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LIGHTS, CAMERA BUT NO ACTION?

A CRITICAL ASSESSMENT OF THE METHODOLOGICAL APPROACH

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EXECUTIVE SUMMARY

A report by Michael Thom in the American Review of Public Administration, henceforth "the paper", investigates the impact of various types of tax incentive programs on economic activity in the Motion Picture Industry (MPI) across a variety of metrics including employment, Gross State Product (GSP), earnings and industry concentration. The analysis implies that the alternative tax measures have different impacts on MPI activity as follows:

- Both sales and lodging tax waivers have no effect on any of the four metrics studied;
- Transferable tax credits have a permanent positive impact on MPI employment but no effect on earnings, GSP or industry concentration; and
- Refundable tax credits have a temporary positive impact on earnings but no effect on employment, GSP or industry concentration.

Our review has identified several issues which cast doubt on the central conclusions of the paper. These include:

- **Lack of precision of dependent variables:** measures of activity in the MPI use historic data from industry code 512. This covers activity in a much broader set of industries than those directly affected by tax incentives including music production and distribution, and film exhibition. The series does offer superior coverage with all data points published by an official source during the relevant period. However, theoretically, the broader measure can only act as a good proxy of trends in film production if there is a reasonably strong co-movement between the two datasets. However, we find that the correlation between the annual growth rate of employment in industry 512 and (where published) the growth rate of employment in the narrower subsector 51211 - "motion picture and video production" – is virtually zero.
- **Misinterpretation of coefficients:** in each equation the existence of various tax credit measures is represented by two separate variables: the dummy (which takes a value of zero or one depending on whether the tax credit is operating); and the duration variable (which measures the number of years that the tax credit has been operating) interacted with the dummy variable. In this context, the impact of the tax credit should be understood by the *combination* of the estimated coefficients for both variables evaluated at the mean duration value. However, in the paper, the only results that are presented are for the *individual* significance of the coefficients. A joint test could have shown statistical significance even though the two variables were not individually significant.
- **Modelling policy variables simultaneously:** for each of the four indicators of MPI activity, the results that are presented test for the impact of the various incentive programs simultaneously. However, given the likelihood that some of these will have co-existed in

different states, it would have been preferable to test each in turn. This feature of the regressions is likely to have affected the estimated coefficients for the policy variables.

- **Growth rate and adjustment for state industry size:** the structure of the US film industry sees two states (New York and California) predominant, a point acknowledged at various points within the paper. Running the regressions in terms of growth rates has two potential limitations. First, growth rates are likely to be less volatile in larger film producing states, which can lead to estimation bias in a similar fashion to the well documented growth convergence modelling. Second, changes in larger states will be under-represented in the analysis. As such, it would have been preferable to at least test a model which used weightings according to industry size and/or controlling for initial state film production/employment level. As this was not undertaken, it is little surprise that the sensitivity test where the model was run without New York and California had no discernible impact on the results.

- **Inclusion of a variable measuring tax credit generosity in level terms:** one of the control variables used in the equations measures the annual change (measured in US$ millions) in tax credit spending in that state. Whilst, we do not object to the inclusion of this variable, the specification of the variable—in terms of absolute rather than percentage change—seems problematic. For example, in light of the discrepancy in state industry size noted in the previous bullet point, changes in "generosity" in California and New York are likely to have dwarfed changes in other states. Conversely, the greater absolute size of activity in California and New York should mean that MPI activity growth (measured in percentage change) is less volatile, other things equal. Taken together, this feature is likely to have dampened the size the estimated coefficient on generosity.

- **No adjustment for possible endogeneity bias:** the regressions contain a number of control variables which might plausibly lead to endogeneity bias. Theoretically, it is easy to see that a rise in film productions in a particular state would lead to a rise in tax credit spending and a rise in employment, other things equal. This bi-causality will introduce simultaneity bias into the model, causing the estimated coefficients to be inconsistent. The paper notes that first differencing corrects for this problem, but that is only the case for endogeneity bias caused by omitted variables, not simultaneity.

- **Issues with diagnostic testing:** we have also noted some small issues in the diagnostic tests used to assess the validity of the model. However, in our view, these are unlikely to have had a substantive effect on the results.

Overall, our review has identified sufficient grounds to question the methodological approach and hence the central conclusions of the study. The use of a fairly broad indicator of sectoral activity is particularly problematic, given the lack of correlation with sub-industry trends (at least as measured by employment).

1. METHODOLOGICAL EVALUATION

This summary report was commissioned by the Motion Picture Association of America (MPAA) in response to the publication of a report by Michael Thom in the *American Review of Public Administration* henceforth "the paper".[1] The research aims to establish the relationship between the implementation of different types of tax incentives programs and economic activity in the motion picture industry, using the experience of US states over a 16-year period.

This document presents the findings and conclusions of an independent evaluation of the methodological approach employed in the paper. The analysis reflects careful consideration of the validity of the underlying approach and econometric specification used in the paper, and the views are entirely our own.

This section of the report details the paper's research methodology and then provides a critical evaluation across a number of dimensions.

1.1 METHODOLOGICAL OVERVIEW

RESEARCH BACKGROUND

The research is motivated by the aim to examine the effectiveness of economic development incentive programs. Although the research and therefore the conclusions are focused on the Motion Picture Industry (MPI), the paper purports to be motivated by a wider objective to investigate the efficacy of these programs that are widespread across the industrial spectrum in the USA.

The focus on the MPI reflects practical considerations given the high volume of incentive programs that have been implemented across different US states during the study horizon period and the availability of alternative metrics that can be used to trace sectoral economic activity.

METHODOLOGICAL SUMMARY

The research uses a panel econometric model which seeks to explain changes in MPI activity in the 50 US states during the period 1997-2013. Since MPI tax incentive programs are reasonably diverse, the model specification includes a number of dummy variables, which capture the existence (or otherwise) of a specific type of program in that state and year. These include waivers for sales and/or lodging tax, refundable tax credits and transferrable tax credits.[2]

The change in industry economic activity is captured via four alternative metrics: the annual percentage point change in MPI employment; the annual percentage point change in MPI wages; the annual percentage point change in MPI GSP; and the annual change in MPI concentration, as measured by the

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[1] M Thom, "Lights, Camera but No Action? Tax and Economic Development Lessons From State Motion Picture Incentive Programs", *American Review of Public Administration*, 2016: 1-23.

[2] A refundable tax credit allows the producer to reclaim the difference in cash from the State Government. In contrast, the transferable tax credit enables the production company to apply the value of unused credits to future projects.

state's Location Quotient (LQ).[3] As a result, there are four behavioural equations, all of which share the same basic specification with an alternative dependent variable.

Explanatory variables include a dummy to represent the existence or otherwise of the four types of incentive programs and a variable to reflect program duration. This is defined as the number of years that the incentive has been in place. In addition, each equation contains a set of control variables including: a variable to control for generosity—the annual absolute change in spending on MPI incentive programs (measured in millions of US$); the annual growth rate of per capita GSP; the annual growth rate of state employment; the annual growth rate of state wages; and the annual percentage point change in the corporate tax burden (based on the average effective rate as a share of GSP).

Therefore, the four specifications can be summarised by the following functional form:

$$Log(Emp_{it}) = \alpha_i + \beta_1(TaxTran_{it}) + \beta_2(TaxTran_{it} * TaxTranDur_{it}) + \beta_3(TaxRef_{it}) + \beta_4(TaxRef_{it} * TaxRefDur_{it}) + \beta_5(TaxSales_{it}) + \beta_6(TaxSales_{it} * TaxSalesDur_{it}) + \beta_7(TaxLodg_{it}) + \beta_8(TaxLodg_{it} * TaxLodgDur_{it}) + \beta_9 * \log(CONTROL) + \varepsilon_{it}$$

where TaxTran, TaxRef, TaxSales and TaxLodg refer to the various incentive programs, the suffix Dur refers to the corresponding variable monitoring program duration and CONTROL refers to the group of control variables such as annual program spending change, GSP, wage and employment growth and the change in corporate tax rate.

Data on economic activity indicators (at either the MPI or macro-economic levels) was drawn from the Bureau of Economic Analysis (BEA). The MPI data is defined by the North American Industry Classification System (NAICS) code 512—the motion picture and sound recording industries. This provides a fairly broad overview of developments in the MPI, encompassing activity in both the production and distribution of motion pictures and sound recordings. Data used to track the existence and duration of incentive programs at the state-level was collected from relevant state websites.

1.2 REVIEW OF RESEARCH METHODOLOGY

VALIDITY OF RESEARCH METHOD

The use of a panel model to produce a quantitative estimate of the effects of incentive programs on various measures of MPI activity is both valid and relatively novel. The author is correct to note that much of the existing literature on the impact of incentive programs is limited by being relatively narrow in scope, with a focus on a single program which, as a result, constrains the generalisability of the findings.

The US also seems to be a very applicable market for this approach given the prevalence of incentive programs and high-quality time series data at the regional level. The exercise is clearly highly data-intensive and therefore

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[3] The LQs provide an indication of the relative importance of the MPI to economic activity in each state, in this case as measured by GSP.

well-suited to the US which has some of the highest quality and most extensive economic datasets in the world. Moreover, the US provides a wealth of material for 'natural experiment' type data with a large number of states implementing, maintaining and sometimes terminating incentive programs during the modelling horizon.

Although it does not affect the modelling results, the report does not reference the international context of these programs—incentives are not simply designed to provide a state a competitive advantage compared to other US states but versus other locations abroad as well. As noted, this characteristic is not problematic for the estimation.

DATA SOURCES

The use of data at the three-digit NAICS level to describe changes in state-level economic activity in the MPI is potentially problematic. These measures (of employment, wages or GSP) track activity in both the production and distribution of motion pictures and sound recordings. As such, they cover a much broader set of activities than is targeted by the various incentive programs that solely relate to, and therefore can only be thought to affect decision-making with regard to, motion picture production. Specifically, the measures will reflect changes in the sound recording industries and in the distribution of motion pictures (including cinematic showings), both of which will not be theoretically linked to the tax incentive programs that the model is seeking to investigate.

When choosing a source to track economic activity, there is a trade-off between series which map closely to the directly affected sector and data coverage. For labour market metrics, more disaggregated industry-level data is available from the Bureau of Labour Statistics (BLS). At the four-digit level (5121) these measures would strip out activity in the sound recording industry, while at the five-digit level (51211) the statistics would be focused solely on movie and TV production. The trade-off from using these more disaggregated series is that the published data is less complete. For example, at the time of writing, approximately one quarter of the data points for state-level employment in industry 51211 were anonymised.

There is a negligible correlation between the employment growth of the data series used (NAICS code 512) and the sub-industry series (NAICS code 51211) which aligns more closely to film production. The extent to which the use of series 512 distorts the estimated coefficients will depend on its degree of co-movement with series 51211. However, as is demonstrated in the chart below, the correlation in growth is negligible, with a correlation coefficient of just 0.057. This implies that, at least for employment, data for NAICS code 512 cannot act as a valid proxy for activity in the film industry.

Fig. 1. **Association between state-wide employment rates in NAICS codes 512 and 51211 industries, 1998-2013**[4]

NAICS code 51211, % yr

Correlation coefficient = 0.057

NAICS code 512, % yr
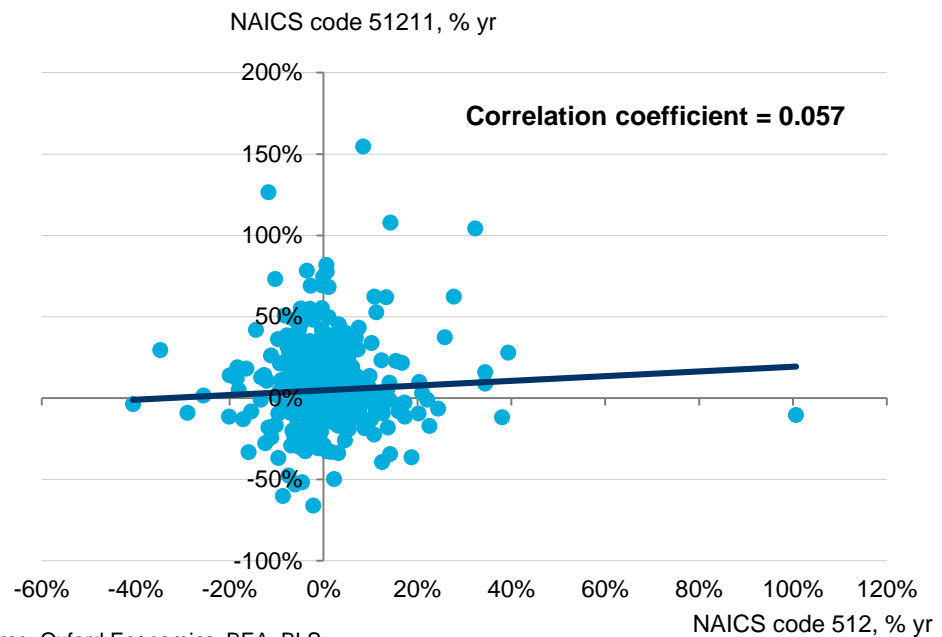
Source: Oxford Economics, BEA, BLS

ECONOMETRIC SPECIFICATION

The issue of endogeneity bias is not fully corrected by the use of first differencing, as is claimed in the paper. The equations contain a number of control variables which might plausibly lead to endogeneity bias due to two-way causality. For instance, the direction of causality between the dependent variable (MPI activity) and the 'generosity' variable would seem not to run primarily from the latter to the former, as specified by the model. Theoretically, it is easy to see that a rise in film productions in a particular state would lead to a rise in tax credit spending and a rise in employment, other things equal. This two-way causality will introduce simultaneity bias in the modelling process causing the estimated coefficients to be inconsistent. The paper suggests that the problem of endogeneity is countered by the use of a dependent variable measured in first differences.[5] However, while first differencing using panel data can, to some extent, correct for omitted variable bias, it will not address the issue of simultaneity bias which is the main issue in this study. Simultaneity bias is more typically corrected for using Instrumental Variable (IV) or Generalised Method of Moments (GMM) techniques.

The inclusion of the 'generosity' variable measured in absolute annual change is problematic, particularly given the uneven structure of the film industry across US states. California and New York remain predominant as production locations, a point acknowledged in the paper. Ceteris paribus, it is likely that the annual absolute change in program spending in these states

[4] This chart omits state/year combinations for which employment growth of industry NAICS code 51211 was not published. In total, this led to the exclusion of around one third of possible growth pairs.
[5] For example, on p.10 the paper states that "the empirical focus on annual changes in labour and other economic indicators should prevent endogeneity".

dwarfed states where production activity is much more limited. On the other hand, annual growth in economic activity (measured in percentage terms) will, other things equal, be less volatile in these states, dampening the size of the estimated coefficient. One possible way to resolve this would have been to define the 'generosity' variable as the change in US$ program spending per film.

Testing each tax credit policy measure individually would have been preferable to including all policy measure identifiers simultaneously in the same equation. For each of the four indicators of MPI activity, the results presented test for the impact of various tax credit measures simultaneously. However, given the likelihood that some of these will have co-existed in different states, it would have been preferable to run four separate equations (for each metric) which individually tested for the impact of a particular type of tax credit. The simultaneous inclusion of tax policy variables could have an effect on the estimated statistical significance of the associated coefficients.

DIAGNOSTICS AND SENSITIVITY TESTING

Although the paper does run a robustness check of excluding California and New York as part of a truncated panel, this does not resolve the potential issues that arise due to the disproportionate size of these **states' MPIs.** The paper does raise the issue potentially created by the disproportionate size of the MPIs of New York and California. However, the robustness check used to test this is, in our view, inadequate. Running a truncated panel merely discards four percent of the data—as such, it is unsurprising that the results are unaffected. An alternative approach would have been to test a model which used weightings according to industry size and/or controlling for initial state film production/employment level.

There are also some issues with Thom's use of diagnostic testing, although, in our view, these are unlikely to have had a material impact on the results. First, the use of Driscoll and Kraay standard errors to deal with the issue of heteroscedasticity is problematic in view of the restricted time horizon of the panel. Second, the use of the Hausman test after the finding of heteroscedasticity is incorrect—the simple Hausman test is calibrated under the condition of normality.

INTERPRETATION OF FINDINGS

Given the use of interaction terms, the interpretation of the coefficients on policy variables is incorrect. The four equations contain a number of interaction terms which cover the dummy variable tracking the existence or otherwise of an incentive program and the 'duration' variable tracking the number of years for which the program has operated. As such, the impact of a specific tax credit should be evaluated based on the combination of the estimated coefficients for both the individual and interaction variables at mean duration i.e. both the 'Transferable' and 'Transferable * Duration' variables. In contrast, when presenting the summary results for each indicator, the coefficients are presented individually with no reference to what these individual coefficients imply in combination.

1.3 CONCLUSION

Overall, our review has uncovered a number of methodological issues with the paper. The most problematic of these is the use indicators of economic activity measured by a relatively aggregated industry definition (NAICS code 512). The ultimate objective of the research is to understand how tax incentive programs affect state-level activity in the film production industry. However, in the case of employment, the analysis here suggests that NAICS code 512 acts as a highly imperfect proxy for NAICS code 51211. The virtual absence of correlation between the growth rates of the two series effectively invalidates the paper's MPI employment regression.

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