Can Tax Incentives Create a Local Film Industry? Evidence from Louisiana and New Mexico

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Abstract

State Film Incentives (SFIs) are a recent and popular economic development incentive. I study these through case studies of two prominent SFIs: those in Louisiana and New Mexico, using the Abadie et al. (2010) synthetic control case study method. This allows me to estimate the effect of SFIs relative to the "business-as-usual": what would have happened without SFIs. I estimate the effects of these SFIs on filming location, using databases from IMDb and Studio System, and on business establishments, and employment in the motion picture production industry, using the Quarterly Census of Employment and Wages. My results show increases in feature films, but not TV series filming, employment, or business establishments. This suggests that while there are some benefits to these incentives, their ability, under favorable circumstances, to develop a local film industry is very limited.

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1 Introduction

Incentives for motion picture production are now prolific in the United States and internationally.[1] These incentives provide aggressive financial support for motion picture production, typically as tax credits or cash rebates. In the United States, these State Film Incentives (SFIs) reduce the cost of qualifying production expenses by about 20% on average (Button, 2018), with more generous rates recently.

This paper evaluates these incentives on their primary goal: creating a film industry in regions without a large industry already (Leiser, 2017). I conduct case studies of Louisiana and New Mexico, which were two early, aggressive, adopters of SFIs in 2002 (see Figure 1 for when other states adopted). These two states are often discussed as being possible "success stories"(Ernst & Young 2009a; McDonald 2006 Cantrell 2007; Calhoun 2010; Luther 2010; McDonald 2011.)[2] Studying these two states as case studies could provide for an upper bound on the effect of incentives since these two states had a first mover advantage, if it exists.

[Figure 1 about here]

I conduct these case studies of Louisiana and New Mexico using the Abadie et al. (2010) synthetic control case study approach. This is a statistical method similar to a "difference-in-differences" panel regression analysis. It allows a

[1]For a helpful database of current international incentives, see EP Financial Solutions (2018).

[2]Both states were argued by many to be success stories because of the perception that their incentives led to a large increase in filming, and perhaps employment or economic activity. See, e.g., Puig (2010), Pitts et al. (2014), and Ortega (2017).

comparison of Louisiana and New Mexico to "synthetic" versions of these states, made up of combinations of states with similar trends that did not adopt SFIs. These synthetic Louisiana and New Mexico represent the "business-as-usual" case: what would have happened had these states not adopted SFIs. This causal approach to estimating the impacts of these SFIs is important as it has been difficult to get credible estimates of the causal impact of SFIs. Other researchers often had to make assumptions about how many motion pictures, jobs, or businesses relocated (Luther 2010; Christopherson & Rightor 2010; Zin 2010 (p. 26)) rather than directly estimating this in a causal framework as I do here.

I quantify impacts of the SFIs in Louisiana and New Mexico on filming location, and employment and the number of business establishments in the motion picture production industry. To quantify the effects on filming location, I use two databases: the Internet Movie Database (IMDb) and Studio System. The former also allows me to study the effects on feature films and TV series separately. To quantify the effects on employment and business establishments specifically in the motion picture production industry, I use data from the Quarterly Census of Employment and Wages (QCEW.)

I find that New Mexico's SFI is associated with a statistically significant increase in IMDb productions and Studio System feature films, but Louisiana's SFI is only associated with an increase in feature films. For neither state is there evidence of a statistically significant increase TV series filming or in employment or business establishments in the film industry.

These results suggest that these two SFIs, often argued to have been highly

successful, got limited benefits from their SFIs. While they were able to capture some feature films, this increase in filming did not lead to more tangible economic impacts that would indicate the development of a local film industry: employment and business establishments in the industry. These results suggest that the ability of policymakers to create a local film industry using incentives is limited.

The rest of this paper is organized as follows. Section 2 describes the relavant literature, Section 3 discusses the incentives under consideration in Louisiana and New Mexico and why they were chosen, Section 4 describes the data, Section 5 explains the Abadie et al. (2010) synthetic control case study methodology, Section 6 presents the results, and Section 7 concludes.

2 Literature Review

There are three lines of literature related to this topic. First, there is a literature on the film industry that discusses how the industry is organized, touching on issues such as agglomeration. This naturally leads to the second line of the literature, which is the economics literature on to what extent tax incentives can affect business location or lead to economic development. Third, there are reports that attempt to quantify or discuss the impacts of SFIs more broadly.

2.1 Economics of the Film Industry

In the literature, the motion picture production industry is characterized as having significant agglomeration (clustering) of motion picture production companies and workers, particularly in the Greater Los Angeles and New York City areas (Batt et al. 2001; Christopherson & Storper 1989; Florida et al. 2011; Lukinbeal 2004; Scott 2002; Scott 2005). This agglomeration is apparent in Quarterly Census of Employment and Wages (QCEW) data, which suggests that of the 204,946 jobs nationally in 2012 that were strictly in motion picture production, almost half (100,461, 49%) were in Los Angeles County alone. This agglomeration provides many benefits, often referred to as "agglomeration economies" that create natural incentives for the film industry to spatially concentrate.[3]

Agglomeration economies in the film industry are numerous and large, and benefit both firms and workers. Firms find it easier to find a diverse set of inputs and at better prices. Some striking evidence of the number of unique inputs into filming comes from Scott (2004), who presents a map showing all the firms in the Greater Los Angeles area that provided inputs into the filming of one TV series. Inputs with fixed costs, ranging from costumes to sound stages, can be rented out to multiple firms when markets are "thicker", that is, when agglomeration is present and there are more buyers and sellers. This lowers the costs of these inputs and allows a larger variety of inputs to be economically feasible (Christopherson & Rightor, 2010). Agglomeration also

[3]See Rosenthal & Strange (2004) for an excellent summary of the evidence of and sources of agglomeration economies more broadly.

leads to more specialized labor: uniquely talented actors and actresses, film crew, and other workers such as specialized attorneys and agents (Christopherson & Rightor, 2010). Firms also benefit from the "happy hour effect" (Brueckner, 2011) whereby physical proximity allows ideas and best practices to spread. One way this occurs is more literally, where workers across firms are more likely to be in contact, perhaps actually at a "happy hour". But another way that ideas are spread is through worker mobility between firms. In "thicker" markets, worker turnover is higher, such that workers move between firms more often, leading to better matches between firms and workers (e.g., Saxenian 1994; Saxenian 1996; Fallick et al. 2006). This increases the spread of knowledge. Agglomeration also seems to increase worker productivity and human capital (e.g., Ciccone & Hall 1996; Brueckner 2011). Christopherson & Rightor (2010) also note that with agglomeration there are more institutions that are formed that support the industry, such as film schools, trade associations, or film festivals. This suggests that strong agglomeration economies may make it hard to relocate motion picture production.

These forces of agglomeration contrast with the act of filming being relatively insensitive to location. While filmmakers often require some scenes at iconic landmarks or at city-identifying locations, filmmakers can easily use one of three strategies to fake the location: an establishing shot, props or set construction to disguise the location, or disguising location characteristics in post-production using computer graphics.[4] While filming benefits from agglomeration economies, it is a shorter-term project that could be done any-

[4]For excellent examples of all three, see Every Frame a Painting (2015).

where, in whole or in part, which provides scope for SFIs to possibly have a large impact on filming, even if the forces of agglomeration continue to tie employment and business establishments to film clusters.

2.2 The Literature on Tax Incentives

An important question is to what extent incentives can move economic activity away from the film clusters in the Greater Los Angeles and New York City areas, or form new self-sustaining clusters altogether? There is an early and growing literature on SFIs specifically. Button (2018) studies SFIs across all states, finding that they relocate some filming, but have no effect on employment and business establishments in the film industry. This evidence suggests that the average state cannot create a local film industry using SFIs. Thom (2018) does a similar analysis, focusing on employment, wages, gross state product, and industry concentration, and similarly finds limited impacts.

The case study approach in this paper provides a useful complement to the previous studies for three reasons. First, by examining two early and aggressive adopters who are argued to be "success stories", we learn more about if SFIs are effective in general. If there is little effect for these two states, who are often deemed to be positive examples by SFI proponents, then it is less likely that SFIs are effective in general (a "most likely crucial case", as per Gerring 2012.) Second, the Abadie et al. (2010) synthetic control methodology in this paper is an improvement to aspects of the general two-way fixed effects (panel) regression in Button (2018) and Thom (2018), for reasons discussed later in the methodology section. Third, these case studies allow for a better comparison

of the costs and benefits of the SFI by providing estimates of, for example, employment that can be compared to program spending to calculate useful metrics such as cost per job created.

More broadly, there is an existing literature on other tax incentives at state and regional levels. These include a large range of incentives and policies, such as those that target other industries (e.g., Lee 2008; Moretti & Wilson 2014; Weinstein 2018), enterprise zones (e.g., Bondonio & Engberg 2000; Neumark & Kolko 2010; Freedman 2013; Briant et al. 2015), empowerment zones (e.g., Krupka & Noonan 2009; Hanson 2009; Hanson & Rohlin 2013), investment tax credits (e.g., Goolsbee 1997; Gupta & Hofmann 2003; Chirinko & Wilson 2008), job creation tax credits (e.g., Chirinko & Wilson 2010; Neumark 2013; Bartik 2017; Neumark & Grijalva 2017) tax-increment financing, (e.g., Anderson 1990; Dye & Merriman 2000), and foreign trade zones (e.g., Rogers & Wu 2012). There is also a literature on the formation of industry clusters (e.g., Porter 2000; Rosenthal & Strange 2004; Martin et al. 2008; Hefner 2009; Weinstein 2018.)

Do these incentives, more broadly, lead to changes in business location or increases in economic development? Wasylenko (1999), Buss (2001), Arauzo-Carod et al. (2010), and Bartik (2017) provide a useful overview of the literature, generally noting that tax incentives have mixed impacts. Some studies show meaningful positive effects (e.g., Bartik 1985; Bartik 1989; Papke 1991; Walker & Greenstreet 1991; Wu 2008; Strauss-Kahn & Vives 2009) while others show little to no effect (e.g., Schmenner 1982; Carlton 1983; Plaut & Pluta 1983; Blair & Premus 1987; Schmenner et al. 1987; Dabney 1991; Calcagno

& Thompson 2004; Lee 2008). Thus, the even broader question of to what extent tax incentives affect business location or lead to economic development is not definitively answered. Studying SFIs is interesting here since they have the potential to have major effects because they are so generous and because filming location is rather "footloose."

However, studying SFIs only informs us about the effectiveness of some types of incentives. Within the broad literature on incentives, studying SFIs tells us most about the effectiveness of incentives that attempt to generate clusters or that target specific industries (see, e.g., Porter 2000; Rosenthal & Strange 2004; Martin et al. 2008; Lee 2008; Hefner 2009; Moretti & Wilson 2014; Weinstein 2018.) In contemporary policy discussions, there are parallels to incentives for technology firms and big enterprises such Amazon's HQ2.[5] SFIs also operate similarly to many job creation tax credits, in that both incentives provide significant incentives to increase employment. SFIs tell us less about incentives that are geographically-targeted at local and regional levels (e.g., enterprise zones, empowerment zones, and foreign trade zones.)

2.3 Reports on State Film Incentives

There are several reports on the impacts of specific SFIs. These reports are often commissioned by state legislatures or are conducted in-house by state economists. While it is difficult for these studies to provide causal estimates on the effects of SFIs, they do provide some clues. These reports generally find that the benefits of SFIs come at a steep cost, for example, high costs

[5]See, e.g, Cohn (2018).

per job created. For example Zin (2010) estimated that, for Michigan's incentive: "The cost to taxpayers of employment associated with the tax credit ranged from $186,519 per job to $42,991 per job, depending on whether only direct jobs or total employment impacts are examined" while Bal (2009) finds $324,838 per job created for Massachusetts residents. Most reports, however, estimate the return on investment (ROI), that is, how much state tax revenue is raised by SFIs. The studies find low ROIs such as 16 to 18 cents of state tax revenue raised per dollar spent in Louisiana (Albrecht, 2005), 14.4 cents in New Mexico (Popp & Peach, 2008), and 19 cents in South Carolina (Calcagno & Hefner 2007; Hefner 2008.)

There are also several reports that are written or commissioned for the film industry stakeholders (e.g., the MPAA) that cannot provide an independent assessment. Examples include Ernst & Young (2009a) and Ernst & Young (2009b). Not surprisingly, these show favorable impacts of SFIs, often by making liberal assumptions such as that all filming is due to the SFI or by employing economic estimation methods that are not transparent.[6] Conclusions from these "studies" deviate significantly from the independent reports discussed above, providing unrealistic ROI estimates of, for example, $1.50 per dollar in New Mexico (Ernst & Young, 2009a) or $2.23 per dollar in New York (HR&A Advisors, 2012).

[6]See critiques of these reports in Luther (2010), Tannenwald (2010), McDonald (2011), and Christopherson & Rightor (2010).

3 Background and Rationale for the Louisiana and New Mexico Case Studies

3.1 Case Study Selection

I had two criteria for selecting states for the case study: feasibility and notability. For feasibility, it needed to be possible to use the synthetic control methodology to analyze the state's SFI. This means that there needed to be a large enough number of control states in order to analyze the effects of the SFI for a reasonable time period, which I consider at least five years (including the year of adoption.) Too short of a period of analysis would only pick up short-run effects during an adjustment period and having too few years makes it difficult to separate the year-by-year noise from the effects of policies (see, e.g., Donald & Lang 2007.) States who adopted SFIs late, after 2004, were ineligible for a synthetic control case study because there were not enough control states for the measurement of effects over at least five years including the year of adoption.[7] Applying this criteria leaves 13 states (Florida, Hawaii, Illinois, Louisiana, Missouri, Mississippi, New Mexico, New York, North Carolina, Oklahoma, Pennsylvania, Rhode Island, and South Carolina) as possibilities for case studies at this point. Then, I removed four states (Hawaii, New York, Rhode Island, and South Carolina) because they were atypical and their experience with SFIs would not reflect the experiences

[7]It is not possible to use the synthetic control case study approach to analyze effects in 2009 or after, because there were only at most nine control states that could be used if the analysis period included 2009 or later. As discussed later in Section 5, this is not a sufficient number of states to conduct inference.

of other states.[8]

Within the remaining nine states (Florida, Illinois, Louisiana, Missouri, Mississippi, New Mexico, North Carolina, Oklahoma, and Pennsylvania) that were eligible for a synthetic control case study, I selected Louisiana and New Mexico because they would provide excellent "most likely crucial cases" (Gerring, 2012).[9] That is, there were more likely to have been effects in Louisiana and New Mexico because they were often discussed as having been successful (see footnote 2 and Ernst & Young 2009a; McDonald 2006; Cantrell 2007; Calhoun 2010; Luther 2010; and McDonald 2011) but also, perhaps, because those two states were early adopters.[10][11]

In addition to choosing Louisiana and New Mexico for case studies, I also had to select a time period for this case study. I selected the period from 2002

[8] While New York's incentive is notable, the film industry in New York city is very large and is much different than the industry in others states or cities (Florida et al., 2011). Thus, studying New York's SFI would only tell us about how New York was affected by SFIs, rather than telling us more broadly how SFIs affect more average states. Also, it is difficult to construct a control group for New York given how unique it is, so a difference-in-differences or synthetic control case study is not feasible. Similarly, but in the opposite direction, Rhode Island is a very small state in terms of geographic size and also in terms of the size of its film industry (6th smallest film industry in 2001, measured based on employment or establishments) and is not representative. For Hawaii and South Carolina, their incentives were very weak, so their SFIs did not reflect the typical, strong, SFIs that were under consideration or adopted in other states. Hawaii is also less interesting due to its more remote location.

[9] "A case-study method that offers particularly compelling evidence for, or against, a proposition. Assumes two varieties: least-likely and most-likely. A least-likely case is one that is very unlikely to validate the predictions of a model or a hypothesis. If found to be valid, this may be regarded as strong confirmatory evidence. A most-likely case is one that is very likely to validate the predictions of a model or a hypothesis. If found to be invalid, this may be regarded as strong disconfirming evidence." (Gerring 2012, p. 418.)

[10] Only Missouri, North Carolina, Rhode Island, and Oklahoma had incentives before Louisiana and New Mexico that could have been considered competitive.

[11] Theoretically, the effect of SFIs should be smaller when more states are offering them. For this reason, the effects of SFIs in Louisiana and New Mexico could have been larger. However, Button (2018) tests if the effect of SFIs was stronger for earlier adopters but does not find any evidence in favor of this.

to 2008. Attempting to extend my case study even to 2009 was not feasible as three states (Alabama, Ohio, and Utah) adopted incentives in 2009 and thus could not be used as control states, rendering the synthetic control case study impossible.[12]

While studying only up to an earlier year, say, 2006, was feasible, it was not ideal for two reasons. First, it did not allow for the study of an important time period for Louisiana and New Mexico, when the incentives were stronger in 2007 and 2008, and were of the order of incentives that are commonly discussed in the media and among policy-makers. Second, it is ideal to have more years to observe the SFIs in effect, as year-to-year noise can often make it difficult to tease out the effects of policies (see, e.g., Donald & Lang 2007.) There is, of course, the question of if my conclusions would have been different had I analyzed up to an earlier year, such as 2006. This is unlikely because the relatively larger effects of SFIs in New Mexico and Louisiana occurred from 2006 to 2008, so excluding 2007 and 2008 would likely have led to even smaller effects of SFIs. This again aligns with this case study being a "most likely crucial case" (Gerring, 2012), providing upper bounds to the effects of SFIs.

3.2 External Validity of Louisiana and New Mexico

An important question regarding the interpretation of my cases studies of Louisiana and New Mexico are if these two states are unique in their circumstances, such that we would expect different effects of similar incentives adopted by other states. So, are these two case studies externally valid?

[12]Extending the analysis to 2009 only allows nine states to be used as control states. As discussed in-depth in Section 5, this does not allow for statistical testing.

One factor that could moderate the effects of SFIs is the size of the existing film industry. Effects may be larger for states with a larger existing film industry if we believe that agglomeration effects matter. However, the film industries in both states before incentive adoption were pretty average. In 2001, Louisiana (New Mexico) had the 29th (32nd) highest employment in the film industry, and the 28th (30th) highest number of establishments.

Regionally, Louisiana and New Mexico are in the south and southwest, and thus may not represent the experiences of northern or northeastern states. For example, Louisiana and New Mexico generally have weather that allows for filming throughout the year. This may make incentives more effective in these states relative to other states, such as Massachusetts or Wisconsin, leading, again, to my estimates being upper bounds or a "most likely crucial case." (Gerring, 2012). However, despite these favorable circumstances, I find few effects of Louisiana and New Mexico's incentives.

Another consideration is if conditions were changing in Louisiana and New Mexico differentially leading up the incentive adoption. As described in Section 5, the synthetic control methodology controls for differences in levels and trends of film industry measures between Louisiana and New Mexico and the states without incentives that are used to create the synthetic controls. However, the economy other than the film industry could have been changing differentially. Looking at changes in economic conditions by state, unemployment rates in New Mexico, and somewhat in Louisiana, were decreasing faster than other states leading up to incentives adoption.[13] Even if this is not con-

[13]Comparing changes in rates by state leading up to incentive adoption, from June 1995 to June 2001, New Mexico actually had the largest decrease from 7.3 to 4.8. For Louisiana this

trolled for, it suggests that despite these economies improving relatively faster, there were still few effects of the incentives, again adding to the narrative of my case studies being "most likely crucial cases." (Gerring, 2012)

3.3 History of SFIs in Louisiana and New Mexico (1980 to 2008)

I use a database of state film incentives (SFIs) compiled by Button (2018) to come up with the legislative history and characteristics of the incentives in Louisiana and New Mexico. I also used this database to determine which states did not have incentives, and when they introduced incentives, in order to come up with control states for the Abadie et al. (2010) synthetic control method.

Louisiana adopted a tax credit of 10% for all production spending, effective July 1, 2002. A base investment of $300,000 was required to be eligible, and an investment of at least $1.5m increased the tax credit rate to 15%. The requirement for this bonus 5% was increased to at least $8m starting on January 1, 2004. This tax credit was initially neither refundable nor transferable but transferability was added effective July 1, 2003. Effective January 1, 2006, the tax credit was increased to 35% for resident labor (hiring state residents), and 25% for non-resident labor (hiring out-of-state residents) and non-labor expenditure,[14] and the bonus 5% rate was removed.

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was 6.6 to 5.4, the 14th largest decrease. This is calculated using Local Area Unemployment Statistics provided by the Bureau of Labor Statistics.

[14]This includes expenses other than labor, such as set construction, travel, food, and lodgings.

New Mexico adopted a 15% refundable tax credit for resident labor and non-labor expenditure (but not non-resident labor) effective January 1, 2002. No minimum expenditure was required for eligibility. Effective July 1, 2003, non-resident labor became eligible for the 15% subsidy. Effective January 1, 2005, a bonus 5% subsidy was available for resident labor and non-labor expenditure if the production was a TV series with at least 60% of the below-the-line crew payroll paid to New Mexico residents. Effective January 1, 2006, the subsidy rates to resident labor and non-labor expenditure were increased to 25%, and the non-resident labor subsidy was removed.

4 Data

To quantify the impacts of incentives in Louisiana and New Mexico on filming, employment, and establishments in the motion picture production industry, I use four sources of data: a unique panel database I compiled of SFIs in the U.S. states (Button, 2018), the Internet Movie Database data on filming location, the Studio System database of TV series and feature films, and Quarterly Census of Employment and Wages (QCEW) data on employment and establishments in the motion picture production industry.

4.1 The Internet Movie Database Data

The Internet Movie Database (IMDb) is a popular online database with information on motion picture productions. IMDb includes information on over four million titles. I use text-based data files provided by IMDb (IMDb,

2018) to extract a sample of the IMDb motion picture productions that include all productions with a release date from 1989 to 2009 that list a filming location in a U.S. state. This sample includes 111,502 productions. I use the release year to estimate the filming year, by assuming the filming year was one year before the release year.[15] I then use this raw data to create state-by-year estimates of the number of productions filmed.[16]

Table 1, Panel A, presents summary statistics for the IMDb data, from 1988 to 2008 for all states. The mean number of productions filming in each state and year is 104.11, but this varies significantly across states and time. As expected, many of these productions are shot in typical film states, such as California and New York, so the median is must lower at 22.0.

[Table 1 about here]

While IMDb provides by far the largest database of motion picture productions, the way the data was coded at the time I accessed it does not allow the productions to be separated by type (e.g., feature films, TV). There is also the concern that because IMDb is populated largely by user contributions there may be errors or some of the included productions are not economically interesting (e.g., student films, shorts). For these reasons I also explore a smaller, but more reliable, database of motion picture productions called Studio System as a complement to the larger IMDb database.

[15] As described later for the Studio System feature films data, most filming occurs the year before the release year.

[16] Some productions film in multiple states. For these I assign them to each state equally.

4.2 Studio System Filming Location Data

Studio System (formerly Baseline) is a proprietary industry database of TV series and feature films, but instead of the content being user-generated like IMDb, the content is carefully managed by their staff to ensure data quality. Compared to IMDb, Studio System lists fewer productions, likely because Studio System focuses on major productions only.

4.2.1 Studio System TV Series Data

From Studio System I extract a database of television series where the series was distributed between 1989 and 2009, it was filmed at least partially in the United States, and it had been picked up for network or cable distribution. This extracted database contains 361 TV series. Data such as the number of seasons, average number of episodes per season, and typical episode length were missing from Studio System. This data is important because each series is not necessarily equal. The filming for a longer-running series, or a series for a 60 minute rather than a 30 minute slot would be more involved. This information was gathered manually from Wikipedia and the Internet Movie Database (IMDb) when available. The average number of episodes per season was taken as an average number of episodes for each completed season of the series.[17] The average episode length was determined based on typical television time slots. A series with a typical episode length between 20 and 30 minutes was considered a 30 minute show, and between 40 and 60 minutes

[17] In some cases, an outlier season was not included in the calculation if it contained significantly more or fewer than the average number of episodes in the other seasons of the series.

was considered an hour-long show. The number of series, average number of episodes, and typical episode length were used to calculate the total hours of filmed content per series. This weights each series based on its duration rather than treating all series as identical.

Table 1, Panel B, presents summary statistics for the Studio System TV data before I collapse it to state-by-year estimates. This database contains 361 TV Series. Of the 229 of these that have a listed broadcast network, 68 were on NBC, 63 were on ABC, 52 were on CBS, 39 were on FOX, 6 were on the CW, and one was on Channel 4. Each series had an average of 4.36 seasons, 20.64 episodes, and was distributed over an average of 5.38 years. 63.99% of series were for one hour TV slots, while the remaining 36.01% were for half-hour slots. Thus the average hours of scheduled content for each series was 73.8 hours over all seasons, or 13.7 hours per year on average.

I then collapse this raw data to state-by-year sums of the hour of content filmed. For each series I calculate the total hours for the duration of the series, and then divide this by the years that the series was active to generate an estimate of the content filmed per year. A small proportion of TV series were filmed in multiple states[18] and for these filming is split between each state equally. Because Studio System does not include filming dates for each season, I make the assumption that the TV series started filming the year before the first season.[19] Table 1, Panel A, presents summary statistics for the average

[18] 37 series (10.2%) have more than one state of film location. I ignore any filming locations outside the US. For cases where one of the filming locations was just for the pilot episode, then this is ignored in assigning filming location.

[19] As described later using the Studio System feature films data, most filming occurs the year before the release year.

hours of TV content associated with each state-by-year cell. The mean hours of content in each state and year is 28.5 hours, but the median is zero since TV filming is particularly concentrated.

4.2.2 Studio System Feature Films Data

I also extract from Studio System a database of feature films where filming was done between January 1, 1988 and December 31, 2008, where filming had been at least partially done in the US, and where the budget was at least $100,000. I use this raw data to create state-by-year estimates of the number of feature films. I follow a similar process as for the Studio System TV data to assign films to states when the film was shot in multiple states.[20]

Unlike for TV series, Studio System sometimes includes filming dates for the feature films. These are used along with release dates to estimate year of filming. Shooting dates are listed for 1,243 out of 3,958 films. For these, the film is assigned to the year it was shot. For the remaining 2,715 cases, it is assumed that the film is shot the year before its US release year.[21]

Table 1, Panel B, presents summary statistics for the Studio System feature films data. The mean feature film budget is $37.18 million in 2012 dollars ($30.33 million at the median). After collapsing these 3,958 films to state-by-year estimates (Panel A), the mean number of films per state and year is 3.70, or one at the median. The mean sum of the budgets of all productions in a

[20] Out of 3,958 films, 787 listed two states as filming locations, 175 listed three, 58 listed four, and 20 listed five or more.

[21] For the 1,214 films that list both a US release year and a filming start date, the US release year is the year after filming in 80 (6.59%) cases, the same year for 678 (55.85%) cases, two years for 342 (28.17%) cases, and three or more years for 114 (9.39%) cases.

state and year is $112.10 million in 2012 dollars ($19.37 at the median).

4.3 QCEW Employment and Establishment Data

The Quarterly Census of Employment and Workers (QCEW), collected by the Bureau of Labor Statistics, provides data on employment and establishment counts that are specific to the motion picture production industry. I use employment estimates only for individuals employed at a private business establishment.

The QCEW data reports employment and establishment counts at different levels of industry specificity, based on the six digit North American Industry Classification Code (NAICS) system and the four digit Standard Industry Classification (SIC) system. The most specific data on motion picture production are at the six digit NAICS level (512110) and four digit SIC level (7812). This does not include motion picture distribution or exhibition, or sound recording. I use SIC data (7812) from 1988 to 2000, and NAICS data (512110) from 2001 to 2008, which match perfectly to make a continuous series.

Table 1, Panel A presents summary statistics for employment and establishment estimates from 1988 to 2008. At the mean (median) there are 3,271 (647) employees and 281 (115) establishments per state and year. The small number of employees relative to establishments suggests that most establishments have fewer than a dozen employees. This table also presents summary statistics for the corporate tax rate controls, taken from Wilson (2009) (for 1980 to 2006) and Moretti & Wilson (2014) (for 2007 to 2012).

A small number of QCEW employment and establishment counts are miss-

ing for certain years,[22] typically in small states where they are suppressed for data confidentiality reasons. These missing years are imputed by taking the average value of the following and preceding years.

4.3.1 Issues with QCEW Employment Data

There are, however, a few problems with the employment estimates in the QCEW that affect how the employment results are to be interpreted. First, and most importantly, while the QCEW includes 99.7% of employee jobs, it does not include contract jobs where an individual is deemed a non-employee and receives a 1099 tax form rather than a W-2. These contract jobs do occur in motion picture production more than in other industries. While these contract jobs are excluded from my employment estimates, they are less interesting because they are not nearly as common, especially with respect to the filming jobs that could be created in Louisiana and New Mexico in the motion picture production industry. There are between 3.8 and 6.7 employee jobs for each contract job in Louisiana and New Mexico in motion picture production.[23] More importantly, these contract jobs in motion picture production are less likely to be created for locals, relative to employee jobs. Contract jobs are only allowed for positions where the contracted individual has behavioral and financial control. This includes setting their own hours and location of work,

[22] 70 (63) state-year observations, or 6.5% (5.9%) of all observations for employment (establishments.)

[23] While it is hard to get firm estimates on the number of contract relative to employee jobs, non-employer statistics provided by the Census give some estimates. For 2008 in Louisiana and New Mexico, the year where I find the largest effects, there were only 788 (357) non-employer firms in motion picture production (NAICS code 5121) in Louisiana (New Mexico.) This is relative to 3,004 employee jobs in Louisiana (2,390 in New Mexico).

and usually requires that they use their own equipment (Internal Revenue Service 2018b; Internal Revenue Service 2018a; and Internal Revenue Service 2012.) This rules out most positions in motion picture production from being contracted, the vast majority of which are deemed "below the line"[24], as usually the management exerts control over creative direction, working conditions, or provides the equipment. Contract positions are, however, very relevant for "above the line" positions (writers, producers, directors, casting directors, and main cast) and a few high-skilled "below the line" positions in management (e.g., lighting director).[25] But it is much more likely that the local jobs created in motion picture production from filming "on location" (outside of a major film clusters) are employee jobs, since the jobs that could qualify as contract jobs are usually creative and management positions that are filled by those who live in these film clusters. Thus, the contract jobs that could be created in motion picture production by SFIs are only a very tiny part of the total possible employment effects in motion picture production. As I show later, even if my employment estimates are liberally inflated upwards to incorporate missing contract jobs in motion picture production, the increase in employment is still not large and is still very costly per job created.

Second, because filming is mobile and project based, some workers may

[24]These positions include assistant director, art director, boom operator, camera operator, character generator, costume designer, dolly grip, drivers, film editor, foley, gaffer, grip, graphic artist, hair stylist, lighting technicians, line producer, location manager, make-up artist, production assistant, property masters, script supervisor, set construction, sound engineer, stage manager, stagehand, stunt performers, technical director (TD), unit production manager, video control broadcast engineering, visual effects editor, and wranglers. See Turner (2015).

[25]In addition to the IRS regulations making it clear that most "below the line" positions should not be contracted, there are numerous sources that argue this as well. See, e.g., ScreenlightandGrip.com (n.d.), King (2018), and Movie Insure (2016).

relocate temporarily, and some of these jobs for these non-residents are counted in the employment estimates. In this way, the employment estimates could be considered upper bounds for the employment in the state, to the extent that employment for non-residents should be disregarded.

Third, the QCEW data does not distinguish jobs based on full-time versus part-time, or full-year versus part-year. Full-year jobs are more associated with established motion picture production firms and are a better indication of an established motion picture production industry. However, it is common for workers in the industry to string together several temporary positions to achieve consistent employment, so jobs that are not full-year are not necessarily bad or odd. What I consider to be more of an issue is the inability to separate out the part-time jobs. Any effects on employment that I estimate are therefore a combination of full-time, part-time, full-year, and part-year jobs. If they are all considered to be full-time jobs then this again creates upper bound estimates of employment effects.

5 Methodology

I conduct case studies of Louisiana and New Mexico's incentives from 2002 to 2008 using the Abadie et al. (2010) synthetic control case study approach. This is a version of a difference-in-differences regression analysis, whereby "treated" groups (Louisiana and New Mexico) are compared to "control" groups (states without SFIs) before and after "treatment" (SFI adoption). This methodology compares the treated state (Louisiana or New Mexico) with

a synthetic (control) version of it. The synthetic state is made up of a weighted combination of states without an SFI. The weights are chosen so that the synthetic and treated state best match in all six outcome variables[26] in the period before the SFI is adopted (1988 to 2001).[27] More specifically, the weights minimize the mean squared prediction error (MSPE) in the pre-treatment period between the actual and synthetic states in all variables used to match. The process is outlined in detail in Abadie et al. (2010). The synthetic control states can be compared to the actual states in the period after the incentive takes effect to get an estimate of its effect over time, net of a "business as usual" trend that is reflected in the synthetic control state.

5.1 Selection of Control States

States are only eligible to be used as control states if they have not had an SFI during the entire sample period. As I discuss in Section 3.1 I choose to analyze Louisiana and New Mexico from 1988 to 2008. Given this, the control states are Alabama, Delaware, Kentucky, Nebraska, Nevada, New Hampshire, North Dakota, Ohio, South Dakota, Utah, and Virginia. Table 2 presents how each control state is weighted to create each synthetic control, for both treated states (Louisiana and New Mexico), and for each outcome variable. New Mexico's synthetic control for IMDb productions is made up of 69.4% Alabama, 15.7% Virginia and 14.9% Nevada. Louisiana's is 39.6% Nevada, 22.2% Al-

[26]IMDb productions, Studio System TV series filming, Studio System feature films, Studio System feature film total budgets, employment, and establishments.

[27]I also include the corporate tax rate as a matching variable to control for these rates and their changes. Since the sources of sales tax rate data I could find only started in 2000, this variable could not be included.

abama, 20.4% Utah, 10.6% Ohio, and 7.2% Delaware. The weights differ a bit by outcome variable, given that each outcome variable trends somewhat differently. The weights for IMDb Productions and Studio System TV series are the most similar, but the weights are similar, although less concentrated, for the other outcome variables.

[Table 2 about here]

5.2 Pre-Trends and the Parallel Paths Assumption

The Abadie et al. (2010) synthetic control case study approach has some advantages over a more traditional panel regression. A key concern in difference-in-differences studies is the parallel paths assumption (also called parallel trends). For a differences-in-differences to provide an unbiased estimate of the causal effect of these SFIs, it must be the assumed that pre-existing trends in the outcome variable (e.g., filming) were the same for the treated and control groups. That is, before SFI adoption, Louisiana and New Mexico would have had similar growth rates in filming as their synthetic versions. The required assumption is that if Louisiana and new Mexico had instead not adopted SFIs, then these similar growth rates would have continued on for Louisiana, New Mexico, and their synthetic versions. Thus, absent treatment, the treated and control groups would be moving in a parallel fashion, and the control group provides the "business-as-usual" case for what would have happened had Louisiana and New Mexico not adopted SFIs. This assumption is violated, if, for example, Louisiana has always experienced a faster growth rate than its synthetic control, and this would have continued even without the

SFI. In this case, the estimated effect is biased upward. The Abadie et al. (2010) minimizes this concern by intentionally generating a synthetic control version of the treated state that best matches the trend of the actual state in the pre-period. While it is impossible to know if these actual and synthetic states would then have had the same trends in the treatment period, absent treatment, it is more likely to be the case when the pre-trends are matched.

This contrasts with how the parallel paths issue is dealt with in more traditional difference-in-differences studies. Researchers typically do one of two things: (1) make the parallel paths assumption, which is a much stronger assumption to make given that the control group is not generated to have matching pre-trends, or (2) add group-specific linear time trends to control for linear differences in existing trends, which partially relaxes the parallel paths assumption (see **?**). But either way, the assumptions required to ensure unbiased causal estimates are weaker under the Abadie et al. (2010) synthetic control case study.

5.3 State Competition and the Independence Assumption

An implicit assumption behind the synthetic control case study approach is that there are no spillover effects or there is no state competition between the treated and control states. While there are usually concerns of this (e.g., Wilson 2009), this is less of a concern in this application for a few reasons.

First, three studies do not find evidence that neighboring states compete with each other, or that the estimated effects of SFIs are different when neigh-

boring state competition is controlled for. Thom & An (2017) and Leiser (2017) both conduct a state panel analysis exploring what factors predicted adoption of SFI, and did not find that SFI adoption was affected by if neighboring states also had SFIs. Button (2018) estimates the effects of SFIs on filming location, employment, and establishments, and also estimates if these effects of SFIs are different when controlling for SFIs in neighboring states following a methodology similar to Moretti & Wilson (2014). He does not find that the estimated effects of SFIs change in a meaningful way when controlling for SFIs in neighboring states.

Second, even if there were state competition, it would not affect my main conclusions. Suppose a zero-sum environment where Louisiana and New Mexico are taking productions from the control states (Alabama, Delaware, Nevada, New Hampshire, Ohio, Utah, and Virginia, all of which have non-zero weights as in Table 2.) If this is the case, then this biases the estimated impacts of the SFIs in Louisiana and New Mexico upward, meaning that my estimates would represent upper bounds of effects. Since these upper bounds do not show much of an effect, the actual effects, if this zero-sum competition were relevant, would be even smaller. So the main conclusions of my study are not affected by this.

Another possibility, which again does not affect my main conclusions, is that the control states are losing filming over time due to nearby states adopting incentives. For example, Alabama is a control state that gets a lot of weight in the synthetic control case studies for both Louisiana and New Mexico. Alabama borders Florida (adopted an SFI in 2003), Mississippi (2004), Georgia

(2005, although this incentive was initially weak), and Tennessee (2006). So starting in around 2003, Alabama could have started losing filming to its bordering states (assuming there was state competition.) If this happened, then this would again lead to an upward-biased estimate of the effect of SFIs in Louisiana and New Mexico. Thus, even if this sort of state competition occurs, which seems unlikely, it leads to upper bound estimates and my conclusions are not affected.

5.4 Inference

The Abadie et al. (2010) synthetic control does not provide for inference through typical standard errors. Inference is conducted through placebo tests where the control states are deemed "treated" and their time series plots, with their synthetic control counterparts, are compared to those of the treated states. If these control states experience a "treatment" effect as well, then it suggests that any effects found for Louisiana or New Mexico are spurious and not statistically significant.

For Louisiana, New Mexico, and each of these placebo tests with control states (Alabama, Delaware, Kentucky, Nebraska, Nevada, New Hampshire, North Dakota, Ohio, South Dakota, Utah, and Virginia), a ratio of the post-treatment to pre-treatment mean squared prediction error is calculated as follows:

$$MSPERatio_i = \frac{MSPEPost\text{-}Treatment}{MSPEPre\text{-}Treatment}$$

$$= \frac{\frac{1}{7}\sum_{t=2002}^{2008}(ActualY_{it} - SyntheticY_{it})^2}{\frac{1}{14}\sum_{t=1988}^{2001}(ActualY_{it} - SyntheticY_{it})^2} \quad (1)$$

These ratios indicate how well the synthetic control matches the actual state in the post-treatment period relative to in the pre-treatment period. Large ratios for Louisiana and New Mexico suggest results that are more likely to be causal. Large ratios can occur in two ways: either there is a large treatment effect so the MSPE post-treatment (numerator) is high, or there is a good fit between the actual and synthetic state in the pre-treatment period so the MSPE pre-treatment (denominator) is low. If control states have a similarly high ratio to the treated states then this suggests that the results for the treated states may have been spurious.

These ratios can then be used to calculate p-values. Suppose, for example, that New Mexico has the highest MSPE Ratio. Then if the treatment was assigned at random in the data, the probability of obtaining a MSPE ratio as large as New Mexico's is $1/12 = 0.083$, indicating statistical significance at the 10% level (Abadie et al., 2010). Unfortunately, given that there are not at least 20 control states, it is not possible to test for statistical significant at the 5% level or lower. However, since most outcomes are not statistically significant even at the 10% level, this doesn't affect the main conclusions in the paper.

In addition to this MSPE ratio calculation, it is standard to also present these placebo tests visually, by comparing each actual control state to its synthetic counterpart. From this it is easy to see if Louisiana and New Mexico stand out or if their experiences were similar to other states without SFIs.

6 Results

6.1 Effects on IMDb Productions

Figure 2 presents the time series of the number of productions for Louisiana and New Mexico, relative to their synthetic control states. The figure suggests large increases in productions in both states starting in about 2005 and peaking in 2007. This is a jump from a pre-treatment period average of 14.9 productions per year in New Mexico and 28.6 productions per year in LA, to a post-treatment period average of 95.7 and 111.4 productions per year, respectively. This is a similar average increase for New Mexico (80.9) as for Louisiana (82.8) but the percent increase is much larger for New Mexico (544.2% versus 290.0%).

[Figure 2 about here]

However, this uncontrolled increase is not necessarily causal. As the time series for the synthetic controls show, filming would have been rising in both states without any interventions, but not to the same degree for New Mexico. For Louisiana there does not appear to be any effect on productions relative to the synthetic control: the average productions in the post-treatment period matches the synthetic control (111.4 versus 111.6). Relative to the synthetic control, New Mexico gained an average of 25.4 productions per year, rather than 80.9 productions, representing a still sizable but much smaller 71.2% average increase in productions relative to the "business as usual" case represented by the synthetic control in the post-treatment period. In this way

the Abadie et al. (2010) synthetic control demonstrates how important it is to control for the existing time trend, as a simple before-and-after analysis without a control group over-estimates the effect of SFIs.

Figure 3 presents a series of placebo tests for the production results in Figure 2. Each series presented here is the gap between the actual state and its synthetic control, divided by the average in the actual state during the pre-treatment period (1988 to 2001), and then multiplied by 100 to create a percentage. Positive (negative) values indicate that the actual state's production levels were higher (lower) relative to the synthetic control. Dividing the gap by the average number of productions in the pre-treatment period allows the interpretation to be the percentage increase (or decrease) in productions in that year relative to the average in the pre-treatment period, net of what is predicted by the synthetic control. The darker, solid, colored lines show the same series for Louisiana and New Mexico from Figure 2, but recalculated as this relative gap. The gray lines represent the control states.

[Figure 3 about here]

Figure 3 suggests that the increase in productions in New Mexico in 2007 and 2008 exceeded many of the control states, while Louisiana blends into the pack. New Mexico's gap of about 800% in 2007 stands out as a clear outlier, suggesting that there is likely a causal effect here, but this can be confirmed more formally by comparing MSPE ratios.

Table 3 presents the ratio of the post-treatment period mean squared prediction error to the pre-treatment period mean squared prediction error. New

Mexico performs well for productions, with a ratio of 55.9. This is the largest out of all the control states, with the next largest being Nebraska with 35.0. Thus, for New Mexico the probability of estimating a ratio for IMDb productions at least as large as that of New Mexico, under a random permutation of the intervention is $1/12 = 0.083$, suggesting statistical significance at the 10% level (Abadie et al., 2010). Louisiana performs poorly, with a ratio of 4.9, putting it at 10th out of 12.

[Table 3 about here]

6.2 Effects on Studio System TV Series

Figure 4 presents the results for Studio System TV series. What is interesting here is that there was no TV series filming in Louisiana or New Mexico, and almost none in the control states, before incentives. However, afterward, both the actual and synthetic Louisiana and New Mexico experience increases in TV series filming. For New Mexico, the increase appears larger in most years than the synthetic control, but for Louisiana this does not appear to be the case.

[Figure 4 about here]

Figure 5 presents the placebo tests. These are presented a bit differently. Normally, as was done for IMDb productions, the difference between the actual and synthetic state is divided by the pre-treatment mean, so the gap can be expressed as a percentage (see, e.g., Abadie et al. 2010). However, most states had no TV series filming in the pre-treatment period. Given this, the figure

presents just the raw difference between actual and synthetic. This figure shows that while Louisiana blends into the pack again, New Mexico stands out, except compared to the control state of Nevada. Nevada experienced a huge increase in TV series filming, without any incentives.[28]

[Figure 5 about here]

Table 3 presents the MSPE ratios. Two versions are presented. The first (left side) is the typical MSPE ratio, discussed above (Equation 1) and presented in the rest of the table. The second (right side) is the post-treatment MSPE without dividing by the pre-treatment MSPE, so

$$MSPEPost\text{-}Treatment = \frac{1}{7}\sum_{t=2002}^{2008}(ActualY_{it} - SyntheticY_{it})^2 \qquad (2)$$

The reason for these two version is that, for many states, the pre-treatment MSPE is zero, leading to division by zero or division by a very small number. Since the fit of the synthetic controls are exceptionally good in the pre-period, because most states have no TV series filming, it makes more sense to just compare the MSPE in the post-period.

However, the results are similar regardless of which version is used. Neither Louisiana nor New Mexico have a statistically significant increase in TV filming. Using the regular MSPE ratio (left side), New Mexico is beat by Virginia and Nebraska and Louisiana is 10th again. Using just the post-treatment

[28]TV series that filmed in Nevada at least in part from 2002 to 2008 include: Dog the Bounty Hunter, Face the Ace, Forty Deuce, Hidden Howie: The Private Life of a Public Nuisance, Inked, Las Vegas, Las Vegas Garden of Love, Last Comic Standing, Playing it Straight, Poker After Dark, Race to the Altar, The Casino, The Jacksons: A Family Dynasty, and Season 6 of Top Chef.

MSPE (right side), Nevada is way larger and beats all other states.

6.3 Effects on Studio System Feature Films

Figure 6 presents the results for Studio System feature films. The pre-period fit for both states is good, with there being about two films shot per year, on average, in each state. This increases up to an average of 6.6 (New Mexico) and 7.9 (Louisiana) per year. Interestingly, the synthetic controls show no increase during this period, unlike for IMDb productions and TV series, which had a large increase during this period.

[Figure 6 about here]

Figure 7 presents the placebo tests. Both New Mexico and Louisiana stand out somewhat compared to the control states, although there is some noise in a few years with a few control states. Comparing the MSPE ratios (Table 3) shows that the MSPE ratios for New Mexico and Louisiana (43.7 and 40.9, respectively) far exceed those of the control states, the largest being Kentucky (2.7). Thus, for both New Mexico and LA, the increase in feature films is statistically significant at at least the 10% level.

[Figure 7 about here]

These results are similar if feature films are weighted by their budgets, by using the total budgets of feature films instead of just the number of feature films. These results are shown in Figures 8, 9, and in Table 3.

[Figure 8 about here]

[Figure 9 about here]

6.4 Effects on Employment

Figure 10 presents the employment results. Employment starts increasing rapidly starting in about 2005 for both states. The average increase in employment, net of the synthetic control, is about 698 jobs in New Mexico and 900 jobs in Louisiana per year, on average, over the period 2002 to 2008. For New Mexico employment is 289% larger on average over the 2002 to 2008 period relative to the "business as usual" case shown by the synthetic control. For Louisiana this is 188% larger.

[Figure 10 about here]

Figure 11 presents the placebo figure for employment. Both states dominate the control states starting in 2005, however, Nevada again stands out and performs similarly to Louisiana, although Nevada's synthetic control has poor fit. Table 3 shows that both Louisiana and New Mexico are beat out in the MSPE ratio by Virginia, so that there is no statistically significant increase in employment.

[Figure 11 about here]

These employment estimates, while large increases in percentage terms, are small in absolute terms even if they are assumed to be causal. Assuming causality, that these jobs were actually created, this would be on-average 830 jobs in New Mexico and 1,111 jobs in Louisiana per year from 2003 to 2008 (ignoring 2002, which increases these employment estimates.) We can be even more generous and assume that these are full-time jobs (however, the

QCEW data includes both full-time and part-time jobs.) Even given these generous assumptions, the average cost per job was $67,757 in Louisiana and $48,002 in New Mexico in 2009 dollars.[29] This decreases to $48,388 per job in Louisiana and $21,035 per job in New Mexico under additional, highly favorable assumptions regarding the possible creation contract jobs.[30] These cost per job estimates reflect those estimated in the reports discussed in the literature review and suggest that, even if the employment increase were causal, the cost per job created was steep.

6.5 Effects on Establishments

Figure 12 presents the results for establishments. Both states show an increase in establishments from 1988 to about 1998, a decrease from about 1998 to 2004, and then a slightly more rapid increase from 2004 to 2008. Net of the synthetic control, the average increase in establishments is 3.5 in New Mexico, but a decrease of 11.0 in Louisiana.

[Figure 12 about here]

[29]This was calculated by dividing the average expenditure per year on SFIs in New Mexico ($25.6m) and in Louisiana ($75.3m) in 2009 dollars over fiscal years 2003-2004 to 2008-2009 by the average increase in employment - 830 and 1,111 jobs, respectively over the period 2003 to 2008. Data sources and calculations are available upon request. I thank Greg Albrecht for providing expenditure data for Louisiana.

[30]Given that, as discussed earlier, contract jobs are a much smaller proportion of all motion picture production jobs, and they are not common for the types of jobs that would have been created in Louisiana and New Mexico, it is very unlikely that Louisiana and New Mexico would have had meaningful increases in employment had contract jobs been included in my estimates. But if we also assume the same percentage increases in employment but for non-employment jobs (289% in New Mexico and 188% in Louisiana), and we again assume that this is a casual increase, then 478 (387) non-employment jobs would have also been created compared to the baseline of 254 (134) non-employment jobs in 2001. Given this, the cost per job created estimates are still very high, at $48,388 for Louisiana and $21,035 for New Mexico.

Figure 13 presents the placebo tests, which clearly show that other control states experienced similar and often larger increase in establishments. The MSPE ratios (Table 3) confirm this result.

[Figure 13 about here]

7 Conclusion

With the rapid growth in aggressive State Film Incentives (SFIs), it is important to evaluate their main goal: are they able to create or grow a local film industry? To investigate this, I conduct case studies of two, early, aggressive adoptors - Louisiana and New Mexico - using the Abadie et al. (2010) synthetic control. To see if SFIs affect filming location, I use the Internet Movie Database and Studio System databases, which allow me to track filming by state. To see if SFIs increase employment and business establishments in the motion picture production industry, I use data from the Quarterly Census of Employment and Wages (QCEW).

I find that New Mexico's incentive from 2002 to 2008 increased some filming of productions listed on IMDb and feature films listed on Studio System. For Louisiana's incentive over the same period, there is only evidence of an increase in feature films. For neither state do I find a causal effect on TV series filming. This is driven by the fact that other states achieved similar or better growth in TV series filming, absent incentives. Similarly, for neither state is there a statistically significant increase in employment of business establishments in the film industry.

These results suggest that these two SFIs, which were widely discussed as alleged "success stories", got limited benefits from their SFIs. While they were able to capture some filming, this did not lead to more tangible effects on employment or business establishments in the film industry, which I consider a crucial gauge of if SFIs can establish a film industry. Thus, these results suggest that SFIs have limited ability to create a local film industry.

What these case studies tell us about economic development incentives more broadly is that incentives that seek to target the development of industry clusters may have limited effects, adding to the larger literature on cluster theory and incentives (e.g., Porter 2000; Rosenthal & Strange 2004; Martin et al. 2008; Hefner 2009; Weinstein 2018.) SFIs are in a context where location choices are much more insensitive to the specific characteristics of each location, meaning that these incentives could have a big effect on location choices, and thus economic development. However, I find that even in these favorable circumstances, these incentives did not lead to meaningful increases in employment or establishments in the targeted industry, suggesting that other incentives are also likely to have limited impacts. However, these case studies do not tell us as much about other types of incentives that affect firms in general, such as general state taxation rates, or incentives that are very geographically focused (e.g., enterprise zones.)

A larger question is if SFIs are worth it, even if they do not meet their goal of creating or significantly bolstering local film industries. Some argue that SFIs are beneficial because they stimulate the economy more broadly. This is certainly true at first blush: the feature films lured to Louisiana and New

Mexico would surely create some economic stimulus. While my results here show no meaningful increase in employment in the film industry, the increased filming from SFIs could increase demand for local services, such as hotels, food, and equipment rentals. But I do not expect large spillover effects on other industries since there are not even statistically significant effects on the targetted industry itself.[31]

In answering the broader question of if SFIs are worth it, it is crucial to consider that the amount spent on SFIs could also have been used for other purposes, such as cutting taxes, providing incentives for another industry (e.g., manufacturing, biotech), or funding public goods such as education, health, or infrastructure (Wang, 2016). This is an especially important consideration in states, such as Louisiana, that are experiencing budget crises.[32] Alternative uses of taxpayer dollars also have multiplier effects, leading to job creation in other industries. The film industry is not unique in its ability to create spillover effects, and the spillover effects for the film industry are pretty average.[33] Thus, it is crucial to compare the effects of SFIs to their goals, and to think critically about how taxpayer dollars should be allocated among competing priorities.

[31]Also, Thom & An (2017) does not find that SFIs impact Gross State Product, so it seems unlikely that SFIs provide any important stimulus to the economy in general.

[32]For example, a budget crisis is causing Louisiana to make severe cuts to crucial programs such as eldercare (Burnside & Simon, 2018).

[33]Economist Bruce Seaman estimates that the multiplier for the film industry is 1.83 in Georgia, which is pretty average. This means that for each $1 spent by the film industry, $1.83 of economic activity is created. This contradicts the much larger multipliers that are unrealistically claimed in reports by industry lobbyists. See Hunt (2015).

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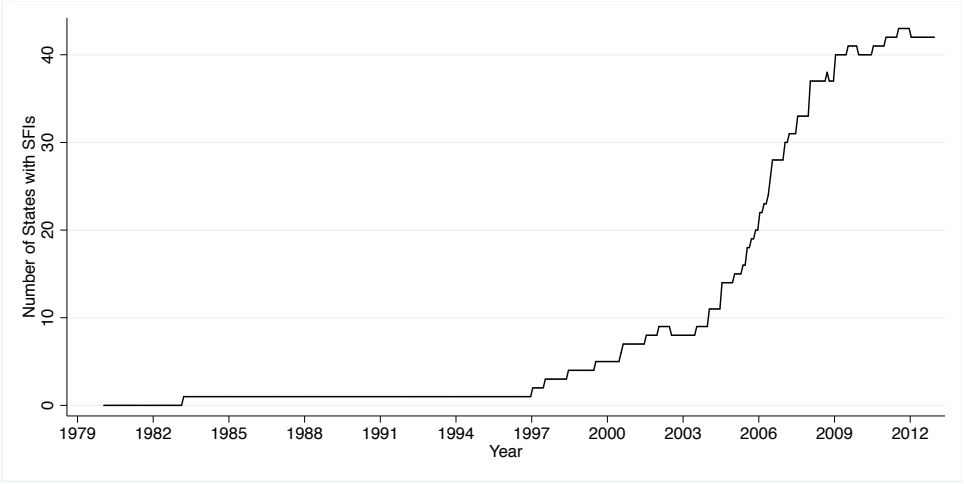
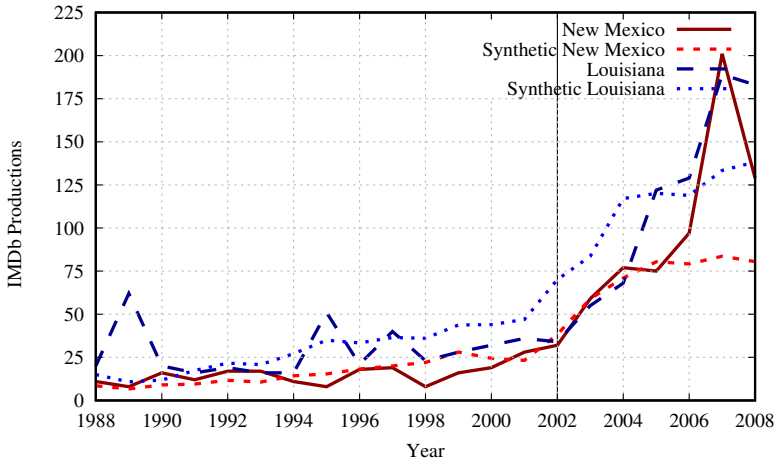
Figure 1: Number of U.S. States with a State Film Incentive (SFI)



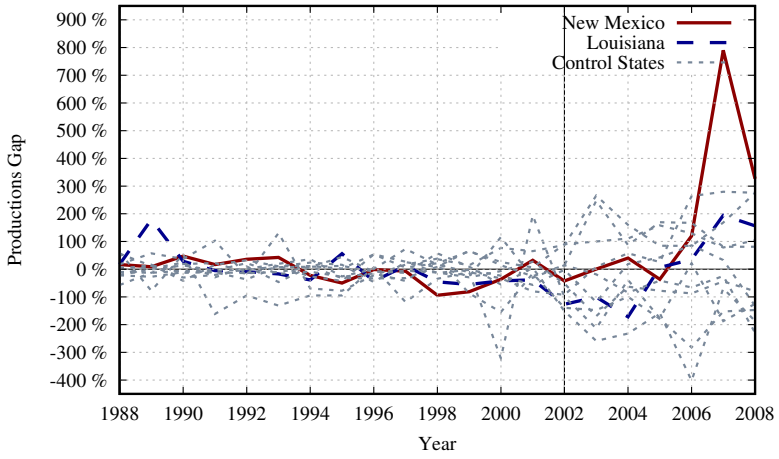
Notes: State film incentives (SFI) here include only cash rebates, grants, or tax credits for motion picture production and do not include states with only sales tax exemptions or other small incentives.

Figure 2: Number of IMDb Productions in New Mexico and Louisiana Relative to Synthetic Controls



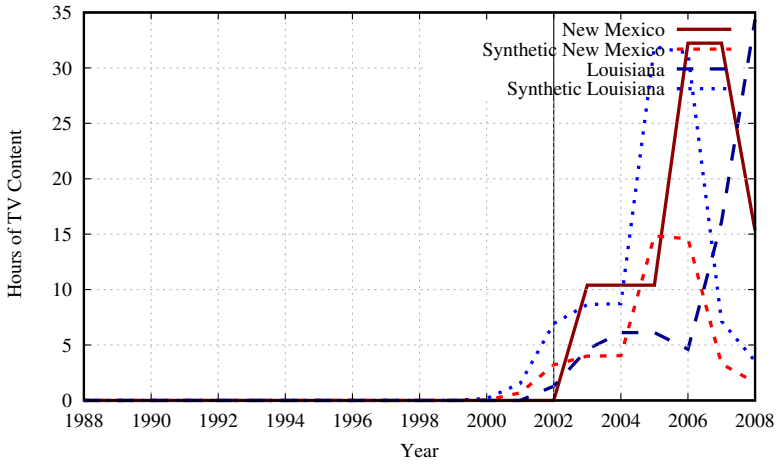
Notes: This figure presents the time series of the number of productions for New Mexico and Louisiana who both adopted incentives in 2002, relative to their respective synthetic control states, constructed following Abadie et al. (2010). The control states are made up of a convex combination of states (Alabama, Delaware, Kentucky, Nebraska, Nevada, New Hampshire, North Dakota, Ohio, South Dakota, Utah, and Virginia) without an incentive during the entire sample period (1988 to 2008). Weights for each control state are determined so that the synthetic control best matches the actual state in the pre-treatment period (1988 to 2001) through minimization of mean squared prediction error, using all six outcome variables and the corporate tax rate control.

Figure 3: Synthetic Control Placebo Tests for IMDb Productions



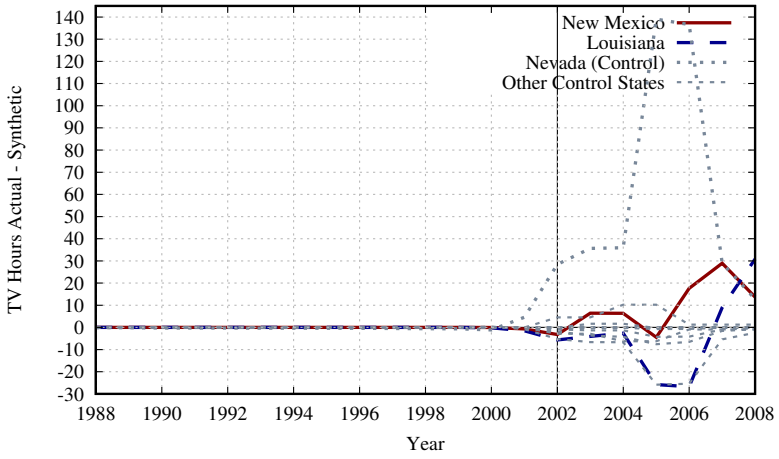
Notes: This figure presents the gap between the number of productions (based on IMDb data) in the state and in the synthetic state, expressed as the difference between the actual and synthetic state, divided by the average number of productions in the state during the pre-treatment period (1988 to 2001), and then converted to a percentage. A value of 50% means that the gap (actual - synthetic) was 50% larger than the pre-treatment mean. In addition to the series for New Mexico and LA, also presented are the series for the control states. ND is not plotted since it has the lowest average productions, leading to a messier and less informative plot as the pre-treatment gap is not centered on zero.

Figure 4: Hours of Filmed TV Content in New Mexico and Louisiana Relative to Synthetic Controls



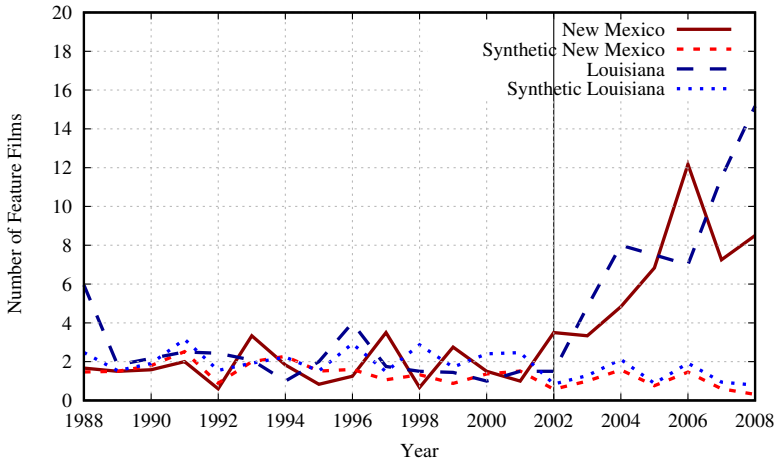
Notes: See notes to Figure 2.

Figure 5: Synthetic Control Placebo Tests for TV



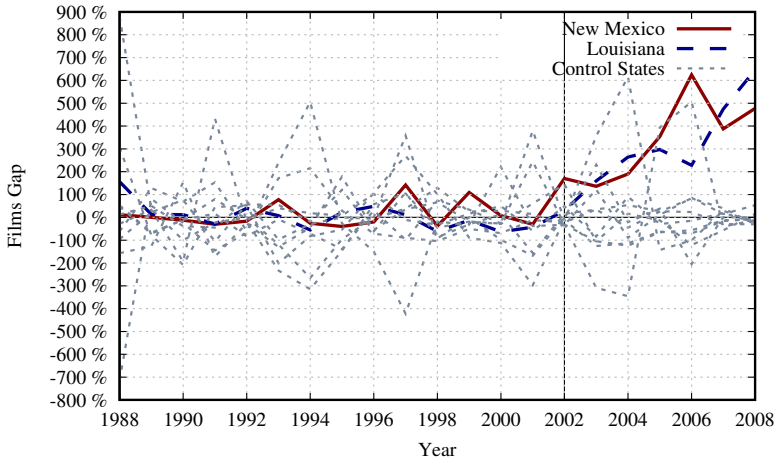
Notes: See notes to Figures 3 and 10.

Figure 6: Number of Feature Films in New Mexico and Louisiana Relative to Synthetic Controls



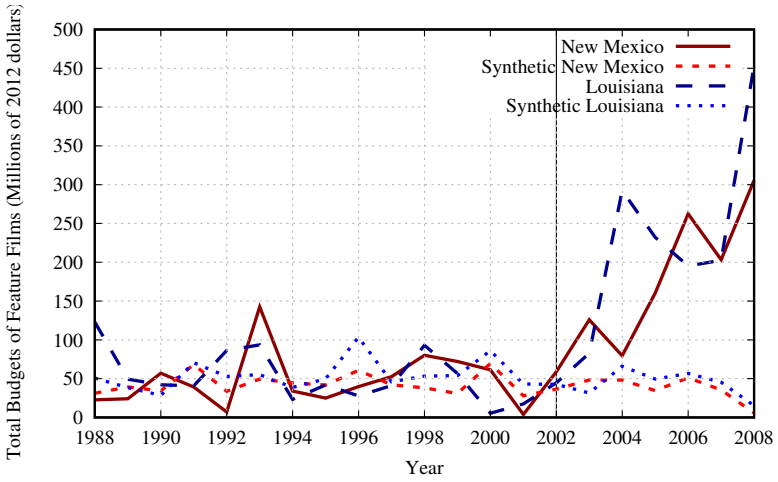
Notes: See notes to Figure 2.

Figure 7: Synthetic Control Placebo Tests for Feature Films



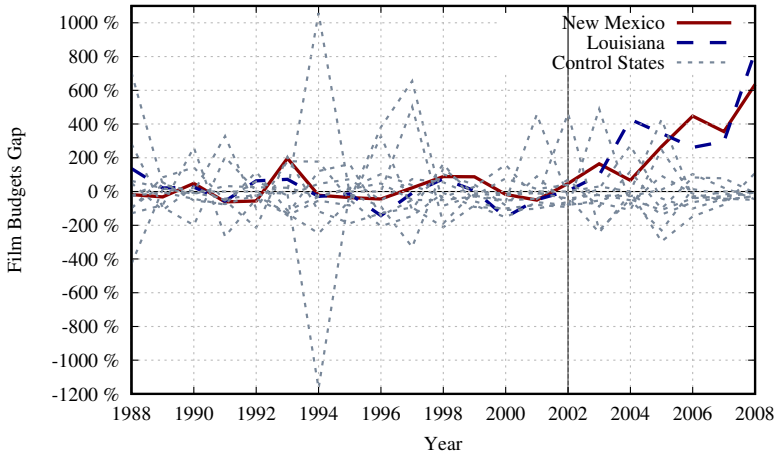
Notes: See notes to Figures 3 and 6.

Figure 8: Total Budgets of Feature Films in New Mexico and Louisiana Relative to Synthetic Controls



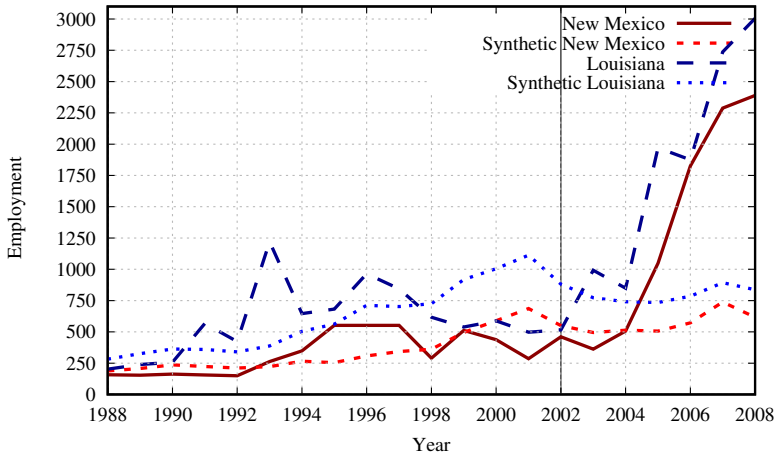
Notes: See notes to Figure 2.

Figure 9: Synthetic Control Placebo Tests for Total Budgets of Feature Films



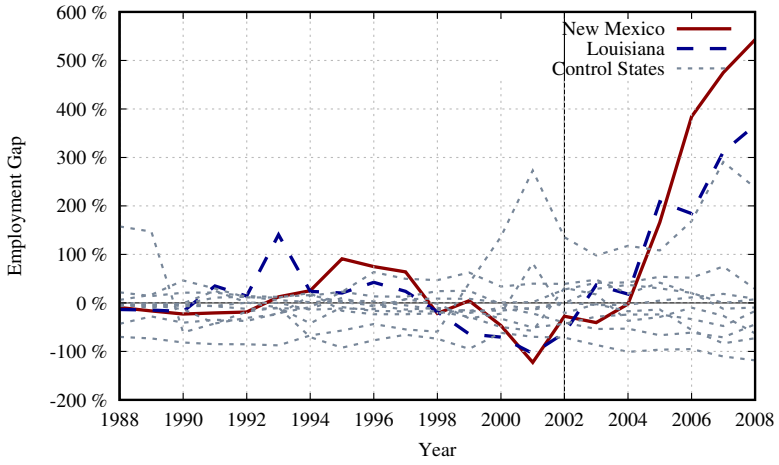
Notes: See notes to Figures 3 and 8.

Figure 10: Employment in New Mexico and Louisiana Relative to Synthetic Controls



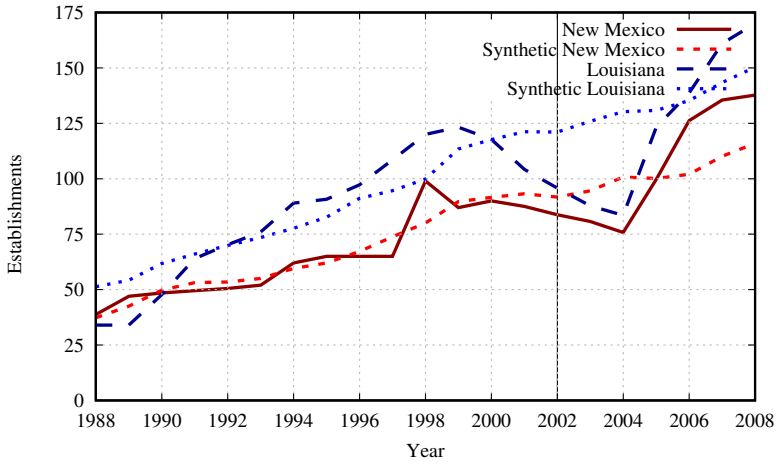
Notes: See notes to Figure 2.

Figure 11: Synthetic Control Placebo Tests for Employment



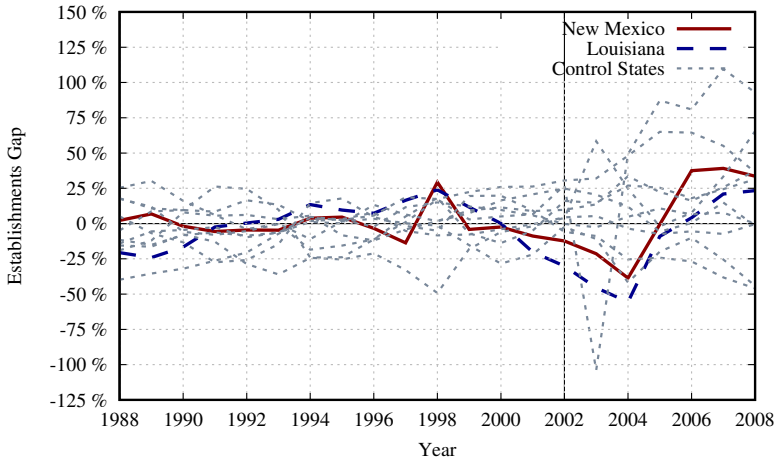
Notes: See notes to Figures 3 and 10.

Figure 12: Establishments in New Mexico and Louisiana Relative to Synthetic Controls



Notes: See notes to Figures 2 and 10.

Figure 13: Synthetic Control Placebo Tests for Establishments



Notes: See notes to Figure 3 and 12.

Table 1: Summary Statistics

Variable	Median	Mean	Std. Dev.	Min	Max	N
Panel A - Collapsed State-Year Data:						
Active SFI	0	0.20	0.40	0	1	1,683
IMDb Productions	22	104.11	361.83	0	4,412	1,071
Hours of Content	0	32.38	164.17	0	1,877.54	1,071
# Feature Films	1	3.70	11.71	0	96.33	1,071
Total Budgets of Films	19.37	112.10	393.90	0	4,054.64	1,071
Employment	647.25	3,271.46	13,683.02	10.33	122,772.50	1,001
Establishments	114.88	280.62	752 .62	3	6,312.75	1,008
Corporate Tax	7.09	6.72	2.73	0	13.80	1,071
Panel B - Raw Studio System Data:						
Years in Distribution (TV)	3	5.38	4.67	2	28	361
Seasons (TV)	2	4.36	4.79	1	28	361
Ave. Episodes per Season (TV)	15	20.64	29.08	1	207	361
Length (TV)		30 min. = 36.01%, 60 min. = 63.99%				
Budget (millions of 2012 dollars) (Films)	30.33	37.18	36.46	0.13	417.06	3,958

Notes: Panel B presents the raw Studio System data before it is collapsed to the state-year level and merged with data from the SFI database, the QCEW data, and control variables (Panel A). The Studio System TV series data is based on 361 TV series with a release year between 1989 and 2009 that list a state of filming. The Studio System feature films data is 3,958 feature films that were filmed between 1988 and 2008 (or released between 1989 and 2009) that list a state of filming and had a budget of at least $0.1 million. QCEW data uses estimates for the motion picture production industry using NAICS 512110 (from 2001 to 2008) and SIC 7812 (from 1988 to 2000), which overlap perfectly. Sales tax data is from the Tax Foundation. Corporate tax rate data is from Wilson (2009) (1980-2006) and Moretti & Wilson (2014) (2007-2008).

Table 2: Control State Weights for New Mexico and Louisiana

Data Source	IMDb				Studio System				QCEW			
Outcome	# Productions		TV Hours		# Films		Total Film Budgets		Employment		Establishments	
State	NM	LA	NM	LA	NM	LA	NM	LA	NM	LA	NM	LA
AL	69.4%	22.2%	77.8%	20.1%	42.9%	21.9%	46.7%	24.8%	27.5%	34.3%	34.6%	22.8%
CA	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
DE	0.0%	7.2%	0.0%	0.0%	16.9%	7.8%	11.8%	5.9%	28.1%	0.0%	22.8%	8.1%
KY	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
NE	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
NV	14.9%	39.6%	10.5%	22.5%	26.0%	42.3%	27.9%	40.8%	30.7%	41.3%	31.2%	42.4%
NH	0.0%	0.0%	0.0%	1.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
ND	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
OH	0.0%	10.6%	0.0%	9.5%	0.0%	13.1%	0.0%	13.4%	0.0%	13.3%	0.0%	14.8%
SD	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
UT	0.0%	20.4%	11.6%	46.5%	2.7%	15.0%	0.0%	15.1%	0.9%	11.1%	0.4%	11.8%
VA	15.7%	0.0%	0.0%	0.0%	11.5%	0.0%	13.7%	0.0%	12.9%	0.0%	11.0%	0.0%

Notes: These weights form the synthetic control groups in Figures 2, 4, 6, 8, 10, and 12. Weights are determined such that the MSPE between the actual and synthetic states is minimized in the pre-treatment period. MSPE is minimized over all six outcome variables, and also sales and corporate tax rates controls. While CA is included here, it is never given weight and it is not included in the placebo tests in Table 3 and Figures 3, 5, 7, 9, 11, and 13.

Table 3: MSPE Ratios for Treated and Control States

Data Source	IMDb	Studio System			QCEW	
State	# Productions	TV Hours	# Films	Film Budgets	Employment	Establishments
			Treated States			
NM	55.9 (1st)*	6,219.5 / 206.9 (4th) / (3rd)	43.7 (1st)*	23.2 (1st)*	36.6 (2nd)	9.3 (2nd)
LA	4.9 (10th)	2,050.4 / 352.0 (10th) / (2nd)	40.9 (1st)*	27.1 (1st)*	13.8 (2nd)	4.7 (4th)
			Control States:			
AL	22.5	3,196.8 / 19.8	0.1	1.9	1.5	7.0
DE	1.2	N/A / 0.0	0.2	0.2	2.8	2.2
KY	23.4	N/A / 0.0	2.7	0.5	0.9	1.9
NE	35.0	78,281.0 / 0.8	2.3	0.4	3.7	2.8
NV	18.1	3,494.5 / 6053.2	1.2	2.1	3.0	2.3
NH	6.0	2,447.1 / 5.8	1.1	0.1	1.2	3.4
ND	3.4	N/A / 0.0	0.2	0.4	0.9	5.7
OH	28.0	4,124.3 / 13.8	0.5	1.1	12.8	0.3
SD	5.3	2,388.8 / 0.2	0.3	0.8	0.3	58.7
UT	24.3	4,126.6 / 209.1	1.6	2.6	0.6	4.5
VA	7.1	405,562.2 / 36.6	0.3	2.5	39.9	0.5

Notes: This table presents mean square prediction error (MSPE) ratios (Equation 1) for the two treated states (New Mexico and Louisiana) and the control states under placebo tests. In parenthesis under the ratios for New Mexico and Louisiana is the rank of each ratio relative to the 11 control states. For each of these rankings a * means the estimate is statistically significant from zero at the 10% level (it is not possible to test at the 5% level). The column for TV Hours includes the MSPE ratio (left side, Equation 1) and just the post-treatment MSPE (right side, Equation 2). See the main text for a discussion. The MSPE ratio (left side) is not defined (N/A) for Delaware, Kentucky, and North Dakota for TV Hours, as for these states both the actual and synthetic states have zero TV hours each year, such that the ratio is 0/0.