; Current Population Survey (CPS) individual-level data aggregated	Employment changes post-UI withdrawal	Sizeable increase in employment when eliminating the UI, for every 100 people who lost benefits, employment increased by 35.
Coombs et al. (2021)	U.S. state-level withdrawal of UI benefits; bank transaction data	Effects on earnings, employment, and consumption.	Early UI withdrawal had modest effects on employment but reduced consumption significantly.
Ganong, Noel & Vavra (2020)	U.S. household employment and income data during pandemic; individual microdata	UI replacement rates and labor supply incentives	High UI replacement rates could discourage employment, but actual effects were limited, and smaller than predicted.
Holzer, Hubbard & Strain (2024)	U.S. state-level withdrawal of UI benefits; individual microdata	Unemployment rates post-UI withdrawal	Substantial pickup in job-finding rates by unemployed individuals & state unemployment rates decreased for the states that withdrew federal UI benefits.
Petrosky-Nadeau & Valletta (2024)	U.S. state-level withdrawal of UI benefits; administrative microdata	Job acceptance rates post-UI withdrawal	More generous UI benefits led to slightly lower job acceptance rates, but effects were minimal and varied across demographic groups.

Despite the general relationship between UI generosity and unemployment duration, recent studies present a more nuanced perspective of the pandemic-era UI benefits. The disparity in findings may be attributed to methodological differences, potentially capturing different

dimensions of job search behavior. For example, in the study by Albert et al. (2022), the unit of analysis was aggregated at the state level and focused on job gains and unemployment rates, while the Holzer et al. (2024) study analyzed individual microdata with a focus on the hiring of the unemployed specifically. The divergent findings from these studies highlight the need for further research to understand the nuances of UI policy's impact on the labor market, particularly during times of economic distress.

Comparing states that withdrew early from the enhanced federal UI benefits with those that maintained them offers a valuable quasi-experimental framework for identifying the labor market impacts of such policies. This geographic variation provides a natural experiment for isolating the effects of UI benefit withdrawal. A deeper understanding of these dynamics is crucial for policymakers to design effective UI programs that provide essential support for unemployed workers while minimizing unintended consequences for the labor market and overall economic recovery. These findings have critical policy implications, such as the trade-offs between supporting unemployed individuals and fostering labor market recovery. Moving forward, researchers advocate for more nuanced policy designs that strike this balance between providing vital social support and maintaining incentives for workforce participation (Ganong & Noel, 2020).

4.3 RESEARCH SETTING & CONCEPTUAL MODEL

4.3.1 Setting and Policy

At the end of 2020, the federal government extended several pandemic programs related to UI generosity and eligibility to September 4, 2021.[22] The Federal Pandemic Unemployment Compensation (FPUC) provided a $300 weekly supplemental UI benefit, in addition to any

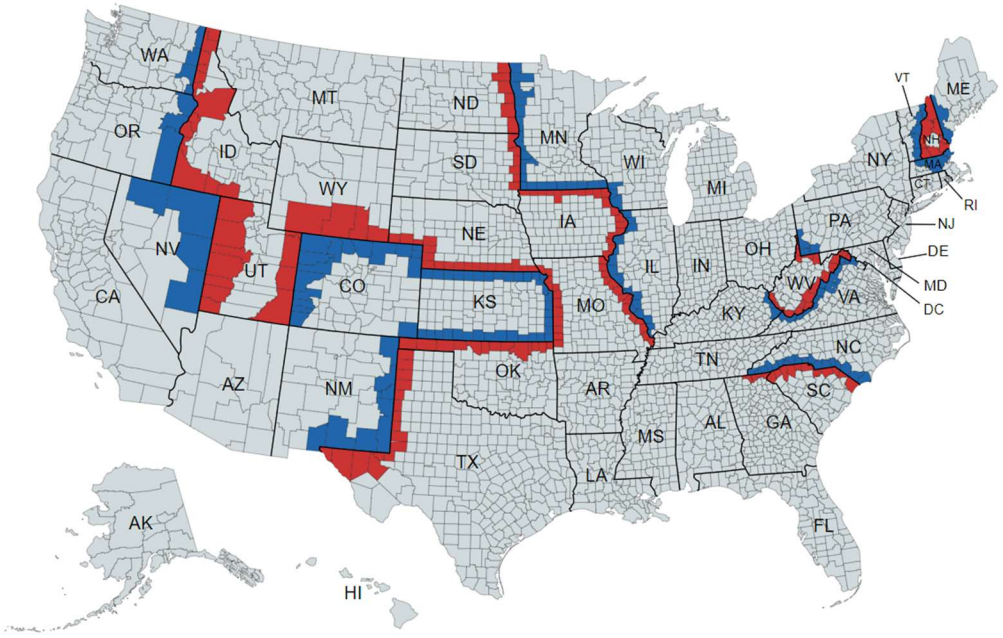
[22] https://crsreports.congress.gov/product/pdf/R/R46687; https://crsreports.congress.gov/product/pdf/IN/IN11679

benefits an individual was receiving. The Pandemic Emergency Unemployment Compensation (PEUC) provided an additional 49 weeks of federal UI benefits for those who exhausted their regular state benefits. And the Pandemic Unemployment Assistance (PUA) extended the federal UI benefits to 75 weeks to individuals not normally eligible (including gig workers, independent contractors, and the self-employed). To assist in stabilizing the economy from recession, these programs expanded eligibility and increased the generosity of UI benefits.

As the economic recovery began to ease, participation in these enhanced federal UI benefit programs was terminated early by several states, citing that they discouraged workplace participation.[23] Notifications from 26 states were sent to the Department of Labor to cease at least some of these UI benefits. Of the 26 states, 22 ended the FPUC benefits in June 2021. Of these 22, 18 withdrawal states additionally ended the PUA and the PEUC, which accounted for 2/3 of all continued claims in states prior to the withdrawals (Department of Labor's weekly claims reports). See Figure 4.1, which highlights the counties and state borders with differing policies on withdrawing the enhanced federal UI benefits.

[23] https://governor.sc.gov/sites/governor/files/Documents/5-6-21%20Gov%20McMaster%20to%20Dir%20Ellzey%20re%20Federal%20UI%20benefit%20termination.pdf

Figure 4.1 County-level Map of State Borders with a Differing Withdrawal Policy



4.3.2 Data Sources and Variables

For this study, I leveraged the Quarterly Census of Employment and Wages (QCEW) program datasets.[24] This dataset provides monthly employment counts by county for individuals covered by UI. The QCEW are not estimates but aggregated from various sources of business data to provide establishment counts, employment, payroll, and industry-level details. This study will look at total employment at the county level. Also, sourcing data from the Bureau of Labor Statistics program on Local Area Unemployment Statistics (LAUS), which estimates state and county-level unemployment data using administrative unemployment insurance recipient records(U.S. Bureau of Labor Statistics, 2024b).

The outcome of interest includes both the total county employment and the county unemployment rates. The data is transformed with the natural logarithm and represented in the

[24] https://www.bls.gov/cew/

model by $LnEmployment_{it}$ and URN_{it}, as measured by the Bureau of Labor Statistics. This transformation increases the interpretability of the coefficient as an elasticity (Törnqvist et al., 1985; Wooldridge, 2015). The formulated notation includes *i* to index each unique county x state combination and *t* to index time.

The primary predictor is a binary indicator to denote states that withdrew UI benefits early. This indicator is 1 for states that withdrew early from the enhanced federal UI benefits, 0 for states that kept the benefits, and 0 for all states in the period before the withdrawal.

$$Withdraw_{it} = \begin{cases} 1, states\ that\ withdrew\ enhanced\ federal\ UI\ benefits\ early \\ 0, retained\ federal\ UI\ benefits\ and\ pre-\ period \end{cases}$$

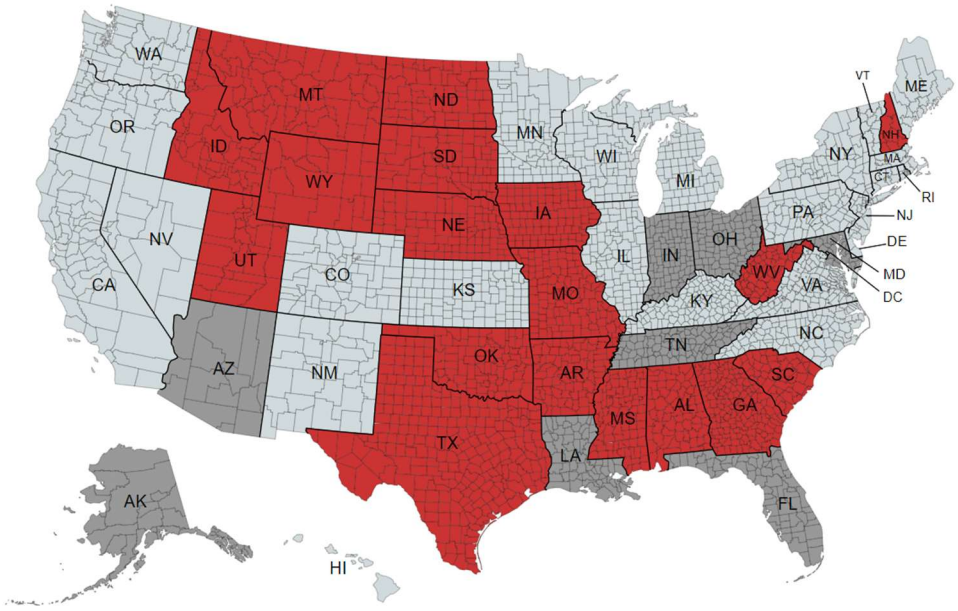
The model includes several fixed effects. First, county-level fixed effects, γ_i, are included to account for time-invariant characteristics that could influence employment for counties on either side of the state border. Time-month fixed effects, λ_t, capture average effects across all observations within a given month. The county identification strategy mitigates potential unobserved heterogeneity by leveraging the selection process to address factors that may affect growth. To account for differences in economic and industrial composition that may influence local employment, several controls, χ_{it}, are included. These factors are related to labor availability, such as average weekly wages in both goods-producing and service-providing industries, and are moderated by the concentration of manufacturing employment in the county.

4.3.3 Methodological Approach and Causal Identification

This paper uses a difference-in-differences (DiD) approach to compare states that ended the enhanced UI benefits early to establish causal identification of their labor market impact. Comparing states that withdrew early from the enhanced federal UI benefits with those that maintained the benefits provides a useful counterfactual of the state-level policy. Figure 4.2 illustrates which states withdrew their federal UI benefits early. The unit of analysis in the study

is county-level employment, specifically comparing the counties on the border of states with differing enhanced UI benefit state policies. The key identification assumption is that as the distance is reduced to zero, the factors (e.g., economic and geographical) not related to the state policy on either side of the border are similar. This follows prior empirical research on state policy that uses the state border in the identification strategy (Holmes, 1998). The counties within states that withdrew the enhanced federal UI benefits early serve as the treatment and the counties across the border in states that kept the benefits act as the control group.

Figure 4.2 The 26 States that Withdrew from the Enhanced Federal UI Benefits (before September, 2022)

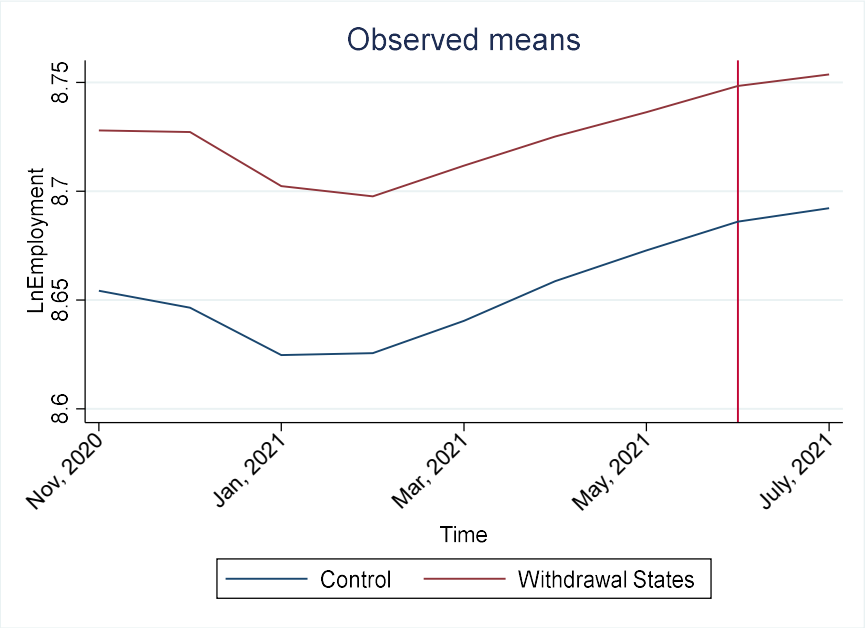


4.3.4 DiD Assumptions

The difference-in-differences (DiD) research design relies on the parallel trends assumption for causal identification. This assumption posits that, in the absence of treatment, employment trends in both the treated and control group counties would have followed similar trends (Angrist & Pischke, 2009). For a valid comparison, an appropriate control group needs to be

selected for the counterfactual. Figure 4.3 illustrates the trends by plotting the observed means for total county employment. The trends in the pre-withdrawal period are comparable for both the treatment and control groups. This serves as model-free evidence supporting the research design (Davis-Sramek et al., 2023). Additionally, a statistical test was conducted by interacting time with the treatment variable in a linear trends model to examine whether pre-treatment trends significantly differed. The results showed no significant differences in pre-treatment trends, reinforcing the assumption of parallel trends. Taken together, the graphical and statistical evidence provides support for the parallel trends assumption.

Figure 4.3 Parallel Trends for Total County Employment



4.4 ANALYSIS & RESULTS

4.4.1 DiD Model

The Difference-in-Differences (DiD) model is used to test the effect on early withdrawal of the enhanced federal UI benefits by some states during the post-pandemic recovery period. The mathematical formulation for the assessment includes the average effect ω in the model. The

fixed effects and controls are described previously, with the residual term ε_{it} for both $LnEmployment_{it}$ and URN_{it} as dependent variables.

$$LnEmployment_{it} = \alpha + \gamma_i + \lambda_t + \boldsymbol{\beta}\chi_{it} + \omega Withdraw_{it} + \varepsilon_{it} \quad (4.1)$$

4.4.2 Main Results

The model was executed in Stata 17.0 with robust standard errors clustered at the state, which is the assignment mechanism (Abadie et al., 2022), and the results are presented in Table 4.2. Equation 4.1 was used to test the anticipated effect of withdrawing from the enhanced federal UI benefits. The results indicate that the average effect of withdrawal on total employment was not statistically significant ($\beta = 0.005$, n.s.), failing to support the predicted impact. Similarly, the results for the county unemployment rate (URN_{it}), also presented in Table 4.2, show no statistically significant effect, providing no support for the expected outcome. Thus, the withdrawal of enhanced federal UI benefits did not have a statistically significant effect on county-level total unemployment or the unemployment rate for those counties where the state policy differed at the border.

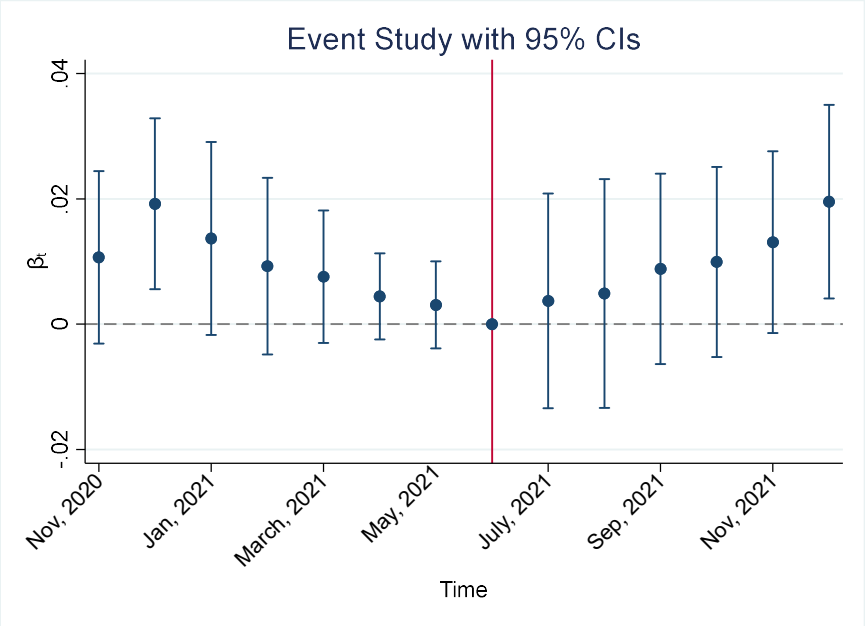
Table 4.2 Analysis of Total County Employment and Unemployment Rates

Dependent Variable:	*LnEmployment*	*URN*
Predictor Variables (interaction term)		
Withdrawal States	-0.005 (0.008)	0.103 (0.239)
Controls		
Avg Weekly Waged - 101	0.000** (0.000)	0.000 (0.000)
Avg Weekly Waged - 102	0.000*** (0.000)	0.000 (0.000)
County Fixed Effects	Included	Included
Time Fixed Effects	Included	Included
Observations	3,640	3,640
R^2	.999	.925

Notes. Includes data from November 2020 to December 2021, county level total nonfarm employment and unemployment rates. Robust standard errors are clustered at the state level and reported in parentheses. * p<0.05, ** p<0.01, *** p<0.001.

This study considers three programs (i.e., FPUC, PEUC, & PUA), with 18 states withdrawing early from all three in June of 2021. The expiration of PEUC and PUA eligibility mechanically ended benefits for two-thirds of UI recipients, and FPUC recipients lost $300 in weekly benefits (Coombs et al., 2022). The difference-in-differences design assumes a linear post-treatment effect for jobseekers to return to work. Rather than relying on a single post-treatment effect that is constant over time, this study explores an event study to evaluate the causal impacts of withdrawing enhanced UI benefits on county employment over time (Schmidheiny & Siegloch, 2023). The event study model provides a dynamic perspective on treatment effects across different time intervals. Using a Granger causality approach focusing on temporal sequencing, the model fits both lags and leads of the treatment period indicator, to assess potential anticipatory behavior and changes over time for the post-treatment period coefficients (Clarke & Tapia-Schythe, 2021; Wing et al., 2018).

Figure 4.4 Event Study for Total County Employment



The results of the event study for county employment are illustrated in Figure 4.4. Although trending upward, the treatment effect is not statistically significant until the 6th month following the expiration of the enhanced federal UI benefits. The withdrawal states did not see a statistically significant increase in county-level employment compared to counties on the other side of the state border, which retained their federal UI benefits in the months immediately after the policy went into effect. The temporal heterogeneity from the event study found a lagged effect for the withdrawal of enhanced federal UI benefits, where the average effect was not found to be statistically significant for either the total county employment or the unemployment rate.

4.4.3 Post-Hoc Analysis

4.4.3.1 Difference-in Differences (DiD) Industry Analysis

A more granular analysis will compare two industries impacted by COVID and sensitive to UI generosity levels. This study splits the analysis by goods-producing and service-providing industries. Using the transformed natural logarithm of employment as our outcome variable and previously described controls, Table 4.3 presents the results from the industry analysis. The average effect for withdrawal states of neither the log of goods-producing ($\beta = 0.015$, n.s.), nor service-providing ($\beta = 0.005$, n.s.) county-level employment was statistically significant.

Table 4.3 Analysis of Industry Employment

	County Employment	
Industry:	**101 Goods-Producing**	**102 Service-Providing**
Dependent Variable:	*LnEmployment*	*LnEmployment*
Predictor Variables (interaction terms)		
Withdrawal States	-0.006 (0.012)	-0.006 (0.005)
Controls		
County Unemployment Rate	-0.026* (0.009)	-0.009** (0.003)
Avg Weekly Waged - 101	0.000 (0.000)	0.000 (0.000)
Avg Weekly Waged - 102	0.000 (0.000)	0.000 (0.000)
County Fixed Effects	Included	Included
Time Fixed Effects	Included	Included
Observations	3,640	3,626
R^2	.999	.999

Notes. Includes data from November 2020 to December 2021. Robust standard errors are clustered at the state level and reported in parentheses. * p<0.05, ** p<0.01, *** p<0.001. The sample sizes vary at the county level, as not all government data is released in order to protect the confidentiality of company-specific information.

4.4.3.2 Event Study Industry Analysis

The results of the event study for the goods-producing industry county employment are illustrated in Figure 4.5. Although trending upward, the treatment effect is not statistically significant until the 6th month following the expiration of the enhanced federal UI benefits. The service-providing industry employment was not significant for the entire six-month period following the treatment, as shown in Figure 4.6. Both goods-producing and service-providing industries did not see a statistically significant increase in county-level employment compared to counties on the other side of the state border, which retained their federal UI benefits in the months immediately after the policy went into effect.

Figure 4.5 Event Study for Goods-Producing Industry *LnEmployment*

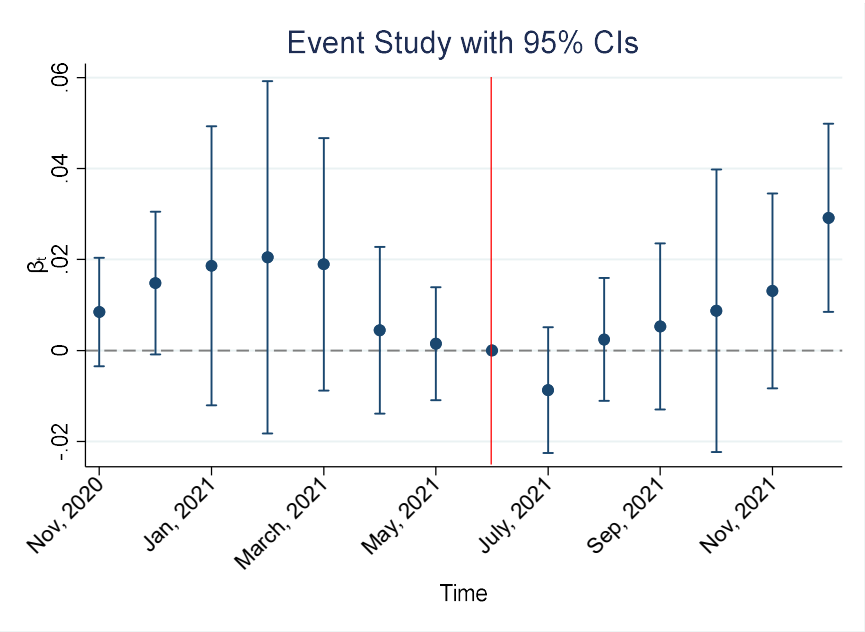
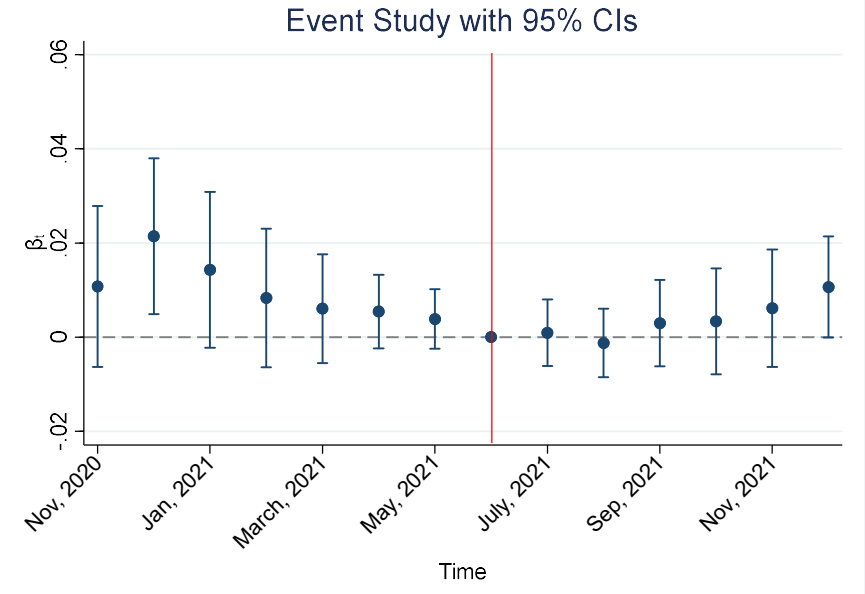


Figure 4.6 Event Study for Service-Providing Industry *LnEmployment*

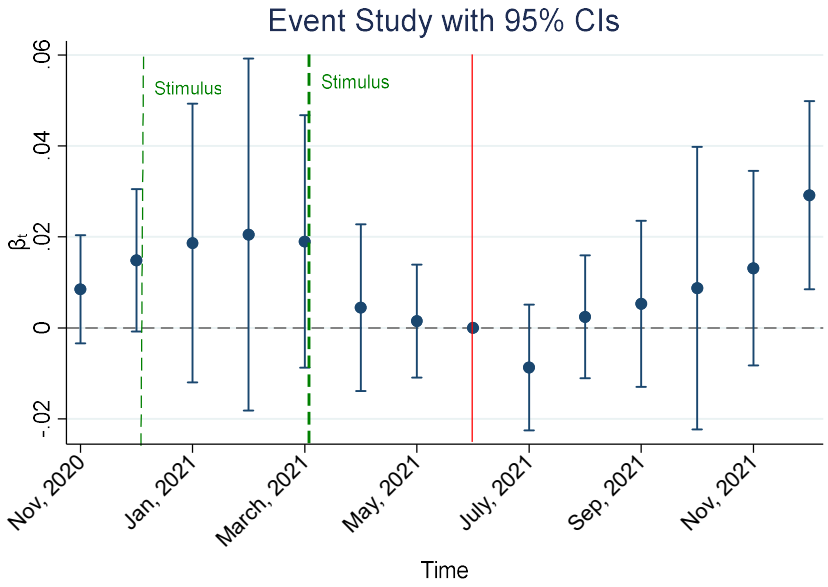


4.4.3.3 Economic Impact Payments

The COVID-19 pandemic was unprecedented in both the economic turmoil it caused (Falk et al., 2021) and the federal government's response related to UI generosity and eligibility. The financial support provided to millions of workers was accompanied by three stimulus payments the government issued to help families cope with the COVID-19 pandemic. Therefore, the findings of this study are likely understated, given the federal government issued stimulus payments to help cope with the pandemic in addition to the enhanced federal UI benefits. Of the three pandemic stimulus payments issued by the IRS, the latter two occurred just months before the enhanced UI federal benefits ended.[25] With the extra liquidity (e.g., $5,600 received in March/April for a qualifying family of four), workers may have experienced less financial pressure to immediately return to work when the enhanced federal UI benefits expired in June for states that withdrew early. This aligns with prior empirical work identifying individual liquidity constraints as a driver of job search behavior (Gerards & Welters, 2020). The potential for additional savings from stimulus checks, ongoing health concerns, and challenges securing childcare may also have kept individuals from returning to work (Casselman, 2021). The timing of the stimulus payments is illustrated in Figure 4.7.

[25] December 2020: $600 per income tax filer, $600 per child (Consolidated Appropriations Act, 2021); March 2021: $1,400 per income tax filer, $1,400 per child (American Rescue Plan Act).

Figure 4.7 Event Study for Goods-Producing Industry *LnEmployment* with Federal Stimulus



4.4.3.4 Event Study State Border Regions

The study further probes the results to consider heterogeneous post-treatment effects by region. If the policy's effect had been heterogeneous across groups or over time, the DiD results may have been misleading (De Chaisemartin & D'Haultfœuille, 2020). The border sections from Figure 4.1 are divided into respective segments, identified as New Hampshire, West Virginia, South Carolina, Texas, Kansas, and the Midwest section (North Dakota, South Dakota, Iowa, and Missouri). The sections of the western states are excluded, as the counties are so much larger and sparsely populated, as has been done in prior empirical studies (Holmes, 1998). The positive gains in goods-producing industry employment are largely a result of both West Virginia and the western border of Texas, the full results are available in Appendix. Both West Texas with the oil and gas extraction industry, and West Virginia's traditional coal mining, represent regions with highly concentrated production employment. Notably, this period coincided with an energy boom (Board of Governors of the Federal Reserve System (US), 2025), which may help explain the observed deviation from other regional patterns.

4.5 INTERPRETATION

The findings of this study provide important understanding into the relationship between the withdrawal of enhanced federal UI benefits and local labor market outcomes during the post-pandemic recovery period. Contrary to the theoretical expectation that reducing benefits would lead to a rapid and significant increase in employment and a corresponding decrease in unemployment, the results do not support these assumptions. Neither county-level employment nor unemployment rates were statistically significant in the post-treatment period after the early termination of enhanced federal UI benefits in the treatment states. This is a salient point given that many states justified early withdrawal policies based on the premise that enhanced benefits created disincentives for job-seeking (Robenalt & Dudek, 2021). While the main DiD model revealed no significant effect on overall county employment, a lagged effect was identified in the event study analysis. Specifically, there was a lagged positive post-treatment effect on goods-producing industry employment in certain border sections, such as West Texas and West Virginia, regions with oil and gas drilling activity. The policy's effect was heterogeneous across groups (e.g., state border sections) and over time. This heterogeneity suggests that regional economic variables and industry-specific dynamics may influence the responsiveness of labor markets to UI policy changes.

Several factors may explain the limited short-term impact of withdrawing enhanced federal UI benefits. Job seekers may have relied on accumulated savings, specifically from the federal stimulus payments and generous federal UI benefits, thus reducing any immediate financial need to return to work. Health concerns related to COVID-19 and challenges securing childcare may also have kept individuals from returning to work (Casselman, 2021). These findings align with recent empirical literature suggesting that the effects of UI generosity on labor market outcomes

are nuanced and context dependent. Studies such as Coombs et al. (2022) and Albert et al. (2022) observed minimal changes in employment metrics following the withdrawal of enhanced UI benefits during the pandemic. However, other research, including Holzer et al. (2024), found significant increases in job-seeking rates under similar conditions, highlighting the variability in empirical outcomes across different metrics and data sources.

4.6 CONTRIBUTIONS

4.6.1 Theory

This study contributes to the existing literature by advancing the application of job search theory and equilibrium labor market models by incorporating the unique context of the COVID-19 pandemic (Arbogast & Dupor, 2022; Coombs et al., 2022). Motivating this research is the need to reconcile conflicting empirical findings regarding the relationship between UI generosity and labor market outcomes—an issue reflective of broader challenges in theory evaluation (Laudan, 1978). Traditional job search models, such as those developed by Mortensen (1970) and Pissaridēs (2000), predict that reductions in unemployment benefits increase job-seeking intensity and shorten unemployment durations. However, the empirical evidence from this study indicates that these theoretical predictions may not fully capture labor market dynamics during economic distress(Card et al., 2015).

This study's findings further challenge conventional predictions by demonstrating that labor market responses to UI policy changes are both temporally and regionally heterogeneous, underscoring the limitations of applying uniform theoretical models across diverse economic contexts. The delayed effect observed in goods-producing industries suggests that industry-specific factors (e.g., such as the pace of demand recovery) may mediate the relationship between UI benefit generosity and duration with employment outcomes. This highlights the need

for a more granular approach to modeling labor market behavior, incorporating industry-level variables and regional economic characteristics.

Additionally, this study contributes to the literature on the relationship between UI generosity and unemployment duration benefits during economic distress. The results emphasize the importance of considering exogenous factors, such as government stimulus payments, the generosity and eligibility of federal UI benefits, health concerns, and challenges securing childcare. These factors may attenuate or amplify the impact of UI policy changes on labor market behavior, suggesting that traditional models should be adapted to account for such external influences. To the best of my knowledge, this study is an outlier in considering the federal stimulus payments and their impact on the labor market recovery during the 2021 post-pandemic period.

4.6.2 Policy

The findings of this study have implications for policymakers striving to balance social welfare and economic efficiency. The lack of immediate employment gains following the withdrawal of enhanced federal UI benefits suggests that such policies may not be as effective in accelerating labor market recovery as anticipated, considering the broader economic distress. Policymakers should consider the broader context, including economic uncertainty, health risks, and childcare availability when implementing similar policies. One policy recommendation would be a flexible, data-driven system that adjusts benefits based on economic indicators such as local unemployment rates and labor force participation trends. This would ensure that support is available where economic distress persists while avoiding either too broad of a policy or arbitrary distinctions. Further, automatic benefit phase-outs, rather than abrupt expirations,

would create a smoother transition for workers, particularly where workers are experiencing longer recovery timelines.

The COVID-19 pandemic recovery saw the federal government acting quickly to support the acute needs of millions in a trade-off that included broad and generalized benefits. As stated by Alan Greenspan in 2003, related to federal UI benefits during periods of economic distress, "you want to be temporarily generous" (108 Cong. Rec. H4613, 2003). Evident in the empirical research on this period, traditional levers of UI generosity and eligibility do not have the same effect on local labor market outcomes and warrant additional consideration. Both Card et al. (2015) and Farber and Valletta (2015) suggest that extended UI plays a redistributive role and supports those who would have otherwise left the labor force. Furthermore, this study highlights the potential for complementary policies to support labor force recovery. Investments in childcare services, healthcare access, and job training programs may help mitigate non-financial barriers to employment and enhance the effectiveness of UI policy adjustments. Policymakers should also consider the timing and sequencing of benefit reductions, ensuring that workers have sufficient time to respond to changing economic conditions.

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APPENDIX

Figure A.1 Goods-Producing Industry Employment: South Carolina

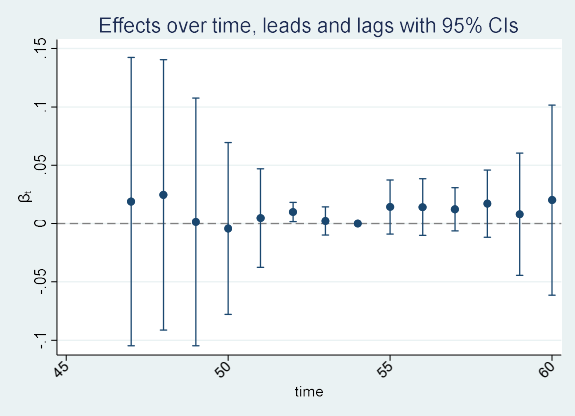


Figure A.2 Service-Providing Industry Employment: South Carolina

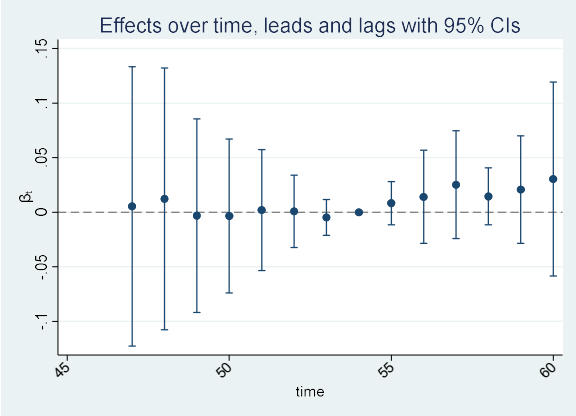
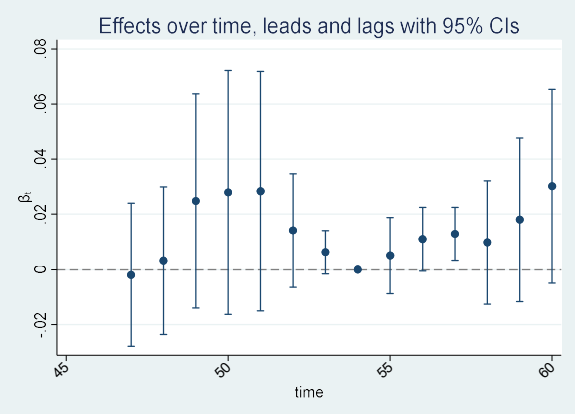


Figure A.3 Goods-Producing Industry Employment: New Hampshire



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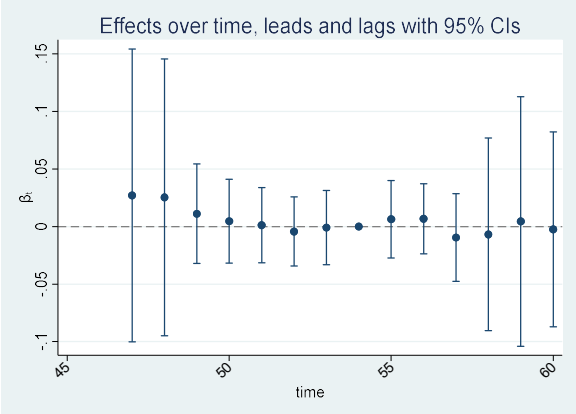
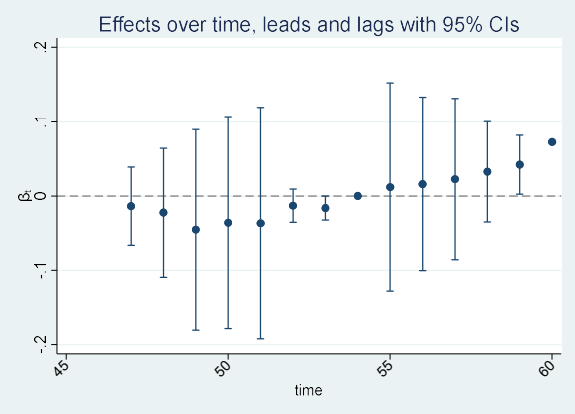


Figure A.5 Goods-Producing Industry Employment: West Virginia



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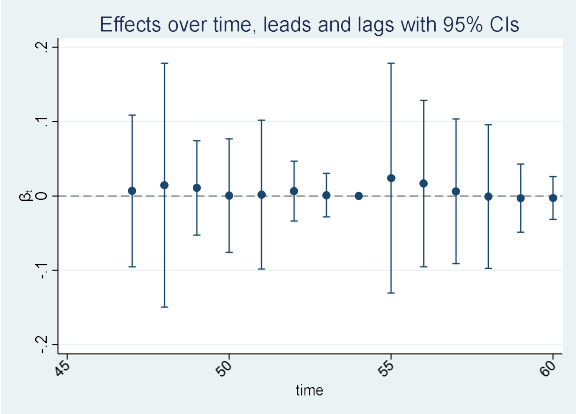

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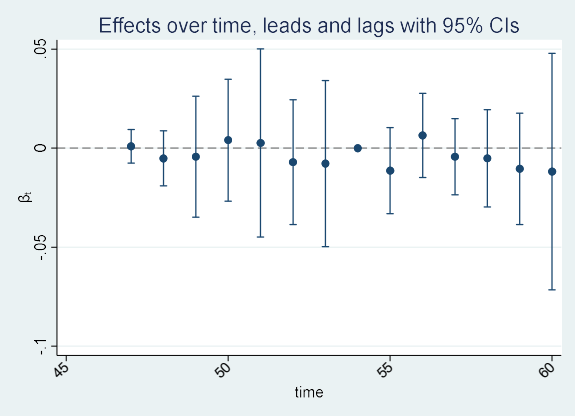

Figure A.8 Service-Providing Industry Employment: Kansas

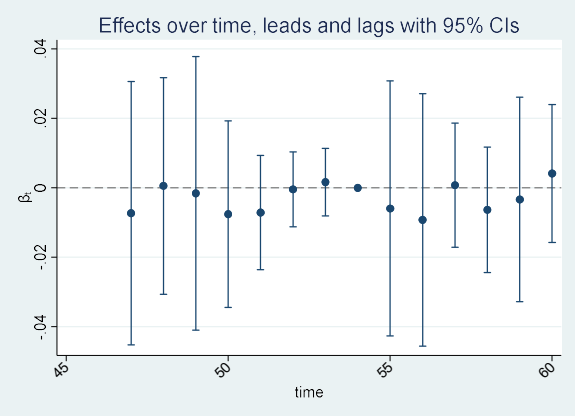

Figure A.9 Goods-Producing Industry Employment: Texas

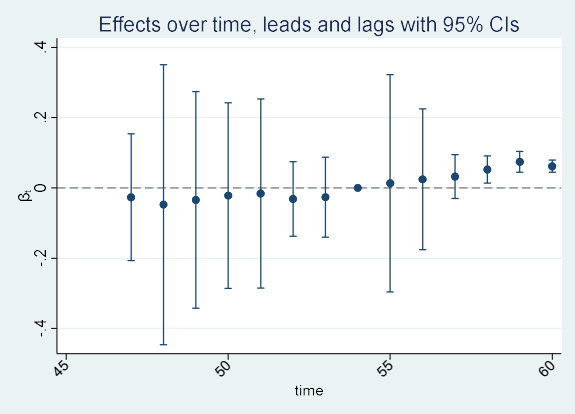

Figure A.10 Service-Providing Industry Employment: Texas

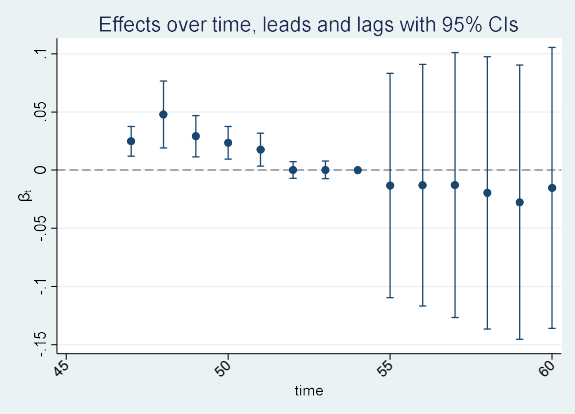

Figure A.11 Goods-Producing Industry Employment: Midwest Border Region

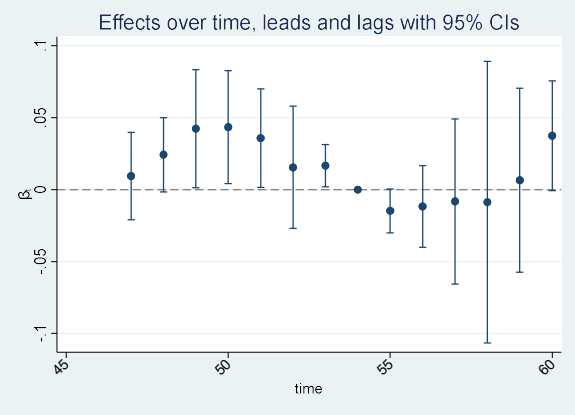

Figure A.12 Service-Providing Industry Employment: Midwest Border Region

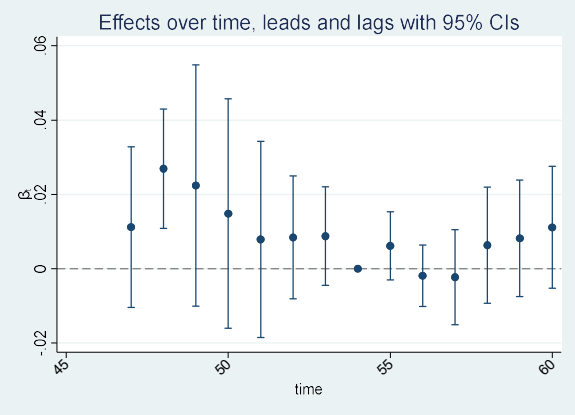

Figure A.13 Parallel Trends for Goods-Producing Industry *LnEmployment*

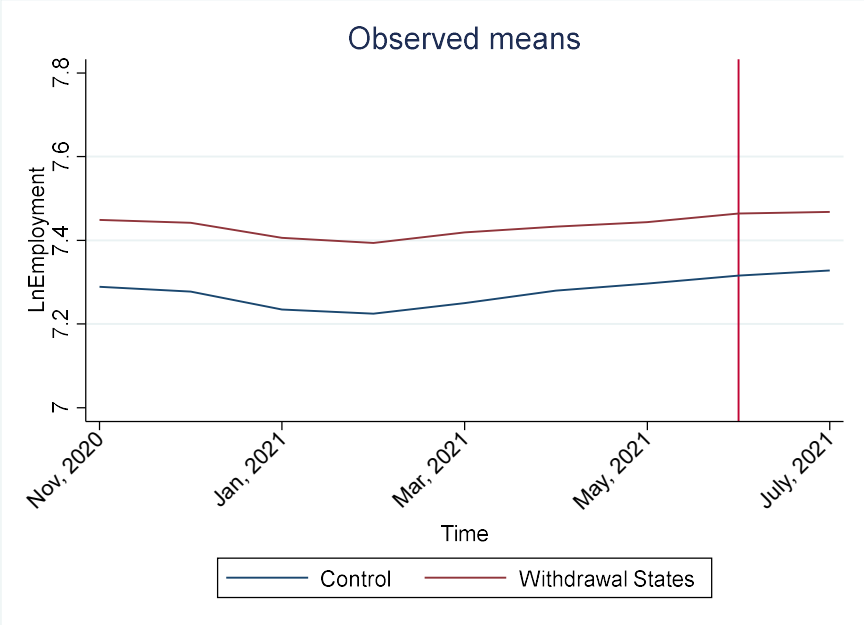

Figure A.14 Parallel Trends for Service-Providing Industry *LnEmployment*