STATE-LEVEL CHOICES FOR NON-RENEWABLE RESOURCE REVENUE FUNDS

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There are 11 major oil, natural gas, coal and mineral producing states in the United States. Over time, each has experienced the boom and bust cycle associated with severance revenues derived from non-renewable resources traded in an open market. This paper asks: What are the differential outcomes of establishing a revenue stabilization fund versus a permanent fund for non-renewable resource severance revenues? Since these revenues are "non-renewable," many states (and nations) chose a permanent fund to promote intergenerational equity. However, Oklahoma and Louisiana recently created a revenue stabilization fund. We model the effect of revenue stabilization and permanent fund using historical data in Oklahoma. A revenue stabilization fund provides short-term gains while a permanent fund creates a long-term endowment for future generations. Public officials considering strategies for revenue allocation can benefit by understanding the predicted short and long-term fiscal effects of their choices

INTRODUCTION

The popularity of the income tax waxes and wanes at the state level. One thing that remains constant, however, is an extreme reluctance by public officials (based on perceived citizen preferences) to raise taxes. In the face of nearly intransigent reluctance for tax increases, public officials seek new revenue sources. In the past, new state revenue sources often came from lotteries, pari-mutuel gambling associated with sports and horse/dog racing, commercial and Indian gaming expansion, marijuana taxes and natural resource extraction.

Decisions about what new revenues to collect, where new revenues will go and how they can be used are influenced by ideology, politics, normative academic prescriptions and professional best practices. In this paper, we analyze the financial outcomes expected from allocation choices for non-renewable resource severance revenues (severance revenues).

To do this, we analyze historical data from the 11 states with the highest severance revenues. According to a Brookings report: "In many cases, … states rely heavily on severance tax revenue—taxes on oil, gas, and other natural resources severed from the ground (though some states impose oil and gas conservation fees, impact fees, levies or assessments in addition to, or instead of, a traditional severance tax) (2016, p. 7). Revenues from severance taxes typically account for 2 percent or less of total tax collections for a majority of states, but severance taxes assume greater importance for the budgets of roughly 10 energy-producing states involved in fracking (Saha & Muro, 2016, pp. 15–16). In 2014, state severance tax revenue as a percentage of total state tax collections was as high as 72 percent in Alaska, 54 percent in North Dakota, and 39 percent in Wyoming. In Oklahoma, severance revenues constitute 7 percent of total state tax collections (2016, p. 8).

There are differences in the treatment of severance revenues. Nine of 11 states have chosen to place all or a portion of the revenues in a permanent fund which operates like an endowment fund.These funds are "permanent" because they are either constitutionally protected or

require super-majority legislative approval to withdraw money from the fund's principal. All permanent funds, except Alaska's, annually direct some or all of the severance revenues into the state's permanent fund. A specified portion of the investment income is then made available for transfers to: 1) the general revenue fund, 2) other governmental entities within the state, 3) infrastructure development funds, 4) economic development activities that support economic diversification, 5) property tax relief, and 6) in the case of Alaska, direct dividend payments to citizens. Instead of creating a permanent fund, the two most recent adopters, Oklahoma and Louisiana, have created severance revenue stabilization funds which operate similarly to a budget stabilization, or rainy day, fund (Hou, 2005).

We are intrigued by the choices in Oklahoma and Louisiana for a revenue stabilization rather than a permanent fund. The choices could reflect a financial strategy, especially if the expected results from a revenue stabilization fund would be more lucrative than those anticipated from a permanent fund. In this paper, we assess the efficacy of this financial strategy by modeling the features of Oklahoma's Energy Revenue Stabilization Fund enacted in 2016 using historical data from FY2000-FY2016. These hypothesized results are compared to the results that would be expected if state officials had chosen a permanent fund rather than a revenue stabilization fund. Comparing the results from different modeling approaches and considering the fiscal outcomes can inform other governments as they consider the treatment of new revenues. Our research also contributes to academic literature by integrating budgetary theories with knowledge about sovereign wealth, natural resource, and commodity funds.

LITERATURE REVIEW

Non-renewable resources, as the name implies, are things like oil, natural gas, propane, coal and minerals that are depleted during the extraction process. Like other commodities, such as plant and animal agricultural products, these resources can only be consumed a single time. Therefore, the decision to sever these resources from the

geographic area means that there will be no future revenues generated from these materials. Instead, the land becomes available for other production activities. Scholarly literature describes two frames for assessing the level of "good" stewardship of non-renewable resource revenues: short-term and long-term goals. We first present budgetary literature that frames the considerations for selection of a revenue stabilization fund, which has a shorter-term perspective. Next, we review literature that details conditions under which a permanent fund would be appropriate based on a longer-term perspective.

BUDGETARY CONSIDERATIONS

Revenue stabilization funds have similar names, goals and fiscal rules as those of budget stabilization (rainy day) funds. Typically, they feature a formula for calculating deposits based on recent revenues. The withdrawal rules are designed to smooth out unexpected short-term revenue drops by allowing a portion of the balance (based on a formula or percentage of the balance) to be transferred to the state's General Revenue Fund.

These types of funds can be beneficial for states that have difficulty forecasting revenues and tend to overestimate revenues during economic downturns (Rockefeller College & Pew Charitable Trust, 2011). In fact, one report concludes that revenue errors have been larger in the 10 previous years than before (The Pew Charitable Trust, n.d., p. 2). Wagner (2003) finds that while Revenue Stabilization Funds could be used to smooth fluctuations, monies in these funds are largely substitutable with general fund monies. From a financial perspective, these funds are attractive since "…the law makes it compulsory to save when the economy is strong and state revenue goes above the expenditure needs and to replenish the fund after use, so the state can stay better prepared for revenue shortfalls." (p. 35).

According to Hou, budget stabilization funds are a counter-cyclical "… fiscal device used by subnational governments to store extra revenues during economic booms for use in economic downturns to supplement inadequate resources for meeting outlay demands" (2005, p. 34). Hou concludes that stabilization funds are politically

attractive since: "Executive officials cannot easily use the money at their discretion because the procedure for use approval is fairly strict in most cases. Legislators cannot readily engage in pork barrel spending with this fund either because the money is available only for predetermined purposes." (p. 35).

The economic cycle is particularly salient in energy production states. "The boom-bust cycle of unconventional oil and gas development highlights the need for strategic management by state governments of fracking-related revenues, not only to minimize the less desirable aspects of the boom-bust cycle but also to enhance long-term prosperity."(Saha & Muro, 2016, p. 2).

The year over year severance revenue volatility between FY2005 and FY2014 for the 11 states we analyzed are dramatic. For positive volatility, New Mexico was highest with an increase of 1274% from one year to the next. Four states had positive volatilities that exceeded 100%, but the average increase for all states was 75% and the lowest positive increase was in Oklahoma at 41%. Three states had a negative volatility over 50%, with an average year over year decrease of 40% for all states. New Mexico also experienced the highest one year revenue drop (100%), while the lowest one year drop was 36% (experienced by seven states). These authors at the Brookings Institute conclude that "…states can convert volatile near-term revenues from unconventional oil and gas development into a longer-term and continuous source of investment funds for building sustainable and dynamic economies." (Saha & Muro, 2016, p. 2).

Another argument for creating revenue stabilization funds is that the energy industry, in general, is highly mobile - meaning that a choice to "re-locate" production has the potential to nearly instantly shift a current energy producing state from boom to bust overnight (Saha & Muro, 2016). Severance funds can smooth volatility that is sector, geography specific.

The differential impacts caused by sector-specific mobility are demonstrated in Figure 1 which displays trends in severance revenues for the FY2005-FY2014 period. To compare "competing" states, we note that Alaska and Texas both experienced a positive

revenue change in the first two columns. In later years, they seem to have a switching pattern where one had positive and the other negative, gains followed in the next year by a reverse in which state had positive and which state had negative gains.

Figure 1
Trends in Severance Revenues in 11 States
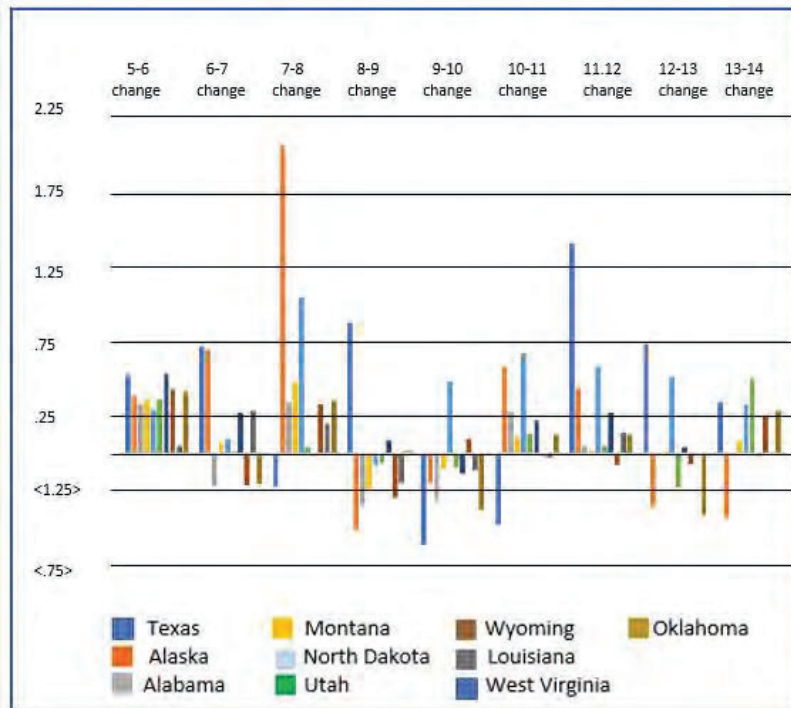
NON-RENEWABLE RESOURCE
REVENUE CONSIDERATIONS

Many U.S. states, as well as nations around the world, have created permanent funds for revenues from natural resource extraction and single use commodities. Unfortunately, natural resource extraction funds have been used by some governments, such as those of Libya, Nigeria, Algeria, and Turkmenistan, to avoid public scrutiny and pursue their own objectives, either by releasing little information on

their activities or using the funds as a parallel and less accountable revenue source (Bauer, Ed., Rietveld, & Toledano, 2014, 16-17).

Creation of a permanent fund helps to avoid the resource curse (or the paradox of plenty) where an abundance of natural resources results in public official corruption or in less economic growth due to underdevelopment of agricultural and manufacturing sectors combined with weak social and environmental regulation by more authoritarian regimes. These factors typically lead to lower living standards for the country as a whole (Revenue Watch Institute & Vale Columbia Center on Sustainable International Investment, 2014).

A common rationale for choosing a permanent fund is that the current generation is depleting an asset that can no longer be used by future generations. Alabama projects that the oil and gas resources in the state will be depleted by 2032. Recognizing the potential negative futurity of today's decisions, decision makers may choose to bank a portion of the revenues derived from these assets for long-term use. A permanent fund protects the corpus (fund balance) by employing long-term investment strategies and, in some cases, investing in economic development activities that foster economic diversification to prepare for when the industry sector no longer exists at some point in the future. New Mexico has created a State Investment Council's tasked with preserving and growing the state's two permanent funds, so future generations can enjoy the same, if not greater, benefits than are provided today.

The concern with inter-generational equity in revenue and asset management decisions is not new. Tobin concluded that elected officials are the "guardians of the future against the claims of the present." An endowment should be permanently sustainable (1974, p. 427). He recommends that non-renewable resource assets should be secured so that the endowment can provide a replacement for future generations of the assets consumed by the current generation.

The danger of overreliance on volatile and fickle severance revenues is amplified when one takes into consideration the economic diversity of the 11 largest states in the severance of non-renewable

resources. Figure 2 uses the Hachman Index as a proxy measure of economic diversity. A fully diverse state economy would have a score of 1.0. The 10 states with the lowest economic diversity include eight of the states with high severance revenues. The danger of low economic diversity is substantiated by a large body of literature that documents how economies based on natural resources grow more slowly relative to diversified economies (part of the resource curse) (Saha & Muro, 2016, p. 11).

Figure 2
Economic Diversity Rankings of the States

Shown above are the 10 states with the lowest economic diversity. The states depicted by red bars are also those that are among the states with high severance revenues.
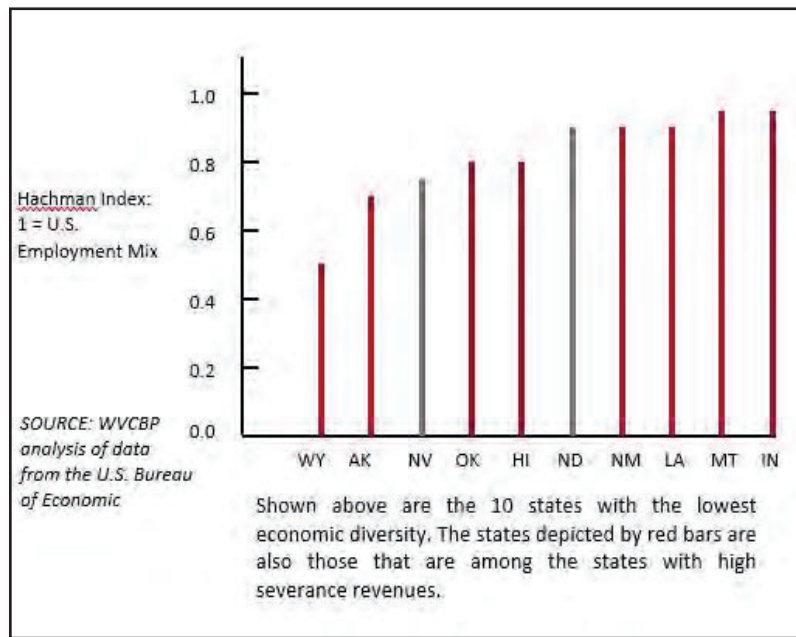
Knowing that citizens employed in these sectors will eventually be unemployed, the state can proactively incentivize new industry sectors that can provide new employment opportunities for these displaced workers (Boettner et al., 2012). Saha & Muro concur in their claim that states should use fund earnings to "invest in an integrated pre-K through 20 educational pipeline," with a focus on

STEM (Science, Technology, Engineering, and Math) education (2016, 23).

Governments around the world already set aside revenues in permanent, or sovereign wealth, funds and use them as sources of capital that can provide resources for longer-term economic development activities that enhance the economic diversity of the geographic jurisdiction. "A permanent fund converts nonrenewable resource wealth into a renewable source of wealth for future generations" (Boettner, Kriesky, McIlmoil, & Paulhus, 2012, p. 11).

Academic literature offers a variety of theories and arguments to guide discussion about the appropriate fund for severance revenues. From the budget and finance theories, the choice of fund should consider the accuracy of revenue forecasting, especially where the revenues are countercyclical, volatile, and/or the industry is rapidly mobile. Scholars who study permanent and sovereign wealth funds describe the potential to mitigate the resource curse, to foster intergenerational equity and to proactively promote economic diversification.

In Oklahoma, there is an additional factor to consider when analyzing the choice of a permanent or a revenue stabilization fund for severance revenues: earthquakes. Much discussion [especially related to fracking] has revolved around environmental concerns and the dangers of air pollution, groundwater contamination, and large withdrawals of surface water. This is a concern in Oklahoma due to the logarithmic increase in earthquakes following increased oil and gas production activity (Whitaker, 2016). One tangible impact of earthquakes has been the increasing frequency with which the Oklahoma Corporation Commission "…has taken numerous actions [including shutdowns, volume reduction and prevention of start-up] related to disposal wells in specific zones around the state based on seismic events, under its statutory authority to oversee oil and gas operations in the state" (https://earthquakes.ok.gov/what-we-are-doing/oklahoma-corporation-commission/). The interaction between budget and regulatory policy within the same geographic setting is yet another factor that must be understood when structuring a fund for severance revenues. To understand the differential outcomes that

would occur when selecting a revenue stabilization versus a permanent fund, we develop and test three different models using historical Oklahoma data. Our research process is described next.

RESEARCH DESIGN

The data used in this analysis came from four secondary sources. First, we gathered financial data from each state's budget, finance, treasurer, comptroller and/or equalization boards' websites. In addition, several states have separate sites for the permanent fund, often hosted by the state's Investment Council (or Investment Advisory Board). Data was also gathered about the laws, rules, policies, reports and public announcements that established the special revenue fund or described the fund's governance structure and fiscal rules. The third data sources were professional and research organizations' publications on special revenue funds and related policies that exist in a specific state/nation, or reports from a meta-analysis of special revenue funds in many states/nations. The last secondary data source was popular press articles reflecting public perceptions of the actions of public officials related to special revenue funds.

Accessing data from multiple sources allowed us to triangulate the accuracy of the data with the public official actions. Since the data are secondary data, there are limited threats to internal validity. However, the one threat is that there may be additional data sources that the authors did not discover that could offer additional perspective on the financial transactions in a special revenue fund. In addition, not all states had FY2015 data available, so the authors uniformly recorded data for the ten-year period between FY2005-FY2014.

There are some uncontrollable threats to internal validity since there may have been other political, economic or social events in a state during the historical sampling frame that could have influenced fund performance. For example, the FY2005 New Mexico CAFR auditor's statement reported material weaknesses. Further investigation uncovered news articles reporting that there had been malfeasance by employees in the Treasurer's office who later left their position. New Mexico has a dedicated agency, the State

Investment Council, that manages all the Permanent Funds in the state. So, we concluded that it is unlikely that the CAFR contained errors that would significantly influence the longitudinal accuracy of the New Mexico data. Further, no New Mexico financial data contributed to the Oklahoma models.

COMPARING THREE DIFFERENT
SEVERANCE FUND MODELS

The first model estimates Oklahoma's severance revenue deposits and withdrawals from FY2005 to FY2016 using the rules of sources and uses established in the Revenue Stabilization Fund law and Investment Policy enacted by Oklahoma Legislature in 2016. Here are the key provisions:

Table 1

Key Provisions of Oklahoma's Revenue Stabilization Fund Law

The initial deposit would occur in the fiscal year following the fiscal year when General Revenue Fund deposits equal or exceed $5,730,000,000.
No monies would be deposited to the credit of the Revenue Stabilization Fund for any month remaining in a fiscal year after the month in which a revenue failure is declared by the State.
Revenues to be deposited are based on five-year moving averages of 100% of gross production tax on oil and natural gas and 75% of corporate income tax plus any direct appropriations by the Legislature.
Withdrawals are allowed in the event of a revenue failure as follows: The Director of the Office of Management and Enterprise Services and the Legislature may each withdraw up to ¼ of the balance available at the beginning of the fiscal year up to the amount of the revenue failure.   If the State Board of Equalization certifies revenues for the upcoming fiscal year as less than the amount of revenue certified by

the State Board of Equalization to be collected in the General Revenue Fund for the current fiscal year at the annual February meeting, then the Legislature may withdraw up to ½ of the balance available at the beginning of the fiscal year up to the amount of the revenue failure.

Oklahoma has experienced seven revenue failures since 2000, in budget years 2002, 2003, 2009 (later restored), 2010, 2015, 2016 and 2017. The State's Constitution tries to cushion against mid-year budget cuts by allowing the Legislature to appropriate no more than 95 percent of the expected revenue. In years when collections come in below the 5 percent cushion, the Office of Management and Enterprise Services (OMES) is required to announce a revenue failure and make across-the-board cuts to agency allocations from the General Revenue Fund (Blatt, 2016). The State Board of Equalization can also announce a revenue failure at its February meeting as noted in item 4b above. These rules and fiscal data were used to calculate allowable withdrawals. For the second model (PF5%), we follow Landon and Smith's (2010) recommendations for "simple and transparent" permanent fund fiscal rules. They make their deposit and withdrawal prescriptions using the Alberta, Canada requirements for deposits of 75% of yearly royalty revenues and withdrawals of 5% of fund's total assets every year.

For the third model (PF42.5%), we adjust the second model so that the final fund balance in the Permanent Fund will be equal to the ending fund balance estimated in Model 1 for the Revenue Stabilization Fund. All other assumptions are the same as Permanent Fund 5%, as described above.

For all three models, data from the State of Oklahoma CAFR, beginning in FY2000, were used to calculate the 5-year moving average of Gross Production Tax (GPT) revenues. These amounts were used to determine the required Revenue Stabilization Fund (RSF) deposits in the 12-year period from FY2005-FY2016. The models included annual investment earnings which used the blended return on the Treasurer's investment portfolio for each year (over time this ranged from 1.85% to 4.84% with an average of 3.16%).

Investment fees were calculated for each year and deducted from the fund balance before calculation of any allowable withdrawals. According to the Oklahoma Treasurer's Annual Report, investment fees as a percentage of revenues ranged from 0.93% to 8.24% during the years studied with an average of 2.87%. To keep the models simple, we did not consider the impact of inflation and therefore used current (nominal) dollar values. The treatment was the same in all 3 models, so there were no threats to validity.

DATA ANALYSIS AND FINDINGS

For the first model of the Revenue Stabilization Fund, six calculations were made for each fiscal year: 1) the deposit to the fund was 100% of the actual amount of Oklahoma's oil and natural gas revenues (GPT), and 75% of the corporate income tax (CIT) revenues, above the 5-year rolling average of each, 2) the amount of a withdrawal allowed for any revenue failure was calculated as ½ of the actual amount of the revenue failure, 3) the earnings in the current fiscal year were calculated on the prior fiscal year fund balance and using the previous year's blended investment rate, 4) the investment fees were the actual percentage fee rate paid by the Treasurer in the prior fiscal year, 5) the year-end balance is calculated as the PY Balance + Deposits + Investment Earnings – Investment Fees, and 6) the General Revenue Fund Transfer in the current fiscal year was 25% of the actual amount of GPT and CIT revenues above a 5-year rolling average.

Table 2 displays the results for all three models. In the second column, we present the Revenue Stabilization Fund (RSF) results. As intended by the Legislature's fund choice, the deposits to the fund vary from year to year, with the bulk of the gross production and corporate income taxes going to the General Revenue Fund and a smaller amount to the RSF (cumulative deposits estimated at $9,294.4M). Revenue failures in FY2010 and FY2016 led to allowable withdrawals from the RSF to deposit into the General Revenue Fund (GRF) in the amount $556.5M. Including a net

investment loss (based on actual experience) of $107.3M, the ending Revenue Stabilization Fund balance is $1,687.8M.

Table 2
**Financial Outcomes Estimates for Three
Severance Revenue Funds Models**

	RSF	Perm. Fund (5%)	Perm. Fund (42.5%)
GRF GPT + CIT Allocations	$9,294,352,303	$6,057,093,069	$12,116,283,975
GPT + CIT Deposits	$2,351,590,845	$9,151,802,992	$9,151,802,992
Revenue Failure	$(556,460,842)		
Withdrawals			
Annual GRF Transfers		$(3,006,492,072)	$(9,065,682,978)
Net Investment Income	$(107,327,997)	$4,509,738,108	$1,599,826,408
Ending Fund Balance	$1,687,802,006	$10,655,049,028	$1,685,946,421
Total GRF Deposits	$9,850,813,144	$9,063,585,141	$21,181,966,954
Diff in GRF [Perm Fund v. RSF]		$(230,767,162)	$11,331,153,809

The model calculations for each of the three models are presented in Appendix A.

The smoothing effect intended by the fiscal rule for calculation of a five-year moving average to establish required deposits can be seen starting in FY2010, after Oklahoma's Gross Production Tax (GPT) revenues dropped from $1,136.3M to $704.9M (-38%) between FY2009 and FY2010. Because of this, beginning in FY2011, gross production taxes were less than the 5-year moving average. This pattern continued to FY2016 and, therefore, the RSF does not

receive any further deposits in the years studied based on the difference between the 5-year moving average and actual GPT revenues. Another impact of the drop in GPT is that (CIT) deposits outpaced those of GPT deposits in the years studied ($1,421.1M versus $930.5M).

For the second model, we estimated a permanent fund (PF5%) using the recommendations of Landon and Smith (2010). Four calculations were made for each fiscal year: 1) the deposit to the PF5% was 75% of the actual amount of gross production taxes and 75% of corporate income tax revenues in Oklahoma, 2) an average net permanent fund investment earnings rate of 7.5% based on the experience of Wyoming -since 1975, the Wyoming portfolio and investment management rules of this state reflect a longer-term investment strategy, 3) the year-end balance was calculated as the PY Balance + Deposits + Net Investment Earnings- General Revenue Fund Transfers), and 4) General Revenue Fund Transfers in the current fiscal year was calculated as 25% of the prior year's revenues from Gross Production Tax (GPT) 25% of the prior year's revenues from Corporate Income Tax (CIT) + 5% of the prior year's fund balance.

In the PF5% model, the Permanent Fund grows rapidly and accumulates GPT and CIT deposits of $9,151.8M and Net Investment Income $4,509.7M, displaying incremental increase patterns that would be predicted for this type of fund. The General Revenue Fund contributions also steadily increase over time, based on a higher level of investment earnings combined with withdrawals due to the FY2010 or FY2015 revenue failures. The cumulative General Revenue Fund contribution is $9,063.6M ($230.8M lower than RSF model). The biggest benefit of this normative permanent fund's rules is the ending fund balance of $10,655.0M. The GPT drop in FY2010 has a modest impact on PF5%.

For the third model, we created a permanent fund (PF42.5%) using the same calculations of PF5%. except for the calculation of the General Revenue Fund Transfer. The GPT and CIT deposits to the permanent fund in this model are the same at $9,151.8M.

To make the ending fund balance roughly equivalent to the ending fund balance for the RSF model ($1,685.9M) the annual General Revenue transfer was set to 42.5% of the prior year's fund balance each year (versus a 5% transfer in the normative PF5% model). With this change, the total amount transferred to the General Revenue Fund was $21,182.0M an amount that is $11,331.2M higher than under the enacted RSF rules. The large annual transfers also caused the net investment income to drop to $1,599.9M, about $3,000.0M less than the Permanent Fund5%, but more than $1.7B higher than the RSF model! The GPT drop in FY2010 has a modest impact on the Permanent Fund deposits and General Revenue Fund transfers in the PF42.5%.

To compare the short-term and long-term effects of decisions establishing fiscal rules and the impact across all fiscal years analyzed, we compare differences between the 12-year total General Revenue Fund contributions as an indicator of short-term decision making effects and the ending severance fund balance as an indicator of long-term decision making effects.

The General Revenue Fund contributions for each year are displayed in Figure 3 (on the next page). The size of the stack in each column is the combined estimated amount to transfer to the General Revenue Fund between FY2005 and FY2016 (a total of $9,850.8M to from the RSF, $9,063.6M from Permanent Fund 5 and $21,182.0M from Permanent Fund 42.5%). The dark color in the middle of the stack denotes the data for FY2010 to call attention to the fund balances prior to the GPT drop of 38%. Based on the fund rules, the remainder of the contributions in the Revenue Stabilization Fund would be obtained solely from the Corporate Income Tax because the GPT annual revenues did not exceed the 5-year moving average any time after FY2010.

These fund estimates suggest that the best approach for smoothing revenues in the short term, to avoid the necessity of tax/revenue increases or drastic expenditure cuts, would be either the Revenue Stabilization Fund or Permanent Fund 42.5% since the amounts are roughly the same by FY2010. However, after FY2010, Permanent Fund42.5% provides far more revenue between FY2011 and FY2016, since the fund still receives deposits from GPT and CIT

revenues, while the RSF only gets revenues from the CIT after FY2010.

Figure 3
Estimated Transfers to the General Revenue Fund from Three Severance Funds Models
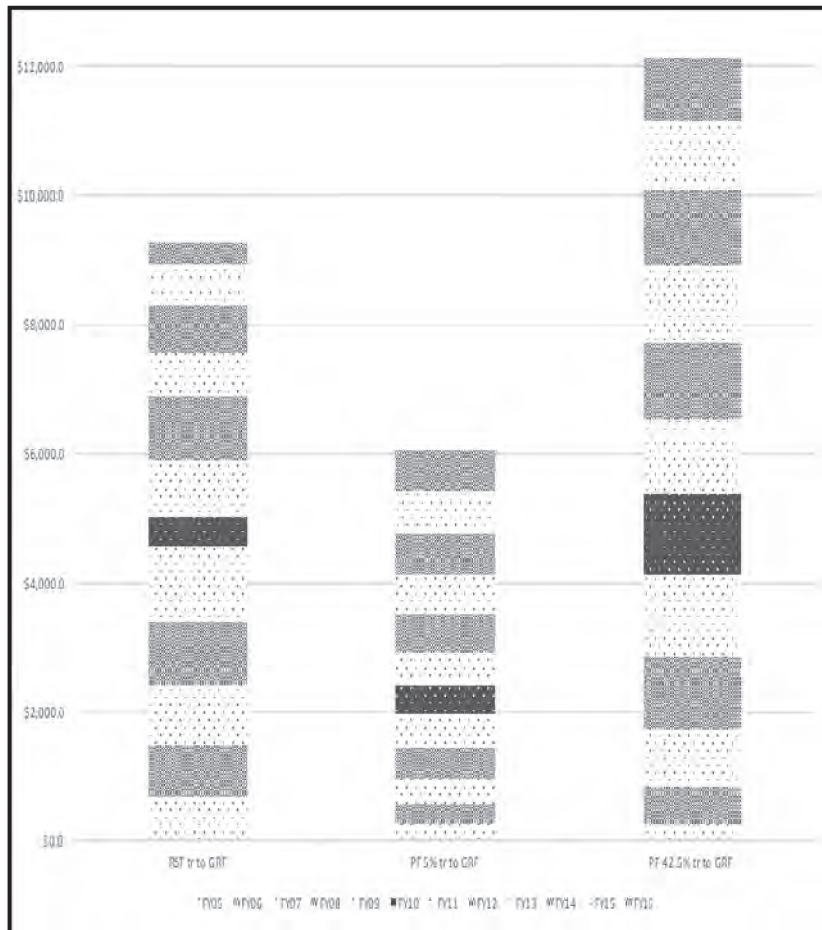
If the goal of the fund was to instead focus on the long-term preservation of funds for future use, then the choice between a Revenue Stabilization Fund and a Permanent Fund would consider not only the annual transfers to the GRF, but also the fund's ending

balance and how it grows over time. Comparing the ending balance for the three models to assess the long-term effects, the Revenue Stabilization fund and the and Permanent Fund42.5% we estimate balances of $1,687.8M and $1,685.9M, respectively by the end of FY2016. The Permanent Fund5% estimated balance is $10,655.0M. These data suggest that the best approach for leaving a legacy for future generations over the long-term would be Permanent Fund5%. It is important to remember, however, that Permanent Fund42.5% provides more cumulative deposits (by$11,331.2M) to the General Revenue Fund than does the Revenue Stabilization Fund) during the 12-year time frame.

Figure 4
Estimated Fund Balances from Three Severance Models
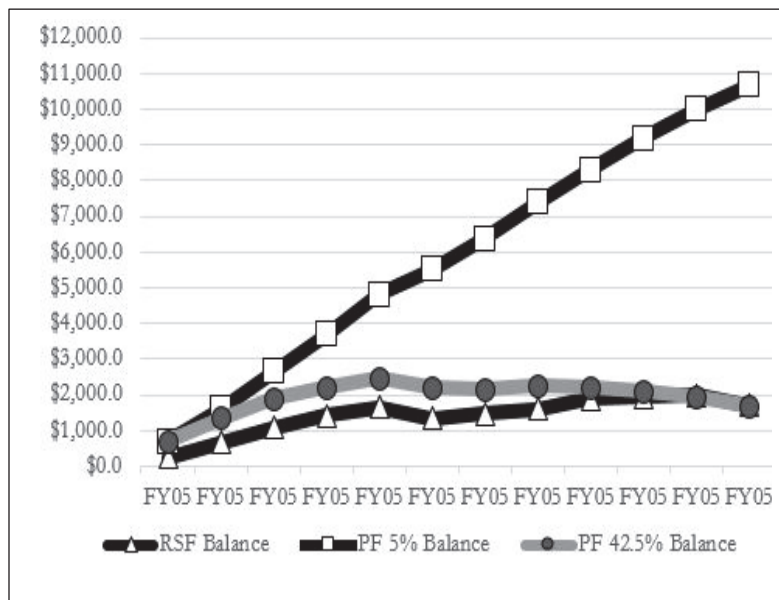
A different way to analyze the short-term and long-term effects of the fiscal rules for each of the three models is to calculate an Intergenerational Equity Index, like what is done by New Mexico. This index uses the total Primary Government Revenue in each fiscal

year as the starting point for public officials to allocate revenues in the next fiscal year for either short-term or long-term purposes. A short-term purpose would be high allocations to the General Revenue Fund. A long-term purpose would be high allocations to a Revenue Stabilization or Permanent Fund.

The percentage amounts allocated in each fiscal year in our three models were calculated. The results are displayed in Table 2. The fund with the highest emphasis on short-term fund revenue access is the Revenue Stabilization Fund. The estimated yearly amounts allocated for short-term use range from 94-100% with short-term average of 98%. Permanent Fund5% has the highest allocation for long-term use, with estimated deposits representing 6-17% of revenues and an average of 10% between FY2005-FY2016. Permanent Fund42.5%, is structured to also have a short-term focus; however, the estimates predict a higher allocation range for long-term purposes (1-13%, average 3%) than does the Revenue Stabilization Fund. The difference is attributed to the continuing, though reduced, deposits from the GPT after FY2010, plus the enhanced investment yield of a longer term, corpus protection strategy.

Table 3
Intergenerational Equity Indexes of Three Fund Models

Fund Type	Minimum	Maximum	12-Year Average
Revenue Stabilization			
Short-term	94%	100%	98%
Long-term	0%	7%	3%
Permanent$_{5\%}$			
Short-term	85%	94%	91%
Long-term	6%	17%	10%
Permanent$_{42.5\%}$			
Short-term	88%	99%	98%
Long-term	1%	13%	3%

These data suggest that revenue allocation decisions in all three models are heavily focused on the short-term. However, the scholarly literature does not offer a definitive benchmark. For comparison, the New Mexico Severance Tax Permanent Fund recently reported the allocation of 25.3% of annual severance revenues for future generations (New Mexico State Investment Council, n.d., p. 3). The State's Land Grant Permanent Fund has a nearly even balance between current and future generations with an Intergenerational Equity Index value of 50.8%.

Even though similar intergenerational equity allocations could not be achieved in any of our models, the models do highlight the challenge of pursuing intergenerational equity as a long-term goal for a new revenue fund. As our models demonstrate, the rules that govern deposit and withdrawal calculations can lead to differential effects that are practically significant: changing the rules slightly in Permanent Fund5% could yield a fund balance that is 5X larger than the RSF as enacted, which would enhance the intergenerational equity of budgetary allocation decisions. On the other hand, Permanent Fund42.5%, offers more than \$10B in GRF contributions than does the model using current RSF rules, suggesting deleterious long-term impacts of a moving average that should be balanced against garnering revenues from a volatile and mobile sector. What our analysis cannot capture; however, are the political, social, and economic implications for the State of Oklahoma when revenue that would normally be contributed to the general fund would be diverted from the next year's revenue estimate. While this would be the case for the each of the three models, it seems that this is a financial trade off that was already accepted by the State's legislators as evidenced by the enactment of the Revenue Stabilization Fund.

CONCLUSION AND FUTURE RESEARCH

Academic literature suggests two different fund types for public officials to consider when creating special revenue funds for severance taxes. A revenue stabilization fund is a short-term revenue management strategy, since the fund is designed to smooth revenues available for appropriation from fiscal year to fiscal year and has

provisions for withdrawals based on the economic cycle. A permanent fund, on the other hand, is a long-term revenue management strategy since it creates an endowment for future generations due to the emphasis on preserving and growing the corpus of the revenues through a different investment strategy.

Of the 11 states that receive the highest severance revenues, the two most recent adopters of special revenue funds have created revenue stabilization funds, while the other nine maintain permanent funds for severance revenues. Examining longitudinal trends across the 11 states, we find evidence of high revenue volatility and mobility in among between states. In addition, these states have among the lowest level of economic diversification in the nation, suggesting the potential for a resource curse. In Oklahoma, there is additional revenue uncertainty related to the regulation of earthquakes and resulting reductions in production after actions taken by the Oklahoma Corporation Commission. For this reason, Oklahoma provided a good contextual case for estimating three models of special revenue funds to compare the short and long-term effects of fiscal rules.

Of the three models we estimated, the Revenue Stabilization Fund (RSF) model that was recently enacted in Oklahoma would have provided almost $10B to the General Revenue Fund (GRF) for short-term budget allocation between FY2005-FY2016. The model developed on normative prescriptions for a Permanent Fund (PF5%) would be expected to provide the largest ending fund balance ($10B), while contributing nearly the same amount to the GRF as the RSF ($9B). The second Permanent Fund model (PF42.5%) was manipulated to have the same ending fund balance as the Revenue Stabilization Fund. To accomplish this, 42.5% of the prior year's fund balance would be transferred to the GRF. The 12-year performance for this fund would provide over $21B to the GRF; however, the ending balance in both PF42.5% and the RSF would have been threateningly low if the recessionary cycle were to continue past FY2016.

Despite nuances in these findings across the three different models, a common finding is that intergenerational equity is weak in all models

in all years. The highest performing fund, in terms of attempting to balance short-term revenue smoothing objectives with long-term asset transfer objectives, was Permanent Fund5% with a special revenue allocation average over 12 years of 10% for future generations. The other two fund models provide a short-term focus on GRF transfers for an average of 98% of all funds available for allocation in any fiscal year.

These findings underscore the importance of considering investment objectives and then creating fiscal rules to accomplish the desired outcomes. The main contribution of our analysis is demonstrating the impact of fiscal rules for both the long and short-term horizons since there are quite differential effects. Minor changes to the fiscal rules of a special revenue fund can have significant short-term effects (measured by the GRF transfers) as was seen in the comparison between the Revenue Specialization Fund and the Permanent Fund42.5%. Distinct long-term effects (measured by the ending fund balance) are demonstrated in the comparison between the Revenue Stabilization Fund and Permanent Fund5%.

There are also cautionary tales from our empirical analysis that are relevant to practicing professionals. States have levers for smoothing revenue streams; however, the structure of special revenue funds should balance short and long-term fiscal discipline. This is critical since low energy commodity prices are predicted to continue and production is falling as oil and gas development becomes a less viable economic activity in several energy states. While short-term economic effects are already being felt in states like Alaska, Louisiana and Oklahoma, the long-term prospects for the industry do not suggest a short-bust cycle (Brown, 2015).

There are bodies of literature examining the preservation of capital related to revenues derived from public land endowments and agricultural commodities, but scant analysis of the long-term versus short-term revenue allocation tradeoffs. In addition, the tobacco settlements received by the states have often been structured with an eye to ensuring long-term benefits in favor of short-term withdrawals. Future research could extend this analysis to determine the efficacy of the various state by state strategies for tobacco settlements as well as other earmarked revenues from new revenue

sources such as lotteries, pari-mutuel gambling, casino gaming revenues and marijuana taxes (recently authorized in 28 U.S. states). What this research demonstrates is that the fiscal outcomes from political choices can have wide reaching and long-lasting effects.

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