Industry Aggregation and Assessment of State Economic Development from Motion Picture and Television Production Incentives

Dan S. Rickman
Oklahoma State University

Hongbo Wang
Oklahoma State University

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Abstract

Studies of the economics of state tax incentives for the motion picture and television industry use differing levels of industry aggregation. This study examines aggregate sector input-output multipliers for 48 states for the motion picture and television industry and shows how the aggregate multipliers may be inaccurate for most states. We conclude that the sub-category Motion Picture and Video Production (NAICS code 51211) most corresponds to the incentivized activity in the industry and the multipliers used in economic impact analyses of state film incentives need to reflect its presence within the aggregate sector. We conduct a hypothetical case study of Oklahoma, a state with little presence of NAICS 51211, using multipliers for the key film incentive states of Louisiana and New Mexico, two states with a large presence of NAICS 51211. The usefulness of the input-output employment multipliers for Louisiana and New Mexico are confirmed based on both cross-sectional correlations and time-series evidence obtained from a difference-in-difference approach.

1 Introduction

Starting in the 1990s, the use of fiscal incentives to attract motion picture and television filming has become widespread across US states. By 2015, forty-four states had film incentives in place at some point in time (Bradbury, 2020; National Conference of State Legislatures, 2018; Sewordor and Sjoquist, 2016). The costs of the programs can be minimal where there are low caps on total incentives such as in Minnesota with its 5 million dollar cap or large in states without incentive caps such as the 1 billion dollars of incentives in Georgia (National Conference of State Legislatures, 2022). Following the onset of the pandemic, ten states enacted measures to implement or expand film incentives in 2021 (National Conference of State Legislatures, 2022) in an attempt to increase their share of a global market in film and television production now estimated to be worth 118 billion dollars.[1] The value of the global streaming market alone is projected to increase from 60.1 billion dollars in 2021 to 213.1 billion dollars in 2028.[2] Networks and streaming services have been visible in their desires to receive state tax incentives (Sayers, 2021; Maddaus, 2022).

A large number of economic impact studies have evaluated state film incentives as a tool for economic development.[3] Among the economic impact studies are those by state fiscal offices in evaluating their states'

[1] IBISWorld, 2022, https://www.ibisworld.com/global/market-size/global-movie-production-distribution/, accessed July 2, 2022.

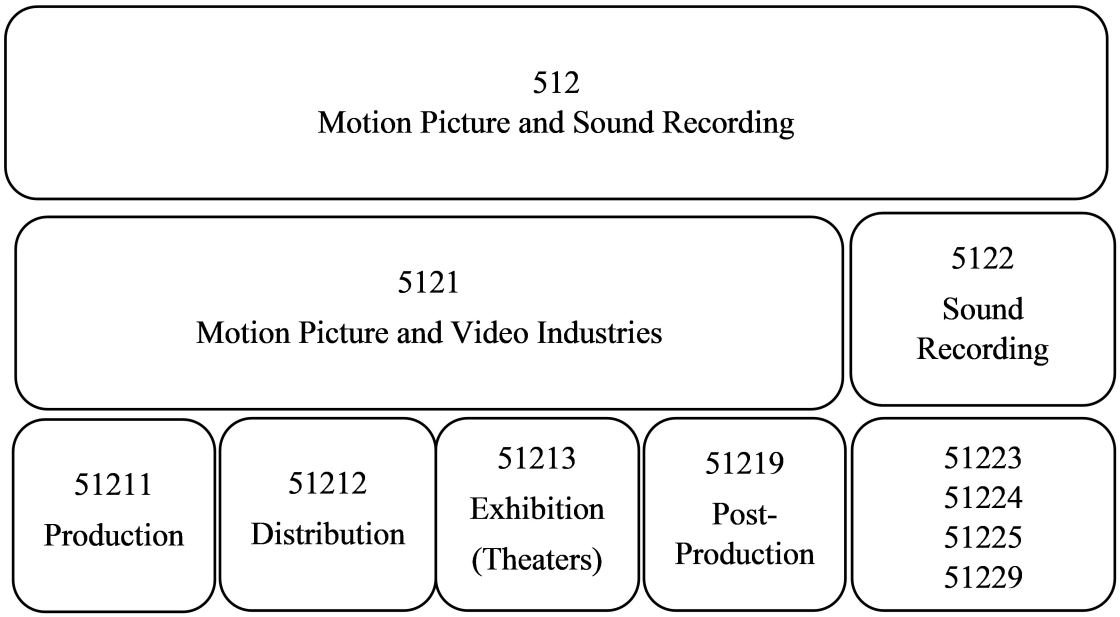
[2] BlueWeave Consulting and Research Pvt Ltd., https://www.globenewswire.com/en/news-release/2022/04/06/2417797/0/en/Global-Video-Streaming-Market-to-Boost-in-Coming-Years-Projected-to-Reach-worth-USD-213-1-Billion-in-2028-B-lueWeave-Consulting.html, accessed July 2, 2022

[3] For reviews see Christopherson and Rightor (2010),Tannenwald (2010),Weiner et al. (2009), and Weinstein and Clower (2000).

programs (National Conference of State Legislatures, 2022). Academic literature similarly has emerged that empirically estimates the effects of incentives on film production and economic outcomes (Adkisson, 2013; Bradbury, 2020; Button, 2019, 2021; O'Brien and Lane, 2018; Owens and Rennhoff, 2020; Swenson, 2017; Thom, 2018, 2019). The metrics used to evaluate the economics of state film incentives range from the number of motion pictures and television series produced and associated spending in a state to indicators of labor market outcomes.

An important consideration of state film incentive studies is the choice of sector classification for motion picture and television filming. The aggregate sector that contains the industry is Motion Picture and Sound Recording (NAICS 512). As shown in Figure 1, the sector includes the four-digit categories of Motion Picture and Video Industries (NAICS 5121) and Sound Recording Industries (NAICS 5122) and several components under each of the four-digit categories. The choices made regarding whether to focus on the aggregate sector or its components are wide-ranging across state film incentive economic impact studies (Table 1).

Figure 1: Structure of NAICS 512 (Motion Picture and Sound Recording)



The problem is that the incentivized component of the film and television industry may greatly differ economically from the rest of the aggregate sector. Such differences can affect the input-output multipliers used in economic impact analysis and empirical estimates of the responsiveness of activity to incentives (Oxford Economics, 2017).[4] This is exacerbated by the concentration of the components most likely to respond to incentives in a few states (Button, 2021). For most states, the aggregate sector primarily consists of activity that would not be expected to respond to incentives such as local theaters.

Input-output multipliers directly affect the estimated benefits and costs of incentives (Bartik and Sotherland, 2019). Nonacademic economic impact studies do not reveal sufficient information on how their multiplier effects are obtained to evaluate the predictions of the studies (Tannenwald, 2010). Academic studies on the impacts of state film incentives either omit consideration of multiplier effects (e.g., Button, 2021) or use aggregate sector multipliers (e.g., Owens and Rennhoff, 2020). Consistent with the general need for standards in evaluating government-incentivized activity (Wassmer et al., 2016), standards are needed for assessing the economic development associated with motion picture and television production.

The aggregation issue is a general concern in input-output analyses of specialized sectors. Low and Isserman (2009) modifies an input-output model to estimate the economic impact of four hypothetical

[4]Oxford Economics (2017) was funded by the Motion Picture Association of America.

ethanol plants in three Illinois counties and one Nebraska county, in which ethanol production is hidden within a much larger sector with different technology in the input-output model. Similarly, Guerrero et al. (2011) modifies an input-output model to incorporate the production of ethanol as a new industry in the Southern High Plains of Texas and adjusts the manufacturing and industrial building sector to reflect the construction of an ethanol plant. Schmit et al. (2016) supplements an input-output model with spending data to address the spending differences between small-scale direct agriculture producers versus the average across the agriculture sector for an 11-county region in New York. Harris et al. (2014) discusses the importance of using disaggregated sectors for input-output impact studies of agriculture and discusses related non-academic applications. Yu (2018) notes that high-speed rail activity is not separately available in input-output data and the use of the multiplier for the general transportation sector in impact analysis of the high-speed rail sector would be inappropriate. In an analysis of Ohio's wood industry, the wide variety of wood-related activities and technologies led Michaud and Jolley (2019) to customize an input-output model to focus on a narrow set of wood industries.

A primary goal of this study is to standardize the industry classification of motion picture and television production for analysis of the economic impacts of state film incentives. We provide guidance on understanding and utilizing information from geographic variation in available multipliers for the industry (Liu and Warner, 2009), particularly for impact analysis in a state containing little incentivized activity. Those attempting to estimate the potential economic impact of state film incentives may not know what types of movie and television productions will take advantage of the incentives nor have access to the requisite proprietary data for the specialized activity to adjust the aggregate sector that is standard in regional input-output models and instead be forced to use multipliers for the unadjusted aggregate sector. Without such guidance, practitioners who are tasked with conducting economic impact studies of the incentives are left to learn by doing (Smith, 2005).

In the next section, we first review the varying industry classifications used in economic impact studies of motion picture and television production incentives and highlight differences in key findings. The review is followed by examining the composition of the aggregate sector containing the motion picture and television industry in Section 3. Section 4 focuses on multiplier analysis for the aggregate sector and its components. We include a brief primer on input-output multipliers, and present and unpack the state multipliers for the aggregate sector. We conclude that economic impact studies of film incentives should use multipliers that primarily reflect the spending patterns of NAICS 51211. We demonstrate that aggregate multipliers in states with little or no presence of NAICS 51211 will understate incentive impacts because the multipliers most often will reflect non-incentivized components of the aggregate sector, namely the local theater industry, and must be adjusted or replaced. For only a few states will use of the multipliers for the aggregate sector accurately reflect the economic impact of the incentivized activity. So, practitioners should check that the IO sector in their models reflects NAICS 51211. This can be done by establishing that NAICs 51211 employment primarily comprises employment in the aggregate sector and by comparing the aggregate sector input-output coefficients for the state with those for states where the aggregate sector is known to be primarily comprised of NAICS 51211. If the IO sector does not reflect the presence of NAICS 51211, absent available proprietary data on expected NAICS 51211 activity, practitioners can use input-output information from economically similar states (Hewings, 1977) and where NAICS 51211 largely comprises the corresponding aggregate sector. This can be done economically using the IO-Snap (2019) input-output modeling system.

Outside of California and New York, only Louisiana and New Mexico contain sufficient activity in NAICS 51211 to make their input-output information for the aggregate sector useful for the analysis of film incentives. Therefore, because it is not clear what input-output information from the two states is useful and what is not, we examine their input-output multipliers and statistically verify the multipliers so that they can be used to guide the impact analysis of film incentives for other similar states that might consider implementing significant film incentive programs. Statistical verification of the multipliers makes our study more consistent with studies that empirically-estimate regional multipliers (Edmiston, 2004; Jofre-Monseny et al., 2018; Munasib and Rickman, 2015; Weinstein, 2014) than those using supplementary information on exogenous spending to modify an input-output model (Low and Isserman, 2009; Michaud and Jolley, 2019; Schmit et al., 2016). Using difference-in-difference methodology we both establish the role of incentives in expanding the film sector in Louisiana and New Mexico and estimate an employment multiplier that is reasonably close to the average of the two states' input-output employment multipliers.

Section 5 considers Oklahoma as a hypothetical case study of a state that contains little of the specialized incentivized activity (NAICS 51211) but is interested in greatly expanding the use of film incentives. In the absence of spending data to supplement an input-output model, we demonstrate that using input-output multipliers for Louisiana and New Mexico would be more accurate than using Oklahoma's input-output multipliers which do not reflect the requirements of the specialized activity. The process of unpacking and verifying input-output multipliers for use in impact analysis can be generalized to analyses of other specialized activities that differ economically from their aggregate sectors, particularly where the incentivized activity is geographically concentrated. The approach is especially needed for activities more detailed than that provided in government-provided input-output data and for which the spending data needed for modifying the input-output model are not available. The last section of the paper contains conclusions from the study and suggestions for future research.

2 Classification of the Motion Picture and Television Industry in Practice

To motivate the case study analysis that follows below, we first briefly review several recent state film incentive economic impact studies and their specification of the film and television industry in the North American Industrial Classification System (NAICS). We choose studies of states that feature prominently in the film industry and the use of incentives. Besides the NAICS classification of the spending, Table 1 highlights the assumed role of incentives in direct spending, the input-output model used and the associated multipliers, the estimated rate of return in revenue from incentives, and the dollar incentive cost per job.[5]

Most studies were commissioned by a state government entity and conducted by private entities. Exceptions include studies conducted by academics (Christopherson et al., 2006; Popp and Peach, 2008) and state entities (Georgia Tech Center for Economic Development Research, 2019; Independent Fiscal Office, 2019). The state entities commissioning the consulting impact studies range from economic development agencies to legislative offices.

Typical assumptions in the impact studies are that most or all spending receiving tax credits occurs because of them or that changes in spending occur because of the creation of incentives. The direct spending in the studies is assumed primarily to occur in the aggregate sector of Motion Picture and Sound Recording Industries (NAICS 512) or one or more of its sub-sectors. Based on supplementary data, Christopherson et al. (2006) includes one-third of spending in NAICS 71151, Independent Artists, Writers and Performers, as directly attributable to film incentives. In contrast, Loren C. Scott & Associates, Inc. (2017) argues that activity in the Independent Artists, Writers and Performers sector (NAICS 7115) is captured by input-output linkages with NAICS 512. The central problem of The PFM Group (2016) study then is the use of NAICS 7115 instead of a NAICS 512 sector or sub-sector as the primary directly incentivized activity.

With one exception, the studies use Type II multipliers, which include both the indirect spending effects between industries and the spending by households induced by the increase in income.[6] Although employment in a state often is reported for the five or six-digit categories within NAICS 512, the IMPLAN model sector for the industry corresponds to the aggregate sector.[7] The RIMS II multipliers produced by the US Bureau of Economic Analysis (BEA) are at most the four-digit level (NAICS 5121).[8] There are 1,000 industries in the input-output model of the private firm EMSI, but it is unclear how the detail that goes beyond that of the BEA national tables, which provide the technical coefficients for non-survey based regional input-output models, is derived.[9]

[5]Studies that used multipliers for NAICS 512 or 5121 that are not listed in Table 1 because of the absence of multiplier estimates or rate of revenue feedback estimates include Los Angeles County Economic Development Corporation (2014) and Motion Picture Association (2019).

[6]The sole exception is the use of the IMPLAN Social Accounting Matrix (SAM) multiplier in Ernst & Young (2009), which endogenizes other local final demands beyond consumption. https://implanhelp.zendesk.com/hc/en-us/articles/115009674768-Explaining-the-Type-SAM-Multiplier

[7]https://implanhelp.zendesk.com/hc/en-us/articles/360034896614-546-Sector-Industries-Conversions-Bridges-Construction-2018-Data (IMPLAN Sectors)

[8]https://www.bea.gov/sites/default/files/methodologies/RIMSII_User_Guide.pdf

[9]https://www.uhv.edu/president/economic-impact-study/appendices/appendix-5-emsi-mr-sam/

Table 1: Summary of Economic Impact Studies

Study/State/Funding Source	Incentive Role Assumption	Input-Output Model/Multipliers	Revenue Feedback (RRR)/Incentive Cost Per Job (ICJ)
Camoin Associates (2019a) /New York/Empire State Development	Spending that could "reasonably" be assumed to have occurred without the incentives, including non-qualifying spending	EMSI/Type II Employ Mult=1.98 (NAICS 512110, 512120, 512191, 512199)	RRR: $1.08 for all jurisdictions, ICJ: fiscal surplus
Camoin Associates (2019b) /Louisiana/State of Louisiana	All spending in the entertainment industry receiving credits	EMSI/Type II Employ Mult=2.74 (Six major six-digit industries)	RRR: $0.35 average for two years; ICJ average cost over two years of $12,895
Christopherson et al. (2006)/New York/New York Film, Television and Commercial Initiative	Changes in spending after incentive adoption	IMPLAN Type II Employ Mult=3.1; VA Mult=2.15 (NAICS 51211, 51219 and one-third of 71151)	RRR: $0.61 based on study results and our calculations; ICJ: average cost over two years of $3,579
Ernst & Young (2009)/New York/State of New York	Credit eligible spending and change in post-incentive trend in non-qualifying spending	IMPLAN/SAM Employ Mult=2.77; Output Mult=2.26 (Film production and post-production activities) (NAICS 5121)	RRR: $1.1 for state tax revenues and $1.9 when New York City is included; ICJ: fiscal surplus
Georgia Tech Center for Economic Development Research (2019)/Georgia/State of Georgia	Estimated total qualifying spending	IMPLAN/Employment Mult=2.90; Output Mult=2.03; Labor Income Mult=2.34 (NAICS 5121, excluding NAICS 51213)	RRR: $0.28; ICJ: $11,951; based on study estimates of labor income and our tax calculations
HR&A Advisors, Inc. (2012)/New York/Motion Picture Association of America	Credit eligible spending and change in post-incentive trend in non-qualifying spending	IMPLAN/Type II Employ Mult=2.29; Output Mult=1.8 (NAICS 51211, 51212, 51219)	RRR: $1.09 for state tax revenues and $2.23 when New York City is included; fiscal surplus
Independent Fiscal Office (2019)/Pennsylvania/State of Pennsylvania	Ninety percent of the spending receiving credit attributable to incentives	IMPLAN/Type II Output Mult=1.8 (NAICS 51211, 51212, 51219)	RRR: $0.13; ICJ: $56,917 per full-time equivalent job
Loren C. Scott & Associates, Inc. (2017)/Louisiana/State of Louisiana	All certified spending of film, sound recording and live performances	RIMS II/Type II Income Mult=1.33; Output Mult=1.37 (NAICS codes covering all entertainment categories)	RRR: $0.23 average for two years; ICJ: $15,504
MNP LLP (2014)/New Mexico/State of New Mexico	All spending assumed attributable to incentives	IMPLAN/Type II Employ Mult=1.79 (NAICS 51211)	RRR: $0.33 for state revenue, $0.10 for local revenue; ICJ: $8,519
The PFM Group (2016)/Oklahoma/State of Oklahoma	All spending assumed attributable to incentives	IMPLAN/Type II five-year average Employ Mult=1.21; Output Mult=1.92 (NAICS 71151)	RRR: five-year average of $0.13; ICJ: $7,914
Popp and Peach (2008)/New Mexico/State of New Mexico	All spending of qualifying projects	IMPLAN/Type II Employ Mult=2.72 (NAICS 51211)	RRR: $0.14; ICJ: $13,424.99
Sage Policy Group (2010)/Maryland/Maryland Department of Business and Economic Development, Maryland Film Office	All spending assumed attributable to incentives	IMPLAN/Type II Employ Mult=2.26; Output Mult=2.03 (NAICS 5121)	RRR: $0.58; ICJ: $376

Employ: Employment; ICJ: Dollar incentive cost per job; Mult: Multiplier; VA: Value Added

The economic impact studies routinely omit discussion of how the motion picture and television spending is entered into the model. If there are modifications to the input-output model, they are not discussed in any detail. The reported or implied multipliers widely vary across the studies and it is difficult to assess their veracity.

The most commonly reported multipliers are for output and employment, though they sometimes have to be inferred from the reported direct and total impacts. Output multipliers range from 1.37 for Louisiana (Loren C. Scott & Associates, Inc., 2017) to 2.26 for New York (Ernst & Young, 2009). Employment multipliers range from 1.21 for Oklahoma (The PFM Group, 2016) to 3.1 for New York (Christopherson et al., 2006).

The studies report widely varying estimates of the incentive cost per job. Several studies conducted by private consultants estimate a net budget surplus from New York's film incentives (Camoin Associates, 2019a; Ernst & Young, 2009; HR&A Advisors, Inc., 2012); i.e., a tax revenue return that exceeds the incentive costs. We refer to the feedback in gross tax revenues per dollar of incentives as the rate of revenue return (RRR) on film incentives. Economic impact studies of film incentives commonly refer to the return on investment (ROI) from incentives. But the reported ROI typically is incorrectly based on gross returns rather than net returns, ignoring the opportunity cost of incentive funds.[10]

Other rates of revenue return (RRR) from incentive investment include \$0.13 for Oklahoma and Pennsylvania. Contrasting values often are reported for the same state: Louisiana–\$0.23 by Loren C. Scott & Associates, Inc. (2017) vs. \$0.35 by Camoin Associates (2019b); New Mexico–\$0.14 by Popp and Peach (2008) vs. \$0.33 by MNP LLP (2014); and New York–\$0.61 derived from Christopherson et al. (2006) vs. those above one by Camoin Associates (2019b), Ernst & Young (2009), and HR&A Advisors, Inc. (2012). These estimates generally fall within the ranges of values reported in earlier reviews of economic impact studies (Christopherson and Rightor, 2010; Tannenwald, 2010; Weiner et al., 2009). The dollar incentive cost per job ranges from a net positive return in studies with RRRs that exceed one to a cost of \$56,917 per full-time equivalent job for Pennsylvania. More common are estimates of dollar incentive costs per job in the thirteen to fifteen thousand dollar range.

3 The NAICS 512 Sector

Figure 1 illustrates the NAICS 512 sector, Motion Picture and Sound Recording Industries. The three-digit sector includes the four-digit categories of Motion Picture and Video Industries (NAICS 5121) and Sound Recording Industries (NAICS 5122). State film incentives primarily are intended to incentivize activity in NAICS 5121 (McDonald, 2011), though some states include incentives for other entertainment activities such as Louisiana (Loren C. Scott & Associates, Inc., 2017).

Among the five-digit categories in NAICS 5121, Motion Picture and Video Exhibition (NAICS 51213), likely primarily satisfies local demand from household consumption and is unlikely to respond to incentives, as it contains NAICS 512131 (Motion Picture Theaters Except for Drive-ins) and NAICS 512132 (Drive-in Motion Picture Theaters). The five-digit categories of NAICS 5121 that are more export-oriented and most likely to be affected by incentives include NAICS 51211 (Motion Picture and Video Production), NAICS 51212 (Motion Picture and Video Distribution), and NAICS 51219, which includes NAICS 512191 (Teleproduction and Postproduction Services), and NAICS 512199 (Other Motion Picture and Video Industries).[11] Therefore, multipliers for either NAICS 512 or NAICS 5121, the NAICS detail for which US BEA input-output information is available, will be misleading in states for incentivized activity in detailed sectors to the extent their linkages to other sectors and wage rates differ from those of the three- or four-digit NAICS aggregates in the states.

Based on US Bureau of Labor Statistics QCEW data for 2017, there are significant differences in pay

[10] In the gross revenue returns definition commonly used in impact studies, an ROI is always greater than or equal to zero. An ROI greater than one implies revenues that are generated that exceed the cost of the incentives. An ROI between zero and one implies new revenues that fall below the cost of incentives. An ROI of one implies break even, with no net cost of the incentives. An ROI above one would not necessarily indicate the best use of funds though as other projects might have higher ROIs and an ROI does not necessarily reflect social welfare.

[11] There are not any distinct six-digit categories listed under NAICS 51211 and NAICS 51212. So, the corresponding six-digit NAICS categories are 512110 and 512120.

across the sub-sectors in Motion Picture and Sound Recording Industries nationally (Table 2). The highest paid jobs are in the Motion Picture and Video Distribution sub-sector (NAICS 51212) with an average pay of $147,975. The lowest-paid jobs are in Motion Picture and Video Exhibition (NAICS 51213), which encompasses NAICS 512131 and 512132, with an average pay of $14,352. Average pay in Motion Picture and Video (NAICS 51211), the largest of the non-local sub-sectors (as shown in Figure 2), is $95,652, far above the aggregate sector (NAICS 512) average of $68,104.

Figure 2: US NAICS Motion Picture and Video Industries Six-Digit Sectors QCEW Employment (Left axis: 512110; Right Axis: 512120, 512191, 512199)

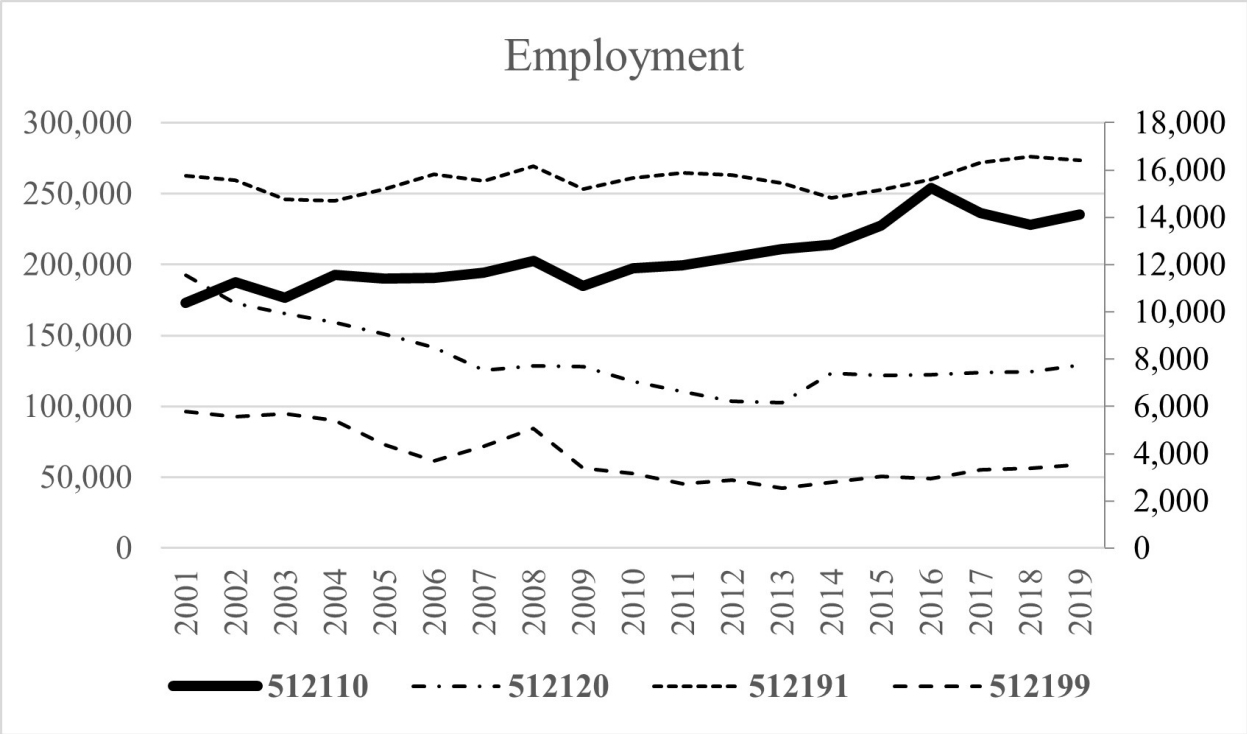


Table 2 also shows that employment in NAICS 51211 comprises fifty-six percent of wage and salary employment in NAICS 512 across the nation, followed by thirty-four percent for employment in 51213. Figure 2 shows that not only does Motion Picture and Video Production dominate in size amongst the export-related (non-local) sub-sectors, but it is also the primary source of growth from 2001 to 2019. This supports the focus on the sector in many economic impact analyses and academic empirical studies. As shown in Figure 3, the real annual wage rate only increases in the Motion Picture and Video Distribution sub-sector (NAICS 512120) over the period, while decreasing or remaining fairly constant in the other sub-sectors.

In the fifth column of Table 3 are the state shares in the non-local components of NAICS 5121 (Motion Picture and Video Production); i.e., the sum of the components excluding exhibition activity (NAICS 512110 + 512120 + 512191 + 512199). California accounts for nearly one-half of the employment in non-local components of NAICS 5121, followed by New York, and Georgia as the other states with more than five percent of the total. This illustrates the concentration of the non-local portion of the film industry and the potential difficulty of estimating its economic impacts in states where there is little or no presence.[12]

[12]QCEW data for the sub-sectors of NAICS 5121 are not perfect measures of the industry. A related NAICS sector (711510) for the film and television industry is Independent Artists, Writers, and Performers. The effects of the sector though are captured, either partially or fully, as an input in the production of NAICS 5121 using input-output analysis in economic impact studies (Christopherson and Rightor, 2010; Loren C. Scott & Associates, Inc., 2017). Another concern with the QCEW data is the omission of proprietors. US Bureau of Economic Analysis total employment includes proprietors but it is only reported for NAICS 512.

Table 2: National Sub-sector Pay in Motion Picture and Sound Recording Industries

	Employment	Share	Annual Wage
Motion Picture and Sound Recording Industries (NAICS 512)	424,508	1	$68,104
Motion Picture and Video Industries (NAICS 5121)	407,390	0.96	$67,484
Motion Picture and Video Production (NAICS 51211)	236,113	0.56	$95,652
Motion Picture and Video Distribution (NAICS 51212)	7,417	0.02	$147,975
Motion Picture and Video Exhibition (NAICS 51213)	144,234	0.34	$14,352
Postproduction Services and Other Motion Picture and Video Industries (NAICS 51219)	19,626	0.05	$88,659
Sound Recording Industries (NAICS 5122)	17,118	0.04	$82,854

Source: US Bureau of Labor Statistics Quarterly Census of Employment and Wages (QCEW)

4 State Input-Output Multipliers for Film Incentive Impact Studies

Multipliers used in economic impact studies of the motion picture and television industry greatly affect its estimated economic returns to incentives. With a basic economic model, a doubling of predicted multiplier effects doubles the ratio of gross benefits to costs of incentives (Bartik and Sotherland, 2019). Multipliers depend in part on the extent of linkages within the state economy. Because of a lack of complete data on these linkages, especially at the sub-national level, film incentive impact studies rely on models produced by the US Bureau of Economic Analysis (RIMS II) or private entities such as EMSI, IMPLAN, or REMI.[13] Regional input-output models differ in the data used, industry level of disaggregation, model closures, and assumptions on the linkages in the economy and their measurement (Rickman and Schwer, 1993).

We examine NAICS 512 input-output multipliers for all states, with particular attention given to the patterns of the multipliers across states and their relationship to the sub-sector employment composition of the aggregate sector. Our investigation uses IO-Snap (2019), which produces state-level Type I and Type II multipliers for output, income, and employment for sixty-seven sectors. We choose IO-Snap because it is economically feasible to obtain a full range of input-output information and multipliers for all states and across periods for research purposes.[14] IO-Snap is developed by researchers at West Virginia University with demonstrated expertise in input-output modeling, and the underlying methodology is documented in the academic literature (Jackson, 1998).[15]

4.1 Multiplier Basics

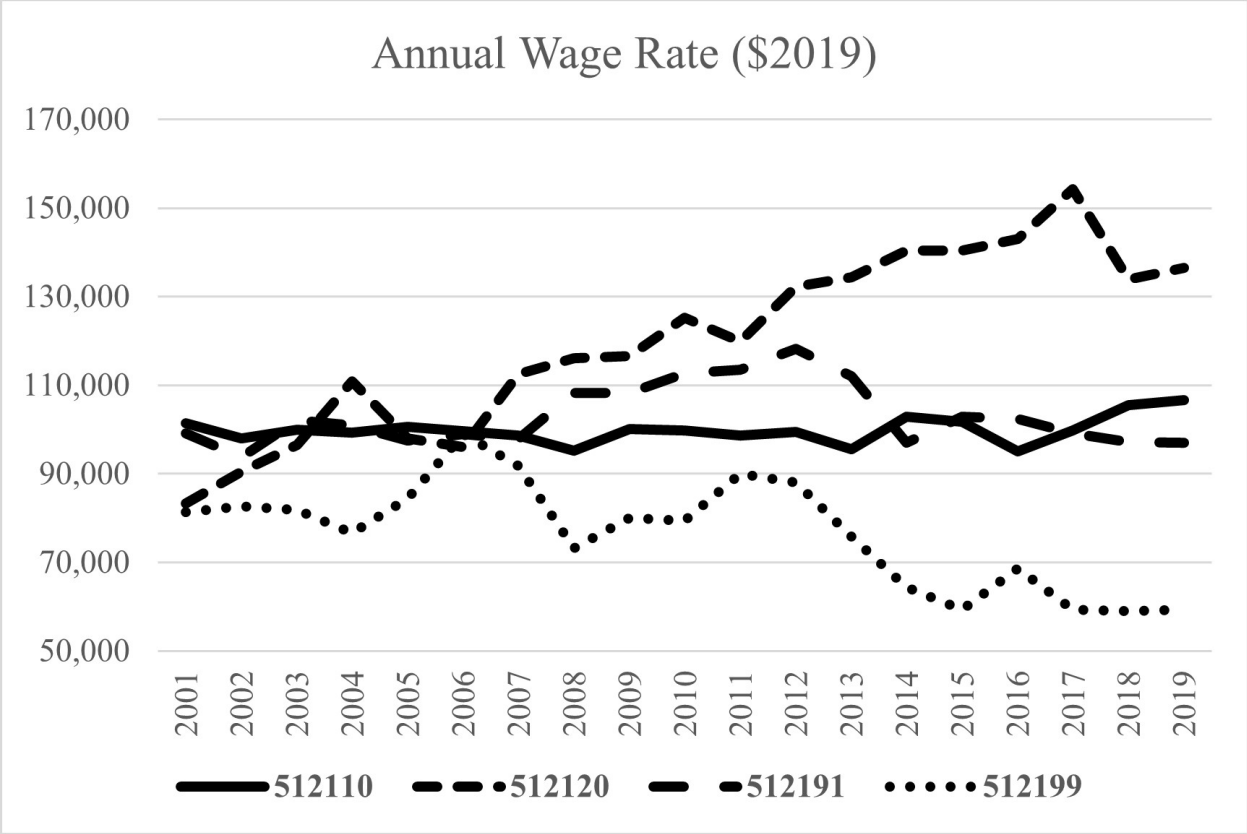
We first briefly review the basics of input-output multipliers. Mostly following Chapter 5 in Schaffer (2020), output (q) in each sector i can be written as the sum of intermediate demands from other sectors and exogenous final demand (fd). Each sector i both purchases from and supplies other sectors in the state and the sum of the sector's purchases equals its production:

[13] https://www.remi.com/models/

[14] https://www.io-snap.com/faq

[15] IO-Snap is a software that uses data on input-output transactions, employment, compensation, and gross state product from BEA to produce full input-output analytical capabilities for the nation, states, and sub-state regions. The software was made available for free for some time during the pandemic, though a subscription was purchased later.

Figure 3: US NAICS Motion Pictures and Video Industries Six-Digit Sectors QCEW Annual Wage Rate ($2019)



$$q_i = \sum_j a_{ij} * q_j + fd_i \tag{1}$$

where a_{ij} is the per dollar demand for i in the state from sector j in the state. Each a_{ij} is composed of two parts: 1) the technical requirements between the sectors, i.e., the proportion of inputs purchased from sector i by sector j, regardless of the location of sector i, p_{ij}; and 2) the proportion of the demand by sector j satisfied by local production, which adjusts for the portion that is imported, m_{ij}, such that $a_{ij} = p_{ij}$ * (1-m_{ij}). Assuming that the import proportion for sector i is the same across all sectors, as is common in non-survey regional input-output models, $a_{ij} = p_{ij}$ * rpc_i, where rpc is the constant proportion of demand satisfied locally, commonly referred to as the regional purchase coefficient (Lazarus et al., 2002; IO-Snap, 2019).

Equation (1) can be written compactly for all i industries in matrix form as

$$\boldsymbol{q} = \boldsymbol{Aq} + \boldsymbol{fd} \tag{2}$$

where $\boldsymbol{q}$ and $\boldsymbol{fd}$ are vectors of dimension n x 1; $\boldsymbol{A}$ is an n x n matrix with the a_{ij} as elements, and is known as the direct requirements matrix. Solving for $\boldsymbol{q}$ yields the following expression

$$\boldsymbol{q} = (\boldsymbol{I} - \boldsymbol{A})^{-1}\boldsymbol{fd} \tag{3}$$

where $\boldsymbol{I}$ is the identity matrix. The inverse of $(\boldsymbol{I}-\boldsymbol{A})$ is the total requirements matrix, in which each element is the total increase in purchases and supply from sector i per dollar increase in final demand in sector j. The sum of the elements in column j is industry j's output multiplier, i.e., the sum of the increased production in the n sectors for a one dollar increase in the final demand of j.

Table 3: Motion Picture and Sound Recording Industries (NAICS 512) IO-Snap Multipliers

State	Output Multiplier Type II (1)	Emp Multiplier Type II (2)	Income Multiplier Type II (3)	Location Quotient (NAICS 512) (4)	Non-local State Shares(%) of National Total[a] (5)	Compensation ($) (6)
California	2.17	3.60	2.37	1.55	45.9	107,861
Tennessee	2.07	2.80	2.38	0.62	2.2	51,905
Georgia	2.02	2.84	2.20	0.75	6.2	63,157
Connecticut	2.01	3.63	2.36	0.47	1.4	63,481
New York	1.99	3.14	2.32	1.12	18.9	95,852
Louisiana	1.92	2.78	2.64	0.48	1.7	41,704
New Mexico	1.80	3.62	2.55	0.68	0.8	56,812
Utah	1.79	1.75	1.89	0.65	0.8	32,262
Florida	1.78	1.66	1.56	0.33	2.6	47,178
Oregon	1.68	1.84	1.74	0.50	1.1	39,273
Nevada	1.63	1.94	2.07	0.48	0.6	30,580
New Jersey	1.49	1.62	1.61	0.35	1.6	50,950
Illinois	1.43	1.46	1.54	0.32	1.7	38,491
Massachusetts	1.38	1.37	1.46	0.34	1.3	40,381
Montana	1.37	1.40	1.53	0.33	0.1	29,645
Virginia	1.37	1.50	1.50	0.29	0.7	34,162
Texas	1.35	1.26	1.35	0.36	2.4	31,979
New Hampshire	1.32	1.33	1.42	0.29	0.1	31,581
Colorado	1.31	1.22	1.36	0.34	0.6	29,737
Arizona	1.30	1.17	1.27	0.39	0.6	25,073
Rhode Island	1.29	1.29	1.34	0.28	0.1	31,583
Michigan	1.28	1.24	1.33	0.29	0.6	29,810
Maryland	1.26	1.27	1.33	0.31	0.5	35,727
Missouri	1.26	1.24	1.30	0.24	0.4	27,565
South Carolina	1.25	1.21	1.28	0.22	0.4	34,028
Washington	1.25	1.27	1.26	0.37	0.8	27,784
Indiana	1.24	1.17	1.24	0.22	0.2	27,158
Maine	1.24	1.24	1.32	0.27	0.1	24,561
Minnesota	1.23	1.16	1.23	0.27	0.4	24,561
North Carolina	1.23	1.16	1.27	0.24	0.7	27,826
Pennsylvania	1.22	1.22	1.27	0.26	1.5	36,800
Wyoming	1.22	1.23	1.29	0.31	0.0	21,022
Ohio	1.22	1.15	1.24	0.22	0.7	27,053
Iowa	1.20	1.15	1.23	0.20	0.1	19,603
Wisconsin	1.20	1.20	1.35	0.22	0.3	24,525
Kansas	1.19	1.16	1.23	0.24	0.1	22,130
Idaho	1.18	1.09	1.17	0.23	0.0	18,313
Oklahoma	1.18	1.09	1.17	0.22	0.1	23,058
Vermont	1.17	1.09	1.16	0.25	0.0	20,465
Kentucky	1.17	1.09	1.15	0.21	0.2	23,570
South Dakota	1.15	1.11	1.17	0.23	0.1	20,042
Alabama	1.15	1.14	1.18	0.18	0.3	25,070
Arkansas	1.15	1.12	1.17	0.17	0.1	25,259
Mississippi	1.15	1.08	1.13	0.15	0.1	21,763
Delaware	1.13	1.10	1.18	0.19	0.0	20,130
Nebraska	1.12	1.04	1.10	0.19	0.0	19,767
North Dakota	1.11	1.06	1.10	0.17	0.0	23,003
West Virginia	1.10	1.03	1.10	0.17	0.1	16,309

[a]Sum of employment in NAICS 512110 + 512120 + 512191 + 512199

If household demand and income are specified as exogenous (i.e., consumption is part of $\boldsymbol{fd}$), the multipliers are classified as Type I multipliers (Schaffer, 2020, Ch. 6), solely reflecting the endogenous purchases between sectors. Type II multipliers result from including household spending as a column and household income as a row in the direct requirements matrix $\boldsymbol{A}$. Type II multipliers reflect both the endogenous intermediate demands between sectors and the induced household spending.

Multipliers for other economic measures such as employment and income can be obtained by assuming their constant proportionality to output. An employment (income) multiplier is the total change in employment (income) for an increase of one employee (dollar of income) associated with increased final demand.

Both Type I and II multipliers can be produced for employment and income as they were for output.

4.2 Multiplier Estimates

In the absence of data on spending between sectors in a region as well as on imports and exports (Harris and Liu, 1998), the starting point for US regional input-output models is the national input-output accounts of the US Bureau of Economic Analysis (BEA) at the four-digit level to obtain the p_{ij}. Type I output multipliers for NAICS 5121 and NAICS 5122 for the nation can be obtained from the BEA total requirements matrix as 1.68 and 1.25, respectively.[16] Based on these estimates, a multiplier for the NAICS 512 aggregate sector would understate the effects of activity in NAICS 5121 and overstate the effects of activity in NAICS 5122. The problem becomes more acute for activity incentivized in specific six-digit categories.

National multipliers for NAICS 5121 and 5122 likely mask significant differences across states, in large part because of the differences in the relative sizes of components of the aggregate sectors across the states. The true p_{ij} and rpc_i at the aggregate level for a state likely are influenced by the composition of the activities of the film sector in the state.

An aggregate three-digit (NAICS 512) Type I output multiplier for the US can be obtained as 1.58 from IO-Snap (2019), which is based on BEA input-output and industry data. The corresponding Type II output multiplier from IO-Snap is 2.48.[17] The three-digit Type I multiplier of IO-SNAP is closer to the BEA Type I four-digit multiplier for NAICS 5121 (vs. NAICS 5122) because it comprises nearly ninety-five percent of NAICS 512 employment.

Table 3 displays the Type II output, employment, and income multipliers for the lower 48 states from IO-Snap for 2017. The output multipliers are highly correlated with both employment multipliers (r=0.93) and income multipliers (r=0.95). The correlation between the employment and income multipliers equals 0.95.

All output multipliers are smaller than the multiplier value of 2.48 for the US. The smaller state multipliers occur because the Motion Picture and Sound Recording Industries sector and other sectors affected by indirect and induced spending will spend more outside a state than all the sectors will spend outside the US. This lessens the ripple effects of spending by the Motion Picture and Sound Recording Industries sector across a state economy compared to those across the national economy.

California has the largest IO-Snap aggregate sector output multiplier. This likely relates to the size of the California economy, the concentration of the industry in California, and California's high labor compensation in the sector. In 2017, BEA total employment in California comprised nearly twenty-three percent of the nation's total employment, while its Motion Picture and Sound Recording Industries BEA total employment comprised over thirty-five percent of the national total in the sector. The ratio of California's employment share in the aggregate NAICS 512 sector to its overall employment share is 1.55, commonly referred to as a location quotient (LQ). The simple correlation between the Type II output multiplier and the LQ across states is 0.75, with larger correlations for Type II multipliers for employment (r=0.82) and income (r=0.78).

California ranks first with its average compensation of $107,861 per employee in Table 3, while New York ranks second with compensation of $95,852 per job. The simple correlation between compensation per employee and the Type II multipliers across states are 0.85 for output, 0.86 for employment, and 0.78 for income. In addition, the simple correlation between the LQ and compensation is 0.91. Because of the differences in pay across the sub-sectors nationally (Table 2), a likely contributing factor to the differences in compensation in Motion Picture and Sound Recording Industries across states is the differences in sub-sector composition of employment in the aggregate sector (NAICS 512).

The composition of employment across the components of the Motion Picture and Sound Recording Industries (NAICS 512) greatly varies across states. To preserve the confidentiality of survey respondents as required by law, QCEW data are suppressed for the sub-sectors in many states. To examine the composition of the industry, we instead use the estimates of unsuppressed data produced by the W.E. Upjohn Institute for Employment Research (Bartik et al., 2018) based on the method of Isserman and Westervelt (2006) for

[16] https://apps.bea.gov/industry/xls/io-annual/IxI_TR_2007_2012_PRO_Det.xlsx

[17] Corresponding IO-Snap Type I and II employment multiplier values for the US are 1.90 and 3.41, while the corresponding income multipliers are 1.71 and 2.80.

Census County Business Patterns Data.

Table 4: State Motion Picture and Sound Recording Industries Sub-sector Employment Shares

State/NAICS Code	5121	51211	51212	51213	51219	5122
Alabama	0.98	0.12	0.00	0.81	0.06	0.02
Arizona	0.98	0.08	0.00	0.88	0.03	0.02
Arkansas	0.97	0.15	0.01	0.80	0.00	0.03
California	0.96	0.80	0.00	0.10	0.06	0.04
Colorado	0.94	0.22	0.00	0.70	0.02	0.06
Connecticut	0.98	0.42	0.02	0.50	0.03	0.02
Delaware	0.96	0.15	0.00	0.80	0.01	0.04
Florida	0.95	0.26	0.01	0.65	0.03	0.05
Georgia	0.95	0.41	0.00	0.51	0.03	0.05
Idaho	0.99	0.05	0.00	0.93	0.02	0.01
Illinois	0.95	0.17	0.00	0.71	0.06	0.05
Indiana	0.97	0.09	0.01	0.84	0.03	0.03
Iowa	0.98	0.12	0.00	0.85	0.01	0.02
Kansas	0.98	0.07	0.00	0.90	0.01	0.02
Kentucky	0.98	0.12	0.00	0.83	0.03	0.02
Louisiana	0.99	0.80	0.00	0.19	0.01	0.01
Maine	0.98	0.14	0.00	0.81	0.03	0.02
Maryland	0.94	0.30	0.00	0.60	0.04	0.06
Massachusetts	0.97	0.21	0.04	0.67	0.05	0.03
Michigan	0.96	0.14	0.00	0.74	0.07	0.04
Minnesota	0.90	0.19	0.00	0.62	0.09	0.10
Mississippi	0.99	0.05	0.00	0.92	0.01	0.01
Missouri	0.98	0.13	0.04	0.78	0.03	0.02
Montana	0.99	0.25	0.01	0.69	0.04	0.01
Nebraska	0.94	0.06	0.00	0.88	0.00	0.06
Nevada	0.97	0.17	0.00	0.77	0.02	0.03
New Hampshire	0.97	0.40	0.00	0.56	0.01	0.03
New Jersey	0.92	0.21	0.01	0.69	0.01	0.08
New Mexico	1.00	0.74	0.00	0.25	0.00	0.00
New York	0.88	0.62	0.02	0.16	0.08	0.12
North Carolina	0.96	0.21	0.00	0.74	0.01	0.04
North Dakota	0.90	0.11	0.00	0.78	0.01	0.10
Ohio	0.97	0.17	0.00	0.77	0.03	0.03
Oklahoma	0.99	0.11	0.00	0.88	0.00	0.01
Oregon	0.95	0.37	0.00	0.54	0.04	0.05
Pennsylvania	0.97	0.20	0.01	0.74	0.02	0.03
Rhode Island	0.84	0.23	0.00	0.60	0.00	0.16
South Carolina	0.81	0.19	0.00	0.61	0.01	0.19
South Dakota	0.99	0.11	0.04	0.82	0.01	0.01
Tennessee	0.68	0.22	0.00	0.42	0.04	0.32
Texas	0.96	0.10	0.01	0.81	0.03	0.04
Utah	0.99	0.12	0.00	0.36	0.51	0.01
Vermont	0.92	0.26	0.00	0.61	0.05	0.08
Virginia	0.98	0.22	0.01	0.71	0.04	0.02
Washington	0.90	0.17	0.00	0.67	0.05	0.10
West Virginia	1.00	0.05	0.00	0.95	0.00	0.00
Wisconsin	0.91	0.14	0.00	0.74	0.03	0.09
Wyoming	0.99	0.12	0.00	0.87	0.00	0.01

Source: Year 2016 Unsuppressed CBP employment from the W.E. Upjohn Institute for Employment Research (Bartik et al., 2018)

From Table 4, we see that except for Tennessee because of Nashville, Motion Picture and Video Industries

(NAICS 5121) employment in a state nearly comprises the entirety of that for the Motion Picture and Sound Recording Industries sector (NAICS 512). The share of Motion Picture and Video Production (NAICS 51211) employment relative to that of the aggregate sector (NAICS 512) exceeds one-half in California (0.8), Louisiana (0.8), New Mexico (0.74), and New York (0.62). Utah stands out as the only state with a large sub-sector employment share in Postproduction Services and Other Motion Picture and Video Industries (NAICS 51219). The local and low-paying Motion Picture and Video Exhibition sub-sector (NAICS 51213) dominates the aggregate sector in the remainder of the states.

4.3 Unpacking the Output Multipliers

4.3.1 Cross-Sectional Evidence

Correlation coefficients (Table 5) of the sub-sector employment shares in NAICS 512 in 2017 (Table 4) with the NAICS 512 IO-Snap output multipliers given in Table 3 reveal the importance of the sub-sector composition of NAICS 512 for the estimated multipliers. The states with larger sub-sector employment shares in Motion Picture and Video Production (NAICS 51211) tend to be those with larger predicted output multipliers by IO-Snap for the aggregate sector, in which the simple correlation between the employment shares in NAICS 51211 and multipliers is 0.75. The NAICS 51213 share is strongly negatively correlated (r=-0.83) with the IO-Snap NAICS 512 multiplier. The differences in the NAICS 51211 and NAICS 51213 shares across states likely lead to differences in compensation and spending on other sectors in the state economy, both of which affect the estimated multipliers.

Table 6 contains a decomposition of the multipliers for the Motion Picture and Sound Recording Industries produced by IO-SNAP for the US, the states of interest for the case study below, and California for comparison. Included are the direct effects, indirect effects, and induced household spending effects. The direct effects are those that occur in the first round and reflect the sum of the change in spending in the sector multiplied by the regional production coefficients, a_{ij}. The indirect effects are business-to-business purchases that flow from direct purchases. Induced effects result from increased labor income and household spending. When added to the exogenous spending change of one dollar, the sum of the direct effects and indirect effects produce the Type I multiplier (allowing for rounding), while the Type II multiplier is obtained by then adding the induced household spending effects. Also included are the direct requirements matrix entries for each state for the three sectors with the largest IO-Snap direct requirements entries for the nation: Motion Picture and Sound Recording Industries; Miscellaneous Professional, Scientific, and Technical Services; and Performing Arts, Spectator Sports, Museums, and Related Activities. Not shown, the next three IO-Snap sectors with the largest direct requirements entries for NAICS 512 are Real Estate, Administrative and Support Services, and Rental and Leasing Services and Lessors of Intangible Assets; for these three sectors the NAICS 512 direct requirements coefficients are much smaller shares of the sectors' row sums relative to the shares for the three sectors shown in Table 6 and are not considered further.

Table 5: Multiplier Correlation Analysis for Motion Picture and Sound Recording Industries (NAICS 512)

	Comp	LQ 512	5121	51211	51212	51213	51219	5122	Multiplier
Compensation	1.00	0.91	-0.22	0.79	0.19	-0.81	0.10	0.22	0.85
LQ NAICS 512	0.91	1.00	-0.15	0.75	0.07	-0.81	0.28	0.15	0.84
NAICS 5121	-0.22	-0.15	1.00	-0.04	0.12	0.29	0.04	-1.00	-0.23
NAICS 51211	0.79	0.75	-0.04	1.00	0.03	-0.90	-0.03	0.04	0.75
NAICS 51212	0.19	0.07	0.12	0.03	1.00	-0.04	-0.02	-0.12	0.10
NAICS 51213	-0.81	-0.81	0.29	-0.90	-0.04	1.00	-0.32	-0.29	-0.83
NAICS 51219	0.10	0.28	0.04	-0.03	-0.02	-0.32	1.00	-0.04	0.27
NAICS 5122	0.22	0.15	-1.00	0.04	-0.12	-0.29	-0.04	1.00	0.23
IO-Snap Multiplier	0.85	0.84	-0.23	0.75	0.10	-0.83	0.27	0.23	1.00

Note: The NAICS variables are the sub-sector employment shares of NAICS 512 employment. LQ denotes location quotient for NAICS 512; Compensation is the annual average compensation in NAICS 512 from IO-Snap; IO-Snap Multiplier is the Type II output multiplier.

The three largest direct requirements matrix entries comprise approximately sixty-two percent of the direct effects for the US (last column). With their large presence of NAICS 51211, Louisiana and New Mexico have direct requirements coefficients close to those for the US. While, with its relatively smaller presence of NAICS 51211, Oklahoma has much lower direct requirements entries for the three sectors. Induced household spending effects follow a similar pattern to the direct effects, though differences in compensation levels contribute to variation in the induced effects, consistent with Louisiana and New Mexico having comparable direct effects to California's but having much lower induced household spending effects. A larger share in the household income row of an input-output model from higher compensation would induce greater household spending and larger Type II multipliers.

IO-Snap uses a supply-demand pooling approach, modified to allow for cross-hauling, in converting the BEA technical coefficients (p_{ij}) to regional production coefficients (a_{ij}) (Jackson, 1998).[18] So, the larger IO-Snap direct requirements coefficients in the states with a larger film industry occur because of larger presences of industries with the largest direct technical requirements entries for NAICS 512. A greater presence of an industry in a region, all else equal, produces larger regional purchase coefficients and larger regional production coefficients in the direct requirements matrix derived from national technical coefficients (Schaffer, 2020, p. 57).

Table 6: Multiplier Decomposition for Motion Picture and Sound Recording Industries

	California	Louisiana	New Mexico	Oklahoma	US
Direct	0.357	0.377	0.346	0.062	0.367
Indirect	0.174	0.159	0.134	0.017	0.216
Induced	0.639	0.382	0.323	0.096	0.892
Type I	1.531	1.536	1.48	1.079	1.583
Type II	2.169	1.917	1.803	1.175	2.475
Motion picture and sound recording industries	0.12	0.127	0.116	0.02	0.123
Miscellaneous professional, scientific, and technical services	0.057	0.061	0.056	0.01	0.059
Performing arts, spectator sports, museums, and related activities	0.045	0.047	0.043	0.008	0.046

To establish that the aggregate sector BEA technical requirements reflect those of NAICS 51211, and not NAICS 51213, for example, we examine the correlation of the 2017 state employment shares in NAICS 51211 and the detailed sub-sectors comprising the aggregate IO-Snap sectors for which direct requirements coefficients are reported in Table 6 (Miscellaneous Professional, Scientific, and Technical Services; and Performing Arts, Spectator Sports, Museums). The sub-sectors chosen have among the top six largest direct requirements coefficients in the US BEA input-output accounts for NAICS 512114[19]: Advertising and Related Services (NAICS 5418); Other Professional, Scientific, and Technical Services (NAICS 5419); Promoters of Performing Arts and Sports and Agents for Public Figures (NAICS 7113); and Independent Artists, Writers, and Performers (NAICS 7115).[20,21]

Table 7 reveals the correlations between the QCEW-based employment location quotients of NAICS 51211 and the four detailed sub-sectors across states. The strongest correlations for NAICS 51211 are with Advertising and Related Services (NAICS 5418) and Independent Artists, Writers, and Performers (NAICS

[18]The greater is supply relative to estimated demand from the technical coefficients, the greater the regional purchase coefficient and regional production coefficient. The modification for cross-hauling is to reduce the tendency to overestimate regional supply and hence output multipliers when using the supply-demand pooling approach (Jackson, 1998).

[19]https://www.bea.gov/industry/input-output-accounts-data#supplemental-estimate-tables

[20]IO-Snap includes Legal Services (NAICS 5411) and Computer Systems Design and Related Services (NAICS 5415) separately, with the remainder of Professional, Scientific, and Technical Services (NAICS 541) appearing to be reflected in Miscellaneous Professional, Scientific, and Technical Services.

[21]The other two sectors in the top six not examined because they are not part of the top three aggregate sectors reported in Table 5 are Other Activities Related to Real Estate (NAICS 53139), and Commercial and Industrial Machinery and Equipment Rental and Leasing (NAICS 5324).

7115). The only weak correlation is with Other Professional, Scientific, and Technical Services (NAICS 5419), though the sub-sector is strongly correlated with the other three related sub-sectors.[22] Recall that the NAICS 51211 location quotients are strongly negatively correlated with those for NAICS 51213 (the local theater component). The correlation coefficients for NAICS 51211 employment location quotients support the largest RIMS II NAICS 5121 and NAICS 512 IO-Snap state direct requirements coefficients as representing NAICS 51211 input-output linkages.

Table 7: Location Quotient Correlation Analysis for Related Sectors

	NAICS 51211	NAICS 5418	NAICS 5419	NAICS 7113	NAICS 7115
NAICS 51211	1	0.67	0.27	0.52	0.66
NAICS 5418	0.67	1	0.83	0.94	0.86
NAICS 5419	0.27	0.83	1	0.92	0.8
NAICS 7113	0.52	0.94	0.92	1	0.88
NAICS 7115	0.66	0.86	0.8	0.88	1

Note: The NAICS variables are sector employment location quotients.

4.3.2 Time Series Evidence

For further verification that the RIMS II NAICS 5121 and IO-Snap NAICS 512 direct requirements coefficients represent NAICS 51211 input-output linkages in the nation and states with large employment shares of the sector, we examine the initial growth of NAICS 51211 employment in Louisiana and New Mexico following the adoption of their film incentives. Not only should employment in NAICS 51211 and the sectors examined in Table 7 be correlated across states but increases in NAICS 51211 employment in the two states also would be expected to increase employment in the four related sectors (Rickman and Miller, 2002).

We follow other studies and empirically estimate short/medium-run employment multipliers using a difference-in-difference (DID) methodology (Jofre-Monseny et al., 2018; Munasib and Rickman, 2015; Weinstein, 2014). Statistically-estimated multipliers can reveal whether the intersectoral linkages contained in an input-output model exist in the economies. The estimated multipliers also will reflect the net effects of agglomeration versus congestion associated with a demand shock (Bartik and Sotherland, 2019), whereas input-output models solely reflect production structure and spending relationships between agents of an economy. Our primary interest though is providing time-series evidence on the existence of linkages between NAICS 51211 and other sectors suggested by the input-output model.

We use the timing of the adoption of film incentives in Louisiana and New Mexico and compare them to thirteen states that did not have incentives over the same period. Louisiana and New Mexico adopted incentives in 2002, and the comparison states never adopted film incentives or adopted them in 2007 or later (Idaho, Indiana, Iowa, Kansas, Kentucky, Michigan, Nevada, New Hampshire, Ohio, South Dakota, West Virginia, Wisconsin, and Wyoming). We use 1998 to 2001 as the period before the adoption of incentives and changes in NAICS 51211 employment in Louisiana and New Mexico and 2002 to 2006 as the treatment period.[23]

We first estimate an OLS regression that produces estimates that are numerically equivalent to those obtained from the canonical difference-in-difference model (Rambachan and Roth, 2022, p. 7) to validate the growth of NAICS 51211 employment in Louisiana and New Mexico as coinciding with the adoption of incentives. The sample for the regression includes the two film incentive states plus the thirteen non-incentive states for the years 1998 to 2006, forming a balanced panel of 135 observations. Because Louisiana and New Mexico both adopted incentives in 2002, the DID formulation is non-staggered. We then estimate OLS regressions for employment in sectors suggested above by the input-output model to be related to NAICS 51211 employment.

[22] Among five other sub-sectors of Professional, Scientific, and Technical Services (NAICS 541) (not shown), the only correlation coefficient over 0.5 with NAICS 51211 is Specialized Design Services; the direct requirements coefficient though is one-tenth of that for NAICS 5419.

[23] States not included as controls because of pre-1998 data disclosures for NAICS 51211 that prohibited sensitivity analysis are Alabama, Arkansas, Delaware, Nebraska, and North Dakota (https://www.bls.gov/cew/data.htm). See footnote 25.

The general form of the OLS regressions performed is as follows:

$$emp_{it} = s_i + yr_t + \sum_j \beta_j * (trs_i * tryr_j) + u_{it} \quad (4)$$

where emp_{it} is employment in the sector for state i and year t, s_i is a state binary indicator variable, yr_t is a year binary indicator variable, trs_i equals 1 for Louisiana and New Mexico and 0 otherwise. $tryr_j$ takes a value of 1 for treatment year j and 0 otherwise, with u_{it} as the error term. The β_j are the difference-in-difference employment estimates for each of the years during 2002-2006, in which the individual year indicator variables allow the treatment effect to vary over time.

In pre-testing, pre-treatment indicator variables are added to test for differences in pre-treatment parallel trends. The inclusion of pre-treatment and post-treatment indicator variables transforms a two-way fixed effects model into a panel event study, allowing for testing of parallel trends during the pre-treatment period and analysis of the temporal variation of the treatment effects (Clarke and Tapia-Schythe, 2021). In all regressions the pre-treatment variables are highly jointly insignificant, suggesting that the parallel trends assumption required for DID holds, and are omitted from the regressions in estimating the post-treatment difference-in-differences.[24]

As shown in Table 8, the average estimated incentive NAICS 51211 (Movie and Video Production) employment effect (β_j) in Louisiana and New Mexico equals 593.3; it ranged from approximately zero in 2002 to 1,360 in 2006. The estimated effects for all treatment years as a group are statistically significant below the 0.01 level based on the Wald Chi-Squared test.[25] Statistically significant DID effects likewise are found for other NAICS sectors suggested by the input-output model to be indirectly affected: 5419 (Other Professional, Scientific, and Technical Services), 7113 (Promoters of Performing Arts, Sports, and Similar Events with Facilities), 51212 (Motion Picture and Video Distribution), and 53139 (Other Activities Related to Real Estate). No other statistically significant effects were found for the IO-Snap sectors not containing these categories. As shown in Table 8, with a total employment impact of 1,276, the average estimated employment multiplier over the years equals 2.15, which is reasonably close to the IO-Snap average employment multiplier of 2.34 for the two states averaged across 2002-2006 (not shown), despite the differences in approaches. For comparison, the average IO-Snap Oklahoma employment multiplier for NAICS 51211 for 2002-2006 equals 1.15, which suggests that using the multipliers from Louisiana and New Mexico would be more accurate than using the Oklahoma multiplier for predicting the impact of an expanding NAICS 51211 sector in the state in response to increased availability of incentives.

We next examine whether there were changes in estimated IO-Snap multipliers for Louisiana and New Mexico with the expansion of their NAICS 51211 sectors in the states during 2002-2006. We compare them to the average of the thirteen states used in the difference-in-difference comparison, along with those for Oklahoma and the nation. Expansion of NAICS 51211 and dependent sectors should lead to increased direct coefficients through increased ratios of supply to demand and regional purchase coefficients in IO-Snap. We examine output multipliers because of their more direct link to direct requirements coefficients.

Supportive of the estimated DID effects, the NAICS 51211 share of NAICS 5121 averaged 0.24 in Louisiana and New Mexico in 2001 while averaging 0.20 in the control group (not shown). By 2006 the averages changed to 0.6 for Louisiana and New Mexico versus 0.17 in the control group. The corresponding shares for NAICS 51213 are an average decrease from 0.69 to 0.37 for Louisiana and New Mexico from 2001 to 2006 versus an average increase from 0.77 to 0.81 for the control group.

In Panel A of Table 9, we see that Louisiana and New Mexico had comparable Type II output multipliers to the thirteen state control group and Oklahoma in 1998 and 2001 (the year before incentive implementation). After the adoption of incentives, by 2006 the estimated output multipliers rose to 1.76 and 2.06 in Louisiana and New Mexico while remaining virtually unchanged in the control group and declining in

[24] An alternative approach to account for or test for pre-treatment trends, that we do not adopt, would be to estimate separate linear trends for each state, though the disadvantage would be that the approach assumes constant trends between the pre-and post-treatment periods (Rambachan and Roth, 2022).

[25] Extending the pre-treatment period backward from 1998 to 1990 produces an average treatment effect over the years of 579.1. The estimated effects for all treatment years as a group are statistically significant below the 0.01 level based on the Wald Chi-Squared test. Based on the joint insignificance of dummy variables for 1997-2001 interacted with the treatment variable for Louisiana and New Mexico when included in the regression, we conclude that there is no difference in pre-treatment trends between the control states and the treatment states in the expanded sample.

Table 8: Estimated Employment Effects (Wald chi-squared test statistics for joint significance in parentheses below)

NAICS Sector	Average Employment Difference
51211	593.3
	(140.9)[a]
5419	317.1
	(10.9)[c]
7113	231.0
	(20.4)[a]
51212	67.8
	(50.0)[a]
53139	67.0
	(13.7)[a]
Summary Concept	**Calculation**
Sum	1,276.2
Multiplier (Sum/51211)	2.15

[a]significant below the 0.01 level
[b]significant below the 0.05 level
[c]significant below the 0.10 level

Oklahoma. Year 2015 values are included to show longer-run outcomes outside the regression sample. We choose 2015 as the ending point because that is the year Louisiana switched from unlimited incentives to an incentive cap of $180 million (Karlin, 2019). No control states adopted and maintained large incentive programs between 2006 and 2015 (National Conference of State Legislatures, 2018).

The relative increases in multipliers are underpinned by relative increases in estimated first-round impacts by 2006 as shown in Panel B. Leading the increases in direct requirement coefficients are the increases in the NAICS 512 own direct requirements coefficient (Panel C), which are driven by the corresponding increased regional purchase coefficients (Panel D). Panel E shows the increase in the average regional purchase coefficient across IO-Snap sectors, weighted by the 2006 direct coefficient as a share of all NAICS 512 coefficients in IO-Snap. The increases in regional purchase coefficients underpin the increases observed in Panels A and B for Louisiana and New Mexico. Panel F shows the increases in estimated income-induced effects in Louisiana and New Mexico, more than doubling from 2001 to 2006. At least in part, the increases occur because of the increased wage rate that occurs with an increasing NAICS 51211 share and decreasing NAICS 51213 share (Table 3). Support is found from implementing the difference-in-difference estimation approach used for employment above for the NAICS 512 aggregate sector annual BEA wage rate (not shown). The estimation reveals parallel pre-treatment trends and statistically significant DID increases in the average aggregate sector wage rate for Louisiana and New Mexico, reaching a maximum of approximately ten thousand dollars in 2006.

5 Estimating Film Incentive Economic Impacts in Practice

The above findings suggest that aggregate sector multipliers will underestimate the economic impacts of new filming activity for states with little or no pre-existing presence of the incentivized activity. To illustrate the importance of the findings for a state with little incentivized activity we next consider the hypothetical case study of Oklahoma expanding its incentive program by $100 million. We assume that spending in the industry expands commensurately with the additional incentives as supported by the DID estimation for the adoption of incentives in Louisiana and New Mexico.

First, we apply the multipliers from IO-Snap for Oklahoma without adjustment. The use of the IO-Snap employment and income multipliers for Oklahoma most likely produces downwardly-biased estimated

Table 9: IO-Snap NAICS 512 Input-Output Estimates across Time

	Oklahoma	Control	Louisiana	New Mexico	US
Panel A. IO-Snap Type II Output Multipliers					
1998	1.34	1.38	1.33	1.46	2.88
2001	1.32	1.37	1.33	1.38	2.71
2006	1.18	1.35	1.76	2.06	2.74
2015	1.22	1.31	1.87	1.84	2.48
Panel B. IO-Snap First-Round Effects					
1998	0.120	0.137	0.111	0.168	0.468
2001	0.117	0.136	0.138	0.149	0.436
2006	0.070	0.133	0.337	0.421	0.463
2015	0.066	0.114	0.310	0.304	0.354
Panel C. IO-Snap NAICS 512 Own Direct Requirement Coefficient					
1998	0.038	0.044	0.036	0.054	0.154
2001	0.033	0.039	0.040	0.043	0.127
2006	0.020	0.038	0.098	0.124	0.134
2015	0.021	0.039	0.114	0.113	0.129
Panel D. IO-Snap NAICS 512 Regional Purchase Coefficient					
1998	0.259	0.291	0.237	0.364	0.985
2001	0.267	0.310	0.311	0.343	0.976
2006	0.148	0.277	0.700	0.884	0.955
2015	0.176	0.304	0.825	0.819	0.937
Panel E. IO-Snap Weighted Average Regional Purchase Coefficient					
1998	0.555	0.586	0.567	0.626	0.972
2001	0.558	0.599	0.578	0.631	0.966
2006	0.507	0.573	0.653	0.764	0.952
2015	0.505	0.565	0.718	0.725	0.939
Panel F. IO-Snap NAICS 512 Income Induced Effects					
1998	0.168	0.188	0.175	0.221	0.198
2001	0.159	0.174	0.134	0.161	0.148
2006	0.088	0.162	0.270	0.414	0.342
2015	0.134	0.157	0.421	0.404	0.412

impacts because the multipliers primarily reflect the NAICS 51213 sector, which has relatively lower intermediate demands and smaller induced effects, rather than reflecting NAICS 51211. Second, we discuss and demonstrate an alternative approach that could be used in practice using multipliers from Louisiana and New Mexico that reflect the production and spending linkages that would emerge with the expected expansion of film production in Oklahoma.

5.1 Hypothetical Base Case for Oklahoma

With a thirty-five percent incentive rate for spending that occurs in Oklahoma (the rate existing before 2021),[26] and assuming that additional spending would not occur without incentives, $100 million in incentive

[26]On July 1, 2021, a newly passed incentive program, Filmed in Oklahoma Act of 2021, went into effect. The program offers a base rate of twenty percent for qualified motion picture and TV productions filmed principally in the state and for post-production work. Uplifts are available such as filming in a rural county or small municipality that can bring the total rebate rate

funds would support $285,714,286 of in-state direct spending. Of that amount, 50.5 percent is assumed spent on in-state labor based on other state experiences (Snead et al., 2020), producing $144,285,714 in Oklahoma wages and salaries.

The IO-Snap Type II income multiplier for Oklahoma equals 1.169 (Table 3), which produces a total wage and salary impact of $168,670,000. We apply a state average tax rate of seven percent for Oklahoma to the wage and salary impact for comparability to Loren C. Scott & Associates, Inc. (2017) and Owens and Rennhoff (2020) for Louisiana,[27] which produces a revenue offset to the cost of incentives of $11,806,900, a twelve percent rate of revenue return. The number of resident employees associated with the total direct spending is assumed to be 2,214 based on industry averages (Snead et al., 2020). Combined with an employment multiplier of 1.094, and the net incentive cost of $88,193,100, this produces a net incentive revenue cost per job of $36,412. The rate of revenue return and incentive cost per job are consistent with the more pessimistic estimates in Table 1.

5.2 Replacing Oklahoma Multipliers with those for Louisiana and New Mexico in Practice

As demonstrated above in Section 4, the Oklahoma multipliers most likely do not reflect the production linkages that will develop in the state and the resulting total economic impact of expanded film production with increased incentives. We next apply employment and income multipliers for Louisiana and New Mexico to the assumed change in film production in Oklahoma. The use of multipliers from other states bears some similarity to using input-output tables from a fully developed economy to assess the potential impact of new or emerging industries in an underdeveloped economy (Miernyk, 2020, p. 61). It is also related to the exchanging of input-output information between regions as examined in Hewings (1977).

Borrowing information or multipliers from other areas presumes that the structures of the areas will converge with the emergence of the industry where it is less developed. In our case, Louisiana and New Mexico have comparable population and average wage rates to Oklahoma's and are perceived as having established successful film incentive programs (Button, 2021), and in addition to California, have the largest employment shares of NAICS 51211 in NAICS 512 (Table 5). We assume that Oklahoma's film incentive program would expand similarly in the medium run with the incentives and that the composition of film spending in Oklahoma would approximate that of Louisiana and New Mexico, producing production linkages similar to those in them. In the words of Hewings (1977, p. 928), Louisiana and New Mexico are "just like" Oklahoma and input-output information from the two states "could be utilized" in Oklahoma.

We use the IO-SNAP multipliers averaged from 2002 to 2006 and across Louisiana and New Mexico because the DID analysis above both establishes that the incentives had statistically and significantly positive effects on filming activity over the five years considered in the two states and that the average IO-Snap employment multiplier reasonably accurately reflected filming's spillover effects to other sectors in the states. Note that Table 9 shows the similarity of IO-Snap input-output multipliers between Oklahoma and the two states in 2002 before their growth in incentivized activity.

Replacing the Oklahoma income and employment multipliers with those for Louisiana and New Mexico averaged from 2002 to 2006, equal to 2.595 and 2.337, improves the rate of revenue return to 0.26 and reduces the incentive cost per job to $14,261. Our estimates are slightly more favorable than those of Loren C. Scott & Associates, Inc. (2017) for Louisiana. Using BEA four-digit aggregate multipliers, Owens and Rennhoff

equal to thirty-eight percent (https://okfilmmusic.org/incentives/). Louisiana offers tax credits up to forty percent with uplifts, such as filming outside of New Orleans, with a total annual cap of $150 million. New Mexico offers a twenty-five percent base rate, where the total rate is capped at thirty-five percent (https://kpmfilm.com/film-tax-credits-by-state-map/new-mexico/) and the total annual spending cap is $110 million. Any differences in the incentive programs are more likely to affect the amount of filming spending in the states than create differences in the economic impacts of the film spending.

[27]Louisiana's Legislative Fiscal Office estimated that every dollar of new household earnings generated $0.07 of new state revenue (Loren C. Scott & Associates, Inc., 2017), a rate also used by Owens and Rennhoff (2020) in their calculations of state film incentive costs. An average tax rate of 0.107 would be obtained for Oklahoma as the ratio of total state taxes as defined by the Census Bureau (Urban Land Institute, 2020) (minus corporate taxes and taxes not elsewhere classified, which include oil and gas severance taxes) to total state wages over the 2015 to 2017 period. But this would overestimate state tax collections because some taxes used in the calculation include those such as sales taxes and motor fuel taxes that in part are paid by non-residents visiting or traveling through the state.

(2020) reports significantly less favorable estimates for the average of Louisiana and New Mexico, and yet more unfavorable results for Oklahoma.[28]

Whether Oklahoma could achieve the outcomes of Louisiana and New Mexico is an open question. Because of their perceived success, the multipliers of Louisiana and New Mexico at a minimum might be argued to be upper bounds, though the analysis above suggests that they are likely to be reasonably accurate and could be used as point estimates. If the state that is considering enacting or expanding incentives differed significantly from Louisiana and New Mexico such as in size, rather than using their multipliers the input-output coefficients for the film sector could be exchanged, though care would be required in the rebalancing of the input-output table (Hewings, 1977). It also is not clear what parts should be exchanged. Development of the industry in a state might develop other parts of the economy outside of those directly affected by the motion picture industry that are not easily identifiable.

6 Summary and Conclusion

The motion picture and television industry attracts considerable attention from state and local economic developers and policymakers. The perception of its high wages, environmentally-friendly production, footloose nature (Christopherson and Rightor, 2010), and expected growth make the industry an attractive target for state fiscal incentives. Evaluations of the efficacy of film incentives lack standardization, which can produce widely varying conclusions. This paper specifically examines the issue of industry aggregation for assessing the economic impacts of state film incentives.

Based on analysis of detailed sector government employment statistics and unpacking of aggregate sector state-level input-output multipliers we conclude that the sector of Motion Picture and Video Production (NAICS 51211) should be the primary focus in film incentive studies. But government input-output accounts that are the basis for regional input-output models only provide information at a more aggregated level that combines higher-paying export-based activities, such as motion picture and television production, with lower-paying locally-based activities, such as local movie theaters. Multipliers from the aggregate sector may be highly inaccurate, particularly for the states with high shares of the lower-paying locally-based activities and low shares of the desired incentivized activity in the aggregate sector.

In states with little pre-existing incentive-responsive activity (Motion Picture and Video Production), input-output multipliers likely are downwardly-biased because of the way the input-output coefficients are regionalized. A standard step in impact studies then should be to check whether the regional coefficients reflect the presence of NAICS 51211. If they do not, input-output accounts would need to be modified to reflect differing input-output linkages and film industry wage rates if detailed spending data are available. In the absence of the required detailed data for the film industry, using Oklahoma as a case study, we demonstrate an alternative approach for obtaining multipliers for use in impact analysis of the film industry in a state with little or no export-related film industry activity. Multipliers from similar-sized states with concentrations of the desired incentivized activity (Motion Picture and Video Production) can be used. At a minimum, the multipliers from other states could be used as a guide for what would be reasonable to expect from consulting-based economic impact studies.

In a further contribution, using difference-in-difference analysis we find evidence of a significant economic role of film incentives in growing the industry and statistically verify the reasonableness of the IO-Snap input-output multipliers for Louisiana and New Mexico. The approach could be more broadly used in estimating the economic impacts of incentives for other specialized activities such as those highlighted in the introduction. The input-output modeling system of IO-Snap is demonstrated to be a particularly useful research tool for such an approach.

Because even the more optimistic of our economic impact estimates suggest a significant cost to the state budget from the use of film incentives, the opportunity cost of the funds in terms of potential alternative expenditures by state governments or lower taxes should be explored in future research. Future research also could focus on standardizing other aspects of assessing the impact of the film industry on state and local economies. The potential of filming to increase tourism could greatly affect the economic development success

[28] Owens and Rennhoff (2020) reports that differences in multipliers underlie much of their estimated state differences in rates of revenue return and incentive cost per job.

of film incentives (Riley et al., 1998; MNP LLP, 2016; Tooke and Baker, 1996). Difficulties with including tourism impacts though (Christopherson and Rightor, 2010) would need to be addressed and standards for their inclusion would be needed.

References

Adkisson, R. V. (2013). Policy convergence, state film-production incentives, and employment: A brief case study. *Journal of Economic Issues*, 47(2):445–454.

Bartik, T. and Sotherland, N. (2019). *Local job multipliers in the United States: Variation with local characteristics and with high-tech shocks*. Upjohn Institute working paper.

Bartik, T. J., Biddle, S. C., Hershbein, B. J., and Sotherland, N. D. (2018). Wholedata: Unsuppressed County Business Patterns data: version 1.0 [dataset]. *Kalamazoo: WE Upjohn Institute for Employment Research*.

Bradbury, J. C. (2020). Do movie production incentives generate economic development? *Contemporary Economic Policy*, 38(2):327–342.

Button, P. (2019). Do tax incentives affect business location and economic development? Evidence from state film incentives. *Regional science and urban economics*, 77:315–339.

Button, P. (2021). Can tax incentives create a local film industry? Evidence from Louisiana and New Mexico. *Journal of Urban Affairs*, 43(5):658–684.

Camoin Associates (2019a). Economic & fiscal impact analysis of New York State film tax credit programs. https://esd.ny.gov/sites/default/files/Camoin_NYS-FilmReport-2017-18.pdf. Online; accessed May 23, 2021.

Camoin Associates (2019b). Economic and fiscal impact of Louisiana entertainment tax credits. https://louisianaentertainment.gov/docs/default-source/default-library/2019-economic-fiscal-impact-of-louisiana-entertainment-tax-credits.pdf. Online; accessed May 23, 2021.

Christopherson, S., Figueroa, M., Gray, L., Parrott, J., Richardson, D., and Rightor, N. (2006). New York's big picture: Assessing New York's role in media production. Report to the New York Film, Television, and Commercial Initiative.

Christopherson, S. and Rightor, N. (2010). The creative economy as "big business": Evaluating state strategies to lure filmmakers. *Journal of planning education and research*, 29(3):336–352.

Clarke, D. and Tapia-Schythe, K. (2021). Implementing the panel event study. *The Stata Journal*, 21(4):853–884.

Edmiston, K. D. (2004). The net effects of large plant locations and expansions on county employment. *Journal of Regional Science*, 44(2):289–320.

Ernst & Young (2009). Estimated impacts of the New York State film credit. https://www.southwindsor-ct.gov/sites/g/files/vyhlif3831/f/uploads/new_york_ernst_and_young_state_film_credit_study.pdf. Online; accessed May 23, 2021.

Georgia Tech Center for Economic Development Research (2019). The economic impact of the film industry in Georgia.

Guerrero, B. L., Johnson, J. W., Amosson, S. H., Johnson, P. N., Segarra, E., and Surles, J. (2011). Ethanol production in the southern high plains of Texas: Impacts on the economy and scarce water resources. *Journal of Regional Analysis and Policy*, 41:23–32.

Harris, R. I. and Liu, A. (1998). Input-output modelling of the urban and regional economy: The importance of external trade. *Regional studies*, 32(9):851–862.

Harris, T., Deller, S., and Goetz, S. (2014). Linkages of the agricultural sector: Models and precautions. In Alfen, N. V., editor, *Encyclopedia of Agriculture and Food Systems*, volume 4, pages 148–155. Elsevier, San Diego.

Hewings, G. J. (1977). Evaluating the possibilities for exchanging regional input—output coefficients. *Environment and Planning A*, 9(8):927–944.

HR&A Advisors, Inc. (2012). Economic and fiscal impacts of the New York State film production tax credit. https://www.motionpictures.org/wp-content/uploads/2014/01/Economic-and-Fiscal-Impacts-of-the-New-York-State-Film-Production-Tax-Credit.pdf. Online; accessed May 23, 2021.

Independent Fiscal Office (2019). Pennsylvania film production credit: An evaluation of program perfor-

mance. https://www.pafia.org/resources/Documents/TC_2019_Film_Production_Tax_Credit_Report.pdf. Online; accessed May 23, 2021.

IO-Snap (2019). Input-output state and national analysis program. https://www.io-snap.com/. Online; accessed May 23, 2021.

Isserman, A. M. and Westervelt, J. (2006). 1.5 million missing numbers: Overcoming employment suppression in County Business Patterns data. *International Regional Science Review*, 29(3):311–335.

Jackson, R. W. (1998). Regionalizing national commodity-by-industry accounts. *Economic Systems Research*, 10(3):223–238.

Jofre-Monseny, J., Sánchez-Vidal, M., and Viladecans-Marsal, E. (2018). Big plant closures and local employment. *Journal of Economic Geography*, 18(1):163–186.

Karlin, S. (2019). Film tax break costs Louisiana millions, new study shows; supporters rally at entertainment summit. https://www.theadvocate.com/baton_rouge/news/business/article_c1d98d48-5193-11e9-b6a0-7bc2825afed3.html. Online; accessed August 20, 2022.

Lazarus, W. F., Platas, D. E., and Morse, G. W. (2002). IMPLAN's weakest link: production functions or regional purchase coefficients? *Journal of Regional Analysis & Policy*, 32(1):33–49.

Liu, Z. and Warner, M. E. (2009). Understanding geographic differences in child care multipliers: Unpacking IMPLAN's modeling methodology. *Journal of Regional Analysis and Policy*, 39(1):71–85.

Loren C. Scott & Associates, Inc. (2017). The economic impact of Louisiana's entertainment tax credit programs for film, live performance & sound recording. https://louisianaentertainment.gov/docs/default-source/default-library/2017-entertainment-impact-study.pdf. Online; accessed May 23, 2021.

Los Angeles County Economic Development Corporation (2014). California's film and television tax credit program: Assessing its impact. https://scag.ca.gov/sites/main/files/file-attachments/scagfilmreport-final.pdf. Online; accessed August 9, 2021.

Low, S. A. and Isserman, A. M. (2009). Ethanol and the local economy: Industry trends, location factors, economic impacts, and risks. *Economic Development Quarterly*, 23(1):71–88.

Maddaus, G. (2022). Netflix wins big again, scoring $60 million in California tax credits. https://variety.com/2022/film/news/netflix-california-film-tax-credits-1235191456/. Online; accessed July 2, 2022.

McDonald, A. (2011). Down the rabbit hole: The madness of state film incentives as a solution to runaway production. *U. Pa. J. Bus. L.*, 14:85.

Michaud, G. and Jolley, G. J. (2019). Economic contribution of Ohio's wood industry cluster: Identifying opportunities in the Appalachian region. *Review of Regional Studies*, 49(1):149–171.

Miernyk, W. H. (2020). *The elements of input-output analysis*. Regional Research Institute, West Virginia University.

MNP LLP (2014). New Mexico film production tax incentive study: Phase I report. https://nmfilm.com/wp-content/uploads/2018/10/Phase-1-Report-Final-Report-July-21-2014.pdf. Online; accessed May 23, 2021.

MNP LLP (2016). New Mexico film production tax incentive study: Phase III report. https://nmfilm.com/wp-content/uploads/2018/10/MNP-Film-Study-Phase-III-20161.pdf. Online; accessed May 23, 2021.

Motion Picture Association (2019). The American motion picture and television industry: Creating jobs, trading around the world. https://www.motionpictures.org/research-docs/the-american-motion-picture-and-television-industry-creating-jobs-trading-around-the-world-2/. Online; accessed August 9, 2021.

Munasib, A. and Rickman, D. S. (2015). Regional economic impacts of the shale gas and tight oil boom: A synthetic control analysis. *Regional Science and Urban Economics*, 50:1–17.

National Conference of State Legislatures (2018). State film production incentives and programs. https://www.ncsl.org/Portals/1/Documents/fiscal/2018StateFilmIncentivePrograms_20189.pdf. Online; accessed February 16, 2022.

National Conference of State Legislatures (2022). Film tax incentives: Back in the spotlight. https://www.ncsl.org/Portals/1/Documents/fiscal/May-2022-Fiscal-Brief-Film-Tax-Incentives.pdf. Online; accessed July 3, 2022.

Owens, M. F. and Rennhoff, A. D. (2020). Motion picture production incentives and filming location decisions: A discrete choice approach. *Journal of Economic Geography*, 20(3):679–709.

Oxford Economics (2017). Lights, camera but no action? A critical assessment of the methodological approach. https://www.oxfordeconomics.com/recent-releases/lights-camera-but-no-action. Online; accessed

May 23, 2021.
O'Brien, N. F. and Lane, C. J. (2018). Effects of economic incentives in the American film industry: An ecological approach. *Regional Studies*, 52(6):865–875.
Popp, A. and Peach, J. (2008). The film industry in New Mexico and the provision of tax incentives. https://arrowheadcenter.nmsu.edu/wp-content/uploads/2015/06/filmindustryfinal.pdf. Online; accessed May 23, 2021.
Rambachan, A. and Roth, J. (2022). A more credible approach to parallel trends. Technical report, Working Paper.
Rickman, D. S. and Miller, S. R. (2002). An evaluation of alternative strategies for incorporating interindustry relationships into a regional employment forecasting model. *Review of Regional Studies*, 32(1):133–147.
Rickman, D. S. and Schwer, R. K. (1993). A systematic comparison of the REMI and IMPLAN models: The case of Southern Nevada. *Review of Regional Studies*, 23(2):143–161.
Riley, R., Baker, D., and Van Doren, C. S. (1998). Movie induced tourism. *Annals of tourism research*, 25(4):919–935.
Sage Policy Group (2010). An economic assessment of Maryland's film & television production industry and policy implications. https://marylandfilm.org/Documents/Sage%20Study.pdf. Online; accessed May 23, 2021.
Sayers, J. (2021). 'Fear the Walking Dead,' filmed in Austin since 2018, leaving for Georgia; many in industry blame paltry incentives. https://www.bizjournals.com/austin/news/2021/11/12/fear-the-walking-dead-austin-texas-film-incentives.html. Online; accessed July 2, 2022.
Schaffer, W. A. (2020). *Regional impact models*. Regional Research Institute, West Virginia University.
Schmit, T. M., Jablonski, B. B., and Mansury, Y. (2016). Assessing the economic impacts of local food system producers by scale: A case study from New York. *Economic Development Quarterly*, 30(4):316–328.
Sewordor, E. and Sjoquist, D. L. (2016). Lights, camera, action: The adoption of state film tax credits. *Public Budgeting & Finance*, 36(2):5–25.
Smith, S. M. (2005). Policy research in the Review of Regional Studies. *Review of Regional Studies*, 35(1):1–7.
Snead, M., Rickman, D., and Jones, A. (2020). Oklahoma's film and TV industry: Growth prospects and state-level incentives.
Swenson, C. W. (2017). Preliminary evidence on film production and state incentives. *Economic Development Quarterly*, 31(1):65–80.
Tannenwald, R. (2010). State film subsidies: Not much bang for too many bucks. *Center on Budget and Policy Priorities*, 9.
The PFM Group (2016). State of Oklahoma incentive evaluation commission film enhancement rebate program final report. https://iec.ok.gov/sites/g/files/gmc216/f/Film Incentive Rebate Final Evaluation_112817.pdf. Online; accessed May 23, 2021.
Thom, M. (2018). Lights, camera, but no action? Tax and economic development lessons from state motion picture incentive programs. *The American Review of Public Administration*, 48(1):33–51.
Thom, M. (2019). Do state corporate tax incentives create jobs? Quasi-experimental evidence from the entertainment industry. *State and Local Government Review*, 51(2):92–103.
Tooke, N. and Baker, M. (1996). Seeing is believing: The effect of film on visitor numbers to screened locations. *Tourism management*, 17(2):87–94.
Urban Land Institute (2020). State and local finance data. https://state-local-finance-data.taxpolicycenter.org/pages.cfm. Online; accessed May 23, 2021.
Wassmer, R. W., Ong, R. S., and Propheter, G. (2016). Suggestions for the needed standardization of determining the local economic impact of professional sports. *Economic Development Quarterly*, 30(3):252–266.
Weiner, J. et al. (2009). *State business tax incentives: Examining evidence of their effectiveness*. New England Public Policy Center.
Weinstein, A. (2014). Local labor market restructuring in the shale boom. *Journal of Regional Analysis & Policy*, 44(1):71–92.
Weinstein, B. L. and Clower, T. L. (2000). Filmed entertainment and local economic development: Texas as a case study. *Economic Development Quarterly*, 14(4):384–394.
Yu, H. (2018). A review of input–output models on multisectoral modelling of transportation–economic linkages. *Transport Reviews*, 38(5):654–677.