

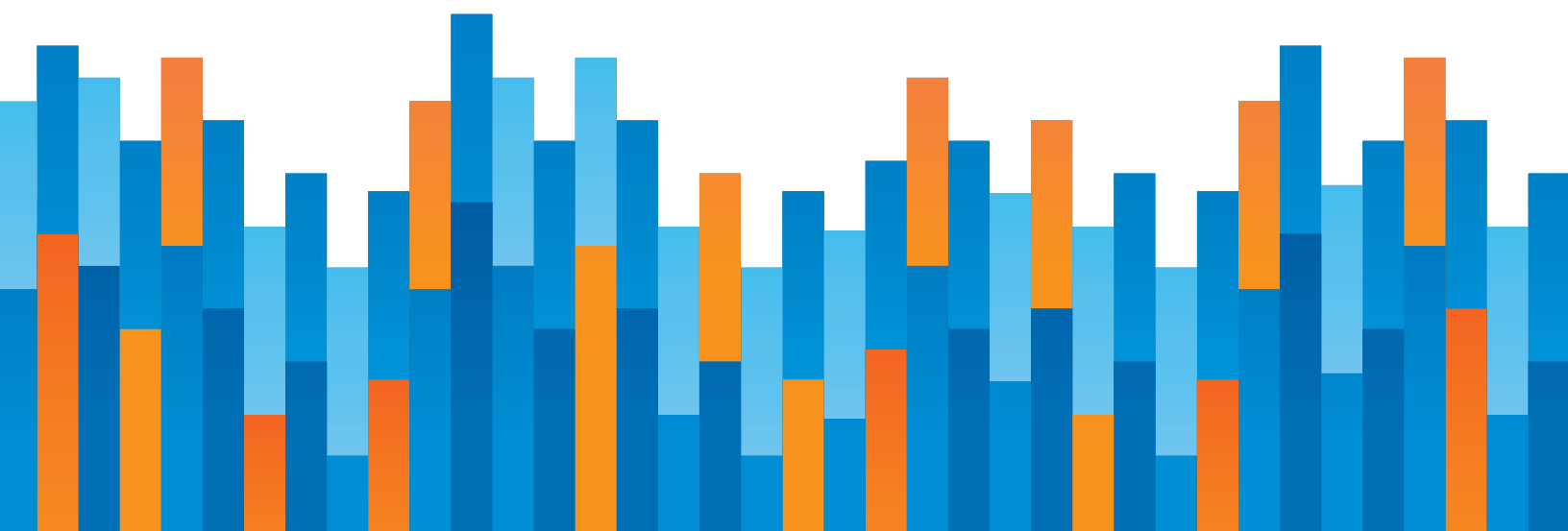


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DETERMINANTS OF PUBLIC PENSION REFORM

by Michael Bednarczuk, Ph.D. and Jen Sidorova

April 2021





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EXECUTIVE SUMMARY

Since 2007, state pension plans across the country have experienced approximately 200 reforms to various aspects of retirement benefit design, funding policy, amortization policy, and more. While these changes are all made to increase the solvency of the plans, little is known about why states choose some reforms over others or why they choose to reform at all. The financial stakes involved in public pensions are enormous; these plans were facing an unfunded liability of \$1.2 trillion before COVID-19, which is expected to increase further with the latest fiscal year reporting.

This brief analyzes several different factors that impact the likelihood of state policymakers making changes to a pension plan. The variables that had the largest and the most consistent effects were passing a prior law or having several states pass a law in the same year; both variables increased the likelihood of passing a reform. Fiscal and workforce variables also frequently mattered, but they had smaller effects and the specific variables that were significant varied from model to model. Often, higher funded ratios made a state less likely to pass a reform, while higher pension contribution ratios made a state more likely to pass a reform. Larger states tended to pass reforms. Those with larger public sectors were more likely to pass reforms, but those with more union members were less likely.

Given these results, pension funding, policy diffusion, and workforce variables should be analyzed to forecast future potential reforms, with reforms being much more likely in states with a recent history of reform or during a time when other states are also reforming their pension plans. The political factors within a state should not be expected to impact change. Finally, these variables should be considered in the context of time; those that are more likely to change quickly, such as pension funding variables, may become more important than those that are less likely to change quickly, such as union membership.

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PART 1

INTRODUCTION

State pension plans face several challenges. First, not only has pension debt has been growing over time, but it is rapidly increasing. At the beginning of 2020, unfunded state liabilities were estimated to be around \$1.2 trillion.¹ This unfunded liability has more than doubled in less than 10 years.² Meanwhile, the combined funding ratio of all state plans has dropped by 24% since 2001.³ Since then, only Maine, Oklahoma, and West Virginia have reduced their pension funding gap.⁴ Furthermore, Reason Foundation has noted that more than \$200 billion in additional debt was added in 2020.⁵

¹ Steven Gassenberger, “Answering Frequently Asked Questions About COVID-19 and Public Pensions,” Reason Foundation, 2020. <https://reason.org/faq/answering-frequently-asked-questions-about-covid-19-and-public-pensions/> (17 December 2020).

² Kristen Kelley, Anthony Randazzo, and Truong Bui, “The Public Employee Pension Crisis Explained,” Reason Foundation, 2014. <https://reason.org/commentary/the-public-employee-pension-crisis/> (17 December 2020).

³ Anil Niraula, “The Funded Status of State-Managed Public Pension Plans,” Reason Foundation, 2020. <https://reason.org/data-visualization/the-funded-status-of-state-managed-public-pension-plans/> (24 February 2021).

⁴ “U.S. Public Pension Plans Funded Status,” Reason Foundation, 2020. <https://reason.shinyapps.io/us-public-pension-plans-funded-status/> (17 December 2020).

⁵ Anil Niraula, Swaroop Bhagavatula, Marc Joffe, and Alix Ollivier, “Pension Debt Grows as Public Pension Systems Post Low Investment Returns for 2020,” Reason Foundation, 2021. <https://reason.org/commentary/pension-debt-grows-as-public-pension-systems-post-low-investment-returns-for-2020/> (24 February 2021).



At the beginning of 2020, unfunded state liabilities were estimated to be around \$1.2 trillion. This unfunded liability has more than doubled in less than 10 years. Meanwhile, the combined funding ratio of all state plans has dropped by 24% since 2001.



Second, the primary driver of increases in pension debt shows little sign of abating. Reason Foundation finds the leading cause of pension debt to be investment underperformance of pension assets.⁶ Various factors have brought on this lower-yield investment environment, such as “subdued economic growth, subpar inflation, and increased market volatility.”⁷ Further complicating this has been reluctance from states to sufficiently adjust their assumed rates of return to this new fiscal environment, which is likely to generate more unexpected costs.⁸ Reason Foundation finds that the 15-year average return for the majority of state pension plans is below the assumed rate of return for 2020.⁹

Third, the first-order and second-order consequences of vast pension debt show that no part of government is immune to their effects. If the debt is not made up via increased investment returns, then it may be recouped through higher contributions or higher taxes. The obligation to fund pension plans may make it more challenging for states to find money for additional government services.

While almost every plan does need reform, it is crucial to note the wide range of unique challenges that these plans face. In other words, not all reforms are equal in their effectiveness. One plan may need significant increases to contributions, while another

⁶ Anil Niraula and Truong Bui, “The ‘New Normal’ in Public Pension Investment Returns,” Reason Foundation, 2020. <https://reason.org/policy-brief/the-new-normal-in-public-pension-investment-returns/> (7 December 2020).

⁷ Ibid.

⁸ Ibid.

⁹ “State Pension Investment Returns,” Reason Foundation, 2020. https://reason.shinyapps.io/State_Pension_Investment_Returns/ (17 December 2020).

needs a COLA reduction. It is important for policymakers to seek out the types of reforms that best address their situation.

1.1

TYPES OF PENSION PLAN REFORMS

Pension reform was not a topic of much discussion in statehouses around the country until the last 20 years, which coincides with a nation-wide decline in the funding ratio of these plans. For example, in 1999, the average funding ratio for state-wide pension plans was 103% of accrued liabilities.¹⁰ Given their funding, people were likely content with the structure of their plans and saw little need to worry about them.

However, pension reform soon became more salient. Following the cumulative effects of the burst of the dot-com bubble and the Great Recession, average funding ratios for state pension plans dropped over 20 percentage points in 10 years.¹¹ Facing these funding shortfalls, pension reforms then became more common across the country. For example, while only two states reformed their plans in 2007, this number increased to seven in 2009, 17 in 2010, and 27 in 2011.

This analysis uses pension funding data from Reason Foundation's Pension Integrity Project database and follows NASRA's grouping of pension plan reforms into several broad categories.¹²

- **Increased Employee Contribution:** These laws make public employees contribute more out of their paychecks to their pension plans.
- **Plan Changes:** These laws significantly shift pension plans into alternative plan designs, such as moving from a defined benefit plan to a defined contribution plan.
- **Increased Age/Service Requirements:** These laws either increase the duration of employment to qualify for a full pension or increase the retirement age to qualify for a full pension.

¹⁰ Ron Snell, "State Pension Reform 2009-2011," National Conference of State Legislatures, 2012. <https://www.ncsl.org/research/fiscal-policy/state-pension-reform-2009-to-2011.aspx> (17 December 2020).

¹¹ Ibid.

¹² Keith Brainard and Alex Brown, "Spotlight on Significant Reforms to State Retirement Systems," National Association of State Retirement Administrators, 2018. <https://www.nasra.org/files/Spotlight/Significant%20Reforms.pdf> (17 December 2020).

- **Reduced Pension:** Some states have decreased the size of an individual pension benefit through laws lengthening the calculation period of the final average salary, reductions to the retirement multiplier, or the elimination of “spiking” (artificially increasing a worker’s salary or pensionable overtime just before retirement to increase pension benefits), for example.
- **Reduced COLA (cost of living adjustment):** A COLA is a periodic increase in a benefit to account for inflation. Reducing the COLA slows the growth of liabilities over time.

This analysis examines reforms from 2007 to 2019, which covers the time when changes in pension plans were becoming more common. Reforms varied in their popularity. The most common changes either reduced the pension amount, increased the employee contribution, or increased the age or service requirement, with around 50 such changes for each of those categories. The least common changed plan design, with only 12 such changes.

Several states often changed their plan designs, while some did not change their plans at all. For example, the states of North Dakota, Virginia, and Wyoming changed their pension plans in four of the years under examination. These changes increased employee contribution and age and service requirements in North Dakota; increased employee contributions, reduced pensions, increased age and service requirements, changed the plan design, and reduced the COLA in Virginia; and increased employee contributions, reduced pensions, increased age and service requirements, and reduced the COLA in Wyoming. On the other hand, Alaska and Idaho did not alter their plans at all.¹³

Some states adopted reforms several times. For example, over a quarter of states that reduced their pensions did so more than once, with two states reducing their pensions more than twice. In all, there were almost 200 unique changes to pension plans during the time period under examination.

Here is a visual overview of changes by state. Each map shows which states made the corresponding change to their plans during the timeframe under examination. Those states that are in dark gray made changes; those in light gray did not.

¹³ Alaska moved to a defined contribution plan in 2006.

FIGURE 1: STATES THAT REDUCED PENSIONS, 2007–2019

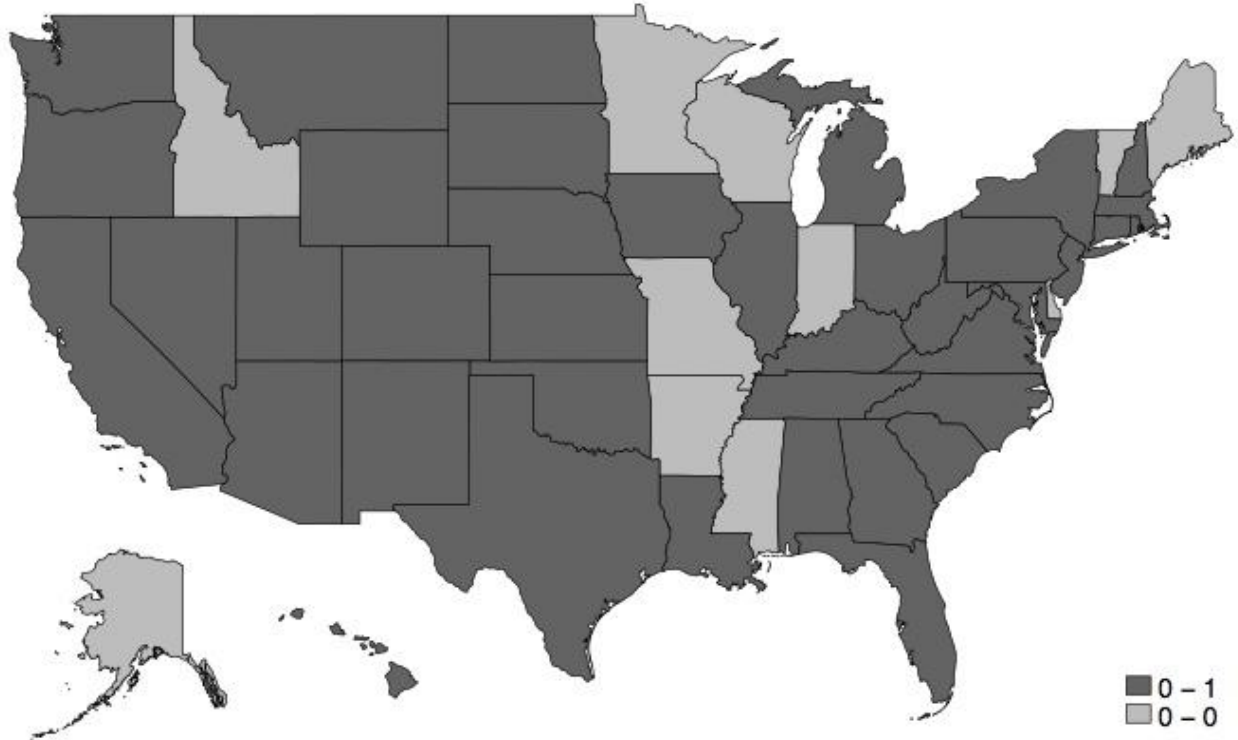


FIGURE 2: STATES THAT INCREASED AGE/SERVICE REQUIREMENTS, 2007–2019

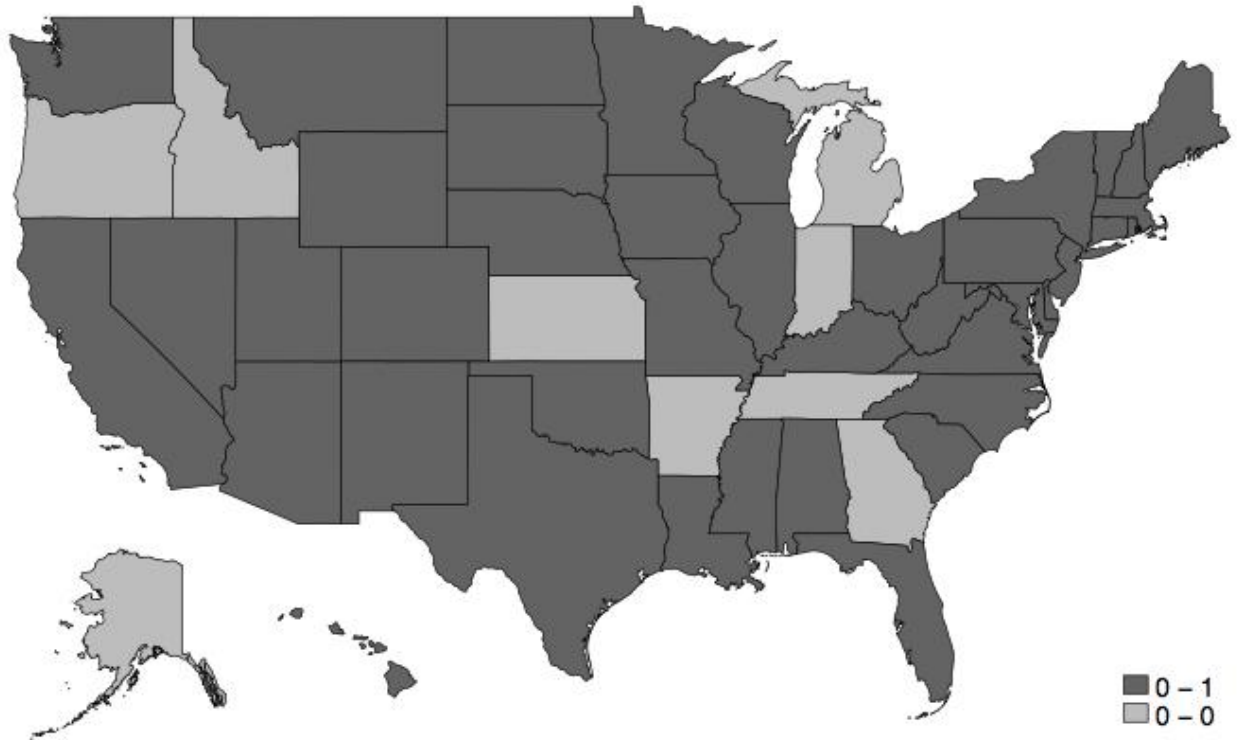


FIGURE 3: STATES THAT REDUCED COLA, 2007 – 2019

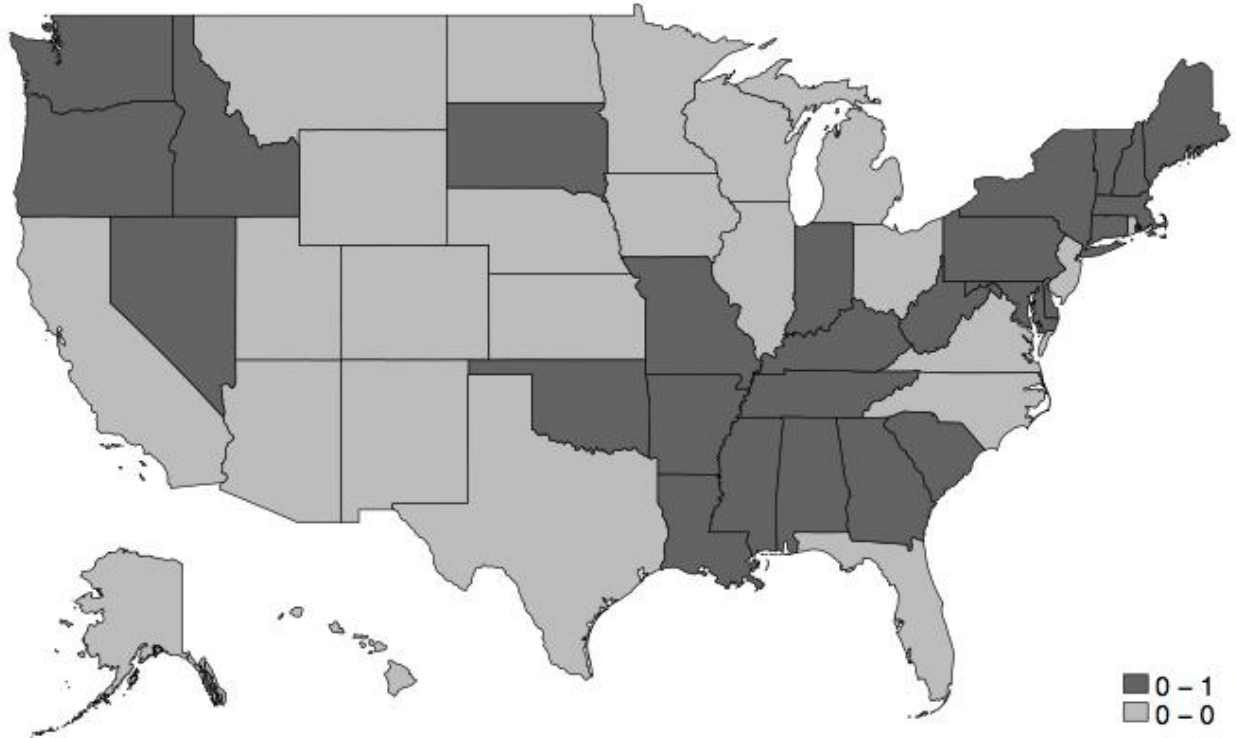


FIGURE 4: STATES THAT INCREASED CONTRIBUTIONS, 2007 – 2019

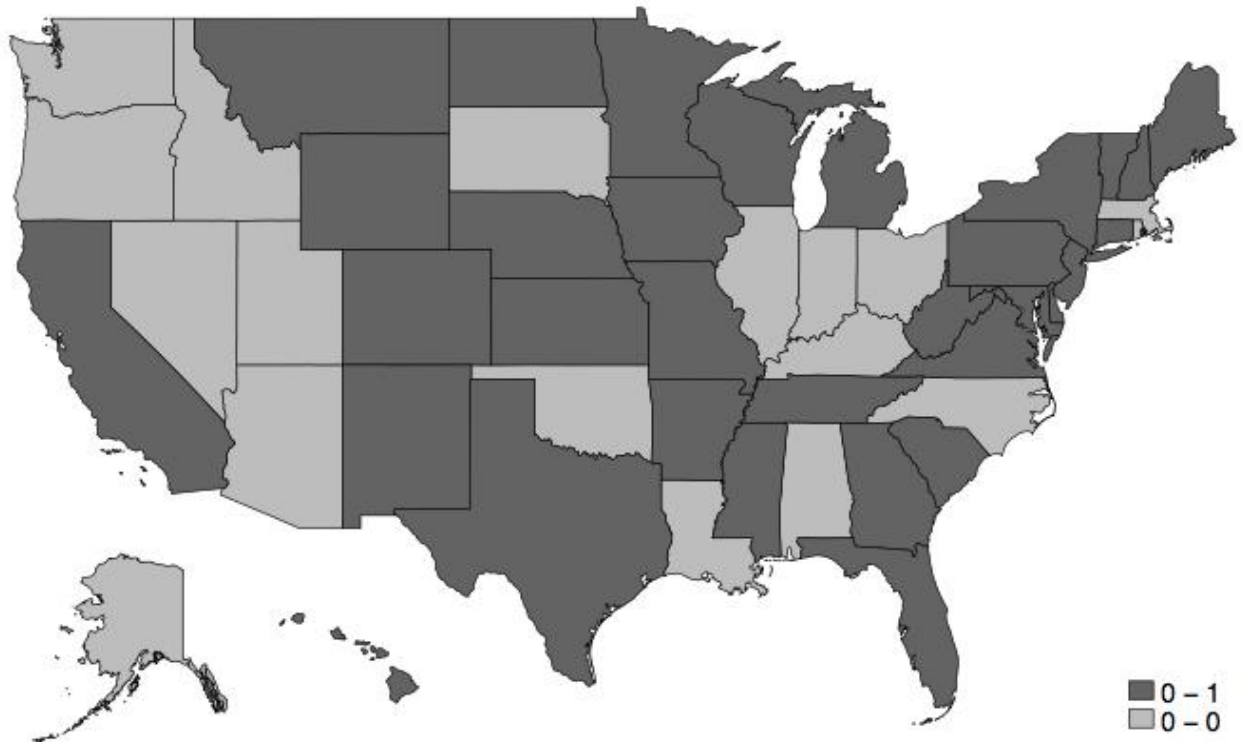
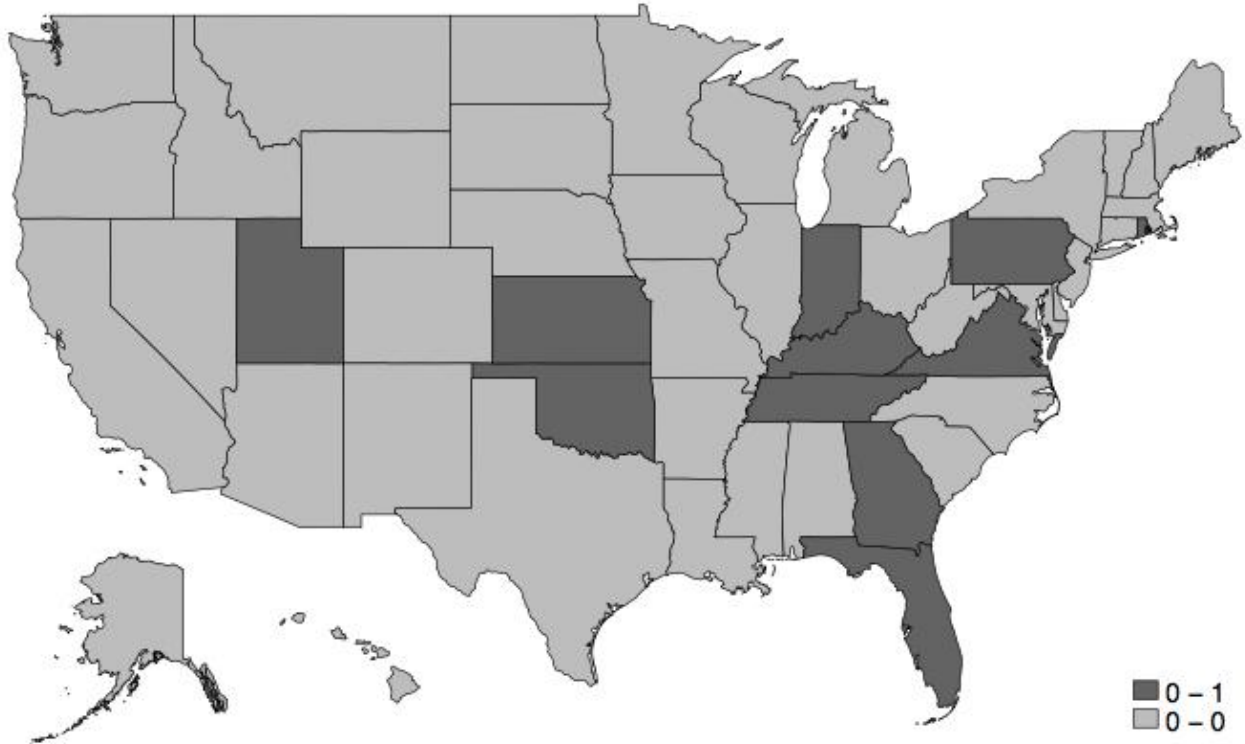


FIGURE 5: STATES THAT CHANGED PLAN DESIGN, 2007-2019



PART 2

WHAT IMPACTS PENSION REFORM?

2.1

FACTORS IMPACTING PENSION REFORM

Several factors can potentially impact the likelihood of pension reform. These factors can be grouped into four categories:

- Pension Funding,
- Policy Diffusion,
- Workforce,
- and Politics and Government.

The category of “pension funding” includes variables that measure the financial status of a state’s pension plan. Different forms of financial stress could increase the likelihood of reform within a state. The category of “pension funding” measures three metrics: pension funded ratio, pension contribution ratio, and unfunded actuarially accrued liabilities.¹⁴

¹⁴ For full description of the categories, please consult the appendix.

UNDERSTANDING PENSION FUND RATIOS

The **pension funded ratio** is the ratio of a plan's actuarial value of assets to its liabilities. The **unfunded actuarially accrued liability** is the amount of promised benefits that are greater than the assets of a pension plan. The **pension contribution ratio** is the comparison of the employee contribution to the employer contribution.

Pension Funded Ratio = Market Value of Assets / Actuarially Accrued Liability

Unfunded Actuarially Accrued Liability = Actuarially Accrued Liability - Market Value of Assets

Pension Contribution Ratio = Employee Contributions / Employer Contributions

The category "policy diffusion" measures several metrics that capture the potential effects of pension reforms on future reforms both within and outside of a state. These measures include the rate of new enactments in other states (the number of states that are passing similar laws), prior reforms within a state (how recently a state changed its own laws), and the ideological similarity of reforms from other states (how similar those states that change their laws are to one another).

Policy diffusion variables, such as prior enactments or the rate of new enactments, measure if states have already passed reforms or how many states had passed reforms, respectively. Ideological distance measures how similar or different those states are that already passed reforms from those states that have not passed reforms.

The workforce of a state may also impact the likelihood of policy adoption. This metric measures the voting-eligible population of a state, the number of people in the public sector in those states, and the number of people in a public sector union in those states, capturing the state's size and the size of its public sector. The latter may push back against reform if they are highly unionized, but large numbers of public sector employees may also be eager for reform.

The workforce category uses data to determine the size of the state and of the public sector. This latter variable captures both how many people work for the government and how many of them are union members.



The government and politics of a state may also shape reforms. These variables include constitutional constraints on reform, government ideology, citizen ideology, term limits, and government trifectas.



The government and politics of a state may also shape reforms. These variables include constitutional constraints on reform, government ideology, citizen ideology, term limits, and government trifectas. Constitutional impediments may slow change, while term limits may reprioritize the goals of legislators, urging them to tackle large projects with long-term implications like pension reform. The type of elected official may also impact what sorts of changes are considered, especially if the legislature and executive are of the same party.

Politics and government variables were calculated from several sources. The partisan makeup of a state measures which political party has a majority in the legislature and the party identification of the governor. Term limits measure whether or not the law precludes legislators from indefinitely running and serving in office. The ideology of the government and the citizens of each state is a measure of how liberal or conservative those in office or those residing in the state may be.

Variables from the factors related to pension funding, policy diffusion, workforce, and politics and government are used to calculate the tendency of states to enact pension reform, followed by a description of the characteristics of each state that may help determine which reforms are most beneficial.

PART 3

REGRESSION RESULTS

Due to the importance of the ideology metric, this analysis uses two separate models to calculate estimates for each type of pension reform. One model employed the variables that measured ideology, while the other omitted them. This method restricted the sample due to availability of ideology data, as there was no measure of ideology beyond 2017, yet the metric was influential enough to require its integration into this analysis. The model with the larger sample size is referred to as the “full model,” while the model with the restricted sample size is referenced as the “reduced model.”

The next six sections identify factors that impacted specific reforms across all the reform types discussed in Part 2, and how those factors did so.

3.1

DETERMINANTS OF PASSING A PENSION PLAN CHANGE OF ANY KIND

When considering the full model for any pension plan change, several variables are significant. As the pension contribution ratio increased, the likelihood of pension reform slightly increased, however, a higher funded ratio made a state far less likely to alter its plan. Having several other states also pass reforms had the largest effect on reform, and a state recently reforming its own plan made that state quite likely to change its plan. More ideological distance between states that had previously reformed their pensions correlated with a state being less likely to reform its own pension. Larger states were more likely to

reform, as were states with larger public sectors, but states with more public sector union members were less likely to reform their laws. These results were robust across the reduced model, aside from the omission of the ideological distance measure.



Having several other states also pass reforms had the largest effect on reform, and a state recently reforming its own plan made a state quite likely to change its plan.



It is often useful to visually inspect the effects of the models. Doing so allows for a better appreciation of how slight differences in the sizes of the variables can have an impact on the likelihood of reform.

Figure 6 shows the effect of changes in the funded ratio on the likelihood of reform. Each line shows how likely a state is to make it to a particular year without any change. That means the higher on the y axis a state's funded ratio is, the less likely it is to enact reform. The only difference between each line is the funded ratio; as the ratio decreases, the odds of making it another year without a change go down. For example, a plan that is 100% funded has an almost 70% likelihood of making it four years without any changes, while a plan that is 40% funded has only about a 30% chance of no reforms at four years (see Figure 6).

FIGURE 6: THE EFFECT OF VARIOUS FUNDING RATIOS ON THE LIKELIHOOD OF REFORM



3.2

DETERMINANTS OF PASSING AN INCREASE TO EMPLOYEE CONTRIBUTIONS

In the models that analyzed the determinants of increasing the employee contribution, several variables were significant. Having more states pass similar legislation increased the likelihood of adoption, as did recently passing laws increasing employee contributions in one’s own state. Larger public sectors increased the odds of adoption, while in the full model, larger states were more apt to increase employee contributions.

3.3

DETERMINANTS OF PASSING A CHANGE TO PLAN DESIGN

In the reduced model that analyzed the determinants for changing a plan design, the most notable variables concern constitutional protection and prior changes. With respect to the latter, recently changing a plan design in a state made that state far less likely to change it again. States that completely switch plan designs are unlikely to need additional pension reforms. The presence of constitutional protections also made this sort of change less

likely. Higher pension contribution ratios also decreased the likelihood of passing a changed plan design. The full model found that higher UAALs decreased the likelihood of changing a plan design, as did higher pension contribution ratios. As more states changed their plan designs, states became less likely to change their own. More-liberal governments were more likely to pass this reform, while more-conservative populations were not. Having Republicans control the legislative and executive branches increased the likelihood of changing a plan design.

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States that completely switch plan designs are unlikely to need additional pension reforms.

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3.4

DETERMINANTS OF PASSING AN INCREASED AGE OR SERVICE REQUIREMENT

In the two models for increasing the age or service requirements of a pension plan, having a higher pension contribution ratio increases the likelihood of reform, as does recently passing similar legislation. In the full model, states with a more conservative population were more likely to pass this reform, as were states with constitutional protections, though this likelihood did decrease over time. States with larger public sector unions were less likely to pass this reform. The reduced model suggests that possessing a Republican trifecta decreased the likelihood of this reform.

3.5

DETERMINANTS OF PASSING A REDUCED PENSION PLAN

In the two models for considering the determinants of a reduced pension plan, several variables were significant. As the funded ratio increased, the likelihood of reform decreased; however, this likelihood of reform was less robust over time. As more states reduced their pension plans, a state became less likely to reduce its own plan, but this effect became less negative over time. Larger states and states with a larger public sector were more likely to pass this type of reform. In the full model, increased unfunded

actuarially accrued liability (UAAL) made a state less likely to reform, while the presence of term limits made a state more likely to reduce its plan.

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3.6

DETERMINANTS OF PASSING A REDUCED COLA PLAN

In the two models for considering the determinants of a reduced COLA, several variables are notable. As the funded ratio increases, the odds of reform decrease. As states see others reduce their COLAs, they are more likely to reduce their own. Similarly, a state recently reducing its own COLA increases the likelihood of it doing so again. The full model also suggests that larger states are less likely to reduce COLAs, but those with larger public sectors are more likely to do so, while higher public sector union membership decreases this likelihood.

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Similarly, a state recently reducing its own COLA increases the likelihood of it doing so again.

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3.7

SUMMARY OF RESULTS

Overall, a few general trends emerge from this analysis. The variables that appear to have the largest and the most consistent effects are passing a prior law or having several states pass a law in the same year; both variables increased the likelihood of passing a reform. Fiscal variables frequently mattered. Often, higher funded ratios made a state less likely to pass a reform, while higher pension contribution ratios sometimes made a state more likely

to pass a reform. Larger states tended to be more apt to pass reforms. Those with larger public sectors were more likely to pass reforms, but those with more union members were less likely.

Examining the fiscal variables provides a better understanding of their role in pension reform. States that pay a higher proportion of pension costs were less likely to change their plan design, but more likely to make any sort of change or increase their age and service requirement. The potential reason for this leading to a decrease in the likelihood of changing the plan design could be linked to other factors that lead to a state paying a larger share of the costs, such as the presence of a constitutionally protected pension, as this variable was also significant in the model. The other two variables could be linked to the politics of the state, as these were also the only models where political variables were significant. That is, the states that are more conservative may also require those in the public sector to pay more, and it is these more conservative states that make these sorts of changes to pension plans.

As the UAAL increased, the likelihood of passing a reform that reduces benefits or a change to plan design decreased. However, this is only significant in the full models and not the reduced models, and when it is significant, the level of significance is at the 0.10-level, which is close to the limit of acceptable. This suggests that broad inferences based on this finding should be met with skepticism.

As the pension funding ratio increased, the likelihood of any change, reducing pensions, or reducing COLAs decreased. This suggests that these sorts of changes are delayed or perhaps less likely to be considered in better-funded plans. Other changes may be considered, but these particular reforms are less likely to be passed. This means that in states with low pension funding ratios, reforms that may increase the age or service requirement or that increase the employee contribution are more likely to be considered than other reforms. It may be that those in states with lower funding ratios see these types of reforms as better addressing this measure of fiscal stress than others.

Here is an overview of the results from the full models for all of the different pension reforms. Cells in green show that the variable will speed up the likelihood of reform, while cells in red show that a variable will slow down the likelihood of reform. This chart provides a simple way of showing which variables should matter and how they should matter when looking at the potential enactment of these reforms.

TABLE 1: FULL MODEL ANALYSIS RESULTS

	...the likelihood of this reform increases.			...the likelihood of this reform decreases.		
	Employee Contribution	Change Plan Design	Increase Age/Service	Reduce Pension	Reduce COLA	Any Changes
As unfunded actuarially accrued liabilities increase...						
As the pension contribution ratio increases...						
As the funded ratio increases...						
As the number of other states passing similar laws increases...						
If the state already passed a similar law earlier....						
If a similar state already passed a law...						
The more conservative a state's government...						
The more conservative a state's citizens...						
If pensions are protected in a state's constitution...						
The larger a state's population...						
The more public sector union members in a state...						
The more public sector workers in a state...						
If a state has term limits...						
If a state has a Republican-controlled government...						
If a state has a Democrat-controlled government...						

Note: Green means that the variable increases the likelihood of that reform. Red means that the variable decreases the likelihood.

CONCLUSION

The results from the models show several factors that are more than likely to shape pension reform. First, policy diffusion, or the effects of earlier reforms on future reforms both within and outside of a state, is the most important factor with respect to adoption. Not only were these variables almost always significant, they also had the largest effects. States that have already passed reforms should be seen as being more likely to pass subsequent reforms. Pension reforms also appear to be motivated by peer pressure; the larger the number of states that pass a reform in a year, the more likely it is that additional states follow.



States that have already passed reforms should be seen as being more likely to pass subsequent reforms. Pension reforms also appear to be motivated by peer pressure; the larger the number of states that pass a reform in a year, the more likely it is that additional states follow.



The variables that are of secondary importance are those involving pension funding and the workforce categories of variables. While these variables were commonly significant, the exact variables within the models that were significant varied across dependent variables. Furthermore, when they were significant, their impact on the likelihood of reform was smaller than the policy diffusion variables. Those states with higher pension contribution ratios should be more likely to reform their plans, while states with higher funded ratios should be less likely to reform their pensions. Larger states are more likely to reform their pensions, as are states with larger public sectors; however, increased union membership decreases this likelihood.

The variables of minor importance that can most likely be ignored with respect to pension reform are the government and political variables. It was rare that the composition of a state's government impacted reform. For most pension reforms, government control of a state was not important.

Finally, these variables need to be considered in the context of time. Some of them are apt to change quickly, which could have a dramatic impact on reform. For example, if a state passes a reform, then it suddenly is more apt to pass a reform the following year.

With other variables, their changes can be forecasted, which could help predict when states may make changes. This may matter the most with respect to the fiscal measures. For example, a state that is projected to increase its funded ratio over time should be seen as less likely to reform its pension laws.

ABOUT THE AUTHORS

Michael Bednarczuk, Ph.D., earned his doctorate in political science at the University of Wisconsin-Milwaukee. He is the founder of Pura Analytics. He has published on topics ranging from election forecasting to caucus votes in Congress to the attitudes and behaviors of bureaucrats in journals such as *PS: Political Science and Politics*, *Journal of Ideology*, *The American Review of Public Administration*, *Journal of Public and Nonprofit Affairs*, *Administration & Society*, and *Public Administration Quarterly*. He has received numerous awards that have recognized him for his graduate school work and his professional accomplishments, such as a Distinguished Graduate Student Fellowship and Distinguished Dissertation Fellowship from the University of Wisconsin-Milwaukee, a Founders' Fellowship, which is the premier award by the American Society for Public Administration to recognize outstanding new professionals, and the James E. Webb Award, which is given to the most exemplary Founders' Fellow.

Jen Sidorova is a policy analyst with Reason Foundation's Pension Integrity Project. Her work focuses on academic and policy research, as well as quantitative analysis. Before joining Reason Foundation, Sidorova worked as a research assistant at Stony Brook University, and interned at the Cato Institute and the United Nations. Sidorova's work has been featured in *The Washington Times*, *MarketWatch*, *Orange County Register*, *Atlanta Journal-Constitution*, and other national and regional publications in the U.S. Sidorova holds Master of Arts degrees in economics and political science from Stony Brook University.

APPENDIX

DEFINITIONS AND DISCUSSIONS OF VARIABLES

The pension funded ratio is the ratio of market value of assets to the actuarially accrued liability, while the unfunded actuarially accrued liability is the actuarially accrued liability minus the market value of assets. As the pension funded ratio decreases, and as the unfunded actuarially accrued liability increases, a pension plan is argued to be under increased stress, which may lead to reform. The pension contribution ratio is the proportion of employee contributions to employer contributions. It has been argued that a ratio skewed toward employees may lead to calls for reform.¹⁵

The rate of new enactments in other states is included because the popularity of a particular reform may encourage states to adopt those same reforms. Prior reforms within a state may also shape current policy enactments, as states may be more apt to make additional changes from learning from past policies.¹⁶ States may also learn from seeing a policy passed in another state. Studies have found that states are more likely to pass a policy from a state that is ideologically similar to them as opposed to a state that is

¹⁵ Sylvester Ogbueghi and Isaac Okeke, "The Effects of Implementation of Retirement Policies in the Public Sector: A Study of Ibeno Local Government Area Akwa Ibom State," *Global Journal of Applied, Management, and Social Sciences* 13 (2016). 291-229.

¹⁶ Mark Lavenia, Lora Cohen-Vogel, and Laura Lang, "The Common Core State Standards Initiative: An Event History Analysis of State Adoption," *American Journal of Education* 121:2 (2015). 145-182.

ideologically distinct.¹⁷ In other words, conservative states should be more apt to pass laws from other conservative states, but not from liberal states, and vice versa.

Areas with larger populations tend to be drivers of policy innovations, so larger states may be more apt to pass reforms.¹⁸ Variables concerning the public sector are relatively uncommon in the policy diffusion literature, but they merit inclusion based on the unique policy under examination: their pensions. As the number of workers in the public sector grows, the more individual demands will be placed on public pensions; therefore, there should be more pressure to change a plan as the public sector becomes a larger part of the population of a state. However, public sector unions will seek to preserve pension plans for their members. As their membership increases, their corresponding political power may also increase, which suggests that states with larger public sector memberships will be less likely to enact changes.

Some states have legal constraints on changing their pension plans. Any such restriction would likely make change more difficult. Term limits may also impact reform, as some have argued that the presence of term limits encourages legislators to tackle harder problems for which they may not receive an immediate reward, such as pension reform. This suggests that the presence of term limits would make it more likely that a state would pass a reform.¹⁹ The remaining variables capture the politics of a state. Given that there exists a positive relationship between public sector unions and more Democratic officeholders with respect to campaign donations,²⁰ it is assumed that those that are more liberal would be less likely to alter a public pension plan if it could be viewed as a change that would be detrimental to the plan. Conversely, there is a narrative that more conservative governments, once they come to power, are more apt to change pension plans, as was seen following the Republican wave of 2010, when 23 states were entirely Republican and 27 states saw reforms in 2011. Therefore, both the ideology of government and of the citizenry are included, with the assumption that more liberal-leaning states and populations will be less apt to change pension plans. Additionally, whether or not a state is controlled entirely

¹⁷ Lawrence Grossback, Sean Nicholson-Crotty, and David Peterson, "Ideology and Learning in Policy Diffusion," *American Politics Research* 32:5 (2004). 521-545.

¹⁸ Charles Shipan and Craig Volden, "The Mechanisms of Policy Diffusion," *American Journal of Political Science* 52:4 (2008). 840-857.

¹⁹ Jeff Cummins, "The Effects of Legislative Term Limits on State Fiscal Conditions," *American Politics Research* 41:3 (2013). 417-442.

²⁰ Daniel DiSalvo, *Government Against Itself: Public Union Power and Its Consequences*, (New York: Oxford University Press, 2015)

by one party was also modeled, as possessing a “trifecta” (control of both legislative houses and the governorship) can be associated with more policy change.²¹

DESCRIPTION OF CALCULATION OF VARIABLES

The pension funded ratio was calculated as the market value of assets divided by the actuarially accrued liability, while the unfunded actuarially accrued liabilities were calculated as the actuarially accrued liability minus the market value of assets. Given that all plans have different discount rates, prior to either calculation, the actuarially accrued liability was rediscounted using adjusted AAL = Original AAL*(1+original discount rate)¹²/(1+New Discount Rate)¹², where the new discount rate was 7%. The pension contribution ratio was calculated by comparing the employee contribution to the employer contribution.

Variables concerning the partisan makeup of a state were taken from Ballotpedia. Data on term limits came from the National Conference of State Legislatures, while data on constitutional protections was from the Center for Retirement Research at Boston College. Government and citizen ideology was calculated by Dr. Richard Fording of the University of Alabama and was available on his personal website. This variable ranged from 0 to 1, with higher values indicating increased conservatism.

Policy diffusion variables, such as prior enactments or the rate of new enactments, were calculated using the NASRA data. Ideological distance data were calculated using Dr. Fording’s ideological data. This was a measure of the absolute value of the ideological distance between a state and the average ideology of states that had passed the policy the previous year. For example, if only two states passed a reform in a given year, and those states had an ideology of 0.8 and 0.9, respectively, then their average would be 0.85. For the following year, it would be hypothesized that a state with an ideology of 1 would be more likely to pass a similar law than a state with an ideology of 0.2, given the differences in their absolute values from the policies in states that had previously passed that law (0.15 and 0.65, respectively).

Workforce data came from two sources. State population was defined as the size of the voting eligible population in each state as defined by Dr. Michael McDonald of the

²¹ Robert Paarlberg, Dariush Mozaffarian, and Renata Micha, “Can US local soda taxes continue to spread?,” *Food Policy* 71 (2017). 1-7.

University of Florida as part of the United States Election Project. Data concerning unions were found in the Union Membership and Coverage Database, a project of Dr. Barry Hirsch of Georgia State University and Dr. David Macpherson of Trinity University.

METHODOLOGY

A Cox proportional hazards model was used to model the data; this is common in the literature on policy adoption.²² This models the time to an event, with the event under examination here being passing a pension reform law. These types of models are often used to study mortality, where the event in question is someone's death. In those sorts of studies, what is of interest is the event happening once and then the observation is removed from the analysis, as someone can only die once. Furthermore, the determinants of the event are usually set at the beginning and do not change over time, such as someone's preconditions.

However, the environment surrounding pension reform is different; therefore, the two most important considerations with this particular model are modeling repeated events and the inclusion of time-varying covariates. Since states commonly pass several different reforms over time, it makes sense to model this process of repeated adoption. Additionally, several of the variables change every year, such as the pension contribution ratio or the partisan makeup of a state. For modeling repeated events, every possible event must be included in the data set. This means that there is an entry for every state for every year, regardless of whether or not the state passed a pension reform that year. For the time-varying covariates, there must be several checks to see how they may impact the model. Fortunately, these checks are the same checks that are used to test the proportional hazards assumption.

Proportional hazards models assume that the impact of a covariate on the dependent variable is constant over time; i.e., it is the same in year one as it is in year n . If this is violated, it must be checked to see if it impacts the model for fear of misspecification. To check for violations of the proportional hazards assumption and to assess their impact on the model, a two-step procedure was employed. First, the Schoenfeld residuals were analyzed; this tests each covariate for proportionality. If a covariate appeared to potentially deviate from the proportional hazards assumption, then the model was re-run with the

²² Michael Thom, "The Drivers of Public Sector Pension Reform Across the U.S. States," *American Review of Public Administration* 47:4 (2017). 431-442.

covariate now included as a time-varying covariate. If the time-varying covariate was significant, then it was retained. If it was not significant, then it was omitted.

Two different procedures were followed to assess model fit. If a model did not include time-varying covariates, then the Gronnesby and Borgan Test was administered.²³ If a model did include time-varying covariates, then a likelihood ratio test was used to determine if the model with time-varying covariates was a better fit for the data over the model without time-varying covariates.²⁴

²³ Jon Ketil Gronnesby and Ornulf Borgan, "A method for checking regression models in survival analysis based on the risk score," *Lifetime Data Analysis* 2:4 (1996). 315-328.

²⁴ David Cox, "Regression models and life-tables," *Journal of the Royal Statistical Society: Series B (Methodological)* 34:2 (1972). 187-202.

