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Lights, Camera, What Action? The Nascent Literature on the Economics of US State Film Incentives

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2 December 2020

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Abstract. The widespread proliferation of US state incentives for film and television production led to a large number of evaluations of their economic impacts. The common assumption by economic impact studies that state and film production would not occur without the incentives has spurred interest in the academic literature. We review the academic empirical studies on the nexus between state incentives and economic activity in the film and television sector. We identify areas of strengths and weakness in the empirical literature and perform additional analysis of numerous states using the synthetic control method to fill in gaps of knowledge. An added contribution of the study is discussion of the economics of the empirical results that mostly is missing in the film incentive literature.

1. Introduction

Starting in the 1990s, the use of state financial incentives to create jobs spread to film and television production. Financial incentives for film and television production include tax credits/rebates for related expenditures, grants, and exemptions from state and local taxes (National Conference of State Legislatures, 2018). The practice quickly became widespread as forty-four states had film incentives in place at some point in time post-2000 (Bradbury, 2020a).[1] The value of incentives for film and television production in the nation exploded from $3 million in 2000 to $1.4 billion in 2010 (Tannenwald, 2010), expanding further to $2.13 billion in 2016 (Thom, 2018a). Budgetary concerns and controversies have led at least thirteen states to end their incentive programs since 2009 (National Conference of State Legislatures, 2018).

Several factors complicate precisely comparing the value of film incentives across states but key features can be identified though that allow for distinguishing the large incentive states from the small incentive states.[2] Most states have limits or caps on the annual incentives that can be paid or require legislative approval of incentive expenditures (KPM Film, 2020). An exception is Georgia, which is the largest film and television incentive state with over 800

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[1] The states never having film incentives are Delaware, Idaho, Nebraska, New Hampshire, North Dakota, and South Dakota.

[2] The year of issuance of the incentive may differ from the year of the budget impact and this varies across states. States use differing forms of incentives, including tax forgiveness. Reporting practices regarding incentives differ across states and some are more transparent than others.

million dollars of expenditures in recent years (Bradbury, 2019). Other large incentive expenditure states, with total incentives or caps of at least 100 million dollars, include California, Connecticut, Illinois, Louisiana, New Mexico, and New York. States with caps or incentives of 10 million dollars or less include Arkansas, Colorado, Montana, Kentucky, Maine, Minnesota, Nevada, Oklahoma, Tennessee, Utah, Virginia, and Washington (National Conference of State Legislatures, 2018; KPM Film, 2020).

As with incentives there is significant variation in the presence of film and television production across states. Labor market outcomes directly associated with the production primarily can be found in the Motion Picture and Video Industries category of the North American Industrial Classification System (NAICS 5121) (McDonald, 2011).[3] Evaluations and studies of the film and television industry then typically focus on parts, or the whole, of the NAICS 5121 sector.

The four-digit Motion Picture and Video Industries (NAICS 5121) category includes several six digit categories, most of which are export-oriented. Two of the sectors though primarily satisfy local demand and unlikely respond to incentives: NAICS 512131 (Motion Picture Theaters Except Drive-ins) and NAICS 512132 (Drive-in Motion Picture Theaters). The four six-digit categories of NAICS 5121 most likely to be affected by incentives include NAICS 512110 (Motion Picture and Video Production), NAICS 512120 (Motion Picture and Video Distribution), NAICS 512191 (Teleproduction and Postproduction Services), and NAICS 512199 (Other Motion Picture and Video Industries). NAICS codes 512110 and 512120 are the sole six-digit categories in the corresponding five digit categories of NAICS 51211 and 51212 and can be used interchangeably.

Table 1 displays US Bureau of Labor Statistics Quarterly Census of Employment and Wage data for the sum of the four NAICS six-digit industries most likely to be export related

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[3] A related NAICS sector (7115) is Independent Artists, Writers, and Performers. But the incentive effects on the sector can be captured as an input in Motion Picture and Video Industries (NAICS 5121) production using input-output analysis in economic impact studies (Christopherson and Rightor, 2010; Loren C. Scott & Associates, 2017).

(512110+512120+512191+512199). For the US, Motion Picture, and Video Production (NAICS 512110) comprises nearly ninety percent of the sums for both employment and wages. US employment in NAICS 512110 grew approximately thirty-six percent from 2001-2019, while it grew four percent in NAICS 512191 and contracted nearly thirty-three percent and thirty-nine percent in NAICS sectors 512120 and 512199.

California, by far, contains the largest film and television presence in the nation, comprising approximately forty-six percent of the nation's wage and salary payroll employment in the export-related sub-sectors. New York ranks second with nineteen percent of national employment, with Georgia a distant third at six percent. Other large incentive states such as Connecticut, Illinois, Louisiana, New Mexico also have a significant film and television production employment. The six states that never had incentives all have a small presence in the sector (Delaware, Idaho, Nebraska, New Hampshire, North Dakota, and South Dakota) as do several of the small expenditure states (e.g., Arkansas, Kentucky, Maine, Montana, and Oklahoma) and those that eliminated their incentives (e.g., Indiana, Iowa, Kansas, Vermont and Wyoming) (National Conference of State Legislatures, 2018). Despite eliminating its incentives in 2016, Florida ranks fourth. With its modest incentives, Texas ranks fifth.

The average wage rate across the nation is $106,328 for the four export-related six-digit sectors, greatly exceeding the national average across all sectors of $59,219 according to the US Bureau of Labor Statistics. Twenty-two states have an average wage rate in the sector that exceeds the national wage rate across all sectors. Only California, Connecticut, New York, and Wyoming have a higher than average wage rate in the four export-related sectors. The footloose, high-paying, and clean production, nature of the film and television sector make it attractive for state financial incentives.

Studies on the economic impacts of state film incentives are voluminous. Reviews of the studies reveal wide ranging conclusions, which often depend on whether a private or public entity conducts the study (Weiner, 2009; Christopherson and Rightor, 2010; Tannenwald, 2010). Among the common critiques of the studies is that they assume that all film production receiving

incentives is attributable to the incentives, or alternatively that incentives are responsible for all increases in film production post-incentive adoption. Economic impact studies of the incentives then apply multipliers from input-output models to the assumed direct spending by film and television productions to derive the estimated total economic impacts of the incentives. Some economic impact studies use the estimated total economic impacts to derive incentive costs of the jobs created and the return to state revenue from the incentive-induced economic activity.

In response to the voluminous number of economic impact studies, an academic literature has emerged that tests the assumptions on the connection between incentives and production in the state film and television industry. The studies greatly vary along several dimensions in their attempts to identify a causal connection between incentives and film and television production. In this paper, we review the studies and assess their effectiveness in identifying the economic effects of state film incentives. Despite the apparent correlation between the size of incentive programs and size of the film and television sector across states discussed above, the empirical findings reviewed are inconclusive, often casting doubt on the efficacy of state film incentive programs. However, we note the incompleteness of the academic literature and implement additional empirical analysis of numerous states using the synthetic control method (SCM) to address the gaps in knowledge. A notable contribution of the empirical analysis is estimation of the impacts of both adopting and eliminating state film incentives, in contrast to prior case studies which have only examined the effects of adopting film incentives. We also evaluate the empirical findings within a broader and fuller economic policy context than currently found in the literature.

In the next section, we critically review the empirical studies that attempt to estimate the causal relationship between incentives and economic activity for the state film and television industry. An assessment of what is learned from the studies and what remains unknown forms the basis for the empirical analysis in Section 3. Included in Section 3 is a discussion of what is learned from our empirical analysis about the nexus between incentives and state film and television activity and a fuller assessment of the economics of state film incentives. Although our

empirical results provide some support for the use of film incentives to stimulate state economies, state film incentives likely do not pay for themselves. Section 4 concludes the paper and discusses the implications for state film incentive policymaking. A primary conclusion is that the state policy context matters in the decision of whether to offer film incentives.

2. Review of Academic Research on State Film Incentive Impacts

The studies reviewed vary along several important dimensions in their approach and in their effectiveness in assessing what part of film and television production in a state is attributable to the incentives and what part would have occurred in the absence of incentives. Table 2 lists the studies, their geographic focus, the time period of analysis, the outcome variables examined and their measurement of film incentives. Table 3 lists the methods of analysis, primary empirical findings, and policy conclusions of the studies. The section concludes with discussion of the key takeaways from the academic literature.

2.1 Focus of the Studies (Table 2)

The studies most often focus on all or nearly all US states. Using a large number of states can provide an assessment of the overall, on-average, experience of states with film incentives. The larger sample also provides degrees of freedom for testing statistical significance of estimated effects. The disadvantage is the potential heterogeneity of state experiences. States differ in their physical, economic, and social characteristics, and in their incentive programs in ways that are difficult to fully measure and account for in pooled sample empirical analysis.

To address the potential heterogeneity of experiences, Button (2018), Bradbury (2019) and Thom (2019) adopt the case study approach. Button (2018) focuses on Louisiana and New Mexico, which are amongst the earliest to adopt aggressive film incentives and have been noted as examples of successes. Thom (2019) likewise focuses on Louisiana, but also examines the experiences of Connecticut, Georgia, Massachusetts, and New York. All five are high incentive expenditure states, comprising seventy-seven percent of all expenditures in 2017 (Thom, 2019, p. 94). Bradbury (2019) takes Georgia and North Carolina as case studies, with North Carolina as an early adopter of film incentives and Georgia the largest incentive expenditure state. Panel

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studies of all states instead attempt to address heterogeneity by adding interaction variables to reflect the size of the industry in the state (Button, 2019) or omit states such as California and New York in sensitivity analysis (O'Brien and Lane, 2018; Thom, 2018b).

The periods of analysis in the studies mostly include the years when film incentives became prevalent, starting in the late 1990s and extending at least several years, through 2017 in two of the studies (Button, 2019; Thom, 2019). Button (2018, 2019) includes many years prior to the adoption of film incentives in any state for comparison to the post-incentive adoption years. Use of all years, combined with use of all states (Swenson, 2017; Thom, 2018b; Button, 2019; Bradbury, 2020a), produces an average effect across a sample which contained early years where only a few states had film incentives and later years where nearly all states had film incentives. Case studies of individual states implicitly allow for varying effects across time in addition to across states. Adkisson (2013) divides states into early film incentive adopters, early followers, and late adopters in case study analysis. In sensitivity analysis, Button (2019) tests whether the timing of incentive adoption mattered for estimated outcomes.

The studies also differ in the outcome variable or metric used to assess the effects of film incentives. Some studies use multiple measures, while others rely on a single measure. A few studies directly examine the number of films or television series that were produced in a state in response to incentives (Button, 2018, 2019; and Owens and Rennhoff, 2020). Because of potential non-residency of workers in the film and television industry and purchases of materials from out of the state, most studies advocate using government measures of employment, wages, or output in the state economy.

The most commonly used labor market measures are employment, number of establishments, and wages and salaries for the Motion Picture and Video Production (NAICS 51211) sector (Swenson, 2017; Button, 2018, 2019; Bradbury, 2019, 2020a). This is the sector believed primarily to be affected by film incentives as it is defined as activities "primarily engaged in producing, or producing and distributing motion pictures, videos, television programs, or television commercials" (North American Industry Classification System 2017, p.

415). The two primary sources of data used for the industry are solely for payroll employment and do not include proprietors: 1) US Bureau of Labor Statistics Quarterly Census of Employment and Wages (QCEW) and 2) US Census Bureau County Business Patterns (CBP). This leads to an understatement of the direct total employment effects of film incentives. Other sectors that may be related to incentives include: Independent Artists, Writers, and Performers (NAICS 7115); Motion Picture and Video Distribution (NAICS 51212); and Postproduction Services and Other Motion Picture and Video Industries (NAICS 51219). To the extent these activities are directly or indirectly affected by incentives the studies that do not consider them understate incentive effects.

Other studies include measures of these related sectors either separately or as part of an aggregated sector. Button (2019) includes payroll-based measures of several detailed sectors highlighted in economic impact studies as related to the film and television industry, including NAICS 7115. Adkisson (2013) examines NAICS codes 51211-51219, which includes establishments in Motion Picture and Video Production, Distribution, Exhibition, Post-Production, and other services. Thom (2018b) focuses on employment, gross state product, and wages and salaries in the aggregate sector Motion Picture and Sound Recording Industries, NAICS 512, which includes the aggregate (four-digit) NAICS sectors of Motion Picture and Video Industries and Sound Recording Industries. More published data sources exist for the aggregated sectors that more likely capture all activities affected by film incentives. But the more aggregated sectors also include activities that are highly unlikely to be affected by film incentives such as movie theaters (included in NAICS 51213) and sound recording studios (included in NAICS 5122). Oxford Economics (2017) reports almost no correlation between state-level QCEW employment in NAICS 51211 and BEA employment in NAICS 512 over the 1998-2013 period, suggesting the aggregate measure is a poor metric for estimating the effects of film incentives. Because of the relatively small size of the film and television industry the problem becomes more acute when using metrics of the entire economy such as in Bradbury (2019, 2020a). Teasing out the impacts of a small industry on the overall state economy is

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problematic because the effects can get overwhelmed by trends in other industries and other events that are nearly impossible to fully account for in empirical analysis.

The most common method of measuring incentives is specification of a binary indicator variable that takes a value of 1 the year an incentive program is adopted or is in place. Some studies include additional binary variables indicating features of the incentive program such as whether tax credits are refundable or transferable, sales tax waivers, lodging tax waivers, and requirements of worker residency (Thom, 2018b; Bradbury, 2020a; Owens and Rennhoff, 2020). Thom (2018b) tests for the influence of incentive duration on outcomes. Case studies implicitly account for both features of incentive programs because of the specific programs in the places of study (Adkisson, 2013; Button, 2018; and Thom, 2019) and the influence of duration of the state incentive program. Thom (2019) uses the magnitude of incentive expenditures instead of binary indicator variables.

2.2 Study Methodology, Findings and Conclusions (Table 3)

The studies vary widely in the empirical methods used to identify the impacts of film incentives. There are recognized best practices in empirical economic research that improve identification of policy impacts that mimic what could be obtained from the outcomes of a randomized experiment (Reich, Allegretto and Godoey, 2017; Button, 2019). We discuss these practices and the extent the studies reviewed meet them. We then discuss the findings of the studies regarding the impacts of film incentive programs on select metrics. This is followed by policy conclusions reported in the studies.

To establish the impacts of film incentives there should be detectable impacts in states that have them compared to states without incentives. The level or growth in the metric should change in a state when the film incentive program is adopted or is in effect relative to the change in the level or growth of the metric in states without incentives. The comparison across time for states with incentives to states without them is commonly referred to as difference-in-differences (DID).

A common method used in DID for state film incentives is panel two-way fixed effects of all states over time (Swenson, 2017; Thom, 2018b; Bradbury, 2020a; Button, 2019). Measures of which states have film incentives and when they were in effect should reveal changes in levels or growth of the desired impact metric. One concern with the panel two-way fixed effects approach is the interpolation across states that are inherently different (Abadie, Diamond and Hainmueller, 2010). Attributing the estimated DID across states to a film incentive program can be biased by differences in state programs and characteristics that are difficult to measure and take into account. Panel two-way fixed effects models can include control variables to mitigate this concern (Thom, 2018b; Bradbury, 2020a; Button, 2019). But there still may be unmeasured differences and nonlinearities in relationships. Another way to address this concern is to establish that the metric examined behaves similarly across states prior to the enactment of incentives in some states (Button, 2019). If the metric behaves similarly, there is said to be parallel trends in the metric and unmeasured confounding factors are argued not to influence the estimated incentive impacts.

An alternative approach is use of the synthetic control method (SCM) of Abadie, Diamond and Hainmueller (2010). In SCM, the comparison of a state with a film incentive program is to a weighted average or synthetic of other states that have similar characteristics and for which the metric behaves similarly prior to enactment of incentives. An additional advantage of SCM is the allowance of nonlinear incentive impacts. Button (2018) applies the SCM separately for Louisiana and New Mexico. One limitation of Button (2018) is the limited number of states that had not enacted a film incentive program that could be used for construction of the synthetic comparison and estimating statistical significance. Bradbury (2019) similarly applies the SCM approach to Georgia and North Carolina.

Owens and Rennhoff (2020) implements a discrete choice model in assessing film location choices. The model includes several variables relating to physical and economic characteristics of geographic locations. The list of characteristics is far from exhaustive and there is the possibility of omitted confounding factors.

Time series analysis of individual states that adopt film incentives do not provide comparisons to the experiences of states without them (Adkisson, 2013; Thom, 2019; Meares et al., 2020). Rather than a difference-in-differences comparison, i.e., differences across time after states have incentives compared to the same differences in states without incentives, the comparison is simply the difference across time in the states after they have incentives. Control variables can be added to capture industry and incentive trends elsewhere (Thom, 2019) but the lack of comparison to other appropriate states limits causal identification.

Another empirical concern is the potential endogeneity of adoption of film incentives by states. If states that are doing well economically and not enduring fiscal stress, for example, more likely adopt film incentives (Sewordor and Sjoquist, 2016), then their estimated effects likely are upwardly biased. Only a few studies explicitly address this possibility.

Use of the SCM approach mitigates endogeneity to the extent similar states are used for comparison, including similarity in the performance of the incentivized sector(s) prior to a state having a film incentive program. Button's (2018) use of SCM established similar pre-treatment paths of the selected metrics for each of Louisiana and New Mexico. But there is not any mention of the similarity of each state with its corresponding synthetic control unit in terms of characteristics that may affect the location of film production. Bradbury (2019) uses the characteristics from Reed (2009) that may affect overall state economic growth, but not characteristics more specific to the film production such as those examined in Owens and Rennhoff (2020).

Bradbury (2020a) relies on instrumental variables estimation to address the endogeneity concern. The approach is based on the findings of Leiser (2017) regarding what best predicts whether a state will put a film incentive program in place. Bradbury uses the age of a state's film commission office and the percent of border states that have a film incentive program to predict whether a state has a film incentive program, removing economic considerations that could confound the estimated impacts.

Button (2019) argues that state fixed effects in panel studies control for persistent differences in economic conditions. But economic shocks occurred during the periods of analysis that differentially affected regions that could confound identification. Button also then separately adds state trend variables, adds control variables from both Leiser (2017) and Thom and An (2017), and drops California and New York in sensitivity analysis. The findings of the study are robust to these changes.

Another concern is whether the outcomes in a state are affected by whether neighboring states have a film incentive program (Sewordor and Sjoquist, 2016). SCM and panel two-way fixed effects models in default form ignore this possibility, invoking what is the so-called Stable Unit Value Assumption (Button, 2019). Unaccounted for spillovers can bias estimates of incentive impacts because changes in outcomes in a state are solely attributed to the incentives in the state. Button (2019) finds that allowing for spillovers from states with incentives onto their neighbors does not affect the main results of the study.

The studies more likely find significant effects of film incentives on filming production than on labor market metrics. Owens and Rennhoff (2020) finds that film incentives significantly influence filming locations and that if all states eliminated their incentives filming would concentrate in a relatively few states. The study also finds refundable credits to have larger effects than transferrable credits because the latter are privately exchanged at a discount. They did not examine any labor market metrics.

Button (2018) finds incentives in New Mexico to be associated with statistically significant increases in filming productions listed on the IMDb database and feature films listed on the Studio System database. Incentives in Louisiana only significantly increase feature film productions. In contrast, Button (2019) finds large effects on TV series filming across all states but not for feature film production. The estimated TV series effect occurs gradually over time, particularly in states with a medium or large existing industry size and is argued to likely persist after incentive repeal.

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Case studies more likely report positive labor market effects than panel studies of all states. Adkisson (2013) reports that fairly equal numbers of states gained or lost employment in Motion Picture and Video Industries (NAICS 5121) after having incentives, which was true for early adopters of incentives, early followers, and late adopters. Button (2018) finds positive effects of film incentives on employment and the number of establishments in the Movie Picture and Video Production (NAICS 512110) sector for both Louisiana and New Mexico. But because of the limited number of states used in constructing the counterfactual comparison, the effects are not statistically insignificant. In contrast, across all states over time Button (2019) finds no evidence for positive effects on employment, wages, and the number of establishments in the Motion Picture and Video Production industry or in related industries, including in the sector comprised of independent artists, writers, and performers. Thom (2019) reports a statistically significant immediate positive effect on Motion Picture and Video Production employment in Connecticut, which the study attributes to the nontax component of incentives, and a statistically significant positive effect over time in Louisiana. No statistically significant effects are found for Georgia, Massachusetts, and New York.

A common policy conclusion of the studies is that film incentives are a zero-sum game (Adkisson, 2013; Swenson, 2017). While incentives may shift filming activity across states, they are argued not to increase filming nationally. But this conclusion is primarily based on stable employment trends in national film production during the period of proliferation of state film incentives, ignoring developments outside of the US such as in Canada (Lester, 2013). The incentive dollar cost per job are reported to be large (Button, 2018) and the net revenue impacts reported to be negative (Owens and Rennhoff, 2020). The studies generally conclude that film incentives are not an effective economic development tool in terms of directly stimulating labor market outcomes. Button (2018) reports evidence that size of the industry matters for incentive effectiveness, suggesting agglomeration economies in the film industry. O'Brien and Lane (2018) finds that organizational diversity and dominance increases filming activity and associated number of jobs and establishments, though this is based on the NAICS 5121

aggregate, which includes businesses that might not be incentivized such as movie theaters (Bradbury, 2020b). Owens and Rennhoff (2020) did not assess whether the incentive effect on film production varied by size of the industry.

2.3 Takeaways from the Academic Research

Despite striking differences in methodology across the studies reviewed there are a number of key takeaways. There also are unanswered questions and under-addressed issues. The evaluation of state film incentives is more nuanced than typically is recognized in the studies and an assessment of the efficacy of film incentives appears unresolved.

State incentive programs are diverse and difficult to measure and interact with differences in state characteristics in ways that make studies of all states less likely to find the effects of state film incentive programs. The heterogeneity of case study results and lack of results in panel studies of all states suggest that the size and composition of the film and television industry and size of the incentive program in the state might matter.

There is no perfect metric to evaluate film incentives. Data on film locations most directly track whether activity in the sector is affected by incentives. But film location data do not provide any information on whether the desired effects on state labor markets occur. A disconnect between production and state labor market outcomes can occur because of non-resident employment in the industry and out-of-state spending. Among labor market indicators that can be used to assess film incentives, many are too aggregated across sectors and the overall economy; many metrics include activities not targeted by the incentives, making it difficult to detect incentive impacts. Narrowly defined indicators, both in concept and by industry, likely miss labor market outcomes that could be associated with film incentives. Most studies use payroll-based measures for the Motion Picture and Video Production industry. This leaves out proprietors, which would create larger induced spending effects from the industry.

In contrast to economic impact studies of state film incentives, the academic studies do not integrate their findings with other relevant information on spillovers to the rest of the economy. At best, there is some use of existing nonacademic studies to perform back-of-the-

envelope calculations. This likely occurs in part because of the cost of obtaining and using input-output models to estimate spending effects on other sectors. Trying to detect the sector spillovers on the broader state economy statistically is difficult because of trends and shocks in other industries.

There is little comparison to other state incentive programs. State incentive programs are ubiquitous and there should be more comparisons of the findings for film incentives to other programs. There is an opportunity cost to every incentive program and many or most programs likely do not pay for themselves. How footloose film industry establishments are compared to establishments in other industries would be a key consideration in benefit-cost comparisons of incentives to other industries (Bartik, 2019b).

There is little or no discussion of film incentives in the studies to public policy making and social welfare more generally. Every action by state and local governments has an opportunity cost. Each dollar expended by government is one less spent in the private sector. There is little evidence that state and local tax reductions pay for themselves (Rickman and Wang, 2018) and in fact may only produce offsetting revenue through increased economic activity (Berck, Golan and Smith, 1997) approximately equal to the amounts often reported for film incentives (Weiner, 2009; Christopherson and Rightor, 2010; Tannenwald, 2010). Governments spend dollars on education and highways in part because of beliefs such expenditures may generate returns through increased economic activity (Bartik, 2019b), though society simply may intrinsically value education, increased safety on the roads, public libraries, public parks, etc. Sports activities and stadiums commonly receive strong public support for tax assistance despite widespread reports of a lack of impact on local economic development (Coates and Humphrey, 2008). There is evidence to suggest that states have adopted film incentives for intangible benefits such as quality of life and publicity (Sewordor and Sjoquist, 2016), which should be weighed against other policy objectives rather than simply assessed on narrow economic development metrics.

3. Empirical Analysis

We attempt to fill in some of the current holes in the academic literature on the economics of state film incentives identified above. Following most of the empirical academic studies and economic impact studies (Weiner, 2009; Christopherson and Rightor, 2010; Tannenwald, 2010), we examine the Motion Picture and Video Production sector (NAICS 51211). The industry metrics we use are the levels of employment and total annual wages reported by the Quarterly Census of Employment and Wages (QCEW). The advantage of the QCEW data are that they are derived from a census, or full count, of activity each quarter of the year rather than from a sample for limited periods. We use the unsuppressed County Business Patterns Data produced by the W.E. Upjohn Institute (Bartik et al., 2018) and regression analysis to fill in suppressions in the QCEW data during 1998-2016. For comparability across states, employment in the sector is divided by the 2011 level of population and corresponding total annual wages is divided by the 2011 level of personal income as reported by the US Bureau of Economic Analysis (BEA).

To all for potential heterogeneity of state experiences with film incentives, we follow Button (2018) and Bradbury (2019) and use the synthetic control method (SCM) of Abadie, Diamond, and Hainmueller (2010). SCM has been used extensively in policy evaluation, including numerous studies of state and local fiscal policy (Rickman and Wang, 2020). In SCM, a counterfactual or unit of comparison is constructed for establishing what would have happened in the absence of a change in policy or occurrence of some event. In our application, the unit of analysis is the state that changes its film incentive policy and the counterfactual is a weighted average of other states that did not make a change in its film incentive policy. The weights are calculated based on matching both the time series movement in the metric of the film industry prior to the policy change and variables representing characteristics that may affect filming activity in the state. The differences in outcomes in the metric before and after the change in policy become the estimate of its effects.

The use of the SCM approach to identify the direct effects of film incentives stands in contrast to approaches used in economic impact studies (Weiner, 2009; Christopherson and Rightor, 2010; Tannenwald, 2010). The three approaches most commonly found in economic

impact studies are: 1) assuming that all production activity receiving incentives is attributable to the incentives, and sometimes including production activity not receiving incentives because of perceived cluster benefits; 2) attributing the change in trend in the state's film production activity to the adoption of incentives; or 3) using the change in the state's trend in film production activity relative to the national trend. All three approaches are problematic, with the first two approaches the mostly likely to yield upwardly biased estimates of the impacts of film incentives on film production. The findings by Owens and Rennhoff (2020) of non-incentive state characteristics influencing the location of film production supports the need to compare states that had similar characteristics and trends in production activity before changes in film incentive policies. Simple comparisons to national trends in the third approach likely produce biased estimates because of the dominance of California and New York in national film production.

3.1 The Case Studies

Because the results of one case study may not readily generalize broadly to other states we consider several scenarios across multiple states. The number of potential case study comparisons is limited though because almost all states have had incentives for the film and television industry in place at some point in time since 1998 (National Conference of State Legislatures, 2018; Bradbury, 2020a). Our solution is to formulate two general scenarios for the SCM analysis using periods where there are sufficient numbers of incentive policy differences across states. First, following Bradbury (2019) and Button (2019) we attempt to assess the effect of early adoption of film incentives. We compare the early adopters to states that never adopted incentives or did not adopt them until later. Second, in extending the literature we assess the effects on states that had film incentives during a sufficient period of time and then eliminated them. We compare these states to those that had incentives during the same period but never eliminated them. We include an analysis of the effects of capping incentives in Louisiana after years of no caps. Table 4 lists and provides details for the incentive scenarios examined.

3.1.1 Early Incentive Adopters

A few states stand out as early adopters of incentives that have continued to maintain them. Focusing on the early adopters of incentives provides comparisons to other states before they adopted them. We follow Button (2018) and examine Louisiana and New Mexico because of their early adoption in 2002 and increased role and perceived success in the film industry (Tannenwald, 2010). We also examine North Carolina and Rhode Island which adopted incentives in 2000 and continue to maintain them, though North Carolina later switched from a tax credit to a grant program (National Conference of State Legislatures, 2018).

To allow for at least five years of post-adoption analysis we examine metrics through 2006. We use data beginning in 1990 to provide a longer period for matching the pre-incentive film production experiences of the early adopters with those of non-adopters, which better matches on unobservable factors over time that may influence film production (Abadie, Diamond and Hainmueller, 2010). The number of states to include as potential donors to the counterfactual unit is limited because of the number of states that had adopted incentive programs by 2006 and QCEW data nondisclosures pre-1998. States included as potential donors that never adopted film incentives for which data are available include Idaho, New Hampshire, and South Dakota. Potential donor states that adopted incentives in 2007 or later include Indiana, Iowa, Kansas, Kentucky, Michigan, Nevada, Ohio, West Virginia, Wisconsin, and Wyoming.

3.1.2 Incentive Eliminators

Re-evaluation of film incentive program impacts, state budget difficulties, and controversies led thirteen states to end their incentive programs between 2009 and 2018 (Verrier, 2011; Skorup, 2017; National Conference of State Legislatures, 2018). Many of the states had maintained the incentive programs for several years. Elimination of the programs has not been without controversy and calls to re-instate them (e.g., Thompson, 2019; Cain, 2020; George, 2020; Morehead, 2020). We examine the experiences of six states that ended their incentive programs as case studies: Arizona, Florida, Indiana, Michigan, Vermont, and Wisconsin.

The six states had incentives in place for the following periods (Table 4) indicated in parentheses: Arizona (2006-2010), Florida (2003-2016), Indiana (2007-2011), Michigan (2008-

2015), Vermont (2006-2011) and Wisconsin (2008-2013). We compare the states ending their incentive programs to states that had incentive programs over the same periods but maintained them through the end of the sample period. Twenty states that had incentives in place from 2006 until 2019 comprise the donor pool: Connecticut, Georgia, Illinois, Maine, Maryland, Massachusetts, Minnesota, Mississippi, Montana, New Mexico, North Carolina, Oklahoma, Oregon, Pennsylvania, Rhode Island, South Carolina, Tennessee, Texas, Utah, and Washington. The pre-treatment period for each state begins with the latter of 2006 or the year of incentive adoption. Years after termination of the incentive program until 2019 comprise the post-treatment period for each state.

3.2 SCM Implementation

The SCM method selects states from a donor pool and assigns them weights to match pre-treatment fits of both the outcome variable and the characteristics of the states. The closer the incentive state examined is to its counterfactual comparison in the outcome variable and characteristics the more likely the counterfactual represents what would have happened in the incentive state without adoption or repeal of incentives. The state characteristics used in the SCM matching are measures of housing costs, the average wage rate, the tax and regulatory climate, natural amenity attractiveness, the share of the adult population a bachelor's degree, population density, and a measure of industry composition. These are characteristics that have been shown to affect both overall economic growth in a state (Rickman and Wang, 2020) and location of filming activity (Owens and Rennhoff, 2020). As shown in Table 5, alternative measures are used for some characteristics to fit the years used for the pre-treatment period of the scenario. All measures pre-date the year of change in incentive program.

3.3 Results and Analysis

Table 6 contains a summary of the SCM results for all scenarios. Reported for each scenario is the difference between each pair of paths in the years after (before) the adoption (elimination) of the incentive program relative to the difference before (after) incentive adoption (elimination); i.e., an estimated difference-in-differences (DID). The DID is interpreted as the

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effect of the state incentive program. Each DID is translated into the impact on the economic measure examined and reported in the third column of the table.

3.3.1 Film Incentive Adoption Scenarios

Figures 1-4 shown the SCM results for the four early adopting states examined. Below each figure are the weights for the states that comprise each synthetic control and the estimated DID (translated into the impacts on employment and wages in Table 6). Although not shown, we discuss how close the characteristics of the synthetic control units are to those of the corresponding incentive-adopting state.

Figure 1 shows dramatic increases in both employment and wages for Motion Picture and Video Production in Louisiana after adoption of incentives in 2002. Prior to adoption of the incentives, Louisiana employment and wages in the sector followed those of the synthetic controls fairly closely. The characteristics of the two synthetic control units closely match those of Louisiana.

The DID estimates for 2002-2006 vs. 1990-2002 equal 0.309 for employment and 0.291 for wages. Converting the difference in estimated DID per capita jobs relative to the actual per capita jobs to total jobs, the DID estimate implies that the increase in the number of employees from 516 in 2002 to 1,875 in 2006 in the sector would have instead been a drop of 56 without the adoption of incentives. The increase represents a two hundred seventy-four percent increase of the 2002 value, which compares to a 1.7 percent increase nationally. The DID estimate for wages implies that the approximately four hundred percent increase that occurred over the 2002-2006 period underestimates (by 27.3 percent) the effect of the incentives and dominates the corresponding sixteen percent that occurred across the nation.

Figure 2 likewise shows strong increases in Motion Picture and Video Production sector employment and wages for New Mexico after its adoption of a film incentive program in 2002. The paths of New Mexico employment and wages follow those of the corresponding synthetic paths from 1990 through at least the last year of not having the incentive program. The synthetic path for employment drops more than New Mexico's during the initial couple of years of

adoption and holds steady for wages. Dramatic divergence of the two sets of paths occur during 2005-2006. The synthetic control characteristics most closely match New Mexico's in terms of lower housing rents, lower average wage rate and lower shares of adults with a bachelor's degree.

The difference-in-differences (DID) estimates for 2002-2006 vs. 1990-2002 equal 0.632 for employment and 0.66 for wages. The employment DID implies that New Mexico's incentives caused the number of jobs in its Motion Picture and Video Production sector to increase two hundred and eighty-six percent of its 2002 value. The estimated DID for wages approximately equals the actual change in wages, which implies that the increase in wages from $12,450 thousand in 2002 to $60,370 thousand in 2006 occurred because of the adoption of incentives.

Figure 3 shows small effects of tax incentives for North Carolina from 2000 to 2006. The pre-treatment period begins in 1993 because of a lack of fit for pre-treatment paths using 1990 as the first pre-treatment year. The synthetic unit characteristics generally are similar to those for North Carolina. Notable exceptions are the relatively faster industry mix employment growth and somewhat lower wage rates in both synthetic control units.

The estimated DID for North Carolina is 0.009 for employment and 0.032 for wages. The employment DID implies that instead of losing 481 jobs in the sector over the period, the state would have lost 567 jobs without the incentives, a positive impact of 86 jobs (equal to 7.7 percent relative to the 2000 value). The DID for wages implies a gain from the incentives approximately equal to fifty-one percent of the 2000 level.

Although Rhode Island adopted incentives in 2000 it is not until 2006, the last year in the sample, that there is a detectable impact of the incentives on employment and wages (Figure 4). Rhode Island's pre-treatment paths of employment and wages closely match the corresponding synthetic unit paths. Although outside the sample because of considerations of having a larger donor pool, employment and wages remain elevated post-2006, suggesting longer term effects of

the incentives. Rhode Island had higher housing rents, wage rates and population density than both synthetic control units.

The DID estimate for employment equals 0.257 and for wages equals 0.493. Rhode Island's estimated employment DID slightly exceeds the actual per capita change in employment from 2000 to 2006. The incentives caused employment to increase by three hundred and fifty-two percent of the 2000 value of seventy-seven. Approximately the entirety of the post-incentive wage increase can be attributed to Rhode Island's adoption of incentives.

3.3.2 Film Incentive Elimination Scenarios

Figures 5-8 display the synthetic control method (SCM) results for states that eliminated their film incentives. Each figure contains the path of employment or wages in the Motion Picture and Video Production sector (NAICS 51211) before and after the repeal of incentives and compares it to the path of the corresponding synthetic control comprised of states that had incentives throughout the period of analysis. The difference between each pair of paths in the years after the repeal of the incentive program relative to the difference before incentive elimination is interpreted as the effect of the state incentive program.

Figure 5 contains the SCM results for Indiana, which had incentives in place between 2007 and 2011. After matching the synthetic control paths during the period when incentives were in place, both employment and wages in the Motion Picture and Video Production sector fell below the synthetic control paths after the repeal of incentives. Indiana is slightly less amenity attractive and slightly more densely populated than each of its synthetic control units.

From Table 6, the estimated DID for Indiana is -0.055 for employment and -0.024 for wages. The estimated DID for employment implies that rather than declining by twenty-four from 2011-2019, employment in Indiana's Motion Picture and Video Production sector would have increased by three hundred thirty-four, an eighty-three percent change relative to the employment level of four hundred thirty-three in 2011. The estimated DID for wages implies about thirty percent lower total annual wages in the sector because of the absence of incentives.

The Wisconsin incentive repeal exhibits a similar pattern in Figure 6 to Indiana's. Wages in the sector especially would have increased more with incentives. The characteristics of the synthetic control units mostly match those of Wisconsin, with the exceptions that Wisconsin is less densely populated and had a greater composition of slower growing industries nationally during 1998-2002.

The estimated DID for Wisconsin is -0.028 for employment and -0.106 for wages in the industry. Rather than only increasing by thirty-six during 2013-2019, the SCM suggests that Wisconsin's employment in the sector would have increased by one hundred ninety-four, the difference representing 26.5 percent growth of the 2013 level of five hundred ninety-six. For the sector's total annual wages in Wisconsin, the estimated DID suggests they would have been higher by one hundred and three percent of the 2013 value.

Figure 7 suggests the repeal of film incentives in Florida reduced both employment and wages in its Motion Picture and Video Production sector. Florida had incentives in place from 2003 to 2016, yielding a long pre-incentive repeal period for matching. Florida's characteristics generally matched those of the synthetic control units with a couple of exceptions. For both the employment and wage comparisons, Florida is somewhat more amenity attractive and more densely populated than the synthetic control units.

Although the differences appear small in Figure 7 compared to the previous figures, this in part is because of the long pre-treatment period and wider range of values. The estimated DID is -0.038 for employment and -0.073 for wage. The estimated employment DID indicates that employment would have increased by seven hundred twenty-four from 2016 to 2019 rather than increasing only by seven. Relative to the level of employment of 6,092 in 2016, this translates into a 11.8 percent lower level than what would have occurred with incentives. Wages would have been 13.1 percent higher relative to the 2016 value had Florida maintained the incentives.

Figure 8 shows Michigan's experience with repealing its film incentives in 2015. With the exception of an upward blip in wages in 2011, Michigan's paths of employment and total annual wages follow those of the synthetic control paths. Michigan is somewhat less natural

amenity attractive and had somewhat lower bachelor's degree shares in 2000 than its synthetic control units, but otherwise matches the synthetic control units well.

The estimated DID for employment is -0.132 and total annual wages is -0.125. The estimated DID for employment suggests that it would have increased by nine hundred forty-nine from 2015 to 2019 rather decrease by three hundred fifty-three, with the difference representing 70.3 percent of employment in the sector in 2015. The estimated DID suggests total annual wages in the Motion Picture and Video Production sector would have been 44.8 percent higher in terms of the 2015 value had Michigan retained its incentives.

We also examine the repealing of incentives for Arizona and Vermont. For both Arizona and Vermont, the employment paths during the pre-incentive years did not match well and violated the parallel trends assumption needed for unbiased estimation of the effect of repealing incentives. The paths for total annual wages matched well for both states. Arizona's synthetic control for total wages is comprised of three states (SC=0.743, TX=0.151, ME=0.106). Compared to the synthetic control unit, Arizona is more natural amenity attractive, had higher wages, had higher housing costs, and had a mix of faster growing industries nationally during 2002-2007. Vermont's synthetic control unit for total annual wages is comprised of four states (MT=0.352, MS=0.326, MN=0.293, RI=0.029) and closely matches Vermont's characteristics.

The estimated DID for total annual wages equals -0.098 for Arizona and -0.11 for Vermont. Arizona's DID estimate suggests that maintaining incentives would have led to an increase in total wages equal to one hundred forty-one percent of the 2010 value. Vermont's DID for total annual wages suggests an incentive-induced increase of total wages equal to 85.6 percent of the 2011 value.

One final scenario considered was the capping of the total amount of incentives in Louisiana. Previously uncapped, Louisiana capped the amount of tax credits that could be claimed at $180 million in 2015 in response to budgetary concerns, reducing the cap further to $150 million in 2017 (Karlin, 2019), which are lower than the 240 million dollar revenue loss associated with incentives in 2014 (The Public Affairs Research Council of Louisiana, 2015).

The response of film production to the capping of incentives in Louisiana provides another test of the role of film incentives in state film production. We specify 2006-2015 as the period to construct the synthetic control match and compare the difference in changes from 2015-2019.

Employment in the Motion Picture and Video Production sector fell post-2015 in Louisiana but the SCM fails to produce a suitable employment counterfactual. SCM succeeds in matching the path of Louisiana's total annual wages in the sector. Louisiana's synthetic control comparison for total annual wages is comprised of the following states, with the weights in parentheses: Connecticut (0.536), New Mexico (0.294), and Tennessee (0.17). In contrast to Louisiana's total wages, total wages of the synthetic control unit rose from 2015 to 2019. There were no major changes in the incentive programs of the states comprising the synthetic control during 2015-2019. The estimated DID for the total annual wage scenario is -0.683. The SCM DID estimate suggests that total annual wages in the sector would have been nearly fifty percent higher in 2019 (forty-three percent of the 2015 value) had Louisiana not capped its incentives.

3.3.3 Placebo Tests

We follow convention in SCM studies and recommended best-practices in empirical research and perform placebo tests. We specify each state in the donor pool as making a change in film incentive policy and use the remaining states in constructing a counterfactual comparison. The difference in outcomes for the placebo states versus their counterfactual comparisons should be nonexistent or at least smaller than the differences for states that made changes in their incentive programs as a state not changing its incentive program would not be expected to have a change in outcome. We use the rank of the difference in outcomes (DID) for the state making a change in its incentive policy relative to the differences for the placebo states divided by the number of donor pool states as the level of significance (Munasib and Rickman, 2015; Rickman and Wang, 2018, 2020).

Figures 9 and 10 show the placebo test results for the state film adoption scenario. Each line represents the difference between the actual outcome and the predicted outcome based on the synthetic control unit. The donor states are shown by thin solid lines, while the four incentive

adopting states examined are shown by dashed colored lines. The synthetic controls for the donor states are constructed using 1990-2000 as the pre-treatment period.

For the donor states, and North Carolina and Rhode Island, the DID calculations use 1990-2000 and 2000-2006, prorated per year. For Louisiana and New Mexico, the calculations use 1990-2002 and 2002-2006, which when compared to 2000 for the donor states makes it more challenging to demonstrate a statistically significant effect for the two states. Based on the DID calculations, for both employment and wages, Louisiana, New Mexico, and Rhode Island rank first compared to the donor states (not shown), making their results statistically significant below the 0.1 level (i.e., 1/13=0.08). North Carolina's DID ranks eighth for employment and fourth largest for wages and salaries, which makes North Carolina's estimated positive effects for employment and wages in the Motion Picture and Video Production sector statistically insignificant.

We repeat the placebo analysis for the states that repealed their incentive programs, or in the case of Louisiana capped its incentives. First, we perform a placebo analysis for Arizona, Indiana, Wisconsin, and Vermont, which did not have incentives for long-periods of time. For the twenty donors we specify 2006-2011 as the pre-treatment (incentive) period and 2012-2019 as the post-treatment period without incentives. Second, we perform a placebo analysis for Florida, Louisiana, and Michigan. The pre-treatment period is 2006-2015, leaving 2016-2019 as the post-treatment period.

For the first placebo analysis, none of the state declines in employment or wages are statistically significant (not shown). The estimated DID for employment ranks ninth for both Indiana and Wisconsin compared to the DID for the placebo states. Recall that the SCM failed to produce a successful employment synthetic control for Arizona and Vermont. For wages, the estimated DID ranks sixth for both Wisconsin and Vermont, seventh for Arizona, and twelfth for Indiana. The DID calculations for the incentive repealing states are based on the year of repeal in each of the states and prorated per year.

Figures 11 and 12 show the placebo test results for Florida, Louisiana, and Michigan. Recall that the SCM failed to produce an efficacious employment counterfactual for Louisiana. So, Louisiana is not included in Figure 11. Of the twenty donor states, the SCM only produced seventeen successful placebo comparisons for both the employment and wage scenarios.

In the employment placebo comparison, the estimated DID for Michigan ranks second and Florida's ranks eighth most negative. With only seventeen placebo comparisons, neither estimated DID qualifies as statistically significant, though Michigan comes close. In the wage placebo scenario, Louisiana ranks first, Michigan ranks second, and Florida ranks fifth, for most negative DID. This qualifies the negative post-incentive repeal of Louisiana as statistically significant, with that of Michigan again nearly significant.[4]

3.4 Re-evaluation of the Cost-Effectiveness of Incentives for Louisiana and New Mexico

Using the above SCM estimates for the adoption of incentives in Louisiana and New Mexico, we estimate the state budgetary return from economic activity stimulated by film incentives and the dollar incentive cost per job created. We compare and contrast them to those of Button (2018), Owens and Rennhoff (2020), and related economic impact studies.

Although our pre-treatment (incentive) period ends in 2006, and two of the states contributing to the synthetic control for employment subsequently adopted incentives, Wyoming in 2007 and West Virginia in 2008, we calculate the synthetic control estimates through 2008 for comparability with Button (2018). If anything, this would bias our estimated incentive impacts for Louisiana downwards if Wyoming's and West Virginia's incentives stimulated their film production post-2006.

From the SCM incentive adoption scenario the average difference in Louisiana's level of Motion Picture and Video Production (NAICS 51211) employment from its synthetic control for 2003-2008 is 1,417. This includes an adjustment for the average difference during the pre-

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[4] Georgia is the placebo state with the strongest positive increase in both employment and wages and salaries after 2014-2015, likely attributable to the opening of Pinewood Atlanta Studios in 2013 and the production of several Marvel films. Georgia only contributed to the synthetic controls of Florida with weights of 0.032 for employment and 0.028 for wages. So, the positive relative outcome in Georgia did not much influence the SCM DID for the incentive elimination scenarios for Florida, Louisiana, or Michigan.

incentive period between Louisiana and its synthetic control. Our estimate exceeds the value of 1,111 reported by Button (2018) for the period. Using a Type II employment multiplier of 2.78 from the IO-Snap input-output model software for Louisiana (IO-Snap, 2019), the total employment impact of the incentives is predicted to be 3,943. The Type II multiplier includes both the estimated indirect effects on other sectors from increased film production spending and estimated induced effects on consumption from increased income.

Louisiana employment in the related sub-sectors of Motion Pictures and Video Distribution (NAICS 51212) and Postproduction Services and Other Motion Picture and Video Industries (NAICS 51219) declined from 2002-2006. Consistent with the empirical evidence by Button (2019) for all states, there does not appear to be an incentive effect on Independent Artists, Writers and Performers sector (NAICS 7115) as it also declined during 2002-2006 in Louisiana. It appears then that Motion Picture and Video Production (NAICS 51211) is the incentivized sector in Louisiana.

The corresponding SCM estimated impact on total annual wages in Motion Picture and Video Production is $55,708,751 for 2003-2008. There is less potential bias in the estimated wage treatment effect for 2007-2008 because the two weights for West Virginia and Wyoming only sum to 0.026 for the wage synthetic control. Consistent with employment, there appears to be no effect on total annual wages in NAICS 51212, 51219, or 7115. Multiplying the SCM direct wage effect by the IO-Snap income multiplier of 2.643 yields a predicted total wage impact of $147,238,229. Using tax data from the Annual Survey of Government Finances (Urban Land Institute, 2020) and BEA wage and salary data, an average ratio of total state taxes (less net corporate income taxes and the category including severance taxes) to wage and salary income over 2003-2008 is calculated as 0.112. Multiplying the total estimated wage impact by this ratio produces an estimated revenue feedback from film-induced economic activity of $16,542,630.

Button (2018) reports an average of $75.3 million in film incentives over the period in 2009 dollars. Converting this into an average of $70.6 million nominal dollars for 2003-2008, the return to state revenue would be 0.23. Subtracting the revenue feedback from the nominal

incentive cost and dividing by the estimated total number of jobs created, produces an estimate of $13,698 cost per job created from the film incentives. In contrast, Button (2018) estimates an incentive cost per job of $48,388 based on the SCM estimated job impact in the paper. While complete details of Button's calculation are not provided in the paper, the estimate appears to only include the direct jobs stimulated but includes the addition of estimated contract jobs in addition to establishment jobs.

The average ratio over the period of BEA total employment, which includes proprietors, and BEA wage and salary employment for the aggregate sector Motion Picture and Sound Recording sector (NAICS 512) is 1.16, suggesting our net revenue cost per job could be sixteen percent lower if the aggregate ratio held for Motion Picture and Video Production (NAICS 51211) (i.e., $13,698/1.16=$11,807). There is a slight negative but statistically insignificant relationship between the ratio across states in 2017 and the Census County Business Pattern share of employment in NAICS 51211 in the aggregate sector, suggesting that adjusting by the NAICS 512 total employment to wage and salary employment ratio may be appropriate for estimating the proprietor impact in NAICS 51211.

Following Button (2018), we perform a similar exercise for New Mexico. The SCM estimate of the average level of employment in NAICS 51211 in New Mexico relative to its synthetic control unit, adjusted for the pre-incentive difference, is 1,048, exceeding Button's estimate of 830. If anything, the estimate could be biased downwards because of the larger weight that West Virginia has in the employment synthetic control. Given the IO-Snap employment multiplier of 3.62, New Mexico's incentives are predicted to have increased total employment in the economy by 3,442. QCEW employment and wage data are not disclosed for most years by BLS for NAICS 51212 and 51219 in New Mexico to preserve confidentiality, and where they are disclosed the values are small. Employment and total annual wages in NAICS 7115 either are flat or decrease over the period.

The corresponding SCM estimate of total annual wages for New Mexico is $37,115,698 which translates into $94,756,378 with an approximate income multiplier of 2.55. Potential

downward bias in the estimate may exist because of the larger weight that Michigan receives in the construction of the synthetic control, which adopted incentives in 2008. The average tax ratio to wages and salaries for New Mexico (as calculated above for Louisiana) over the period is 0.123, which when applied to the total estimated change in total annual wages produces an estimated return to state tax revenue of $12,369,570. The rate of return on film incentive dollars to the state budget then equals 0.48. The net revenue cost per job created from the film incentives equals $3,593, which as with Louisiana is much lower than the estimate by Button (2018), reported as $21,035. Our estimated cost could be yet sixteen percent lower because of the ratio of total employment to wage and salary employment over the 2003-2008 period (i.e., $3,593/1.16=$3,097).

Besides differences in SCM estimates and our use of input-output multipliers to capture indirect effects, differences in our estimates of the cost-effectiveness of the incentives from Button (2018) may arise from the tax rates used in the calculations. We assume that increased wages affect most categories of taxes and not just the major categories such as income taxes and sales taxes, which produces larger estimated revenue feedbacks. The sole categories removed from consideration are net corporate income taxes and taxes NEC (which includes severance taxes), both of which are sensitive to the energy industry in each state.[5]

Our estimates of the cost per job of $13,698 and return on investment equal to 0.23 are closer to those of other studies of Louisiana for different time periods. For 2013, Owens and Rennhoff (2020), which includes multiplier effects, report a state return-on-investment of $0.17 and dollar incentive cost per job of $20,224 for Louisiana. In economic impact studies, Loren C. Scott & Associates estimate an incentive dollar cost per job of $15,494 for 2015-2016, while for 2017-2018 Camoin Associates (2020) report a return-on-investment of $0.35 and dollar incentive cost per job of $12,895. The above rate of return estimate for New Mexico of $0.48 and

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[5] The tax revenue feedbacks are close to those predicted from regressions of the tax measures on total wages and salaries in natural logarithms for the two states from 1990-2008; Louisiana's regression estimates suggest slightly higher feedback on revenue, while New Mexico's regression estimates suggest slightly lower revenue feedback.

associated estimated net cost per job of $3,593 are more favorable than those reported for New Mexico by Owens and Rennhoff (2020) of $0.20 and $17,807, and the economic impact study by Popp and Peach (2008) of $0.14 and $13,424.99. More comparable estimates of $0.33 and $8,519 are provided by *MNP LLP* (2014) in an economic impact study.

3.5 Discussion of Key Findings

1) State film incentives likely increase economic activity in the intended sector.

   a. For three of the four early adopters examined, both employment and wages in the Motion Picture and Video Production sector significantly increased in the state after adoption of an incentive program relative to a matched comparison unit that predicts what would have happened without the incentives. For the fourth early adopting state, estimated relative wages increase after adoption of incentives, but the estimate is not statistically significant.

   b. Evidence from examining six states that repealed their incentives suggests meaningful declines in Motion Picture and Video Production employment and wages after the elimination of incentives, though they lacked statistical significance. The capping of incentives in Louisiana is shown to have significantly reduced wages in the film sector, though an effective comparison unit for employment is not available.

   c. Incentives can play a much larger role in Motion Picture and Video Production than do state incentives in other sectors. Based on a review of 34 empirical incentive studies, Bartik (2018) concludes that incentives generally play a minor role in other sectors. Depending on the relative credence given to each of the studies reviewed, Bartik suggests that between 75 percent to 98 percent of firm location decisions would have been the same without the incentives received. Based on the analysis above, comparable calculations for the percent of Motion Picture and Video Production employment that would have occurred without film incentives in the four early incentive adopters in 2006 are 24.5, 28, 86.4 and 17.4 for Louisiana, New Mexico, North Carolina, and Rhode Island.

2) Successful state film incentives programs likely generate significant budgetary returns from increased spending in Motion Pictures and Video Production and its indirect effects on spending in the rest of the economy. The incentives programs are highly unlikely to pay for themselves though unless the increase in state filming increases tourism or increases quality of life and attracts new residents, considerations not examined in the study. Our estimated net revenue costs per job associated with state film incentives for Louisiana and New Mexico compare favorably to those of other export-based sectors. Bartik (2019a) reports an average cost of $24 thousand of state job and investment tax credits per direct job created across the US in 2015. Assuming an average state employment multiplier of two across the nation reduces the incentive cost to $12 thousand per job. But assuming an upper bound of 25 percent of the jobs as incentivized from the above discussion increases the cost to $48 thousand, which greatly exceeds our state film incentive estimates of $13,698 for Louisiana and $3,593 for New Mexico.

3) Successful state film incentive programs likely pass a benefit-cost analysis. Using a baseline model of general incentive benefits and costs, Bartik (2019b, p. 40) reports a benefit-cost ratio of 1.52. Included in the baseline model is an assumption that incentives induce the location or expansion decision of 12 percent of the firms. The findings above for four early film incentive adopting states that incentives induced 13.6 to 82.6 percent of film spending suggest benefit-cost ratios that are multiples of the baseline model benefit-cost ratio of Bartik (2019b) for the more successful programs.

4. Conclusions

This paper advances empirical knowledge and policy discussion of the economics of state film incentives through critically reviewing existing academic empirical studies, conducting additional empirical analysis, and placing the issue within the broader context of state financial incentives and social welfare analysis. Previous empirical studies report mixed support for the ability of state film incentives to induce the intended activity. Studies more likely find the intended incentive effects on the number of film and television productions than on related labor market outcomes. Case studies more likely find positive effects of incentives than panel studies

of all states, though the effects mostly are modest or statistically insignificant. At best, the studies reviewed are inconclusive on the efficacy of state film incentives as an economic development tool.

We further pursue the case study approach using the synthetic control method (SCM). In an extension of previous SCM studies and a contribution to the empirical literature, we not only examine the scenarios of early film incentive adoption we also examine several scenarios where states eliminated film incentives that had been in place for at least several years. We examine both employment and wages and use additional information in constructing the synthetic counterfactual comparisons. Overall, we find it more likely than not that state film incentives increase employment and wages in the state film and television sector. Where the results are statistically significant, we find support for the assumption used in some economic impact studies that all changes in state film and television production after a change in incentives occur because of the change. But the commonly used assumption in economic impact studies that all state film and television spending receiving incentives occurs because of them is suggested to significantly overstate the effects of the incentives.

We similarly find support for the values of the return on incentive investment (ROI) and incentive cost per job reported in the more thorough and transparent economic impact studies such as for Louisiana and New Mexico. Much like the conclusions of studies regarding reductions in state and local taxes (Rickman and Wang, 2020), the incentives do not pay for themselves. But because of the higher average pay in most incentivized state and local film activity, and the greater estimated footloose nature of the industry, state film incentives can produce a higher ROI, a lower incentive cost per job, and a larger benefit-cost ratio, than the typical state incentive.

The literature review and added empirical analysis suggest, however, that not all incentive programs likely are successful. Those that are small, having low caps on spending, or requiring legislative approval each year, may lack sufficient size and certainty to attract state film and television productions. The reductions in employment and wages in the Motion Picture

and Video Production sector following the elimination or capping of incentives though suggest that any cluster effect that exists with size is not sufficiently strong to offset the continual need for some amount of film incentives once the industry is established in the state to maintain the size attained.

The policy context of the state matters in evaluating the social welfare implications of state film incentives. Are other state government services adequately funded? If education or physical infrastructure are insufficiently funded, reducing funding for them further to provide incentives may not pass a benefit-cost analysis. Citizens might value the presence of state film and television production to pay for net costs of the incentives such as often occurs for sports teams (Coates and Humphreys, 2008). Each case should be assessed on its own merits, taking into account program characteristics, state economic conditions, and citizen preferences. No simple, universally applicable policy recommendation, regarding state film incentives likely is possible.

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Table 1. State Film and Television Industry Labor Market Statistics: Year 2019

State	Establishments	Employment	Employment as % of US	Annual Wage Rate ($)
California	10,247	120,752	45.9	134,929
New York	3,062	49,692	18.9	107,377
Georgia	612	16,433	6.2	69,519
Florida	1,151	6,875	2.6	76,390
Texas	859	6,290	2.4	61,926
Tennessee	304	5,739	2.2	54,834
Illinois	691	4,458	1.7	84,739
Louisiana	204	4,450	1.7	59,298
New Jersey	293	4,081	1.6	100,522
Pennsylvania	371	3,928	1.5	68,287
Connecticut	258	3,627	1.4	140,040
Massachusetts	353	3,383	1.3	69,009
Oregon	330	2,944	1.1	55,309
New Mexico	145	2,205	0.8	80,179
Utah	337	2,165	0.8	52,208
Washington	301	2,048	0.8	53,466
Virginia	260	1,884	0.7	72,164
North Carolina	437	1,779	0.7	57,659
Ohio	307	1,779	0.7	54,249
Colorado	386	1,648	0.6	58,437
Michigan	336	1,622	0.6	64,167
Hawaii	129	1,560	0.6	61,987
Nevada	214	1,549	0.6	41,230
Arizona	255	1,514	0.6	32,049
Maryland	277	1,436	0.5	64,320
Missouri	181	1,091	0.4	48,661
South Carolina	138	971	0.4	53,250
Minnesota	211	933	0.4	53,887
Alabama	133	721	0.3	57,901
Wisconsin	180	672	0.3	47,341
Indiana	164	478	0.2	55,228
Kentucky	146	468	0.2	47,677
Rhode Island	79	388	0.1	77,264
New Hampshire	51	350	0.1	65,036
Oklahoma	107	317	0.1	47,722
Montana	77	290	0.1	59,624
Iowa	82	249	0.1	50,652
West Virginia	34	232	0.1	27,615
Arkansas	88	224	0.1	69,774
Mississippi	67	218	0.1	27,428
Maine	89	169	0.1	46,846
Kansas	77	167	0.1	41,930
South Dakota	56	143	0.1	36,301
Vermont	38	127	0.0	40,663
Nebraska	55	110	0.0	40,326
Idaho	44	105	0.0	42,025

Delaware	36	63	0.0	11,371
North Dakota	25	42	0.0	81,834
Alaska	25	40	0.0	34,498
Wyoming	23	36	0.0	134,418
United States	24,460	263,064	100.0	106,328

Note: Industry statistics are from the QCEW database. The industry is defined as NAICS 512110 + 512120 + 512191 + 512199.

Source: Bureau of Labor Statistics – Quarterly Census of Employment and Wages (Annual averages).

Table 2. Study Focus

Study	Region	Years	Outcomes Examined	Incentive Variables
Adkisson (2013)	44 states with incentives	1997-2011	Motion Picture and Video Industries QCEW Employment (NAICS 51211-51219)	Year of adoption of any incentive
Swenson (2017)	Lower 48 states	1998-2011	Motion Picture and Video Industries CBP Employment and Establishment Shares (NAICS 512110-512199); D&B non-wage contractors	Year of adoption of any incentive
Button (2018)	Louisiana, New Mexico	1998-2008	IMDb productions; Feature Films; Television Series; Motion Picture and Video Production QCEW Employment and Establishments (NAICS 512110, SIC 7812)	Year of adoption of any incentive
O'Brien and Lane (2018)	49 states plus Washington, D.C. (excludes Iowa)	1998-2010	IMDb Feature Films; Motion Picture and Video Industries CBP Employment and Establishments (NAICS 5121)	Year has any incentive and estimated dollar value of incentives
Thom (2018b)	Lower 48 states	1998-2013	Motion Picture and Sound Recording Studios BEA Gross State Product, Employment, Wages (NAICS 512)	Year of adoption or elimination for each of four incentives; Annual SFI spending
Bradbury (2019)	Georgia and North Carolina	1990-2016	Per Capita Income	Year of adoption for Georgia; Years of adoption and increased generosity of incentives for North Carolina
Button (2019)	50 states plus Washington D.C.	1976-2017	Feature Films; Television Series; QCEW and CBP Motion Picture and Video Production Employment and Establishments (NAICS 512110, SIC 7812) and related industries	Year of adoption for any incentive
Thom (2019)	Connecticut, Georgia, Louisiana, Massachusetts, New York	1991-2017	QCEW Motion Picture and Video Production Employment (NAICS 512110)	SFI Expenditure
Bradbury (2020a)	Lower 48 states	2000-2015	BEA Gross State Product and Personal Income Per Capita; Motion Picture and Sound Recording Studios Gross State Product (Share and Per Capita)	Year has any incentive and by type

Meares et al. (2020)	Georgia	2002-2017	Number of Movie and Television Productions; Employment, Establishments, and Annual Wage in Sector	Year has any incentive
Owens and Rennhoff (2020)	Locations in lower 48 states	1999-2013	IMDb Feature Films (majors, mini-majors, independents)	Year has any incentive and by type; value of incentive by type

BEA-US Bureau of Economic Analysis; CBP-US Census County Business Patterns; D&B-Dun and Bradstreet; DID-Difference-in-Differences
FE-Fixed Effects; NAICS-North American Industrial Classification System; QCEW-US Bureau of Labor Statistics Quarterly Census of Employment and Wages;
SFI-State Film Incentive; SIC-Standard Industrial Classification System

Table 3. Study Methodology and Findings

Study	Method	Empirical Findings	Policy Conclusions
Adkisson (2013)	Case study trend analysis	A few states slightly gained employment, others lost employment; Occurred across early and late incentive adopters and early followers	Incentives are a zero-sum game for national film production employment
Swenson (2017)	Panel Difference-in-Differences; State and year fixed effects	None of the incentive variables are statistically significant for employment or establishments; No net effect on D&B non-wage contractor moves	Zero-sum game from most states offering incentives
Button (2018)	Synthetic Control Method case study	Significant effect on IMDb productions and feature films but not television series; Positive but insignificant effects on employment or establishments	Best case cost per job, including contractors, $48,388 for Louisiana and $21,035 for New Mexico
O'Brien and Lane (2018)	Panel Difference-in-Differences; Gross Domestic Product as a Control Variable	Existence of any incentives increases number of films produced in the state; Mixed evidence for incentive effects on employment and establishments; Diversity and dominance of companies increases filming activity, employment, and number of establishments	Design incentives to increase organizational diversity, especially for companies involved in distribution, marketing, and sales of films
Thom (2018b)	Panel Difference-in-Differences; State and year fixed effects; Control variables	Refundable credits significantly increased wages in the industry; Duration of transferrable credits increased employment; Annual SFI spending insignificant; No gross state product effects	More attention needed for incentive design; Need for better cost-benefit analysis and oversight of programs
Bradbury (2019)	Synthetic Control Method case study	Negative but statistically insignificant effects on per capita income (despite raw increases in QCEW NAICS 512110 employment and establishments)	No wider impacts on overall economy; Incentives ineffective for economic development
Button (2019)	Panel Difference-in-Differences; State and year fixed effects; Control variables; Event study	Large effect on TV series filming that occurs gradually over time and in states with a medium or large existing industry size and may persist after incentive repeal; Little evidence feature film production location is	Agglomeration spillovers of TV series filming suggest magnitude of incentive program matters

		affected by incentives; No evidence for meaningful positive effects on labor market indicators in the sector or in related sectors	
Thom (2019)	Case study; Interrupted Time Series Analysis; Control Variables	Statistically significant immediate effect on Connecticut, which is attributable to the nontax component of incentives; Statistically significant effect over time on Louisiana	Evidence of interstate competition; No practical significance of incentives for job creation
Bradbury (2020a)	Instrumental Variables Estimation Panel Difference-in-Differences; State and year fixed effects; Control variables	No link between incentives and overall economic activity	No basis for economic development to justify film incentives.
Meares et al. (2020)	Case study trend analysis	Increased number of NAICS 5122110, QCEW establishments, employment, wages; Increased number of IMDb productions and money spent in the state	Incentive costs per job in motion picture and video production estimated at $52,216.86. Significant transfer of taxpayer resources to the film industry.
Owens and Rennhoff (2020)	Discrete choice model; Location characteristic control variables	Incentives significantly influence location of filming; Refundable credits more effective than transferrable credits; Over fifty-two percent of film production would shift if all incentives were removed; Concentration would occur as 17 states would gain production of films without incentives but 32 states gain in 2013; No lasting effect of incentives if they are removed.	Revenue negative for states; State revenue feedback ranges from low of $0.13 per dollar of incentive in Oklahoma to high of $0.77 in Texas; Incentive cost per job stimulated ranges from high of $24,114 in Missouri to low of $1,426 for Texas; Lower than cost of directly increasing the number of state employees; Attractiveness depends on opportunity cost of funds

SFI-State Film Incentive; QCEW-US Bureau of Labor Statistics Quarterly Census of Employment and Wages

Table 4. State Incentive Program Actions

State	Incentive Program Action
Arizona	Adoption-2006; Elimination-2010
Florida	Adoption-2003; Elimination-2016
Indiana	Adoption-2007; Elimination-2011
Louisiana	Adoption-2002; Capped-2015
Michigan	Adoption-2008; Elimination-2015
New Mexico	Adoption-2002
North Carolina	Adoption-2000
Rhode Island	Adoption-2000
Vermont	Adoption-2006; Elimination-2011
Wisconsin	Adoption-2008; Elimination-2013

Table 5. State Characteristics

Variable	Description and Measurement	Incentive Adoption Scenario	Incentive Repeal Scenario
RPP-Rent	BEA rent component of regional price parity (2011)	No	Yes
FMR	HUD Fair Market Rent averaged across 2, 3 and 4 bedroom apartments	Yes	No
AMEN	USDA ERS Natural amenity scale	Yes	Yes
COLLEGE	Census share of the adult population 25+ with a bachelor's degree (2000)	Yes	Yes
WAGE00	BEA nonfarm wage rate in 2000	Yes	No
WAGE11	BEA nonfarm wage rate in 2011	No	Yes
DENSITY	Census population density in 2000	Yes	Yes
INDMIX0207	Industry mix employment growth 2002-2007 (Dorfman et al., 2011)	No	Yes
INDMIX9802	Industry mix employment growth 1998-2002 (Bartik et al., 2018)	Yes	No
ECFREE00	Fraser Economic Freedom Index 2000	Yes	No
ECFREE03	Fraser Economic Freedom Index 2003	No	Yes

BEA-US Bureau of Economic Analysis; HUD-US Department of Housing and Urban Development; USDA-United States Department of Agriculture, Economic Research Service

Table 6. Synthetic Control Method Results

| State (Scenario)	DID	Labor Market Outcome
Arizona (Eliminate, 2010)	Wage = -0.098	Wage=lower by one hundred and forty-one percent of 2010 value
Florida (Eliminate, 2016)	Employment = -0.038; Wage = -0.073	Employment=lower by twelve percent of 2016 value; Wage=lower by thirteen percent of 2016 value
Indiana (Eliminate, 2011)	Employment = -0.055; Wage = -0.024	Employment=lower by eighty-three percent of 2011 value; Wage=lower by thirty percent of 2011 value
Louisiana (Adopt, 2002)	Employment = 0.309; Wage = 0.291	Employment=higher by two hundred and seventy-four percent of 2002 value; Wage=lower by four hundred and twenty-seven percent of the 2002 value
Louisiana (Cap, 2015)	Wage = -0.683	Wage=lower by forty-three percent of 2015 value
Michigan (Eliminate, 2015)	Employment = -0.132; Wage = -0.125	Employment=lower by seventy percent of 2015 value; Wage=lower by forty-five percent of 2015 value
New Mexico (Adopt, 2002)	Employment = 0.632; Wage = 0.66	Employment=higher by two hundred and eighty-six percent of 2002 value; Wage=higher by three hundred and eighty-six percent of 2002 value
North Carolina (Adopt, 2000)	Employment = 0.009; Wage = 0.032	Employment=higher by eight percent of 2000 value; Wage=higher by fifty-one percent of 2000 value
Rhode Island (Adopt, 2000)	Employment = 0.257; Wage = 0.493	Employment=higher by three hundred and fifty-two percent of 2000 value; Wage=higher by seven hundred and twenty-two percent
Vermont (Eliminate, 2011)	Wage = -0.11	Wage=lower by eighty-six percent of the 2011 value
Wisconsin (Eliminate, 2013)	Employment = -0.028; Wage = -0.106	Employment=lower by twenty-seven percent of 2013 value; Wage=lower by one hundred and three percent of the 2013 value

Figure 1. Louisiana Incentive Adoption: LA Employment and Wage vs Synthetic (Synth)
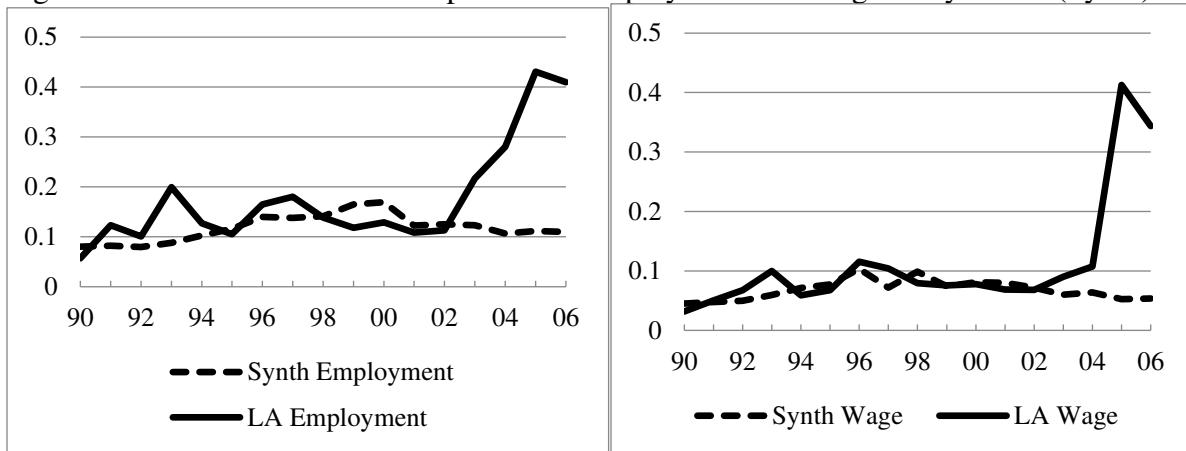
Weights: Employment (MI=0.602, WV=0.221, WY=0.176); Wage (KY=0.434, ID=0.356, OH=0.184, WY=0.018, WV=0.008)
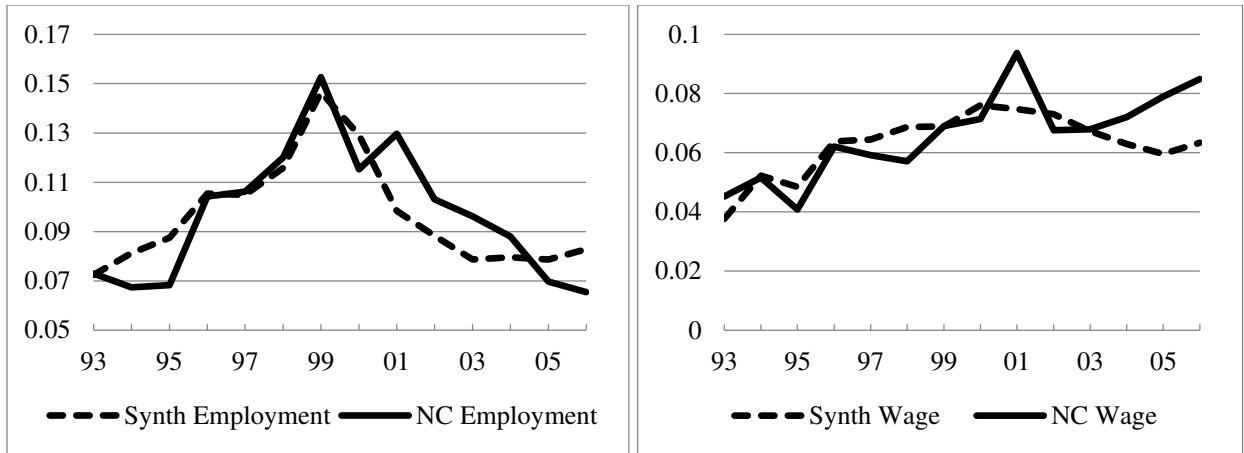DID: Employment=0.309; Wage=0.291

Figure 2. New Mexico Incentive Adoption: NM Employment and Wage vs Synthetic (Synth)
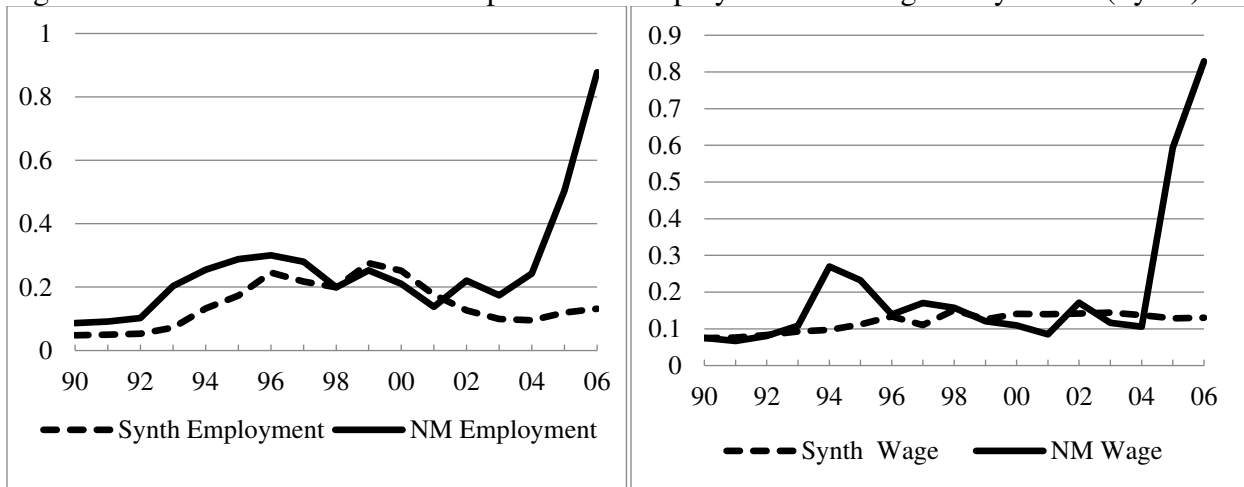
Weights: Employment (WV=0.6, NV=0.23, ID=0.17); Wage (MI=0.584, ID=0.416)
DID: Employment=0.632; Wage=0.66

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Figure 3. North Carolina Incentive Adoption: NC Employment and Wage vs Synthetic (Synth)

Weights: Employment (IN=0.708, WY=0.181, WV=0.059, OH=0.052); Wage (KS=0.542, KY=0.311, WY=0.09, NH=0.05, WI=0.007)
DID: Employment=0.009; Wage=0.032

Figure 4. Rhode Island Incentive Adoption: RI Employment and Wage vs Synthetic (Synth)
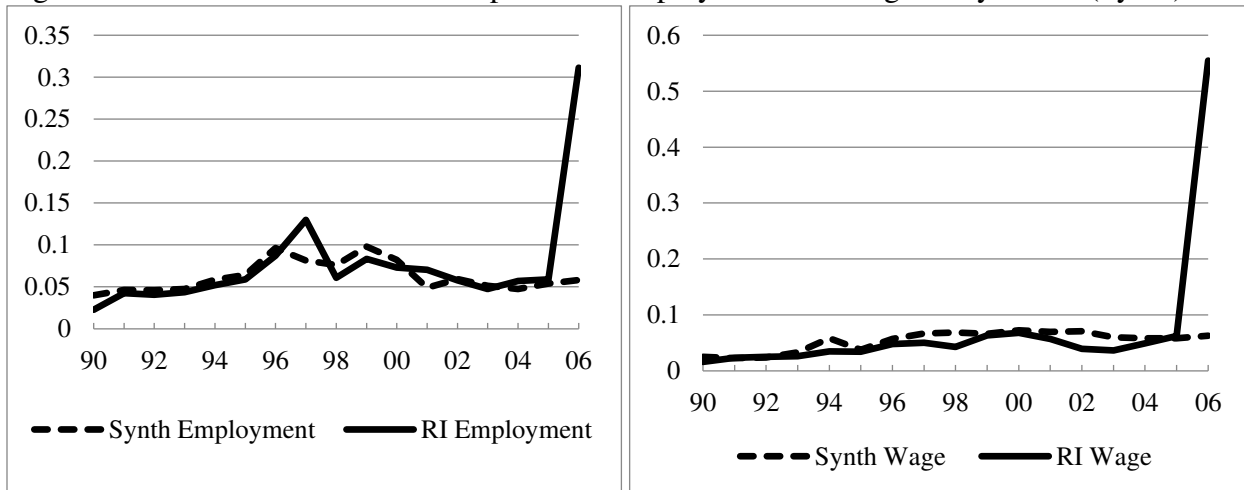
Weights: Employment (WY=0.695, WV=0.19, KS=0.114); Wage (KS=0.707, WY=0.232, KY=0.033, OH=0.029)
DID: Employment=0.257; Wage=0.493

Figure 5. Indiana Incentive Repeal: IN Employment and Wage vs Synthetic (Synth)
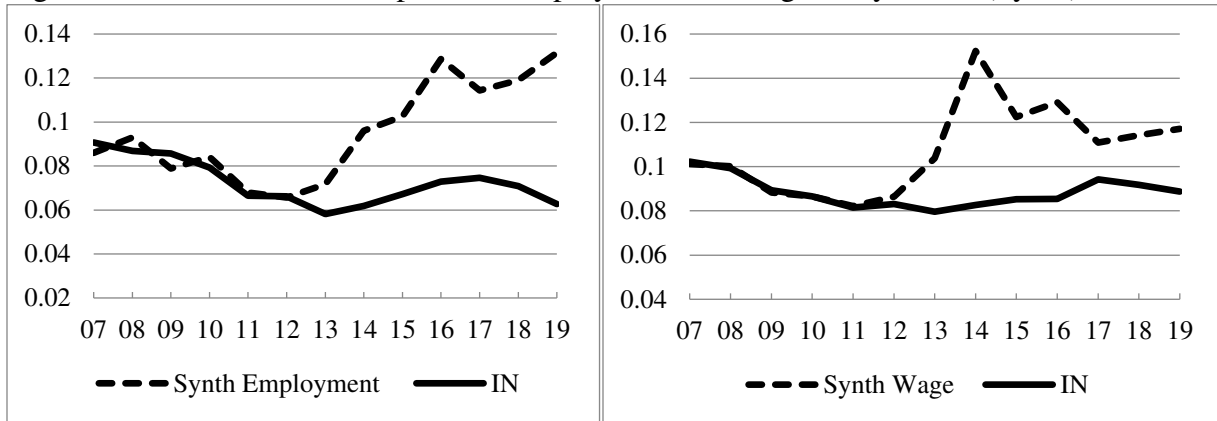
Weights: Employment (NC=0.454, MS=0.391, IL=0.118, ME=0.037); Wage (MS=0.571, MN=0.38, IL=0.049)
DID: Employment=-0.055; Wage=-0.024

Figure 6. Wisconsin Incentive Repeal: WI Employment and Wage vs Synthetic (Synth)
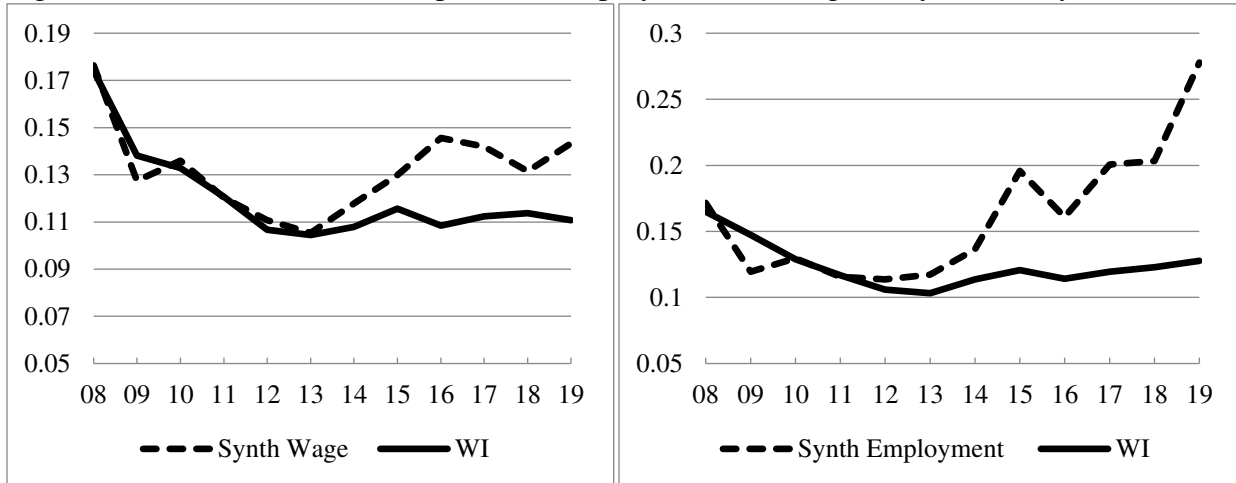
Weights: Employment (NC=0.333, MS=0.306, MD=0.215, ME=0.093, WA=0.053); Wage (SC=0.491, MN=0.361, RI=0.094, ME=0.054)
DID: Employment=-0.028; Wage=-0.106

Figure 7. Florida Incentive Repeal: FL Employment and Wage vs Synthetic (Synth)
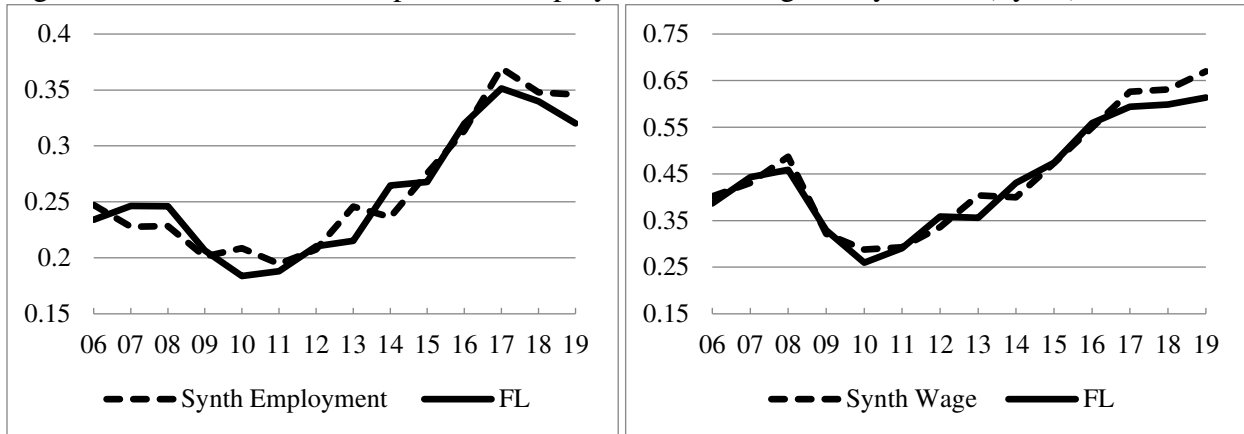
Weights: Employment (TX=0.591, MD=0.194, UT=0.183, GA=0.032); Wage (ME=0.362, UT=0.272, MD=0.252, NM=0.039, CT=0.035, GA=0.028, OR=0.012)
DID: Employment=-0.038; Wage=-0.073

Figure 8. Michigan Incentive Repeal: MI Employment and Wage vs Synthetic (Synth)
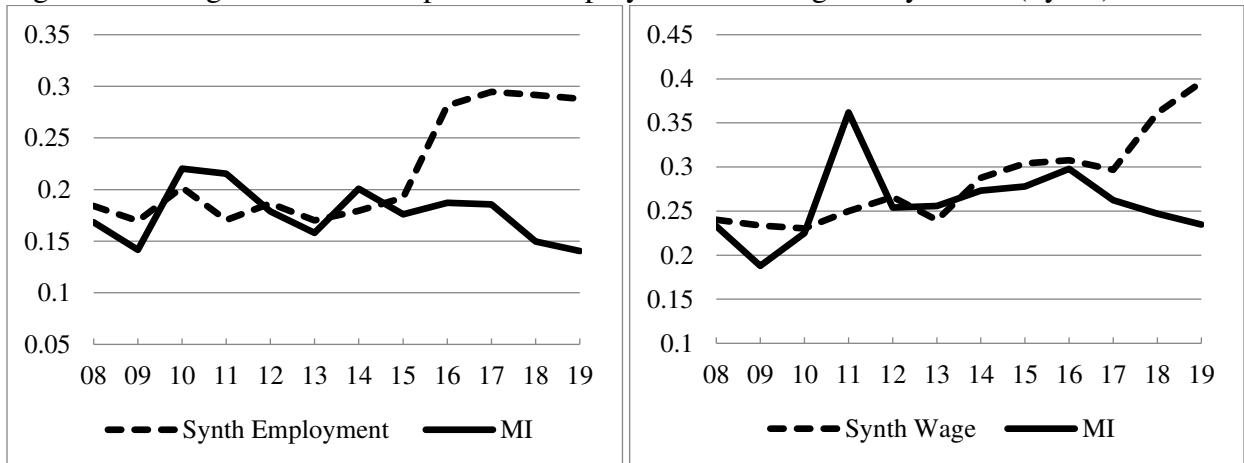
Weights: Employment (TN=0.345, MS=0.271, MN=0.167, PA=0.159, RI=0.057); Wage (PA=0.297, MS=0.209, IL=0.208, NC=0.137, OR=0.086, MN=0.053, TN=0.011)
DID: Employment=-0.132; Wage=-0.125

Figure 9. Film Incentive Adoption Placebo Analysis: Employment
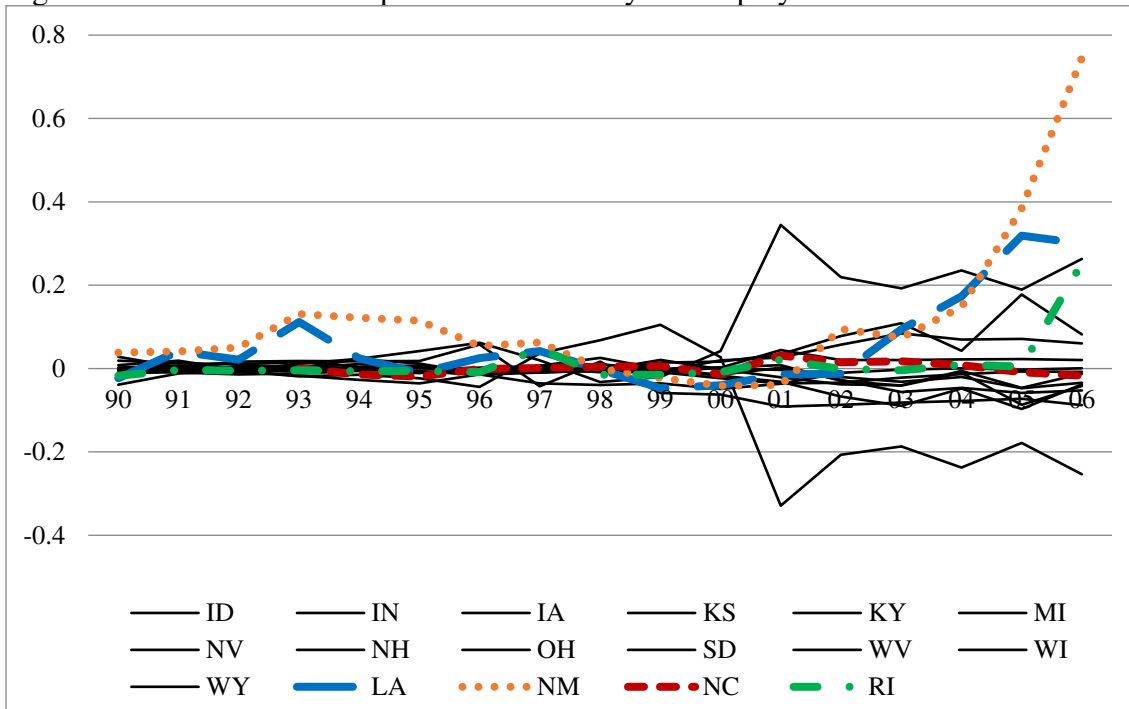

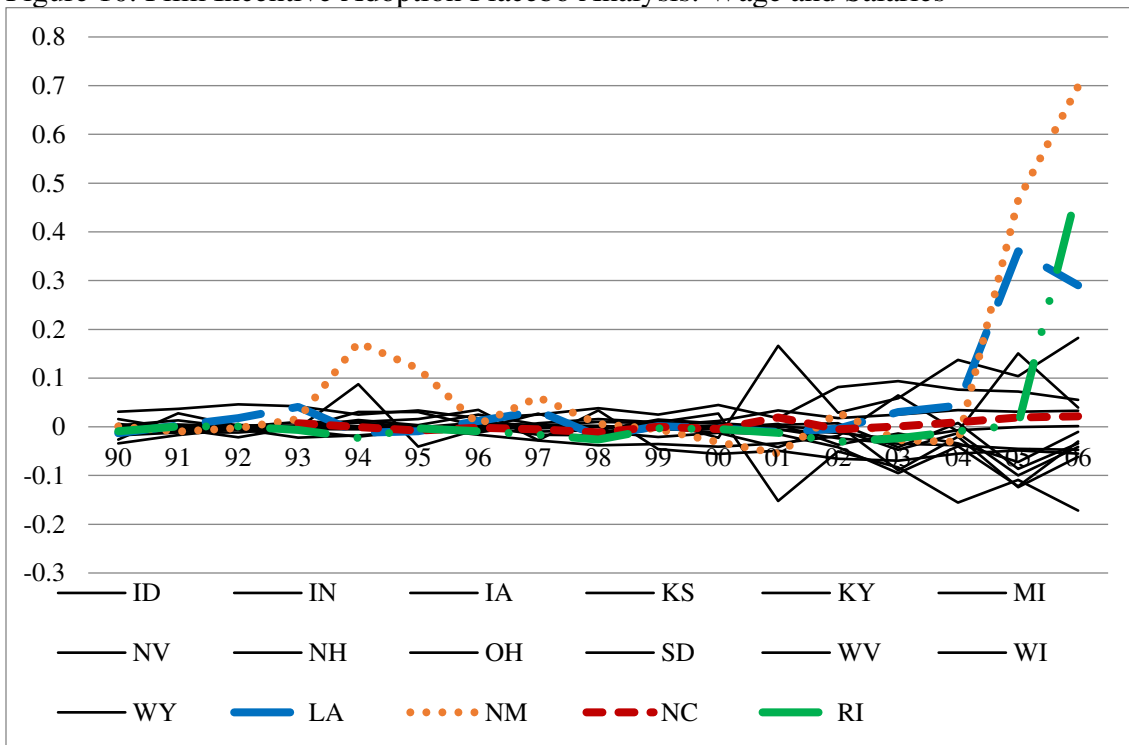Figure 10. Film Incentive Adoption Placebo Analysis: Wage and Salaries

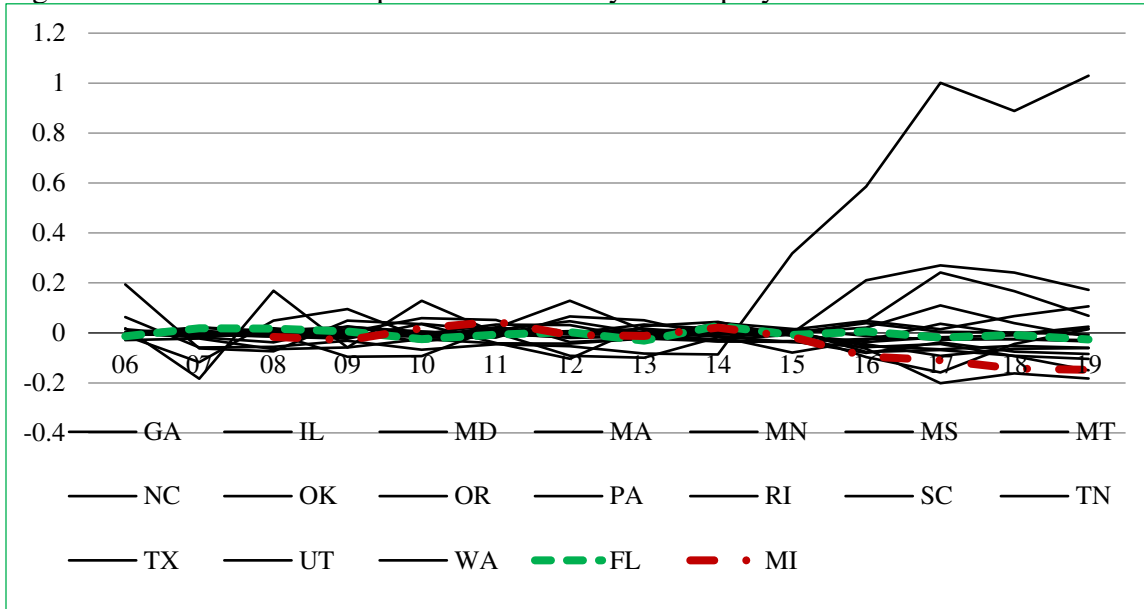Figure 11. Film Incentive Repeal Placebo Analysis: Employment

Figure 12. Film Incentive Repeal Placebo Analysis: Wage and Salaries