Energy Policy 107 (2017) 448–458

Contents lists available at ScienceDirect

Energy Policy

journal homepage: www.elsevier.com/locate/enpol

Short-run impacts of a severance tax change: Evidence from Alaska

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ARTICLE INFO

JEL classification:
H71
Q48
Q43

Keywords:
Alaska
Severance taxes
Oil
Synthetic control
Case study
Policy evaluation

ABSTRACT

Energy states face a fundamental tradeoff when increasing severance tax rates: potential gains in tax revenues versus potential losses in exploration, development, and production activity. Despite the significant implications of this tradeoff, there is very little empirical evidence on the short-run responsiveness of extraction-related activities to changes in severance taxes. We conduct a comparative case study to evaluate the short-term impact of a severance tax increase on oil-related activities and development in Alaska. In 2007, the introduction of "Alaska's Clear and Equitable Share" (ACES) more than tripled the tax liability for much of the oil already under production in Alaska. We construct a synthetic Alaska from a set of U.S. energy states, with the purpose of estimating the counterfactual evolution of oil production, exploration and development wells, gross state product, and employment, in the absence of ACES. Overall, our results indicate that there is no discernible difference in the outcome variables of interest between Alaska and its synthetic control after the implementation of ACES, suggesting that ACES had a minimal effect on Alaskan oil-related activity and development in the short run.

1. Introduction

On April 14th, 2013, the Alaska State 28th Legislature passed Senate Bill 21 (SB 21), a reform of the state severance tax system geared toward fostering new oil production and enhancing Alaska's global competitiveness and investment climate in the long term. The new tax structure under SB 21 was a drastic change from Alaska's previous tax regime, and marked a significant reduction in Alaska's effective severance tax rate. Unlike previous legislatures, which looked to replace declining revenues with increased oil production tax rates, the 28th Legislature expected that the SB 21 incentive program would stimulate exploration, field development, oil production, and job creation. In general, the fundamental tradeoff that the energy-producing states face when incentivizing energy producers through lower severance taxes involves the potential losses in tax revenue versus potential gains in exploration, development, and production activity. Despite the significant implications of this tradeoff for energy-producing states, there is very little empirical evidence on the responsiveness of extraction-related activities to changes in severance taxes.[1]

Alaska's recent severance tax reform was a response to declining oil production from Alaska's North Slope "legacy" fields. According to Alaska's Governor at the time, Sean Parnell, declining oil production was "not because [Alaska is] running out of oil, but because [Alaska is] running behind in the competition. Alaska's North Slope has billions of proven barrels of oil, but [Alaska does] not have a tax system designed to attract new investment for more production."[2] Much of the evidence entered into the public record during the debate over SB 21 focused on establishing the impact of implementing Alaska's previous tax system—referred to as "Alaska's Clear and Equitable Share" or ACES—in 2007. Combined with the simultaneous increase in oil prices in 2007, the introduction of ACES more than tripled the tax liability for much of the oil already under production in Alaska (Department of Revenue, 2012). Supporters of tax reform under SB 21 claimed that the progressive tax structure under ACES diminished incentives for investment in development and exploration, and would ultimately lead to reduced employment opportunities and future oil production. In contrast, opponents of SB 21 pointed to statistics showing increases in oil and gas employment and investment following the introduction of ACES, and claimed that there was no evidence of ACES' negative impact on Alaska's investment climate.

Evaluating the impact of ACES ultimately requires asking the key question of causal inference: how would have the State of Alaska

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[1] Abbreviations: Senate Bill 21 (SB 21); Alaska's Clear and Equitable Share (ACES); Economic Limit Factor (ELF); Petroleum Profits tax (PPT); Synthetic Control Method (SCM); Gross Domestic Product (GDP); Mean Square Prediction Error (MSPE).

[2] Quote from Gov. Parnell's State of the State Address on January 15, 2013.

http://dx.doi.org/10.1016/j.enpol.2017.05.014
Received 17 May 2016; Received in revised form 21 March 2017; Accepted 7 May 2017

evolved since 2007 in the absence of ACES? Our work attempts to answer this question through a rigorous *ex post* analysis of the impact of Alaska's previous severance tax system on Alaskan resource development and employment. Without establishing how the outcome variable(s) may have evolved in the absence of the intervention, it is difficult to accept whether or not ACES led to any actual gains or losses.

We propose to use a comparative case study using the synthetic control method to evaluate the impact of tax policy on resource development in Alaska. Comparative case studies are often used by researchers interested in the effects of events or policy implementations that take place at an aggregate level. Classic examples include Card's (1990) study on the impact of the 1980 influx of Cuban immigration (i.e. the Mariel Boatlift) on the labor market in Miami and Card and Krueger's (1994) evaluation of the effects of minimum wages on employment in fast food restaurants in New Jersey. In comparative case studies such as these, researchers estimate the evolution of aggregate outcomes for a unit affected by a particular event or intervention of interest and compare it to the evolution of the same aggregates estimated for some control group. As Abadie et al. (2010) note, there is some degree of ambiguity in how comparison units are chosen. Researchers often select comparison groups on the basis of subjective measures of affinity between affected and unaffected units. Additionally, comparative case studies typically employ data on a sample of disaggregated units and inferential techniques that measure only uncertainty about the aggregate values of the data in the population. The idea behind the synthetic control approach is that a combination of units often provides a better comparison for the unit exposed to the intervention than any single unit alone. The synthetic control approach uses a data-driven procedure to construct a suitable comparison group by calculating "optimal" weights to be assigned to each comparison unit in a donor pool (Abadie et al., 2010; Abadie and Gardeazabal, 2003).

In this paper, we construct a synthetic Alaska from a donor pool of U.S. energy states,[3] with the purpose of estimating the counterfactual evolution of certain Alaskan aggregate outcomes—such as oil production, exploration and development wells, active drilling, and employment—in the absence of ACES between 2007 and 2011. Comparing these counterfactual outcomes with the actual Alaska outcomes that occurred immediately after the implementation of ACES, we are able to estimate the short-run impact of ACES on the Alaskan economy.

Overall, our results indicate that there is no discernible difference in the outcome variables of interest between Alaska and its synthetic control in the first few years after the implementation of ACES, suggesting that ACES had a minimal short-run effect on Alaskan oil activity. In particular, our analysis finds no detectable effect of ACES on the number of development and exploratory wells drilled, oil production, GDP, and employment in the short run. Accordingly, the arguments used to support the lowering of the severance tax burden under SB 21 are not supported by the evidence presented in this paper.

There are several factors, however, that limit the conclusions that can be drawn from our analysis. We have only a five-year window (2007–2011) for which to evaluate the impact of the increased severance tax.[4] If it is the case that oil producing firms are only responsive to fiscal policy in the long run, then our analysis fails to capture the long-run impacts of ACES on future resource development. However, we believe that there are several reasons why understanding the short-run effects of a severance tax change provides important information to policy makers. First, as we discuss in more detail below, economic theory is inconclusive with respect to the short-run responsiveness of oil production to a severance tax change. Early models of the extraction of an exhaustible resource with finite reserves demonstrate that a severance tax will tilt production to the future, resulting in reduced resource extraction in the short run (e.g., Hotelling, 1931; Herfindahl, 1967). However, Heaps (1985) demonstrates that when extraction costs are allowed to depend on cumulative production, the net effect of an increased severance tax on intertemporal production is ambiguous. Further, the dynamics of resource extraction become overly complex when modeling exploration and production jointly, so much so that predictions of the short-run effect of a severance tax change can only be obtained through numerical simulations with parameters calibrated to a particular situation (e.g., Kunce et al., 2003; Chakravorty and Gerking, 2010). Thus, the extent to which oil-extraction activities respond to a severance tax change in the short-run largely remains an empirical question, one that we attempt to address in this paper.[5]

Second, understanding the short-run effects of a severance tax change is especially important at a time when states frequently change their tax regimes. For example, the State of Alaska altered its fiscal regime 18 times between 1973 and 2007, with most regimes lasting no more than four years (Berman, 2014). Furthermore, Weber et al. (2016) find significant increases in average tax rates at the national level in response to higher oil prices. Similarly, the recent decline in oil prices has led some energy states, such as North Dakota, to consider reforming their tax regime to rid itself of volatility.[6] Internationally, several countries have reformed their tax regimes in recent years in response to oil prices. For example, the United Kingdom reformed their tax regime four times between 2001 and 2011, increasing government take in times of high oil prices and offering fiscal incentives in times of low oil prices (Agalliu, 2011). The frequency in which governments adjust their tax regime therefore makes our attempt to estimate the short-run effects of a severance tax change particularly relevant for policy makers.

Some of our results are also somewhat inconclusive given the difficulty of creating a synthetic control state that resembles Alaska.[7] Further, we are not able to completely isolate the impact of the severance tax change under ACES from other confounding effects, such as the shale boom that took place in all of the other energy states. It is important to note, however, that the shale boom induces a positive shock in the shale-rich states, and thus a bias towards finding a negative effect of the tax change. Therefore, our null results are conservative estimates of the impact of ACES and the shale boom does not affect the conclusion that ACES had no detectable short-term effect on oil activity in Alaska. Finally, we are unable to isolate the impacts induced by the increased severance tax from those induced by other components of ACES, such as the expansion of Alaska's severance tax credits.[8] Such tax credits were designed to encourage investment and enhance future production of oil and gas within the state, and therefore dampen the severity of the severance tax increase on exploration and capital investment decisions, potentially counteracting against the effects due to the severance tax alone. Thus, our results for exploratory and development drilling, as well as employment, should be interpreted with this caveat in mind.[9] Disentangling these two aspects of ACES would require a more structural approach that is able to model the decision rules of oil-producing firms and separate the effects of the

[3] The distinguishing mark of an energy state is the rapid expansion and contraction of the state's energy industry in response to changes in energy prices—as well as the strong effects of the industry on other aspects of the state's economy (Snead, 2009).

[4] We are only able to examine this five-year window due to the fact that ACES was replaced by SB 21 in 2013.

[5] For example, recent work shows that the supply decisions of onshore oil-producing firms in California were relatively responsive in the short-run to the temporary Windfall Profit Tax introduced in 1980 (Rao, 2013).

[6] http://insideenergy.org/2015/04/30/amidst-low-prices-north-dakota-scrambles-to-change-oil-tax-rate/

[7] We are able to construct a synthetic control that resembles Alaska reasonably well for outcome variables such as gross state product and mining employment, but less so for variables such as development and exploratory well drilling.

[8] See footnote 15 for more details regarding these tax credits.

[9] Given the length of time needed for exploration activities to produce oil, we would not expect the expanded set of tax credits to influence oil production in the five-year window examined here.